

**(2011)**

**SYLLABUS OF SUBJECTS**

**Graduate School of Advanced Technology and Science  
The University of Tokushima**



# Table of Contents

<b>Chapter 1</b>	<b>MASTER's DEGREE</b>	<b>1</b>
Intelligent Structures and Mechanics Systems Engineering . . . . .		3
Civil and Environmental Engineering . . . . .		3
Mechanical Engineering . . . . .		17
Earth and Life Environmental Engineering . . . . .		29
Chemical Science and Technology . . . . .		29
Biological Science and Technology . . . . .		39
Ecosystem Engineering . . . . .		51
Systems Innovation Engineering . . . . .		63
Electrical and Electronic Engineering . . . . .		63
Information Science and Intelligent Systems . . . . .		77
Optical Systems Engineering . . . . .		87
<b>Chapter 2</b>	<b>DOCTOR's DEGREE</b>	<b>99</b>
Intelligent Structures and Mechanics Systems Engineering . . . . .		101
Civil and Environmental Engineering . . . . .		101
Mechanical Engineering . . . . .		111
Earth and Life Environmental Engineering . . . . .		123
Chemical Science and Technology . . . . .		123
Biological Science and Technology . . . . .		131
Ecosystem Engineering . . . . .		138
Systems Innovation Engineering . . . . .		147
Electrical and Electronic Engineering . . . . .		147
Information Science and Intelligent Systems . . . . .		159
Optical Systems Engineering . . . . .		167



# Chapter 1

## MASTER'S DEGREE

<b>Intelligent Structures and Mechanics Systems Engineering</b> .....	<b>3</b>
Civil and Environmental Engineering .....	3
Mechanical Engineering .....	17
<b>Earth and Life Environmental Engineering</b> .....	<b>29</b>
Chemical Science and Technology .....	29
Biological Science and Technology .....	39
Ecosystem Engineering .....	51
<b>Systems Innovation Engineering</b> .....	<b>63</b>
Electrical and Electronic Engineering .....	63
Information Science and Intelligent Systems .....	77
Optical Systems Engineering .....	87



## Intelligent Structures and Mechanics Systems Engineering — Civil and Environmental Engineering

### SYLLABUS OF SUBJECTS

● *Integrated Subjects*

<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和	3
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee, Faculty of Engineering · First-line men with experience of practical business	4
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer	4
<b>Long-term Internship (M)</b> ... Yamanaka	4
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · Part-time Lecturer	5
<b>International Advanced Technology and Science 1</b> ... Murakami	5
<b>International Advanced Technology and Science 2</b> ... Murakami	5
<b>Presentation Method (M)</b> ... Graduate School of Advanced Technology and Science	6
<b>Internship (M)</b> ... Yamanaka	6
<b>Venture Business (M)</b>	6

● *Common Subjects*

<b>Applied Fluid Dynamics</b> ... Ishihara · Muto	6
<b>Advanced Structural Dynamics</b> ... Nagao · Noda	6
<b>Advanced Fracture and Structural Mechanics</b> ... Nariyuki	7
<b>Advanced Properties of Material</b> ... Hashimoto	7
<b>Project Management</b> ... Namerikawa · Morimoto	7

● *Departmental Subjects*

<b>Quantum mechanics and advanced lecture in quantum physics</b> ... Michihiro	8
<b>Solid State Ionics</b> ... Nakamura	8
<b>Methods for analysis of mathematical phenomena</b> ... Imai	8
<b>Differential Equations</b> ... Fukagai	8
<b>Advanced Computational Science</b> ... Takeuchi	9
<b>Topics of Analysis for Mathematical Science</b> ... Kohda	9
<b>Advanced applied analysis</b> ... Okamoto	9
<b>Advanced Water Circulation Engineering</b> ... TAMURA	9
<b>Advanced slope disaster reduction</b> ... Jiang	10
<b>Advanced Disaster Reduction Engineering</b> ... Nakano	10
<b>Advanced Soil Structure Earthquake Resistance Design</b> ... Ohsumi	10
<b>Advanced Environmental Ecology</b> ... Kamada · Kawaguchi	11
<b>Advanced Soil Mechanics</b> ... Suzuki	11
<b>City and Transport System Planning</b> ... Yamanaka · Sanada · WATANABE	11
<b>Advanced Geotechnical Engineering</b> ... Uzuoka · Ueno	11

<b>Advanced Earthquake Engineering</b> ... Mikami	12
<b>Advanced reinforced concrete engineering</b> ... Ueda · Watanabe	12
<b>Advanced Lecture in Technical English</b> ... Teacher of course	13
<b>Technical English Conversation</b> ... McDonald · Mikami	13
<b>Advanced Structural Design</b> ... Nagao · Noda	13
<b>Urban and Regional Planning</b> ... Kondo	13
<b>Advanced building construction</b> ... Miyamoto	14
<b>Principles of Disaster Risk mitigation engineering</b> ... Kozuki · Yamanaka	14
<b>Information Engineering of Regional Environment</b> ... Okushima	15

● *Specialized Exercise and Experiments*

<b>Advanced Civil and Environmental Engineering Seminar</b> ... Teacher of course	15
<b>Advanced Civil and Environmental Engineering Exercise</b> ... Teacher of course	15
<b>Advanced Civil and Environmental Engineering Laboratory</b> ... Teacher of course	15
<b>Advanced Internship on Civil and Environmental Engineering</b> ... Teacher of course	16

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### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target**) Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline**) It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style**) Lecture

**Keyword**) *intellectual property, patent law, protect and use of intellectual property*

**Requirement**) No requirement

**Notice**) 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal**)

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule**) 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による

育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student)** For the course students and other graduate school students.

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成 14 から 16 年度にかけて「大学発ベンチャー 3 年 1000 社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もある。くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword) management, management of technology**

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.4), "Long-term Internship (M)"(0.5, ⇒p.18), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.5), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumnuni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and



practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor. Students who want to take an exam of registered architect need to execute practical training about architectural design or construction management in company or governmental office.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=222141>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))  
⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** ◇Students who resist the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program. ◇Practice place of students who want to take an exam of registered architect is company or governmental office which is possible to work about architectural design or construction management. Advisor of the case is first-class registered architect who is recognized by the department.

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。 ・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型「葉っぱビジネス」「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考>>平成22年度ビジネスモデル特論 >> 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。 ○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ごう奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり、90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(棚いりどり代表取締役社長) 10. 重要文化的景観「檜原の棚

田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!--地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!--地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be surthorized. The report and portfolion on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, proffolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of the technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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### Presentation Method (M)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentation in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Internship (M)

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices of 90 hours. Their fulfillment is evaluated by activity reports during internship. Students who want to take an exam of registered architect need to execute practical training about architectural design or construction management in company or governmental office.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=222142>

**Student)** Able to be taken by only specified class(es)

**Note)** ♦A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors. ♦Practice place of students who want to take an exam of registered architect is company or governmental office which is possible to work about architectural design or construction management. Advisor of the case is first-class registered architect who is recognized by the department.

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### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Applied Fluid Dynamics

2 units (selection)

Kunihiko Ishihara · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Yasunori Muto · PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This subject is concerned with flood flow, sediment transport and riverbed variation. The aim of this subject is to understand fundamentals of those phenomena, as well as of various solution methods for river designing and management.

**Outline)** Firstly, characteristics of flood flow and riverbed variation are interpreted and the basic equations of those phenomena are deduced and presented. Secondly, turbulence characteristics of the river flow and sediment transport mechanism are lectured in detail. Then solution methods toward various problems on river designing and management are introduced, in relation to how the fundamental knowledge is applied to the solution.

**Style)** Lecture

**Keyword)** *flood flow, turbulent flow, sediment transport, riverbed variation, river designing*

**Relational Lecture)** "Advanced Disaster Reduction Engineering"(0.7, ⇒p.10), "Advanced Water Circulation Engineering"(0.7, ⇒p.9)

**Requirement)** Fundamental knowledge of hydraulics and river engineering is necessary.

**Notice)** not specified.

**Goal)** fundamentals of flood flow, sediment transport and riverbed variation are understood, and idea and basic application methods of such fundamentals toward practical problems are mastered.

**Schedule)** 1. guidance (problems on river designing and management) 2. basic equations of river flow 3. turbulence structure of river flow (1) 4. turbulence structure of river flow (2) 5. experimental methods (1) 6. sediment transport mechanism 7. formulas of sediment transport 8. riverbed variation 9. experimental methods (2) 10. numerical models for river flow 11. numerical models for riverbed variation 12. observational methods 13. examples of river designing (1) 14. examples of river designing (2) 15. self-forming process of channel and regime theorem

**Evaluation Criteria)** Reports

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216579>

**Student)** only for specified course

**Contact)**

⇒ Muto (A415, +81-88-656-7329, muto.yas@ce.tokushima-u.ac.jp)

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### Advanced Structural Dynamics

2 units (selection)

Fumiaki Nagao · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Minoru Noda · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To understand the dynamic response and control of structures

**Outline)** In the first half of the semester, following the 'Introduction on Structural Dynamics' learned in under graduate course, methodologies to construct the physical and mathematical models of structural oscillations are reviewed and meanings of their mathematical solutions are examined again in physical standpoint. In the latter half, random vibration theories based on the statistics and probability and passive and active structural oscillation control are introduced. For the purpose to deepen the understanding, many exercises are prepared.

**Style)** Lecture and exercise

**Keyword)** *analysis of dynamic response, analysis of random vibrations, control of dynamic response*

**Fundamental Lecture)** "Structural Dynamics and Exercise"(1.0)

**Relational Lecture)** "Advanced Structural Design"(0.5, ⇒p.13)

**Goal)** To understand the dynamic response and control of structures

**Schedule)** 1. Introduction 2. Basic descriptive properties of random data 3. Joint properties of random data 4. Theory of stationary random processes 5. Models of random excitations 6. Stochastic responses of SDOF systems 7. Stochastic responses of MDOF systems 8. Stochastic responses of continuous systems 9. Design of structures for random excitations 10. Controls of vibrations 11. Passive vibration control 12. Semi-active vibration control 13. Active vibration control 14. Aerodynamic vibration of structures 15. Control of Aerodynamic vibration of structures

**Evaluation Criteria)** evaluated by attitude in class (80%) and reports (20%)

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216707>

**Contact)**

⇒ Nagao (A515, +81-88-656-9443, fumi@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

⇒ Noda (A514, +81-88-656-7323, noda@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

## Advanced Fracture and Structural Mechanics

2 units (selection)

Yoshifumi Nariyuki · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To understand method of matrix displacement analysis of plane framed structures which is widely used as a suitable method for computer programming.

**Outline)** First, method of matrix displacement analysis of plane framed structures is explained. Next, some problems are given for exercises in analysis of them. Finally, term examination is set. This class is a seminar type using textbook written in English.

**Style)** Lecture

**Keyword)** *framed structure, matrix displacement method, plane frame, elastic analysis, English textbook*

**Fundamental Lecture)** "Structural Mechanics 1"(1.0), "Structural Mechanics 3"(1.0), "Applied Structural Mechanics"(0.8), "Structural Analysis with Exercise"(0.8)

**Relational Lecture)** "Advanced building construction"(0.5, ⇒p.14), "Advanced Civil and Environmental Engineering Seminar"(0.5, ⇒p.15)

**Requirement)** Students are required to have a good understanding of undergraduate-level structure mechanics.

**Notice)** Students are required to do two hours preparation and two hours review for each lesson.

**Goal)** To understand method of matrix displacement analysis of plane frames

**Schedule)** 1. Guidance/A few historical remarks(pp.1-10) 2. Basic considerations of structural analysis 1(pp.11-16) 3. Basic considerations of structural analysis 2/Determinate and indeterminate structures(pp.16-21) 4. Methods of analysis (pp.21-26) 5. Displacement method/Stiffness matrix of a bar element subjected to axial force(pp.26-33) 6. Bar structure stiffness matrix(pp.33-39) 7. Some properties of stiffness matrices/Stiffness matrix of a bar element subjected to torsion(pp.39-44) 8. Stiffness matrix of a beam element (pp.44-47) 9. Assembly of the structure stiffness matrix by the direct stiffness method 1(pp.47-54) 10. Assembly of the structure stiffness matrix by the direct stiffness method 2(pp.54-59) 11. Symmetrical geometry(pp.59-64) 12. Further remarks on prescribed displacements(pp.64-70) 13. Problem exercises(pp.71-72) 14. Problem exercises(pp.72-73) 15. Term examination 16. Restoration of answer papers and comments

**Evaluation Criteria)** Term examination and report are marked out of 60 and 40 respectively and those marks are summed up. The passing mark is 60.

**Textbook)** Matrix and finite element displacement analysis of structures, D.J.DAWE, Clarendon press, Oxford, 1984

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216812>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nariyuki (A510, +81-88-656-7326, nariyuki@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

## Advanced Properties of Material

2 units (selection)

Chikanori Hashimoto · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Understanding on the relationship between micro-structures and macro-properties of construction materials particularly concrete using waste or by-products in a concept of sustainable materials cycling society.

**Outline)** It is necessary understanding appropriate material for a construction method to satisfy the required performances in each civil work. For this reason, it is very important to understand the relationship between micro-structures and macro-mechanical properties of concrete or material using waste or by-products properties for construction materials. And, it is introduced a concept on construction material in sustainable material cycling society.

**Style)** Lecture

**Keyword)** *construction material, concrete, susatinable cycling society*

**Relational Lecture)** "Advanced reinforced concrete engineering"(0.5, ⇒p.12)

**Requirement)** No requirement.

**Notice)** When several foreign students are studying lecture, Official language is English and Japanese, but main language is English.

**Goal)** Understanding on the relationship between micro-structures and macro-properties of construction materials particularly eco-concrete.

**Schedule)** 1. Guidance on lecture 2. Portland cement concrete(1) 3. Portland cement concrete(2) 4. Sulphur concrete(1) 5. Sulphur concrete(2) 6. Phosphate cement 7. Magnesium oxychloride and oxysulphate cements 8. Regulated cement 9. High alumina cement 10. Alkali-aggregate reaction 11. Biological attack and unsoundness of cements containing MgO and CaO 12. Frost action(1) 13. Frost action(2) 14. Carbonation shrinkage 15. Sea water attack 16. Comments for Reports on Concrete

**Evaluation Criteria)** Evaluate by presentation in the lecture and reports for each subject.

**Textbook)** Ramachandran,V.S.,Feldman,R.F. and Beaudoin,J.J.:Concrete Science,Chap.810,Heyden & Son Ltd, 1981.

**Reference)**

◇ Standard Specification for Concrete JACE.

◇ Okada,K. and Muguruma,H. Ed.,Concrete Handbook,Asakura Co. Ltd,1981.

◇ Nevill,A.M.:Properties of concrete,Fourth and Final Ed.,Pearson Education,2002.

**Webpage)** <http://www.ce.tokushima-u.ac.jp/kysys/mizuguchi>.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216671>

**Student)** Able to be taken by student of other faculty and university

**Contact)**

⇒ Hashimoto (A505, +81-88-656-7321, chika@ce.tokushima-u.ac.jp) (Office Hour: 金曜日 14:35~ 16:05< 昼間コース >, 金曜日 18:00~ 19:30< 夜間主コース >)

**Note)** It is necessary getting the unit of lecture and understanding the lecture for 2 hours to prepare of the lecture for 2 hours and review of the lecture for 2 hours.

## Project Management

2 units (selection)

Susumu Namerikawa · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this lecture is to understand PMBOK (Project Management Body of Knowledge), which is global standard in project management.

**Outline)** This lecture is outlined as follows: A)Current of global standardize pivoted on U.S. in project management. B)PMBOK (Project Management Body of Knowledge), which is global standard in project management.

**Style)** Lecture

**Keyword)** PMBOK

**Fundamental Lecture)** “Construction Management”(0.2)

**Goal)** Understanding of project management body of knowledge

**Schedule)** 1. Guidance 2. Project and Project Management 3. Initiating Processes 4. Project Charter 5. Scope and WBS 6. Resource Planning and Estimate 7. Control of Project Planning 1 8. Control of Project Planning 2 9. Develop Project Planning 1 10. Develop Project Planning 2 11. Develop Project Team 12. Performance Measurement Baseline 13. Change Control 14. Closing Processes 15. Professional Responsibility 16. Semester Examination

**Evaluation Criteria)** Achievement level of the target is evaluated by the semester examination. Score of 60points or over is required to clear the target.

**Textbook)** Textbook is introduced in the class. Related documents is distributed to students.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216876>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Namerikawa (A412, +81-88-656-9877, namerikawa@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示を参照すること)

## Quantum mechanics and advanced lecture in quantum physics 2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the quantum mechanics.

**Outline)** Basics of quantum mechanics are introduced.

**Style)** Lecture

**Keyword)** quantum mechanics

**Goal)** To understand the outline of quantum mechanics.

**Schedule)** 1. Introduction 2. Variational method 3. Lagrangian 4. Hamiltonian 5. Poisson's bracket expression 6. Quantization 7. Operator 8. Wavefunction 9. Expectation value 10. Schrödinger equation 11. Example (1) the square well potential 12. Example (2) the linear harmonic oscillator 13. Angular momentum 14. Example (3) hydrogen atom 15. Heisenberg equation 16. Field quantization

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216866>

**Contact)**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

## Solid State Ionics 2 units (selection)

Koichi Nakamura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces topics in solid state ionics, conduction mechanism in ionic conductors and techniques to study solid state ionics.

**Outline)** Basic experimental and theoretical approaches to understand solid state ionics are introduced and discussed in terms of "ion dynamic" in ionic/superionic conductors.

**Keyword)** ionic conductor, ionic diffusion, secondary battery

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand basic physical and chemical properties of ionic conductors.

2. To understand basic technique to study ionic conductors.

**Schedule)** 1. Introduction to solid state ionics 2. Band theory and conduction mechanism 3. Defect in Ionic crystal 4. Diffusion in solid 5. Diffusion mechanism in solid 6. Solid electrolyte - Oxides, Silver halide - 7. Solid electrolyte - Li compounds - 8. Mixed conductor 9. Electrical conductivity measurement 10. Electrical conductivity on ionic conductors 11. Nuclear Magnetic Resonance 12. Relaxation model in NMR 13. NMR on ionic conductors 14. Application - Ion secondary batteries - 15. Topics and Future in solid state ionics

**Evaluation Criteria)** Assignments count 100%.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216654>

**Contact)**

⇒ Nakamura (A216, koichi@pm.tokushima-u.ac.jp)

## Methods for analysis of mathematical phenomena 2 units (selection)

Hitoshi Imai · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the to analyze the mathematical phenomena.

**Outline)** Methods used in analysis of mathematical phenomena are introduced. Especially, those in numerical analysis are focused on.

**Style)** Lecture

**Keyword)** mathematics, numerical analysis

**Fundamental Lecture)** “Numerical Analysis”(1.0)

**Relational Lecture)** “Advanced Computational Science”(0.5, ⇒p.55)

**Requirement)** Only the premise that have studied basic mathematics.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)** Being able to understand a numerical scheme to one-dimensional boundary value problems for the Poisson equation

**Schedule)** 1. Introduction to computer 2. Common sense in numerical computation 3. High-speed computation (Parallel computing) 4. Finite difference method I 5. Finite difference method II 6. Finite difference method III 7. Finite difference method IV 8. Finite element method I 9. Finite element method II 10. Finite element method III 11. Finite element method IV 12. Boundary element method I 13. Boundary element method II 14. Boundary element method III 15. Iterative method

**Evaluation Criteria)** Evaluation by the report.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216714>

**Contact)**

⇒ Imai(A220, +81-88-656-7541, The inquiry by means of the cellular phone or E-mail is not acceptable) (Office Hour: Office hours: Thursday 14:00-15:00)

## Differential Equations 2 units (selection)

Nobuyoshi Fukagai · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Introduction to mathematical theory of differential equations.

**Outline)** Boundary value problems of second order linear differential equations.

**Style)** Lecture

**Keyword)** 微分方程式の境界値問題, Sturm-Liouville 問題

**Goal)** To be familiar with Sturm-Liouville type equations.

**Schedule)** 1. Introduction 2. Helmholtz's equation 3. Eigenvalues and eigenfunctions 4. Green's function 5. Residue analysis 6. Expansion of Green's function 7. Fourier series 8. Existence theorem 9. Sturm-Liouville problems 10. Characteristic function 11. Solvability of boundary value problems 12. Basic estimates 13. Distribution of eigenvalues 14. Eigenfunction expansion 15. Review

**Evaluation Criteria)** Evaluation will be based on assignments.

**Reference)** 望月清・トルシン 『数理物理の微分方程式』 培風館

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216853>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ 工学部数学教室 (A棟219室) (Office Hour: 木曜日 15:00~16:00)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Advanced Computational Science

2 units (selection)

Toshiki Takeuchi · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class provides the basic technology for numerical calculation for the differential equation.

**Outline)** The numerical calculation methods for the differential equation are introduced.

**Style)** Lecture

**Keyword)** *numerical analysis, numerical computation, differential equation*

**Fundamental Lecture)** “Numerical Analysis”(1.0), “Basic Mathematics/微分積分学 I”(1.0), “Basic Mathematics/微分積分学 II”(1.0)

**Relational Lecture)** “Methods for analysis of mathematical phenomena”(1.0), “Numerical Analysis”(1.0)

**Requirement)** Students have to understand basic mathematics of undergraduate-level.

**Goal)** To understand principle of numerical calculation methods.

**Schedule)** 1. Introduction to numerical simulation 2. Mathematical model 3. Lagrange interpolation 4. Spline interpolation 5. Least squares method 6. Finite difference method 7. Arbitrary precision formula 8. Application to ordinary differential equation 9. Application to partial differential equation 10. Gauss-Seidel method 11. Successive Over-Relaxation method 12. Explicit method 13. Implicit method 14. Crank-Nicolson method 15. Numerical instabilities

**Evaluation Criteria)** Assignments count 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216626>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Takeuchi (A206, +81-88-656-7544, takeuchi@pm.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00-15:00)

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### Topics of Analysis for Mathematical Science

2 units (selection)

Atsuhito Kohda · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Mathematical theory and technique for analysis of engineering phenomena

**Outline)** Mathematical theory to analyze problems in engineering and its application, mainly theory and technique of differential equations

**Style)** Lecture

**Relational Lecture)** “Advanced applied analysis”(0.2, ⇒p.9), “Differential Equations”(0.2, ⇒p.8)

**Requirement)** If you like undergraduate-level mathematics, it will be sufficient.

**Goal)** To be familiar with mathematical theory, that helps engineering study.

**Schedule)** 1. Theory of sets and maps 2. Cardinal numbers and bijection 3. Equivalence relations and cryptography 4. Linear space and tensor 5. Vector analysis and differential form 6. Cauchy's theorem and vector analysis 7. Differential form and Cauchy's theorem 8. Projective plane 9. Quadratic curves and projective plane 10. All quadratic curves are circles? 11. The index of vector fields 12. Applications of the index: fundamental theorem of algebra 13. Vector fields on the unit sphere 14. Why there is the north pole on the earth 15. Mathematics and computers 16. Summary

**Webpage)** <http://math1.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216710>

**Contact)**

⇒ Kohda (A211, +81-88-656-7546, kohda@pm.tokushima-u.ac.jp) (Office Hour: 月曜 12:00~13:00)

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### Advanced applied analysis

2 units (selection)

Kuniya Okamoto · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the functional analytic methods which are basic tools for mathematical sciences.

**Outline)** This subject provides basic theory of functional analysis which is considered as linear algebra in infinite-dimensional spaces. Functional analytic approaches to phenomena described by differential equations are introduced.

**Style)** Lecture

**Relational Lecture)** “Topics of Analysis for Mathematical Science”(0.5, ⇒p.9)

**Goal)** To apply the theory of modern analysis and recognize its significant role.

**Schedule)** 1. Differential equations and their solutions 2. Exponential of matrices 3. Uniqueness of solutions 4. Existence of solutions 5. Eigenvalues and eigenspaces 6. Projective representation 7. Exponential of matrices 8. Generalized eigenvalue problems 9. Dunford integrals 10. Holomorphic functions of matrices 11. Solution curve and stability 12. Stability of solutions 13. Ljapunov's method 14. Nonlinear case 15. Linear approximations 16. Summary

**Evaluation Criteria)** Evaluation by the report.

**Reference)** 『新微分方程式対話』 笠原皓司著, 日本評論社

**Webpage)** <http://math9.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216572>

**Contact)**

⇒ 岡本(A棟212室, TEL/FAX: 088-656-9441, E-mail: okamoto@pm.tokushima-u.ac.jp) (Office Hour: 【WEB頁】のHPを参照のこと)

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### Advanced Water Circulation Engineering

2 units (selection)

Takao TAMURA · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The objective of this subject is to learn models and theories on rainwater and solute runoff system in river basin.

**Outline)** The models and theories on rainwater and solute runoff system in river basin are introduced. The Muskingum method is a commonly used lumped flood routing method for handling a variable discharge-storage relationship. The kinematic wave model is the simplest distributed model defined by the continuity equation for an unsteady flow and the momentum equation assuming the friction and gravity forces balance each other. A report of solving problems related to lecture items is imposed.

**Style)** Lecture

**Keyword)** *linear and non-linear lumped flood routing method, kinematics distributed flood routing method, rainwater runoff system in forested basin, solute runoff system in forested basin*

**Relational Lecture)** “Applied Fluid Dynamics”(0.7, ⇒p.6), “Advanced Disaster Reduction Engineering”(0.7, ⇒p.10)

**Requirement)** Fundamental knowledge of hydraulics, river engineering and numerical analysis is necessary.

**Notice)** not specified.

**Goal)**

1. Understand the theory of both linear and non-linear lumped and kinematics distributed flood routing models.
2. Understand the evaluation technique and study results on the water conservation function and the water quality conservation function of forests.

**Schedule)** 1. Unit Hydrograph 2. Response Function 3. Unit Hydrograph Derivation 4. Lumped Flow Routing 5. Runge-Kutta Method 6. Muskingum Method 7. Linear Reservoir Model 8. Classification of Distributed Routing Models 9. Kinematic Wave Celerity 10. Analytical Solution of Kinematic Wave 11. Numerical Solution of Kinematic Wave 12. Muskingum-Cunge Method 13. Conservation function of forest 14. Water quality conservation function of forest 15. New development of water conservation function of forest

**Evaluation Criteria**) Reports

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216890>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ TAMURA (A414, +81-88-656-9407, tamura@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

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### Advanced slope disaster reduction

2 units (selection)

Jing-Cai Jiang · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) The objective of this subject is to make students aware of the slope stability methods and to develop an understanding of the procedures and processes involved in the design of engineered slopes and slope stabilization works.

**Outline**) Topics of the subject covered include slope stability analysis methods, types of shear strengths for both engineered and natural slopes, selection of strength parameters, types of slope stabilization works and their design, and seismic instability of slopes. This subject is related on engineering.

**Style**) Lecture

**Keyword**) *slopes, stability analysis, shear strength, slope stabilization*

**Relational Lecture**) “Advanced Disaster Reduction Engineering”(0.5, ⇒p.10), “Advanced Soil Structure Earthquake Resistance Design”(0.5, ⇒p.10), “Advanced Soil Mechanics”(0.5, ⇒p.11)

**Requirement**) not specified

**Goal**)

1. On the completion of this subject, students should have a knowledge of slope engineering practices in static and seismic stability analyses, determination of shear strengths, and design of slope remedial works.
2. The students should understand the measurement and selection of the peak, fully softened, and residual shear strengths for use in stability analyses, and understand the design outline of slope stabilization works.

**Schedule**) 1. Examples and causes of slope failure 2. Introduction of slope disaster reduction 3. Static slope stability methods (Part 1) 4. Static slope stability methods (Part 2) 5. Total stress analysis and effective stress analysis 6. Types of shear strengths for engineered and natural slopes 7. In-situ determination of shear strengths 8. Laboratory determination of shear strengths 9. Determination of shear strengths by back analysis (Part 1) 10. Determination of shear strengths by back analysis (Part 2) 11. Slope stabilization (unloading and drainage) 12. Slope stabilization (anchors) 13. Slope stabilization (piles) 14. Slope stabilization (soil reinforcement) 15. New development of slope disaster reduction 16. Examination

**Evaluation Criteria**) Reports and tests.

**Textbook**) Reading and discussing materials are distributed.

**Reference**) Soil Strength and Slope Stability by Michael J. Duncan and Stephen G. Wright (John Wiley & Sons)

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216695>

**Contact**)

⇒ Jiang (A311, +81-88-656-7346, jiang@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

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### Advanced Disaster Reduction Engineering

2 units (selection)

Susumu Nakano · PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) The purpose of this subject is to understand the present conditions in natural disaster reduction and to learn theory and technology about disaster reduction measures.

**Outline**) First, the present conditions for natural disaster reduction in Japan are presented. Next, effective methods to promote voluntary activities for disaster reduction are presented with practices.

**Style**) Lecture and exercise

**Keyword**) *regional disaster reduction, voluntary activities of disaster reduction*

**Relational Lecture**) “災害リスク論”(1.0), “Advanced Earthquake Engineering”(0.5, ⇒p.12), “Applied Fluid Dynamics”(0.5, ⇒p.6)

**Requirement**) not specified

**Notice**) not specified

**Goal**)

1. To understand the present conditions in regional disaster reduction
2. To learn the bases of theory and technology for voluntary activities of disaster reduction

**Schedule**) 1. Guidance, Outline of this subject 2. Strategy for natural disaster reduction 3. Strategy for earthquake disaster reduction 4. Voluntary activities of disaster reduction 5. Risk management for natural disaster in a company, report(1) 6. Damage assumption for the Nankai earthquake 7. Practice of disaster imaging (1) 8. Practice of disaster imaging (2) 9. Practice of disaster imaging (3) 10. Disaster imaging game “Crossroad” 11. Practice with the DIG game “Crossroad” 12. How to make a map for natural disaster reduction 13. Practice of making a map for natural disaster reduction (1) 14. Practice of making a map for natural disaster reduction (2) 15. Education for disaster reduction, Report(2)

**Evaluation Criteria**) marks of report (1) and (2) are summed with the weights of 4 and 6, respectively, and the passing mark is 60%.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Webpage**) <http://hyd.ce.tokushima-u.ac.jp/suiko/index.htm>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216754>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Nakano (A310, +81-88-656-7330, nakano@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと。)

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### Advanced Soil Structure Earthquake Resistance Design

2 units (selection)

Tsuneco Ohsumi · PROFESSOR / GEOTECHNICAL AND GEORENVIROMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) This subject is concerned with earthquake resistance design. The aim of this subject is to understand parameter setting with seismic wave and epicenter. The purpose of this lecture is to let the students understand the methods and the modeling for earthquake resistance design.

**Outline**) Central issues of this lecture are the parameter setting for earthquake resistance design, to understand earthquake resistance design methods. This lecture is carried out by the use of power point with motion pictures.

**Style**) Lecture

**Keyword**) *Soil Structure, Earthquake Resistance Design, Immediate Evaluation Method*

**Fundamental Lecture**) “Earthquake Engineering”(1.0), “Geotechnical Engineering”(1.0)

**Relational Lecture**) “Advanced Geotechnical Engineering”(0.5, ⇒p.11), “Advanced Earthquake Engineering”(0.5, ⇒p.12)

**Requirement**) Students are required to have a good knowledge of undergraduate level structural dynamics and soil mechanics.

**Goal**) To understand the Earthquake Resistance Design and Earthquake information systems.

**Schedule**) 1. Guidance 2. Seismic wave and Epicenter 3. Performance-Based Seismic Design for Soil Structures 4. Input Ground Motion for Earthquake Resistance Design 5. Parameter setting for Earthquake Resistance Design 6. Bridge 7. Underground Structure 8. Soil Structure 9. Dam 10. Quay wall 11. Electricity Facility 12. Earthquake information systems 13. Immediate Evaluation Method 14. Earthquake Seismograph Network 15. Summary 16. Test

**Evaluation Criteria**) Based on attendance, Evaluation by Reports and test score. Over 60% marks is necessary to pass.

**Textbook**) Not specified.

**Reference**) To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216689>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Teacher of course
- ⇒ Ohsumi (A405, +81-88-656-9721, t\_ohsumi@ce.tokushima-u.ac.jp) (Office Hour: Monday and Friday 16:00~ 17:00)

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### Advanced Environmental Ecology

4 units (selection)

Mahito Kamada · PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Yoichi Kawaguchi · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose is to develop the knowledge and skill for conservation and restoration of ecosystems.

**Outline)** Current situation of ecosystems and technical problems for conservation and restoration are explained. The way of ecosystem management is emphasized to improve ecosystem. All students must give a presentation to introduce their own activities.

**Style)** Lecture in combination with Portfolio

**Keyword)** *ecosystem management, environmental conservation, nature restoration*

**Goal)** Every student has basic knowledge and skill to improve ecosystem function in the actual society.

**Schedule)** 1. Guidance 2. Interdisciplinary aspects for ecosystem management 1 3. Interdisciplinary aspects for ecosystem management 2 4. Current situation and problems in ecosystem management 1 5. Current situation and problems in ecosystem management 2 6. Current situation and problems in ecosystem management 3 7. Current situation and problems in ecosystem management 4 8. View points to know the structure and function of ecosystems 1 9. View points to know the structure and function of ecosystems 2 10. View points to know the structure and function of ecosystems 3 11. View points to know the structure and function of ecosystems 4 12. Toward an adequate management of ecosystems 1 13. Toward an adequate management of ecosystems 2 14. Toward an adequate management of ecosystems 3 15. General discussion / Report

**Evaluation Criteria)** Result is evaluated by contents of the reports, which are set after every related lectures. Over 60% marks is necessary to pass.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216600>

**Student)** Able to be taken by student of other department and faculty

**Contact)**

- ⇒ Kamada (A306, +81-88-656-9134, kamada@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること。)
- ⇒ Kawaguchi (308, +81-88-656-9025, kawaguchi@ce.tokushima-u.ac.jp) (Office Hour: 金曜午後)

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### Advanced Soil Mechanics

2 units (selection)

Hisashi Suzuki · ASSOCIATE PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this lecture is to learn the critical state mechanics which is formed a theoretical base of a modern soil mechanics for clay and sand.

**Outline)** The purpose of Advanced Soil Mechanics is to learn the critical state mechanics which is formed a theoretical base of a modern soil mechanics for clay and sand. Firstly, the results of typical experiments related to shear properties of a saturated clay are shown and a constitutive law existing at stress-strain relationship of clays are explained. Secondly, the relationship is expanded to the theory of sand and the differences between clay and sand are made clear easily. The elasto-plastic theory for soil is explained using the cam clay model and its applications to numerical analysis are explained showing new research results. Finally, the critical soil mechanics is learned through this lecture.

**Style)** Lecture

**Keyword)** *critical soil mechanics, cam clay model, flow rule, constitutive law for soils*

**Goal)** Values of stress-strains and pore pressures for saturated soils in various states can be calculated by using critical state soil mechanics theory.

**Schedule)** 1. cam clay model 2. shear properties of saturated clay 3. existence of critical state line 4. Drained and Undrained tests of normally consolidated clay 5. 3 dimensional expression of critical state

line 6. existence of Roscoe Surface 7. shape of Roscoe Surface 8. behavior of overconsolidated clay 9. yield surface of Hvorslev Surface 10. the 2 and 3 dimensional complete state boundary surface 11. mechanical behavior of sands 12. equivalent consolidated pressure 13. elasto-plastic theory of saturated clay 14. cam clay model 15. state boundary equation for cam clay model 16. term-end test

**Evaluation Criteria)** Degree of achievement for the aim is examined by the semester test and the passing mark is more than 60%.

**Textbook)** Some prints are distributed in lectures.

**Webpage)** <http://www.ce.tokushima-u.ac.jp/www/jiban/jiban.html>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216800>

**Contact)**

- ⇒ Suzuki(A403, 088-656-7347, suzuki@ce.tokushima-u.ac.jp)

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### City and Transport System Planning

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Junko Sanada · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Kojiro WATANABE · ASSISTANT PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Advanced course on concept and case study of social and public policies on urban, regional and transport planning. Study on contents and usage of measures on such planning fields.

**Outline)** Lectures on Systems approaches on city planning and transport planning, theories and usage of planning models and planning methods. A unit is consisted of three hours lecture and an hour training.

**Style)** Lecture and exercise

**Keyword)** *city planning, transport planning, GIS*

**Fundamental Lecture)** “Urban & Transport Planning”(1.0), “Project Evaluation Methods for Infrastructure Planning”(1.0)

**Related Lecture)** “都市・地域計画論”(0.5), “Infrastructure Planning”(0.5)

**Goal)**

- 1. Understanding of problems and recent strategies on city and transport planning
- 2. Understanding of consensus building method for developing city and transport strategies

**Schedule)** 1. Problems of City and Transport Systems 1 2. Problems of City and Transport Systems 2 3. Recent Planning Strategies of City and Transport System 1 4. Recent Planning Strategies of City and Transport System 2 5. Recent Planning Strategies of City and Transport System 3 6. Recent Planning Strategies of City and Transport System 4 7. Debate by group on transport strategies 8. City and Regional Planning 1 9. City and Regional Planning 2 10. City and Regional Planning 3 11. City and Regional Planning 4 12. Introduction of GIS 13. Practice on GIS for City and Transportation Planning 1 14. Practice on GIS for City and Transportation Planning 2 15. Practice on GIS for City and Transportation Planning 3

**Evaluation Criteria)** Achievement level of the each target is evaluated by the submitted essays and reports. Score of 60points or over is required to clear the target. Students are required to clear the both of targets. Total score is average of the scores of two targets.

**Textbook)** Textbook is introduced in the class. Related documents is distributed to students.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216797>

**Student)** Able to be taken by student of other department

**Contact)**

- ⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示を参照のこと)
- ⇒ Sanada (A411, +81-88-656-7578, sanajun@ce.tokushima-u.ac.jp)
- ⇒ WATANABE (kojiro@ce.tokushima-u.ac.jp) (Office Hour: See the department notice board every year)

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### Advanced Geotechnical Engineering

4 units (selection)

Ryosuke Uzuoka · PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Katsutoshi Ueno · ASSOCIATE PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this lecture is to understand the method to analyze failure and deformation of soil structures.

**Outline)** First the fundamental equations governing deformation/failure of ground and their finite element formulations are given. Second the mechanical properties of soil and their elasto-plastic models are given. Finally the numerical methods of the finite element method incorporated with the elasto-plastic models are given to understand the deformation/failure of ground.

**Style)** Lecture

**Keyword)** *Porous media theory, elasto-plastic model, finite element method*

**Fundamental Lecture)** “Methods for analysis of mathematical phenomena”(1.0, ⇒p.8), “Advanced Soil Mechanics”(1.0, ⇒p.11)

**Relational Lecture)** “Methods for analysis of mathematical phenomena”(0.5, ⇒p.8), “Advanced Soil Mechanics”(0.5, ⇒p.11)

**Requirement)** Fundamental of differential/integral calculus and linear algebras are required.

**Notice)** Homework for 8 hours before and after the class for 4 hours is required.

**Goal)**

1. To understand the fundamental equations governing deformation/failure of ground and their finite element formulations
2. To understand the mechanical properties of soil and their elasto-plastic models
3. To understand the numerical methods of the finite element method incorporated with the elasto-plastic models

**Schedule)** 1. Introduction 2. Porous media theory 3. balance equations (1) 4. Balance equations (2) 5. Constitutive equations 6. Governing equations 7. Weak forms (1) 8. Weak forms (2) 9. Time integration 10. Newton-Raphson method 11. Newton-Raphson method (Exercise 1) 12. Newton-Raphson method (Exercise 2) 13. Linearization of weak forms (1) 14. Linearization of weak forms (2) 15. Finite element formulation (1) 16. Linearization of weak forms (2) 17. Nnumerical analysis (Exercise 1) 18. Nnumerical analysis (Exercise 2) 19. Elasto-plastic model (1) 20. Elasto-plastic model (2) 21. Fundamental mechanical property of soil 22. Elasto-plastic model of soil (1) 23. Elasto-plastic model of soil (2) 24. Elasto-plastic model of soil (3) 25. Two dimensional analysis (1) 26. Two dimensional analysis (2) 27. Two dimensional analysis (3) 28. Two dimensional analysis (4) 29. Numerical analysis (Exercise 1) 30. Numerical analysis (Exercise 2) 31. Numerical analysis (Exercise 3) 32. Numerical analysis (Exercise 4)

**Evaluation Criteria)** The Score is calculated by the efforts such as exercises and reports, and higher than 60 percent passes the grade.

**Textbook)** The text book is given in the class.

**Reference)** The text book is given in the class.

**Webpage)** <https://uls.is.tokushima-u.ac.jp/u-learning/index.php>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216617>

**Student)** Students in other courses can take this lecture.

**Contact)**

- ⇒ Uzuoka (A401, +81-88-656-7345, [uzuoka@ce.tokushima-u.ac.jp](mailto:uzuoka@ce.tokushima-u.ac.jp)) (Office Hour: Monday, afternoon)
- ⇒ Ueno (A504, +81-88-656-7342, [ueno@ce.tokushima-u.ac.jp](mailto:ueno@ce.tokushima-u.ac.jp)) (Office Hour: 学科の掲示を参照のこと)

## Advanced Earthquake Engineering

2 units (selection)

Atsushi Mikami · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn fundamental knowledge in Earthquake Engineering.

**Outline)** To provide students with fundamental knowledge in Earthquake Engineering including (1) Seismology (2) Ground Motion (3) Finite Element Analysis.

**Style)** Lecture

**Keyword)** *seismology, wave propagation theory, ground motion, finite element analysis*

**Relational Lecture)** “Advanced Structural Dynamics”(0.5, ⇒p.6)

**Requirement)** Fundamental knowledge of dynamics of structures

**Goal)** To understand fundamental knowledge in earthquake engineering

**Schedule)** 1. Introduction 2. Earthquake Mechanism 3. Fault Model 4. Propagation of Seismic Waves 5. Surface Ground Motions 6. Probabilistic Analysis Methods for Input Ground Motion 7. Synthesis and Simulation Methods Stochastic for Input Ground Motion 8. Microtremor Measurements and Analysis 9. Seismic Response of SDOF 10. Seismic Response of SDOF 11. Seismic Response of MDOF 12. Seismic Response of MDOF 13. Seismic Response of MDOF 14. Kinematic Soil-Structure Interaction 15. Inertial Soil-Structure Interaction 16. Seismic Soil-Structure Interaction

**Evaluation Criteria)** Evaluation by Reports, Minimum Requirement=60%

**Textbook)**

- ◇ Introduction to seismic spectral analysis
- ◇ Finite Element Method

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216748>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Mikami (A512, +81-88-656-9193, [amikami@ce.tokushima-u.ac.jp](mailto:amikami@ce.tokushima-u.ac.jp)) (Office Hour: Friday, 16:00-19:00 (or by appointment))

## Advanced reinforced concrete engineering

4 units (selection)

Takao Ueda · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Takeshi Watanabe · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The objective of this subject is to understand the recent technology on methods of structural analysis of reinforced concrete structures and the recent technology on maintenance of reinforced concrete structures.

**Outline)** It is important that understanding the new type structures, the design method and the analytical method of concrete structures to realize a durable, safe and low-priced concrete structure. In this lecture, the realizing method of high performance concrete structures and the application of finite element method for concrete structures is explained, including the new type structures, application of new materials for concrete structures, PRC structures, the durability design and the slife cycle design. A lecture items is as follows. 1. Deterioration mechanism RC structures. 2. Evaluation of durability of RC structures. 3. Repair method of RC structures. 4. Programming of bending analysis for RC and PRC structures using the fiber model. 5. Basic concept of durability design. 6. Basic concept of life cycle design. 7. Engineering ethics for civil engineers.

**Style)** Lecture and exercise, Practice

**Keyword)** *programming of bending analysis, new materials nad new construction methods, field visit, deterioration mechanism, evaluation of durability, repair method, life cycle design*

**Requirement)** It is necessary for students to learn the basic attainments on the concrete technology and reinforced concrete mechanics.

**Notice)** Each subject is lectured for 180 minutes such as two times as the lecture’s time of usually other subject. So be careful.

**Goal)**

1. The purpose is to understand the recent technology on methods of structural analysis of reinforced concrete structures and the recent technology on materials and construction methods concerned with reinforced concrete structures.
2. The purpose is to understanding the recent technology on maintenance of concrete structures.

**Schedule)** 1. Guidance and Programming of bending analysis for RC and PRC structures using the fiber model (1). 2. Programming of bending analysis for RC and PRC structures using the fiber model (2). 3. Recent technology on application of the new materials for reinforced concrete structures(1). 4. Recent technology on application of the new materials for reinforced concrete structures(2). 5. Recent technology on the new construction methods for reinforced concrete structures(1). 6. Recent technology on the new construction methods for reinforced concrete structures(2). 7. Field visit. 8. Engineering ethics in practice the case study approach on construction of concrete structures. 9. Deterioration mechanism of reinforced concrete structures (1). 10. Deterioration mechanism of reinforced concrete structures (2). 11. Evaluation of durability of reinforced concrete structures (1). 12. Evaluation of durability of reinforced concrete structures (2). 13. Repair method of reinforced concrete structures (1). 14. Repair method of reinforced concrete structures (2). 15. Life cycle design of reinforced concrete structures. 16. Preliminary

**Evaluation Criteria)** Evaluate by reports for each subject.

**Textbook)**



- ◇ Handout of photo copying materials for each subject (Hashimoto).
- ◇ Infrastructure Maintenance Engineering, University of Tokyo Press (Ueda)

**Reference)** Standard Specifications for Concrete Structures, "Maintenance"

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216775>

**Contact)**

- ⇒ Ueda (A502, +81-88-656-2153, ueda@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)
- ⇒ Watanabe (A506, +81-88-656-7320, watanabe@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

## Advanced Lecture in Technical English

4 units (selection)  
Teacher of course

**Target)** The purpose of this subject is to develop the ability of reading comprehension of English technical papers of each special field.

**Outline)** First, a technical paper of each special field is selected by students according to their teacher's instruction. Next, understanding of selected paper and translation of it into Japanese are made. Finally, translation reports are submitted and presented to their respective teachers. Number of papers selected in each semester is one.

**Style)** Portfolio

**Keyword)** *technical English, reading comprehension, translation into Japanese*

**Fundamental Lecture)** "Introduction to Technical English"(0.5)

**Relational Lecture)** "Advanced Civil and Environmental Engineering Seminar"(0.5, ⇒p.15)

**Requirement)** Students are required to have fundamental knowledge of English.

**Goal)** To translate English technical papers of each special field into Japanese.

**Schedule)** 1. Guidance 2. Selection of a technical English paper in the first semester. 3. Reading comprehension and translation into Japanese. 4. Submission of translation report 1. 5. Oral examination 1. 6. Selection of a technical English paper in the second semester. 7. Reading comprehension and translation into Japanese. 8. Submission of translation report 2. 9. Oral examination 2.

**Evaluation Criteria)** Both of the reports(No.1 & No.2) are marked out of 50 and those marks are summed up. The passing mark is 60.

**Textbook)** Tech Talk Pre-Intermediate (Oxford University Press)

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216614>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Committee Member of School Affair

## Technical English Conversation

2 units (selection)

Angus McDonald-Alexander · FOREIGN TEACHER / マックインガリッジスクール

Atsushi Mikami · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this subject is to develop technical English conversation ability of students who aim to be an international engineers.

**Outline)** Lecture and exercise on technical English conversation are given by a foreign teacher. In addition, preparation for TOEIC is partially included in this class.

**Style)** 英語 (Speaking 中心)

**Keyword)** *technical English, English conversation, TOEIC*

**Fundamental Lecture)** "Introduction to Technical English"(0.8)

**Relational Lecture)** "Advanced Civil and Environmental Engineering Seminar"(0.5, ⇒p.15)

**Requirement)** Not specified.

**Goal)** To be fairly good at speaking English as a future engineer.

**Schedule)** 1. Introduction and pre-course test. 2. First meeting and spelling 3. Saying what you want. 4. E-mail addresses and telephone messages 5. Describing controls, facilities and tests 6. Describing features, materials, shapes 7. Explaining what things do and dimensions. 8. Tools and equipment 9. Warning signs 10. Locating things 11. Suggesting solutions 12. Work tasks 13. Explaining functions 14. Reporting damage 15. Describing a project 16. Test

**Evaluation Criteria)** Based on attendance and test score.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216613>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Mikami (A512, +81-88-656-9193, amikami@ce.tokushima-u.ac.jp) (Office Hour: Friday 9:30~ 11:00)

**Note)** English-Japanese and Japanese-English dictionaries should be brought without fail.

## Advanced Structural Design

2 units (selection)

Fumiaki Nagao · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Minoru Noda · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this class is to evaluate the safety of structures based on the probabilistic models for static and dynamic loads and resistance variables and structural reliability theories

**Outline)** The probabilistic models for static and dynamic loads and resistance variables, some structural reliability theories and outlines of recent topics to structural design are explained.

**Style)** Lecture

**Keyword)** *safety of structures, probabilistic models for loads, structural reliability theories*

**Relational Lecture)** "Advanced Structural Dynamics"(0.5, ⇒p.6)

**Goal)** To understand the safety of structures

**Schedule)** 1. probabilistic models for static and dynamic loads and resistance variables 1 2. probabilistic models for static and dynamic loads and resistance variables 2 3. probabilistic models for static and dynamic loads and resistance variables 3 4. probabilistic models for static and dynamic loads and resistance variables 4 5. probabilistic models for static and dynamic loads and resistance variables 5 6. limit state of structures 1 7. limit state of structures 2 8. evaluation of structural safety 1 9. evaluation of structural safety 2 10. evaluation of structural safety 3 11. evaluation of structural safety 4 12. evaluation of structural safety 5 13. recent topics to structural design 1 14. recent topics to structural design 2 15. recent topics to structural design 3

**Evaluation Criteria)** evaluated by attitude in class (80%) and reports (20%)

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216638>

**Contact)**

- ⇒ Nagao (A515, +81-88-656-9443, fumi@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)
- ⇒ Noda (A514, +81-88-656-7323, noda@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

## Urban and Regional Planning

2 units (selection)

Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The concept and technique to describe not only the vision but also design in the future urban and regional plan are lectured.

**Outline)** The technique of urban and regional planning is explained using various materials in practical planning. The debate is introduced to develop the ability in design of planning for students.

**Style)** Lecture and exercise

**Keyword)** *urban and regional planning, proposition of vision, planning design*

**Fundamental Lecture)** “Advanced Environmental Systems Engineering”(0.2, ⇒p.33)

**Relational Lecture)** “Information Engineering of Regional Environment”(0.8, ⇒p.15)

**Requirement)** 特になし

**Notice)** 特になし

**Goal)** To understand the concept and technique to describe the future urban and regional plan.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of urban planning 3. Examples of regional planning 4. Planning and law 5. Examples of application of law 6. Economic analysis in planning (Theory) 7. Economic analysis in planning (Application) 8. Concept of systems analysis in planning 9. Application of systems analysis in planning 10. Explanation of Exercise 11. Exercise of planning 1 12. Exercise of planning 2 13. Presentation of planning 14. Discussion about the future of region 15. Discussion about the vision of region

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Webpage)** <http://www.eco.tokushima-u.ac.jp/w3/kondo/top/index.htm>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216799>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp) (Office Hour: 月曜日9-10校時)

**Note)** 特になし

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## Advanced building construction

2 units (selection)

Shoji Miyamoto · PART-TIME LECTURER

**Target)** The purpose of this subject is to learn the bases of structure design calculation and seismic safety evaluation of a building construction.

**Outline)** In this subject, invited extraordinary lecturer, who is a first class authorized practical architect and builder, introduces design calculation and seismic safety evaluation of a building construction.

**Style)** Lecture

**Keyword)** *design calculation, seismic safety evaluation*

**Fundamental Lecture)** “Introduction of Architecture”(0.5), “Architectural Environmental Engineering”(0.5), “Architectural Planning”(0.5)

**Relational Lecture)** “Advanced Fracture and Structural Mechanics”(0.5, ⇒p.7)

**Requirement)** Student are required to have a good understanding of undergraduate-level structure mechanics.

**Goal)** To understand the bases of design calculation and seismic safety evaluation of a building

**Schedule)** 1. Guidance/Introduction 2. Basis of design calculation (part 1) 3. Basis of design calculation (part 2) 4. Basis of design calculation (part 3) 5. Basis of design calculation (part 4) 6. Basis of design calculation (part 5) 7. Basis of design calculation (part 6) 8. Basis of design calculation (part 7) 9. Basis of seismic safety evaluation (part 1) 10. Basis of seismic safety evaluation (part 2) 11. Basis of seismic safety evaluation (part 3) 12. Basis of seismic safety evaluation (part 4) 13. Basis of seismic safety evaluation (part 5) 14. Basis of seismic safety evaluation (part 6) 15. Basis of seismic safety evaluation (part 7) 16. Assignment of term paper

**Evaluation Criteria)** Assignments count 100%

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216645>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Miyamoto(s.miyamoto@viola.ocn.ne.jp)

⇒ SAto(A511, sato@ce.tokushima-u.ac.jp)

⇒ Nariyuki (A510, +81-88-656-7326, nariyuki@ce.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

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## Principles of Disaster Risk

2 units (selection)

Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand concept of risk, risk management, damage reducing measure ability to natural disaster

**Outline)** To understand historical earthquakes and tsunamis, characteristics of earthquake and tsunami, prediction of damage, to cultivate presentation skill and debate ability.

**Keyword)** *earthquakes and tsunamis, disaster prevention assessment, risk management*

**Relational Lecture)** “Principle of Environmental Risk”(0.5)

**Goal)** Training-up of technical knowledge to the natural disaster, the basic knowledge which can correspond to the risk management and the crisis management

**Schedule)** 1. Historical Earthquakes in Japan 2. Historical Tsunamis in Japan 3. Characteristics of Earthquake 4. Characteristics of Tsunami 5. Generation Characteristics of Nankai Earthquake 6. Generation Characteristics of Nankai Earthquake and Tsunami 7. Disaster Prevention for Earthquakes and Tsunamis 8. Disaster Prevention Assessment for Earthquakes and Tsunamis 9. What is Risk Management? 10. Practice of Risk Management for Earthquakes and Tsunamis(1) 11. Practice of Risk Management for Earthquakes and Tsunamis(2) 12. Presentation of Tsunami Risk Assessment 13. Study tour: The January 17, 1995 Hyogoken-Nanbu earthquake 14. Study tour: Nankai Earthquake in Tokushima 15. Study tour: Tokushima Disaster Prevention Center

**Evaluation Criteria)** Assignments Count 100%

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216659>

**Student)** To be limited to students of course

**Contact)**

⇒ Kozuki (Eco505, +81-88-656-7335, kozuki@eco.tokushima-u.ac.jp) (Office Hour: 火曜日, 14:35 から 16:05, 18:00 から 19:30)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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## mitigation engineering

2 units (selection)

Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Takashi Nakanishi · PART-TIME LECTURER / 総合科学職, Ken Hirai · PART-TIME LECTURER / 非常勤講師

**Target)** To understand the background and the significance of mitigation and to acquire fundamental principles of mitigation technique.

**Outline)** To explain concept, history, technology and examples of mitigation for national land development and global environment problems

**Style)** Lecture

**Keyword)** *mitigation, coastal environment, ecosystem, environmental restoration*

**Fundamental Lecture)** “Principles of Disaster Risk”(1.0, ⇒p.14), “Urban and Regional Planning”(1.0, ⇒p.13)

**Relational Lecture)** “Advanced Environmental Ecology”(0.5, ⇒p.11), “Advanced Environmental Systems Engineering”(0.5, ⇒p.33)

**Goal)** To acquire ideas and fundamental of mitigation

**Schedule)** 1. Introduction 2. Deterioration of coastal environment 3. Mitigation for coastal environment(1) 4. Mitigation for coastal environment(2) 5. Mitigation for coastal environment(3) 6. Mitigation for coastal environment(4) 7. Environmental Risk 8. Mitigation of global environment problems(1) 9. Mitigation of global environment problems(2) 10. Discussion: Mitigation for land development(1) 11. Discussion: Mitigation for land development(2) 12. Discussion: Mitigation for land development(3) 13. Discussion: Mitigation for land development(4) 14. Discussion: Mitigation for land development(5) 15. Examination 16. Discussion

**Evaluation Criteria)** Evaluate learning results by reports, debates and examination

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216894>

**Contact)**

⇒ Yamanaka (総合研究実験棟 (エコ棟)504 号室, +81-88-656-7334, yamanaka@eco.tokushima-u.ac.jp)  
(Office Hour: Tuesday 14:35-17:50)

**Note)** Preparation (2 hours) and review (2 hours) is required for each class.

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### Information Engineering of Regional Environment

2 units (selection)

Masashi Okushima · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The information of regional environment, technique of analysis and information management are explained. The method and technique using for application of environmental information to development of regional policies are lectured.

**Outline)** The information of regional environment, technique of analysis, information management and geographic information system are explained using the various kinds of materials and examples in practical planning.

**Style)** Lecture and exercise

**Keyword)** *information of regional environment, technique of analysis*

**Relational Lecture)** “Urban and Regional Planning”(0.8, ⇒p.13), “Advanced Environmental Systems Engineering”(0.2, ⇒p.33)

**Requirement)** 特になし

**Notice)** Please download files for this lecture from u-learning system, print out and take to the lecture room. The materials are not distributed in the lecture.

**Goal)** To obtain the knowledge of the information of regional environment, technique in survey, information management and computer aid systems, and apply them to design of regional plan and political simulation.

**Schedule)** 1. Bayes's theorem 2. discrete choice analysis 3. expert system 4. fuzzy reasoning 5. neural network 6. genetic algorithm 7. decision tree 8. analytic hierarchy process 9. fuzzy integration 10. game theory 11. evolution game theory 12. reinforcement learning 13. complex system 14. presentation of results of exercise : part 1 15. presentation of results of exercise : part 2

**Evaluation Criteria)** Evaluation of calculation exercises and final presentation count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Webpage)** <http://uls01.ulc.tokushima-u.ac.jp/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216753>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Okushima (ECO 603, +81-88-656-7340, okushima@eco.tokushima-u.ac.jp)

**Note)** 特になし.

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### Advanced Civil and Environmental Engineering Seminar

4 units (compulsory)

Teacher of course

**Target)** The first purpose of this subject is to obtain the fundamental knowledge regarding research theme and develop the abilities to find and solve problems and present the results of research. The second one is to improve the ability to communicate in English by taking TOEIC.

**Outline)** Papers regarding research theme are read. The reports on contents of those papers are submitted to your own teachers. The contents of those reports are presented at seminars. In addition, taking TOEIC is required.

**Style)** Portfolio

**Keyword)** *civil and environmental engineering, paper, seminar, TOEIC*

**Relational Lecture)** “Technical English Conversation”(0.5, ⇒p.13), “Advanced Lecture in Technical English”(0.5, ⇒p.13)

**Notice)** Students should follow their own teacher's advices on how to find papers to be read and schedule for seminars and promptly inform their own teachers of scores on TOEIC every time without fail.

**Goal)**

1. To obtain the fundamental knowledge regarding research theme and the presentation ability.
2. To get a larger score on TOEIC than criteria set separately by specified course.

**Schedule)** 1. Guidance 2. Seminar on research theme 3. TOEIC

**Evaluation Criteria)** Attainment level of goal 1 is evaluated by presentations and submitted materials in seminars and passing mark is 60%. Attainment level of goal 2 is evaluated from the score on TOEIC and passing mark is 60%. To get credits of this subject, it is necessary to pass both criteria. Grade is finally calculated by summing both marks with the weights of 60% and 40%, respectively.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216644>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nariyuki (A510, +81-88-656-7326, nariyuki@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

⇒ Committee Member of School Affair

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### Advanced Civil and Environmental Engineering Exercise

4 units (compulsory)

Teacher of course

**Target)** The purpose of this subject is to obtain deeper knowledge of related phenomena and develop the abilities to find and solve problems and creativity through some exercises toward each Master's thesis.

**Outline)** Exercises for discovering and solving various problems related to research theme are performed.

**Style)** Portfolio

**Keyword)** *exercise, discovery of problem, solution of problem, civil and environmental engineering*

**Goal)** To understand how to discover and solve problems regarding research theme.

**Schedule)** 1. Guidance 2. Discovery of problems 3. Investigation on the method for solving problems 4. Report

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216639>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Committee Member of School Affair

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### Advanced Civil and Environmental Engineering Laboratory

4 units (compulsory)

Teacher of course

**Target)** The purpose of this subject is to obtain deeper knowledge of related phenomena and develop the abilities to find and solve problems and creativity through some experiments and investigations toward each Master's thesis.

**Outline)** Experiments and investigations are performed toward Master's thesis.

**Style)** Portfolio

**Keyword)** *experiment, investigation, Master's thesis*

**Goal)** To understand how to discover and solve problems regarding research theme.

**Schedule)** 1. Guidance 2. Discovery of problems 3. Designs of experiments and Investigations 4. Experiments and Investigations 5. Report (Master's thesis)

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216643>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Committee Member of School Affair

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**Advanced Internship on Civil and Environmental Engineering** 4 units (selection)  
Teacher of course

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**Target)** To make clear images on future jobs from wider aspects and increase knowledge and technical skill to the levels applicable in actual scenes.

**Outline)** Actual works at out of the university such as research institutes, governmental office, private enterprise, etc. are experienced for 180 hours. Students who want to take an exam of registered architect need to execute practical training about architectural design or construction management in company or governmental office.

**Style)** Portfolio

**Keyword)** *internship, extension, special knowledge, special technique*

**Notice)** Propriety and place of practice must be decided after a consultation with a supervisor.

**Goal)** To master practical knowledge and technical skill.

**Schedule)** 1. Guidance 2. Consultation with supervisor about practice 3. Practical Exercise 4. Report 5. Presentation

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216640>

**Student)** Able to be taken by only specified class(es)

**Contact)**

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**Note)** Practice place of students who want to take an exam of registered architect is company or governmental office which is possible to work about architectural design or construction management. Advisor of the case is first-class registered architect who is recognized by the department.

## Intelligent Structures and Mechanics Systems Engineering — Mechanical Engineering

### SYLLABUS OF SUBJECTS

● *Integrated Subjects*

<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和.....	17
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business.....	18
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer.....	18
<b>Long-term Internship (M)</b> ...Yamanaka .....	18
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · Part-time Lecturer.....	19
<b>International Advanced Technology and Science 1</b> ...Murakami.....	19
<b>International Advanced Technology and Science 2</b> ...Murakami.....	19
<b>Presentation Method (M)</b> ...Graduate School of Advanced Technology and Science.....	19
<b>Internship (M)</b> .....	20
<b>Venture Business (M)</b> .....	20

● *Common Subjects*

<b>Applied Fluid Dynamics</b> ...Ishihara · Shigemitsu .....	20
<b>Advanced Applied Dynamics of Machine</b> ...Hino .....	20
<b>Advanced Fracture and Structural Mechanics</b> ...Murakami · Yonekura .....	21
<b>Physical properties of materials</b> ...Okada · Nishino .....	21
<b>Project Management</b> ...Namerikawa · Morimoto .....	21

● *Departmental Subjects*

<b>Quantum mechanics and advanced lecture in quantum physics</b> ...Michihiro.....	22
<b>Superconductivity and superconducting materials</b> ...Kishimoto.....	22
<b>Advanced Computational Science</b> ...Takeuchi .....	22
<b>Methods for analysis of mathematical phenomena</b> ...Imai · Jin .....	22
<b>Solid State Ionics</b> ...Nakamura .....	23
<b>Solid Mechanics</b> ...Oishi .....	23
<b>Material Engineering</b> ...Yoshida · Takagi .....	23
<b>Fluids Energy Conversion Engineering</b> ...Fukutomi · Ichimiya .....	23
<b>Advanced thermodynamics</b> ...Suekane · Kiyota.....	24
<b>分子エネルギー遷移論</b> ...Deguchi.....	24
<b>System Design</b> ...Konishi .....	24
<b>Energy Conversion System</b> ...Nada.....	25
<b>Digital Control Theory</b> ...Mizutani.....	25
<b>Actuator Control Theory</b> ...Miwa.....	25
<b>Measurement Science and Technology</b> ...Iwata · Ukida .....	26

**Theory and Application of Non-traditional Machining and Metal Forming Processes** ... Ishida · Nagamachi  
26

**Production and Manufacturing System** ...Tada.....26

**Precision Machinery** ...Yasui · Kusaka .....

**Micro-Nano Engineering** ...Part-time Lecturer .....

**Advanced Lecture on Semiconductor Nanotechnology** ...Isu · Kitada .....

● *Specialized Exercise and Experiments*

**Seminar on Mechanical Engineering** ...Teacher of course.....27

**Exercise on Mechanical Engineering** ...Teacher of course.....27

**Mechanical Engineering Laboratory** ...Teacher of course.....28

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### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style** Lecture

**Keyword** *intellectual property, patent law, protect and use of intellectual property*

**Requirement** No requirement

**Notice** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook** To be used textbooks made by lecturers.

**Reference** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student** For the course students and other graduate school students.

**Contact**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14年から16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もあるので、くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword) management, management of technology**

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.18), "Long-term Internship (M)"(0.5, ⇒p.18), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.19), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda" "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))  
⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

### Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考>平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル)上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日)上勝学舎(第1回~第12回)○集中講義-2(ICTビジネスモデル) \* 12月21日(火)常三島キャンパス(第13回~第15回)○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ごう奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究院) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇<http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be surthorized. The report and portfolion on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, profolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of thechnology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Applied Fluid Dynamics

2 units (selection)

Kunihiko Ishihara · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Toru Shigemitsu · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This theme is concerned with Flow-induced vibration and noise. The aim of this theme is to understand the generation mechanism and to learn the prediction and countermeasure techniques

**Outline)** In application of fluid dynamics, there are two aspects such as the performance and safety of turbomachines. This theme discusses how the fluid dynamics is applied to the safety design about several examples described below. 1. Vibration of turbomachine blade, 2. Flow-induced vibration of structures in a piping system. 3. Vibration of heat exchanger tube bundles, 4. Aeroacoustics, 5. Self sustained tone, etc. The aim of this theme is to understand their generation mechanisms and to train the ability of obtaining the countermeasure's plan

**Keyword)** *aeroacoustics, flow-induced vibration, self-sustained tone, noise*

**Relational Lecture)** "Energy Conversion System"(0.5, ⇒p.25), "Advanced Applied Dynamics of Machine"(0.5, ⇒p.20)

**Requirement)** Fundamental knowledge of fluid dynamics and vibration engineering is necessary

**Notice)** not specified

**Goal)** training of researcher and engineer in an enterprise

**Schedule)** 1. Guidance(Flow-induced vibration and noise) 2. Fundamental knowledge of acoustics(1)(Nature of sound) 3. Fundamental knowledge of acoustics(2)(Distant attenuation of sound) 4. Fundamental knowledge of acoustics(3)(Diffraction of sound) 5. Intermediate test(1) and samarise 6. Aeroacoustics(1) (Present state of investigation of aeroacoustics) 7. Aeroacoustics(2) (Kind of aeroacoustics and basic equation) 8. Aeroacoustics(3) (Prediction method of sound from cylindrical body) 9. Aeroacoustics(4) (Prediction method of sound from plate) 10. Intermediate test(2) and samarise 11. Flow-induced vibration(1) (Examples of trouble) 12. Flow-induced vibration(2) (Cause of vibration of cylindrical structure) 13. Flow-induced vibration(3) (Shirking of self excited vibration) 14. Flow-induced vibration(4) (Steady drag force and random vibration) 15. Flow-induced vibration(5) (Vibration of tube array) 16. Final test

**Evaluation Criteria)** average of tests (1)~ (3) and reports are summed with the weights of 7 and 3, respectively, and the passing mark is 60%.

**Textbook)** prints

**Reference)** not specified

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216578>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ishihara (M518, +81-88-656-7366, ishihara@me.tokushima-u.ac.jp) (Office Hour: 木曜日 17:00~ 18:00)

### Advanced Applied Dynamics of Machine

2 units (selection)

Junichi Hino · PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The basic technologies which evaluate and control dynamic behavior of mechanical systems and their applied technologies are made to master.

**Outline)** The theoretical and experimental modal analysis methods to grasp dynamic properties of structures and derive mathematical models are studied. In recent vibration analysis, the vibration analysis procedures with computers are of increasing importance. The algorithms to solve eigenvalue problems and numerical Integration methods of ordinary differential equations are introduced. Subsequently, active and passive vibration control methods of mechanical systems are studied are lectured.

**Style)** Lecture

**Keyword)** *vibration analysis, modal analysis, vibration control*

**Requirement)** Students are required to have a good understanding of undergraduate-level applied mechanics and related subjects.

**Goal)**

1. To understand dynamic design method
2. To understand modal analysis
3. To acquire computer vibration analysis procedure
4. To understand vibration control method



**Schedule**) 1. Modeling of mechanical systems 2. Formulation of mechanical systems 3. Natural frequencies and mode shapes 4. Eigenvalue problem and solution 5. Computational analysis of mechanical systems; Runge Kutta Method 6. Computational analysis of mechanical systems; Newmark Method 7. Experimental modal analysis; Vibration testing 8. Experimental modal analysis Modal identification; SDOF Method 9. Experimental modal analysis Modal identification; MDOF Method 10. Active and passive control methods 11. Vibration control with a dynamic absorber 12. Vibration control and state equation 13. Vibration control, pole placement method 14. Vibration control, observer 15. Vibration control, optimal control 16. Examination

**Evaluation Criteria**) Assignments count 50% and examinations count 50%

**Textbook**)

- ◇ Printed synopses are used.
- ◇ To be introduced in the class

**Reference**) To be introduced in the class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216706>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Hino (M422, +81-88-656-7384, hino@me.tokushima-u.ac.jp) (Office Hour: monday 17.00-18.00)

## Advanced Fracture and Structural Mechanics

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Daisuke Yonekura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) Because the machine and structure should be safety, it is important to evaluate the stress distribution in front of the defect like crack which is in the component of machine. In Fracture Mechanics, the stress distribution is expressed by stress intensity factor,  $K$ . Also, the fracture of component depends on fracture toughness of material. In this lecture, it is explained that for the defect like crack, how the stress intensity factor is expressed. It is then mentioned that how the fracture is toughness evaluated. The students should submit the reports each exercises. Finally, the knowledge of safety design and fracture prevention for machine and structure can be mastered.

**Outline**) The purpose of fracture mechanics is the evaluation of the strength and fracture of machine and structure and then is the guarantee of safety of machine and structure. We should study the mechanical behavior of crack, the stress distribution in front of crack, the fracture analysis by fracture mechanics and the nonlinear mechanical behavior of elastic-plastic state. It is explained the theory of safety design and prevention of fracture for machine and structure.

**Keyword**) fracture, safety design, crack, machine/structure, stress intensity factor

**Relational Lecture**) “Solid Mechanics”(0.5, ⇒p.23), “Material Engineering”(0.5, ⇒p.23), “Physical properties of materials”(0.5, ⇒p.21)

**Goal**)

1. Concept of Fracture Mechanics
2. Application to fracture analysis of stress intensity factor
3. Concept of Fracture Toughness
4. Concept of J Integral

**Schedule**) 1. Introduction of linear fracture mechanics 2. Stress intensity factor 3. Fracture toughness and fracture analysis 4. Safety design of machine by fracture mechanics 5. Elastic-plastic deformation in front of crack tip 6. Linear and nonlinear fracture mechanics 7. Midterm examination 8. Concept of J integral 9. Evaluation method of J integral 10. Fracture toughness by J integral 11. Condition of fracture initiation 12. Stable and unstable fracture 13. Application of nonlinear fracture mechanics 14. Fracture analysis by nonlinear fracture mechanics 15. Summary 16. Final examination

**Evaluation Criteria**) Over 60% of group discussion, reports and examination

**Textbook**) Prints

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216811>

**Contact**)

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp) (Office Hour: Monday 16:00-17:00)

## Physical properties of materials

2 units (selection)

Tatsuya Okada · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Hideo Nishino · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) Electron microscopy, the most effective observation method of crystallographic defects which dominate mechanical properties of materials, is briefly described. Ultrasonic propagation phenomena depending on the elastic properties of materials and their applications are also described.

**Outline**) Mechanical properties of crystalline materials are dominated by microscopic lattice defects. In the first half of this lecture, transmission electron microscopy, a powerful experimental method for direct observation of microscopic defects in materials, is discussed. Emphasis is put on the understanding of crystal orientation determination from electron diffraction patterns, based on the idea of reciprocal lattice. In the last half of this lecture, basic properties of wave propagation for ultrasonic material characterizations are discussed. The aim of the lecture is to give ultrasonic propagation phenomena. Several theoretical deductions of the wave equation from the continuity equation, the Navier-Stokes equation, the equation of state and the energy conservation law, respectively, and wave simulations are also shown in the lecture.

**Style**) Lecture

**Keyword**) transmission electron microscopy

**Fundamental Lecture**) “Material Engineering”(1.0, ⇒p.23)

**Notice**) 2-hour study before and after each lecture is necessary.

**Goal**)

1. To understand the Ewald sphere construction for the analysis of electron diffraction patterns.
2. To understand the wave equation for 3-dimensional anisotropic solid material and computer simulation for wave-propagation.

**Schedule**) 1. Transmission electron microscope, Basic crystallography 2. Reciprocal lattice and diffraction 3. Indexing of electron diffraction pattern 4. Kikuchi pattern 5. Image from perfect crystal 6. Contrast from planar defects 7. Contrast from dislocations 8. Introduction of wave propagations and NDI techniques with ultrasounds 9. Displacement, stress and strain of 3-dimensional anisotropic solid material 10. Mathematical deduction of wave equation for 3-dimensional anisotropic solid material 11. Physical meanings of wave equation 12. Finite differential simulation of wave equation 13. Boundary descriptions for wave equation 14. Physics for ultrasonic guided waves 15. Mathematics for SH mode guided waves 16. Examination

**Evaluation Criteria**) Assignment 50%, Examination 50%

**Reference**) 坂著「結晶電子顕微鏡学」(内田老鶴圃)

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216672>

**Contact**)

⇒ Okada (M616, t-okada@me.tokushima-u.ac.jp)  
⇒ Nishino (M618, +81-88-656-7357, nishino@me.tokushima-u.ac.jp)

## Project Management

2 units (selection)

Susumu Namerikawa · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) The purpose of this lecture is to understand PMBOK (Project Management Body of Knowledge), which is global standard in project management.

**Outline**) This lecture is outlined as follows: A)Current of global standardize pivoted on U.S. in project management. B)PMBOK (Project Management Body of Knowledge), which is global standard in project management.

**Style**) Lecture

**Keyword**) PMBOK

**Fundamental Lecture**) “Construction Business Management”(0.2)

**Goal**) Understanding of project management body of knowledge

**Schedule**) 1. Guidance 2. Project and Project Management 3. Initiating Processes 4. Project Charter 5. Scope and WBS 6. Resource Planning and Estimate 7. Control of Project Planning 1 8. Control of Project Planning 2 9. Develop Project Planning 1 10. Develop Project Planning 2 11. Develop

Project Team 12. Performance Measurement Baseline 13. Change Control 14. Closing Processes 15. Professional Responsibility 16. Semester Examination

**Evaluation Criteria**) Achievement level of the target is evaluated by the semester examination. Score of 60points or over is required to clear the target.

**Textbook**) Textbook is introduced in the class. Related documents is distributed to students.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216875>

**Student**) Able to be taken by student of other department

**Contact**)

⇒ Namerikawa (A412, +81-88-656-9877, namerikawa@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示を参照すること)

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### Quantum mechanics and advanced lecture in quantum physics 2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) This class introduces the quantum mechanics.

**Outline**) Basics of quantum mechanics are introduced.

**Style**) Lecture

**Keyword**) *quantum mechanics*

**Goal**) To understand the outline of quantum mechanics.

**Schedule**) 1. Introduction 2. Variational method 3. Lagrangian 4. Hamiltonian 5. Poisson's bracket expression 6. Quantization 7. Operator 8. Wavefunction 9. Expectation value 10. Schrödinger equation 11. Example (1) the square well potential 12. Example (2) the linear harmonic oscillator 13. Angular momentum 14. Example (3) hydrogen atom 15. Heisenberg equation 16. Field quantization

**Evaluation Criteria**) Assignments count 100%.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216865>

**Contact**)

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

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### Superconductivity and superconducting materials 2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) To understand basics and recent developments in superconductivity.

**Outline**) This class reviews quantum mechanics and introduces superconductivity and recent superconducting materials.

**Style**) Lecture

**Keyword**) *superconductivity, Cooper pair, superconducting energy gap, density of states, anisotropic superconductivity*

**Goal**) To understand the outline of superconductivity.

**Schedule**) 1. Introduction to superconductivity 2. Review of quantum mechanics (1), Schrödinger equation and wave function 3. Review of quantum mechanics (2), operators and expected values 4. Review of quantum mechanics (3), perturbation theory 5. Free electron model of metals 6. Phenomenological theory of superconductivity 7. To understand Meissner effect on the basis of quantum mechanics 8. Formation of Cooper pair 9. Formation of superconducting energy gap 10. Density of states, and energy gap at finite temperatures 11. Introduction to Nuclear Magnetic Resonance method 12. Frontier of superconductivity (1), strong coupling superconductor 13. Frontier of superconductivity (2), heavy Fermion superconductor 14. Frontier of superconductivity (3), copper oxide high Tc superconductor 15. Summary

**Evaluation Criteria**) Reports on several subjects in the class.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216768>

**Contact**)

⇒ Yutaka Kishimoto (A202)

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### Advanced Computational Science 2 units (selection)

Toshiki Takeuchi · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) This class provides the basic technology for numerical calculation for the differential equation.

**Outline**) The numerical calculation methods for the differential equation are introduced.

**Style**) Lecture

**Keyword**) *numerical analysis, numerical computation, differential equation*

**Fundamental Lecture**) “Numerical Analysis”(1.0), “Basic Mathematics/微分積分学 I”(1.0), “Basic Mathematics/微分積分学 II”(1.0)

**Relational Lecture**) “Methods for analysis of mathematical phenomena”(1.0), “Numerical Analysis”(1.0)

**Requirement**) Students have to understand basic mathematics of undergraduate-level.

**Goal**) To understand principle of numerical calculation methods.

**Schedule**) 1. Introduction to numerical simulation 2. Mathematical model 3. Lagrange interpolation 4. Spline interpolation 5. Least squares method 6. Finite difference method 7. Arbitrary precision formula 8. Application to ordinary differential equation 9. Application to partial differential equation 10. Gauss-Seidel method 11. Successive Over-Relaxation method 12. Explicit method 13. Implicit method 14. Crank-Nicolson method 15. Numerical instabilities

**Evaluation Criteria**) Assignments count 100%

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216625>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Takeuchi (A206, +81-88-656-7544, takeuchi@pm.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00-15:00)

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### Methods for analysis of mathematical phenomena 2 units (selection)

Hitoshi Imai · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Cheng-Hai Jin · PROFESSOR / INTERNATIONAL CENTER

**Target**) To learn the to analyze the mathematical phenomena.

**Outline**) Methods used in analysis of mathematical phenomena are introduced. Especially, those in numerical analysis are focused on.

**Style**) Lecture

**Keyword**) *mathematics, numerical analysis*

**Fundamental Lecture**) “Numerical Analysis”(1.0)

**Relational Lecture**) “Advanced Computational Science”(0.5, ⇒p.55)

**Requirement**) Only the premise that have studied basic mathematics.

**Notice**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal**) Being able to understand a numerical scheme to one-dimensional boundary value problems for the Poisson equation

**Schedule**) 1. Introduction to computer 2. Common sense in numerical computation 3. High-speed computation (Parallel computing) 4. Finite difference method I 5. Finite difference method II 6. Finite difference method III 7. Finite difference method IV 8. Finite element method I 9. Finite element method II 10. Finite element method III 11. Finite element method IV 12. Boundary element method I 13. Boundary element method II 14. Boundary element method III 15. Iterative method

**Evaluation Criteria**) Evaluation by the report.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216712>

**Contact**)

⇒ Imai(A220, +81-88-656-7541, The inquiry by means of the cellular phone or E-mail is not acceptable) (Office Hour: Office hours: Thursday 14:00-15:00)

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## Solid State Ionics

2 units (selection)

Koichi Nakamura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces topics in solid state ionics, conduction mechanism in ionic conductors and techniques to study solid state ionics.

**Outline)** Basic experimental and theoretical approaches to understand solid state ionics are introduced and discussed in terms of "ion dynamic" in ionic/superionic conductors.

**Keyword)** *ionic conductor, ionic diffusion, secondary battery*

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand basic physical and chemical properties of ionic conductors.
2. To understand basic technique to study ionic conductors.

**Schedule)** 1. Introduction to solid state ionics 2. Band theory and conduction mechanism 3. Defect in Ionic crystal 4. Diffusion in solid 5. Diffusion mechanism in solid 6. Solid electrolyte - Oxides, Silver halide - 7. Solid electrolyte - Li compounds - 8. Mixed conductor 9. Electrical conductivity measurement 10. Electrical conductivity on ionic conductors 11. Nuclear Magnetic Resonance 12. Relaxation model in NMR 13. NMR on ionic conductors 14. Application - Ion secondary batteries - 15. Topics and Future in solid state ionics

**Evaluation Criteria)** Assignments count 100%.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216653>

**Contact)**

⇒ Nakamura (A216, koichi@pm.tokushima-u.ac.jp)

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## Solid Mechanics

2 units (selection)

Atsuya Oishi · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The aim of this lecture is to master the fundamentals of the finite element method, which is important in designing the strength of machines and structures.

**Outline)** Finite element formulations for heat conduction and stress problems are described, and numerical methods used in the finite element analyses are also described.

**Style)** Lecture and exercise

**Keyword)** *elasticity, finite element method*

**Fundamental Lecture)** "Mechanics"(1.0), "Numerical Analysis"(1.0), "Computational Mechanics"(1.0)

**Relational Lecture)** "Advanced Computational Science"(0.5, ⇒p.55), "Methods for analysis of mathematical phenomena"(0.5, ⇒p.22)

**Goal)**

1. To understand a finite element formulation of a heat conduction problem
2. To understand a finite element formulation for stress analysis
3. To understand various numerical methods for finite element analyses

**Schedule)** 1. Brief introduction to the finite element method 2. Finite element analysis of 1-D heat conduction problem 3. Finite element analysis of 2-D heat conduction problem 4. Formulation of 3-D stress analysis 5. Finite element analysis of 3-D stress problem 6. Fundamentals of computer science 7. Method of Numerical Integration (Newton-Cotes Integration Method) 8. Method of Numerical Integration (Gauss Integration Method) 9. Solution of a system of linear equations (Direct method) 10. Fast direct solvers 11. Solution of a system of linear equations (Iterative method) 12. Fast iterative solvers 13. Solution methods for large-scale problems 14. Mesh generation algorithms 15. Mesh generation and visualization algorithms 16. Final Examination

**Evaluation Criteria)** Assignment (30%), Examination(70%)

**Reference)**

- ◇ Theory of Elasticity 3rd, S.P.Timoshenko and J.N.Goodier, McGraw-Hill, 1970.
- ◇ O.C.Zienkiewicz and K.Morgan, Finite Elements & Approximation, Dover, 2006

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216655>

**Student)** only corresponding students for the course

**Contact)**

⇒ Oishi (M622, +81-88-656-7365, oishi@me.tokushima-u.ac.jp)

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## Material Engineering

2 units (selection)

Kenichi Yoshida · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Hitoshi Takagi · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class acquires the knowledge on solidification and growth, transformation, heat treatment, thermomechanical treatment in materials, material structure control and composite materials

**Outline)** Recent research development is remarkable in the material field. Solidification and growth of materials, transformation, heat treatment and thermomechanical treatment will be introduced from the point of engineering view based on material science. Also up-to-date topics will be lectured on material structure control and composite materials. Practices and reports will be imposed in each chapter to evaluate results of students. This subject is related to industrial problems.

**Style)** Lecture

**Keyword)** *the study of failure, material structure control, environment-friendly composites*

**Relational Lecture)** "Physical properties of materials"(0.3, ⇒p.21), "Theory and Application of Non-traditional Machining and Metal Forming Processes"(0.5, ⇒p.26)

**Requirement)** Students are required to be interested in materials and have the good understanding of material science in an undergraduate course.

**Goal)**

1. To understand the structural control of materials
2. To understand the mechanics of composites and the benign technology for environment

**Schedule)** 1. Introduction to the study of failure 2. Material engineering and ethics for engineers 3. Innovation of material processing toward environmentally benign society 4. Barrier-free processing and treatment of impurity elements 5. Construction of deformation process suppressing deteriorating effects of impurities in steel material 6. High-strain rate flexible forming of aluminum and magnesium alloys 7. Material structure control due to the thermomechanical treatment of steel materials 8. Up-to-date material structure control technology 9. Concept of composite materials 10. Characteristics of composite materials 11. Functions of composite materials 12. Rule of mixture (modulus of elasticity) 13. Rule of mixture (stress) 14. Environmental problem and recycle of composite material 15. Environment-friendly green composites 16. Regular test

**Evaluation Criteria)** Regular test result 100%

**Textbook)**

- ◇ Not used (Yoshida).
- ◇ Will be introduced in the class (Takagi).

**Reference)** Will be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216667>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yoshida (M619, +81-88-656-7358, yoshida@me.tokushima-u.ac.jp) (Office Hour: Thursday and Friday, 17:00 to 18:00)

⇒ Takagi (M620, +81-88-656-7360, takagi@me.tokushima-u.ac.jp) (Office Hour: Friday 17:00-18:00)

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## Fluids Energy Conversion Engineering

2 units (selection)

Junichiro Fukutomi · PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Masashi Ichimiya · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces united interpretation and manipulation for principles which dominates characteristics of turbomachinery which transforms dynamical energy in fluids to mechanical work. This class also aims to understand dynamics of viscous fluid which is fundamental to utilize fluid energy.

**Outline)** 1.Theoretical and experimental analysis method is introduced on flow condition of turbomachinery and its characteristic. 2.Dynamics of viscous fluid which is fundamental to utilize fluid energy is introduced.

Lecture heads are as follows. (1) Outline of fluid energy conversion, (2) Internal flow and performance of centrifugal turbomachinery, (3) Internal flow and performance of axial turbomachinery, (4) Anomalous phenomena of the turbomachinery, (5) Nature of viscous fluid, (6) Equations of motion for viscous fluid

**Style)** Lecture

**Keyword)** *viscous fluid, equation of motion, energy conversion, turbomachinery*

**Fundamental Lecture)** “Fluid Dynamics”(1.0), “Fluid Dynamics”(1.0), “Fluid Machinery”(1.0)

**Goal)** To understand the principle which dominate the characteristic of turbomachinery and dynamics of viscous fluid

**Schedule)** 1. Nature of viscous fluid 2. Motion of viscous fluid 3. Difference between viscous and inviscid fluids, cylinder in inviscid fluid 4. Difference between viscous and inviscid fluids, cylinder in viscous fluid 5. Similarity between viscous and inviscid fluids 6. Derivation of equations of motion for viscous fluid 7. Interpretation of equations of motion for viscous fluid 8. Summary and examination for viscous fluid 9. Hydrodynamics of centrifugal and diagonal turbomachinery 10. Hydrodynamics of axial turbomachinery 11. Characteristics of turbocharger for automobile 12. Numerical simulation of internal flow 13. Turbomachinery and noise 14. Anomalous phenomena of turbomachinery 15. One-dimensional flow of compressible fluid 16. Examination for turbomachinery

**Evaluation Criteria)** Examination for viscous fluid counts 50 points and examination for turbomachinery counts 50 points.

**Textbook)** Not used

**Reference)** Will be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216902>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Fukutomi (M519, +81-88-656-7367, fukutomi@me.tokushima-u.ac.jp)

⇒ Ichimiya (M520, +81-88-656-7368, ichimiya@me.tokushima-u.ac.jp) (Office Hour: 毎週火曜日, 17:00~18:00)

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## Advanced thermodynamics

2 units (selection)

Tetsuya Suekane · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Masanori Kiyota · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Quality of energy must be considered to promote effective utilization of energy as well as its quantity. Exergy is suitable for that purpose since it is based on the second law of thermodynamics. So understanding of exergy and its application to the practical systems are aimed to realize effective use of energy. The latter part is an introduction to energy and environmental problems in modern civilization based on enormous consumption of fossil fuel. Emphasis is placed on thermal engineering and fluid dynamical aspects of efficient utilization of energy and the relationship between global environment and material circulation.

**Outline)** Exergy analysis is used to realize effective use of energy. Exergy is stated and its use is illustrated by presenting some examples. Lecture items are 1)About exergy, 2)Exergy flow in the steam power plant, 3)Exergy of combustion process, 4)Exergy flow in the co-generation system. In the latter part, emphasis is placed on the relation among the society, civilization, economics and technology from the viewpoints of global warming and/or huge consumption of energy.

**Keyword)** *exergy, global warming on the earth, fossil fuels*

**Requirement)** The knowledge of engineering thermodynamics.

**Goal)**

1. Acquiring ability to apply exergy analysis to actual energy systems
2. Obtaining deeper understanding of entropy through examples of exergy analysis
3. Understandings of energy and environmental issues from global point of views.

**Schedule)** 1. About exergy 2. Conservation of exergy 3. Calculation of exergy 4. Exergy flow of steam power plant 5. Second law analysis of combustion process 6. Exergy of fuel 7. Exergy flow of co-generation systems (1) 8. Exergy flow of co-generation systems (2) 9. Environmental economics and sociology 10. History of the earth 11. Global warming and carbon emissions of anthropological activities 12. Conventional and un-conventional resources 13. Renewable energy 14. Carbon dioxide capture and storage 15. Waste management and material circulation 16. Final examination

**Evaluation Criteria)** Scores of reports and final test are used at a rate of 6 to 4.

**Textbook)** Manuscripts prepared by the lecturer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216810>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Suekane (M521, suekane@me.tokushima-u.ac.jp)

⇒ Kiyota (M522, kiyota@me.tokushima-u.ac.jp)

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## 分子エネルギー遷移論

2 units (selection)

Yoshihiro Deguchi · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the two- and three-dimensional steady-state heat conduction problems, a number of heat transfer problems in either periodic or transient temperature variations and phase change problem.

**Outline)** The key problem of heat transfer is to determine the rate of heat transfer at a specified temperature difference to estimate the cost, the feasibility and the size of equipment necessary to transfer a specified amount of heat in a given time. In this class, following the two- and three-dimensional steady-state heat conduction problems, a number of heat transfer problems in either periodic or transient temperature variations and phase change problem are explained.

**Style)** Lecture and exercise

**Keyword)** *multidimensional steady-state heat conduction, periodic heat conduction, heat transfer with phase change*

**Requirement)** Students are required to have a good understanding of undergraduate-level thermodynamics, hydrodynamics and related subjects.

**Goal)** To understand the solution of multidimensional steady-state heat conduction and heat transfer with phase change problems.

**Schedule)** 1. Recent topics on heat transfer 2. Multidimensional steady-state heat conduction problem (1) 3. Multidimensional steady-state heat conduction problem (2) 4. Quasi-steady-state heat conduction problem (1) 5. Quasi-steady-state heat conduction problem (2) 6. Unsteady-state heat conduction problem (1) 7. Unsteady-state heat conduction problem (2) 8. Unsteady-state heat conduction problem (3) 9. Boundary layer theory in laminar flow (1) 10. Boundary layer theory in laminar flow (2) 11. Boundary layer theory in laminar flow (3) 12. Heat transfer problem with phase change (1) 13. Heat transfer problem with phase change (2) 14. Heat transfer problem with phase change (3) 15. Heat transfer problem with phase change (4)

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216787>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Teacher of course

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしようとして授業を受けることが、授業の理解と単位取得のために必要である。

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## System Design

2 units (selection)

Katsunobu Konishi · PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces some representative methods for control system design and image recognition

**Outline)** System design is a process in which scientific principles and engineering tools are used to produce a plan which satisfy a human need. In this lecture, the control system design methods such as modeling, equations of motion, modal analysis, observer and controller, and the image recognition methods such as neural network, support vector machine, mean shift and sparse template are explained.

**Style)** Lecture

**Keyword)** *modeling, equation of motion, vibration control, neural network, support vector machine, mean shift, sparse template*

**Fundamental Lecture)** “Digital Control Theory”(1.0, ⇒p.25)

**Relational Lecture)** “Advanced Applied Dynamics of Machine”(0.5, ⇒p.20)

**Requirement)** Students are required to have a good understanding of undergraduate-level design engineering and automatic control theory.

**Goal)**

1. To understand the modeling and control methods for mechanical systems.
2. To understand the image recognition methods for object detection

**Schedule)** 1. Modeling 2. Equations of motion(1) 3. Equations of motion(2) 4. Modal analysis 5. Vibration control(1) 6. Vibration control(2) 7. Simulation 8. Intermediate examination 9. Basic image processing(1) 10. Basic image processing(2) 11. Basic image processing(3) 12. Image segmentation by mean shift 13. Object tracking by sparse template 14. Object detection by neural network 15. Object detection by HOG and SVM 16. Final examination

**Evaluation Criteria)** Evaluate based on two examinations and reports

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216683>

**Student)** 開講コース学生のみ受講可能

**Contact)**

⇒ Konishi (M423, +81-88-656-7383, konishi@me.tokushima-u.ac.jp)

## Energy Conversion System

2 units (selection)

Yuzuru Nada · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand principle of energy conversion and to consider improvement of energy conversion technologies on the point of saving energy consumption and decreasing environmental damages

**Outline)** Lecture on principle of energy conversion and its application, and on combustion mechanism and technologies of reducing toxic emissions of combustion engines as examples of energy conversion systems. This subject is concerned with industry.

**Style)** Lecture

**Keyword)** *energy conversion, environmental protection, combustion, energy resources, toxic emissions*

**Requirement)** None

**Notice)** None

**Goal)** To understand principle of energy conversion, environmental effect of energy conversion and present technologies of energy conversion, and to recognize the importance of improvement of energy conversion technologies against environmental protection

**Schedule)** 1. Present energy problem 2. Combustion chemistry 1 3. Combustion chemistry 2 4. Thermal and fluid dynamics in combustion phenomena 1 5. Thermal and fluid dynamics in combustion phenomena 2 6. Premixed combustion 1 7. Premixed combustion 2 8. Non-premixed combustion 1 9. Non-premixed combustion 2 10. Spray combustion 1 11. Spray combustion 2 12. Toxic emissions by combustion 1 13. Toxic emissions by combustion 2 14. Energy saving technologies (Present technologies) 15. Energy saving technologies (Future technologies)

**Evaluation Criteria)** Appraise the understanding of the content of the lecture by setting some reports

**Textbook)** Takashi Niioaka, “Fundamentals of Combustion Phenomena”

**Reference)** None

**Webpage)** <http://www.eco.tokushima-u.ac.jp/w3/miwa/index.html>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216569>

**Student)** Any students other than Ecosystem Engineering can attend this lecture.

**Contact)**

⇒ Nada (ynada@eco.tokushima-u.ac.jp)

**Note)** Need to submit some reports

## Digital Control Theory

2 units (selection)

Yasuhiro Mizutani · ASSOCIATE PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the fundamental concept of digital control and neural network that can be used to design the optimal control systems based on the modern control theory.

**Outline)** In this lecture the fundamental conception of a digital control system and digital control strategies to apply the modern control theory is presented. In particular, two freedom control and a neural network is explained. The recent topics related to control engineering are also introduced.

**Style)** Lecture

**Keyword)** *two freedom control, neural network, optimal control*

**Fundamental Lecture)** “Automatic Control theory 1”(1.0), “Automatic Control theory 2”(1.0)

**Relational Lecture)** “Actuator Control Theory”(0.5, ⇒p.25)

**Requirement)** Students are required to have a good understanding of undergraduate-level control theory and related subjects.

**Goal)**

1. To understand the outline of the digital control.
2. To understand the applications of AI, neural network and fuzzy control

**Schedule)** 1. Outline of digital control system 2. Difference of analog and digital control systems 3. Mathematical representation of control signal 4. Pulse transfer function 5. Stability and steady state deviation 6. Design of digital control system(PID) 7. Design of digital control system(two freedom control) 8. Design of digital control system(model prediction) 9. Intermediate examination 10. Outline of artificial intelligence 11. Exercise of artificial intelligence 12. Outline of neural network 13. Exercise of neural network 14. Outline of fuzzy theory 15. Exercise of fuzzy theory 16. Final examination

**Evaluation Criteria)** evaluate based on two examinations and reports.

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216774>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ lwata (M427, +81-88-656-9743, iwata@me.tokushima-u.ac.jp)

## Actuator Control Theory

2 units (selection)

Masafumi Miwa · ASSOCIATE PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the characteristics of actuators, the design methods of servo system.

**Outline)** The structure and function of actuators or control valves, the design of servo system, PWM control method, the practical and intelligent control algorithm are explained.

**Style)** Lecture

**Keyword)** *actuator, servo system, control algorithm*

**Relational Lecture)** “Digital Control Theory”(0.5, ⇒p.25), “Measurement Science and Technology”(0.5, ⇒p.26)

**Requirement)** Students are required to have a good understanding of undergraduate-level control engineering and related subjects.

**Goal)** To understand the design methods of servo system using actuators.

**Schedule)** 1. Outline of actuators 2. Micro-drive electromotive actuators 3. Electromotive actuators 4. Novel actuators 5. Hydraulic actuators 6. Hydraulic control valves 7. Hydraulic servo system 8. Pneumatic actuators 9. Pneumatic control valves 10. Pneumatic servo system 11. PWM control method 12. Model matching methods 13. Neural controller 14. Two-degree-of-freedom control method 15. Model driven control method 16. Examination

**Evaluation Criteria)** Assignments count 30 % and examination count 70 %.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216552>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Miwa (M420, +81-88-656-7387, miw@me.tokushima-u.ac.jp)

## Measurement Science and Technology

2 units (selection)

Tetsuo Iwata · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Hiroyuki Ukida · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To understand importance of the Fourier transformation for developing various kinds of measurement techniques, measurement equipments, measurement systems.

**Outline)** Among the various measurement techniques used in the fundamental and applied research, optical measurement methods including their principles, methodologies, instrumentations, and evaluation methods are reviewed. In the lecture, emphasized is the importance of the concept of the Fourier transformation to understand and to deal with linear systems in the modern scientific measurement system. Practical methods of object inspections, distance measurements, and shape reconstructions using images are also lectured.

**Style)** Lecture

**Keyword)** *measurement techniques, measurement devices, Fourier transform*

**Relational Lecture)** “Micro-Nano Engineering”(0.5, ⇒p.27), “Digital Control Theory”(0.5, ⇒p.25), “Actuator Control Theory”(0.5, ⇒p.25)

**Goal)**

1. 1. To understand Fourier series and Fourier transform.
2. 2. To understand relations among Fourier transform and measurement principles of scientific instruments.
3. 3. To understand techniques used with practicable various measurement devices.

**Schedule)** 1. Frequency response of the amplifier 2. Optical information processing 3. Fourier-transform infrared spectroscopy 4. Subfringe interferometry 5. Computed tomography 6. Sampling theorem and quantization theorem 7. Wavelet transformation 8. Lock-in amplifier and boxcar integrator 9. Optics for microscope 10. X-ray diffraction 11. Image measurement systems 12. Feature extraction from images 13. Binocular stereo method 14. Pattern projection 15. Shape from shading and texture 16. Examination

**Evaluation Criteria)** Assignments count 50% and examinations count 50%.

**Textbook)** Printed synopses are used.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216630>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Iwata (M427, +81-88-656-9743, iwata@me.tokushima-u.ac.jp)  
⇒ Ukida (M424, +81-88-656-9448, ukida@me.tokushima-u.ac.jp) (Office Hour: 毎週金曜日 17:00~ 18:00)

## Theory and Application of Non-traditional Machining and Metal Forming Processes

2 units (selection)

Tohru Ishida · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE  
Takuo Nagamachi · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The class introduces the principles, characteristics, and applications of representative methods of non-traditional machining. And then it introduces foundation of the numerical simulation by elastic and elasto-plastic finite element method and their application to metal forming processes.

**Outline)** In the former half of the class, non-traditional machining is discussed. Non-traditional machining has many kinds of methods which use a variety of principles. These methods are put in practical use and have their own particular merits and demerits. Therefore, to achieve efficient, desired machining, these methods must be suitably selected by taking shapes, dimensions, accuracy, surface quality, material, cost, environmental impact, and so on into consideration. To meet the requirements, the principles and characteristics of representative methods of non-traditional machining are introduced and the merits and demerits of them in applying them to machining of various metals are discussed. In the latter half of the class, metal forming processes are discussed. Although metal forming techniques are diverse, the primary objective is to produce a desired shape change. The major concerns of the engineer are the forces required for the operations and the properties of the work materials. Engineering plasticity and its application to metal forming processes are introduced.

**Style)** Lecture

**Keyword)** *Non-traditional Machining, finite element analysis*

**Relational Lecture)** “Production and Manufacturing System”(0.5, ⇒p.26)

**Requirement)** Students are required to have a good understanding of undergraduate-level mechanical engineering, physics, chemistry, and mathematics.

**Goal)** To understand the principles and characteristics of representative methods of non-traditional machining and foundation of the numerical simulation by elastic and elasto-plastic finite element method

**Schedule)** 1. Fundamentals of electrical discharge machining 2. Applications of electrical discharge Machining 3. Fundamentals of electrochemical machining 4. Applications of electrochemical machining 5. Laser beam machining 6. Electron beam machining and ion beam machining 7. Etching and ultrasonic machining 8. Exercise 9. Analysis principle of finite element method 10. Plane strain 11. Plane stress 12. Axial symmetry 13. Principle of virtual work 14. Triangle element 15. Quadrangle element 16. Plastic deformation

**Evaluation Criteria)** Assignments count 50% , exercises and examinations count 50%.

**Textbook)** Predistributed printed synopses are also used.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216623>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Ishida (ishidat@me.tokushima-u.ac.jp)  
⇒ Nagamachi (M524, ngmch@me.tokushima-u.ac.jp) (Office Hour: 毎週水曜日 17 時 ~ 18 時)

## Production and Manufacturing System

2 units (selection)

Yoshihiro Tada · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Work measurement based on predetermined time standard system for advanced manufacturing and production are introduced.

**Outline)** This class introduces basic-MOST for work measurement and determination of the standard time based on predetermined time standard system.

**Style)** Lecture

**Keyword)** *industrial engineering, work measurement, standard time*

**Relational Lecture)** “Theory of Plasticity and Application to Metal Forming Processes”(0.5)

**Requirement)** Students are required to have a good understanding on fundamentals of material processing technologies and manufacturing system.

**Notice)** Students are required to prepare and review the class

**Goal)** To understand the basic concepts and related aspects of work measurement and predetermined time standard system.

**Schedule)** 1. Introduction to work analysis 2. Work study and time study 3. Rating techniques 4. Predetermined time standard system 5. Fundamentals of MOST 6. General move sequence 7. Exercise of the general move sequence 8. Controlled move sequence 9. Exercise of the controlled move sequence 10. Analysis of continuous move 11. Exercise of continuous move 12. Tool use sequence 13. Exercise of the tool use sequence 14. Manual crane sequence 15. Exercise of the manual crane sequence 16. Examination

**Evaluation Criteria)** Exercises and assignments count 50%, and examination counts 50%.

**Textbook)** Printed synopses are used.

**Reference)** Work study, ISBN4-526-00084-1.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216592>

**Contact)**

- ⇒ Tada (M319, +81-88-656-7381, tada@me.tokushima-u.ac.jp)

**Note)** Students are required preparation (2 hours) and review (2 hours) for every two hours class work.

## Precision Machinery

2 units (selection)

Takeshi Yasui · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Kazuya Kusaka · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To understand the principles, applicability, and recent trend of two measurement techniques based on X-ray and THz wave for precise machinery.

**Outline)** In the first half of this lecture, we learn about residual stress measurement method by using X-ray diffraction. Large residual stresses in materials may sometime cause destruction or transformation. Therefore, a measurement of residual stress is important. THz wave, located at a boundary between optical and electric waves, has attracted attention as a new tool for precise machinery. In the later half, students learn THz instrumentation and metrology.

**Keyword)** X ray diffraction, X-ray stress measurement, THz spectroscopy, THz imaging

**Fundamental Lecture)** "Measurement Science and Technology"(1.0, ⇒p.26), "Material Engineering"(1.0, ⇒p.23)

**Relational Lecture)** "Physical properties of materials"(0.5, ⇒p.21), "Material Engineering"(0.5, ⇒p.23)

**Requirement)** To master Mechanical Measurement and Scientific Measurement in bachelor course

**Goal)**

1. Understanding of X-ray stress measurement
2. Understanding of THz instrumentation and metrology

**Schedule)** 1. X-ray diffraction (1) Characteristics of X-rays 2. X-ray diffraction (2) Crystal structures 3. X-ray diffraction (3) Diffraction by an atom and a small crystal 4. X-ray diffraction (4) Powder diffraction 5. X-ray stress measurement in poly-crystal material 6. X-ray stress measurement in textured material 7. Presentation of measurement example 8. Report and presentation 9. Introduction to THz technology 10. Generation of THz wave 11. Detection of THz wave 12. THz spectroscopy 13. THz imaging 14. THz applications 15. Report and presentation 16. Examination

**Evaluation Criteria)** Report & presentation 60%, examination 40%

**Textbook)** Printed synopses are used.

**Reference)** None

**Webpage)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=197328>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216739>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Yasui (M317, +81-88-656-7377, yasui@me.tokushima-u.ac.jp)  
 ⇒ Kusaka (M322, +81-88-656-9442, kusaka@me.tokushima-u.ac.jp)

**Target)** This class introduces basic principles of the semiconductor nanotechnology and their application to the quantum devices.

**Outline)** Basics of semiconductor physics and quantum mechanics are introduced to understand material properties of quantum confined nanostructures. Recent progress in fabrication techniques and device applications of semiconductor nanostructures (quantum wells, wires and dots) will be reviewed.

**Style)** Lecture

**Keyword)** quantum confined nanostructures, semiconductor nanoscience, electron devices, photonic devices

**Requirement)** None.

**Notice)** None.

**Goal)** To understand basic properties of semiconductor nanostructures and quantum devices.

**Schedule)** 1. Introduction to semiconductor nanostructures 2. Electronic states in quantum confined structures 3. Electrical properties of superlattices 4. Fabrication technique of quantum wires and wells 5. Characterization of heterointerfaces 6. Characterization of nanostructures 7. High-speed electron devices 8. Optical properties of quantum wells 9. Semiconductor laser diodes 10. Quantum effect devices 11. Fabrication technique of quantum dots 12. Quantum dot devices 13. Device application of quantum nano structures 14. Recent topics of semiconductor nanotechnology (1) 15. Recent topics of semiconductor nanotechnology (2)

**Evaluation Criteria)** Assignments count 100%

**Textbook)** None.

**Reference)** The Physics of Low-Dimensional Semiconductors, J.H. Davis, Springer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216818>

**Student)** Any students can attend the class.

**Contact)**

- ⇒ Isu (A224, +81-88-656-7670, t.isu@frc.tokushima-u.ac.jp) (Office Hour: Tue -Thu 10:00-14:00)  
 ⇒ Kitada (A224, +81-88-656-7671, kitada@frc.tokushima-u.ac.jp) (Office Hour: Mon. 10:00-14:00)

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### Seminar on Mechanical Engineering

4 units (compulsory)  
 Teacher of course

**Target)** To obtain deeper knowledge and presentation abilities by reading scientific papers concerning mechanical engineering related to each Master's thesis.

**Outline)** In order to complete each Master's thesis, to read and to understand scientific papers and to make a discussion with an instructor.

**Keyword)** Master's thesis, mechanical engineering

**Goal)** To obtain abilities to read scientific papers concerning each Master's thesis and to make a presentation.

**Schedule)** 1. To read ten scientific papers concerning each Master's thesis and to make a presentation. 2. To read five scientific papers concerning mechanical engineering and to make a presentation.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216607>

**Student)** Able to be taken by only specified class(es)

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### Exercise on Mechanical Engineering

2 units (compulsory)  
 Teacher of course

**Target)** To obtain sufficient knowledge and information required for completing each Master's thesis and to make a discussion with an instructor.

**Outline)** To read scientific papers on Master's thesis and to make a presentation under the direction of each laboratory's instructor.

**Keyword)** Master's thesis, mechanical engineering

**Goal)** To obtain knowledge and information concerning each Master's thesis.

**Schedule)** 1. To make a research on a problem concerning each Master's thesis and to make a presentation. 2. To discuss and to make a presentation on each Master's thesis.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216603>

**Student)** Able to be taken by only specified class(es)

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### Micro-Nano Engineering

2 units (selection)  
 Part-time Lecturer

**Target)** This class introduces the fundamentals of micro-nano engineering.

**Outline)** Basics of micro-nano engineering for the beginners.

**Requirement)** Students are required to have a good understanding of under-graduate level physics and related subjects.

**Goal)** To understand the fundamentals of micro-nano engineering

**Schedule)** 1. Basics of micro-nano engineering 2. Various micro-nano process and photo-induced process 3. Laser radiation and oscillator 4. Optical components for laser systems 5. Laser induced phenomena 6. Heat conduction in laser processing 7. Laser welding 8. Laser drilling and cutting 9. Ultra-fast laser processing 10. Micro thermal process 11. Micro/nano processing in industry 12. Thermal inkjet process 13. Piezo inkjet process 14. Inkjet for biotechnology 15. Latest inkjet technology 16. Examination

**Evaluation Criteria)** Assignments counts 100%

**Textbook)** Norimitsu Hirai, Practical Laser Technology, Kyoritsu publishing ISBN4-320-08470-5 Takeshi Amari, Inkjet printer, CMC publishing ISBN4-88231-859-8 Electronic files on Web

**Reference)** Mitsuo Nakazawa, Practical Ultrafine Process and Measurement, NTS ISBN4-86043-035-2 Kenichi Iga, Basic Laser Optics, Ohm-sha ISBN4-274-02137-8 Kunihiro Sato, Yoshihiko Mukai, Masao Toyoda, Welding Engineering, Rikogaku-sha ISBN4-8445-2108-X

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216802>

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### Advanced Lecture on Semiconductor Nanotechnology

2 units (selection)  
 Toshiro ISU · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

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**Mechanical Engineering Laboratory**

6 units (compulsory)  
Teacher of course

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**Target)** To obtain comprehensive abilities for completing each Master's thesis through some related experiments.

**Outline)** To carry out some experiments concerning each Master's thesis.

**Keyword)** *Master's thesis, mechanical engineering*

**Goal)** To make a plan and to carry out experiments and to make a discussion on the results.

**Schedule)** Under the direction of the instructor, to make a plan and to carry out the experiment required for completing a Master's thesis.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216606>

**Student)** Able to be taken by only specified class(es)



## Earth and Life Environmental Engineering — Chemical Science and Technology

### SYLLABUS OF SUBJECTS

#### • Integrated Subjects

<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和.....	29
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business.....	30
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer.....	30
<b>Long-term Internship (M)</b> ...Yamanaka .....	30
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · Part-time Lecturer.....	31
<b>International Advanced Technology and Science 1</b> ...Murakami.....	31
<b>International Advanced Technology and Science 2</b> ...Murakami.....	31
<b>Presentation Method (M)</b> ...Graduate School of Advanced Technology and Science.....	31
<b>Internship (M)</b> .....	32
<b>Venture Business (M)</b> .....	32

#### • Common Subjects

<b>Advanced Environmental Technology on Chemistry</b> ...Teacher of course .....	32
<b>Engineering of Biological Environment</b> ...Nakamura .....	32
<b>Advanced Environmental Systems Engineering</b> ...Kidoguchi · Kozuki · Kondo · Hashimoto · Fujisawa · Okushima · Matsuo · Yamanaka · Tomita · SATO · Ito · Nada .....	33

#### • Departmental Subjects

<b>Quantum mechanics and advanced lecture in quantum physics</b> ...Michihiro.....	33
<b>Differential Equations</b> ...Fukagai.....	33
<b>Advanced applied analysis</b> ...Okamoto.....	33
<b>Topics of Analysis for Mathematical Science</b> ...Kohda .....	34
<b>Solid State Ionics</b> ...Nakamura .....	34
<b>Advanced Materials Design</b> ...Kawamura · Minagawa .....	34
<b>Advanced Organic Chemistry</b> ...Kawamura · Nishiuchi.....	34
<b>Advanced Topics in Polymerization Reactions</b> ...Ute · Hirano .....	34
<b>Advanced Physical Chemistry</b> ...Uosaki · Suzuki.....	35
<b>Advanced quantumchemistry</b> ...Kanezaki .....	35
<b>Advanced Analytical and Environmental Chemistry</b> ...Yasuzawa · Yabutani.....	36
<b>Advanced Chemical Reaction Engineering</b> ...Sugiyama · Sotowa · Nakagawa .....	36
<b>Advanced Separation Technology</b> ...Kato · Horikawa.....	36
<b>Advanced Materials Science</b> ...Moriga · Murai.....	37
<b>Advanced Topics in Synthetic Chemistry</b> ...Part-time Lecturer .....	37
<b>Advanced Topics in Materials Science</b> ...Part-time Lecturer .....	37

<b>Advanced Topics in Chemical Process Engineering</b> ...Part-time Lecturer.....	37
<b>Advanced Lecture on Semiconductor Nanotechnology</b> ...Isu · Kitada .....	38
<b>Engineering of Correlated Electron Matter</b> ...Kawasaki .....	38

#### • Specialized Exercise and Experiments

<b>Graduate Seminar in Chemical Science and Technology</b> ...Teacher of course .....	38
<b>Advanced experiments on chemical science and technology</b> ...Teacher of course.....	38

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### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Requirement)** No requirement

**Notice)** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方・特許は明細書を中心に動く - (山内) 10. 技術者が知っておくべき実務知識・特許法上の留意事項 - (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student)** For the course students and other graduate school students.

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜: 8時30分から17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business - PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成 14 から 16 年度にかけて「大学発ベンチャー 3 年 1000 社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もある。くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword) management, management of technology**

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.30), "Long-term Internship (M)"(0.5, ⇒p.30), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.31), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー: 年度ごとに学科の掲示板を参照のこと)  
⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))  
⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

### Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考>平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル)上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日)上勝学舎(第1回~第12回)○集中講義-2(ICTビジネスモデル) \* 12月21日(火)常三島キャンパス(第13回~第15回)○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ごう奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究院) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be surthorized. The report and portfolion on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, profolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of thechnology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Advanced Environmental Technology on Chemistry

2 units (selection)  
Teacher of course

**Target)** The present situation and subjects on chemistry in view of environmental pollution will be introduced. Recent development in chemistry to attempt to solve those subjects will be explained.

**Outline)** Based on the historical background on environmental pollution, the recent progress on analytical chemistry, biochemistry, catalysis and chemical process engineering for environmental protection will be explained.

**Style)** Lecture and exercise

**Keyword)** *environment, analytical chemistry, biochemistry, catalyst, chemical process*

**Fundamental Lecture)** "Advanced Analytical and Environmental Chemistry"(1.0, ⇒p.36), "Advanced Physical Chemistry"(1.0, ⇒p.35), "Advanced Materials Science"(1.0, ⇒p.37)

**Relational Lecture)** "Engineering of Biological Environment"(0.5, ⇒p.32), "Advanced Environmental Systems Engineering"(0.5, ⇒p.33)

**Requirement)** Requires undergraduate level knowldge of chemistry and chemical engineering.

**Goal)**

1. To understand the present situation for environmental subjects on engineering.
2. To develop ability for solving the environmental subjects.

**Schedule)** 1. Endocrine disrupters 2. Microwave dielectric heating: Its application to chemical reaction 3. Environmental problem and crystal growth 4. Analysis of trace elements 5. Properties of supercritical fluids and their utilization 6. Recent advances in organic chemistry: Synthesis and Function 7. The mystery of natural rubber 8. Asymmetric synthesis 9. Polymer materials and environment 10. Biodegradable polymer 11. Introduction to engineering utilization of space environment 12. Utilization of adsorption phenomena 13. Approach using apatite to studies on energy and environment 14. Present situation of phosphors for white LEDs 15. Optimization of chemical processes

**Evaluation Criteria)** Assignments count 100% mainly based on the presentation and report submitted.

**Textbook)** To be announced in the class.

**Reference)** To be announced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216581>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Committee Member of School Affair

### Engineering of Biological Environment

2 units (selection)

Yoshitoshi Nakamura · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand recent studies on engineering of biological environment.

**Outline)** Advanced lectures for recent studies on engineering of biological environment

**Style)** Lecture

**Keyword)** *environment, biology, engineering*

**Requirement)** N/A

**Notice)** N/A

**Goal)**

1. To understand general concepts of biomass
2. To understand biomass conversion engineering
3. To understand general concepts of bioremediation

**Schedule)** 1. General concepts of biological environment 2. Characteristics of biomass and its effective utilization 3. Pretreatment of biomass by physical method 4. Pretreatment of biomass by chemical method 5. Pretreatment of biomass by biological method 6. Conversion of biomass into useful materials 7. Conversion of biomass into useful materials 8. Process system engineering for effective conversion of biomass 9. Reports 10. Classification, role, and application method of environmental organism 11. Bioremediation in water environment 12. Bioremediation in air environment 13. Bioremediation in soil environment 14. Environmental hormones, chemical pollutions and ethics 15. Recent topics and trend of industry for engineering of biological environment 16. Final Reports

**Evaluation Criteria)** Evaluation of Reports

**Textbook)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216734>

**Contact)**

⇒ Nakamura (720, +81-88-656-7518, ynakamu@bio.tokushima-u.ac.jp) (Office Hour: 水曜日 17:00-18:00)

**Note)** ◇When you take this class, it is necessary to do preparation for 2h and revies for h every 2h class for your understanding and taking credit. ◇成績評価に対する平常点と試験の比率は 50:50 とする。平常点には講義への参加状況、演習への回答及びレポートの提出状況と内容を含み、試験は中間テストと最終試験の成績を含む。

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### Advanced Environmental Systems Engineering 2 units (selection)

Yoshiyuki Kidoguchi · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Shuichi Hashimoto · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Shoichiro Fujisawa · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Masashi Okushima · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Shigeki Matsuo · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Takuro Tomita · ASSISTANT PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Katsuya SATO · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Shin-ichi Ito · ASSISTANT PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
 Yuzuru Nada · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand the present environmental problems and to acquire the advanced of the technique and the approach to solve problems on the point of the ecosystem engineering.

**Outline)** To explain the structure and function of environmental systems, the relationship between civil life and disaster prevention systems, and the changes of social system due to the technological revolution and the policy.

**Style)** Lecture

**Keyword)** *environmental policy, natural disaster, energy saving technology, welfare technology, biomechanical engineering*

**Goal)**

1. To understand the factor of environmental systems
2. To understand the structure of environmental systems
3. To understand the civil life and natural disaster prevention systems

**Schedule)** 1. The policy and natural disaster prevention measures (1) 2. The policy and natural disaster prevention measures (2) 3. The factor of environmental systems 4. Example of environmental systems 5. The structure of environmental systems 6. Example of structure of environmental systems 7. Civil life and nano-technology 1 8. Civil life and nano-technology 2 9. Midterm presentation 10. Well being technology 1 11. Well being technology 2 12. Ecosystem engineering 1 13. Ecosystem engineering 2 14. Hydrogen engine technology 15. Diesel engine engineering

**Evaluation Criteria)** Assignments count 100%

**Textbook)** To be introduced in th class

**Reference)** To be introduced in th class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216598>

**Contact)**

⇒ SATO (eco705, +81-88-656-2168, katsuyas@eco.tokushima-u.ac.jp)

**Note)** 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Quantum mechanics and advanced lecture in quantum physics 2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the quantum mechanics.

**Outline)** Basics of quantum mechanics are introduced.

**Style)** Lecture

**Keyword)** *quantum mechanics*

**Goal)** To understand the outline of quantum mechanics.

**Schedule)** 1. Introduction 2. Variational method 3. Lagrangian 4. Hamiltonian 5. Poisson's bracket expression 6. Quantization 7. Operator 8. Wavefunction 9. Expectation value 10. Schrödinger equation 11. Example (1) the square well potential 12. Example (2) the linear harmonic oscillator 13. Angular momentum 14. Example (3) hydrogen atom 15. Heisenberg equation 16. Field quantization

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216864>

**Contact)**

⇒ 道廣嘉隆(A203) (Office Hour: 木曜日17時-18時)

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### Differential Equations 2 units (selection)

Nobuyoshi Fukagai · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Introduction to mathematical theory of differential equations.

**Outline)** Boundary value problems of second order linear differential equations.

**Style)** Lecture

**Keyword)** 微分方程式の境界値問題, Sturm-Liouville 問題

**Goal)** To be familiar with Sturm-Liouville type equations.

**Schedule)** 1. Introduction 2. Helmholtz's equation 3. Eigenvalues and eigenfunctions 4. Green's function 5. Residue analysis 6. Expansion of Green's function 7. Fourier series 8. Existence theorem 9. Sturm-Liouville problems 10. Characteristic function 11. Solvability of boundary value problems 12. Basic estimates 13. Distribution of eigenvalues 14. Eigenfunction expansion 15. Review

**Evaluation Criteria)** Evaluation will be based on assignments.

**Reference)** 望月清・トルシン 『数理解物理の微分方程式』 培風館

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216852>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ 工学部数学教室 (A棟219室) (Office Hour: 木曜日 15:00~ 16:00)

**Note)** 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Advanced applied analysis 2 units (selection)

Kuniya Okamoto · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the functional analytic methods which are basic tools for mathematical sciences.

**Outline)** This subject provides basic theory of functional analysis which is considered as linear algebra in infinite-dimensional spaces. Functional analytic approaches to phenomena described by differential equations are introduced.

**Style)** Lecture

**Relational Lecture)** “Topics of Analysis for Mathematical Science”(0.5, ⇒p.34)

**Goal)** To apply the theory of modern analysis and recognize its significant role.

**Schedule)** 1. Differential equations and their solutions 2. Exponential of matrices 1 3. Uniqueness of solutions 4. Existence of solutions 5. Eigenvalues and eigenspaces 6. Projective representation 7. Exponential of matrices 2 8. Generalized eigenvalue problems 9. Dunford integrals 10. Holomorphic functions of matrices 11. Solution curve and stability 12. Stability of solutions 13. Ljapunov's method 14. Nonlinear case 15. Linear approximations 16. Summary

**Evaluation Criteria)** Evaluation by the report.

**Reference)** 『新微分方程式対話』 笠原皓司著, 日本評論社

**Webpage)** <http://math9.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216571>

**Contact)**

⇒ 岡本(A棟212室, TEL/FAX: 088-656-9441, E-mail: okamoto@pm.tokushima-u.ac.jp) (Office Hour: [WEB頁] のHPを参照のこと)

## Topics of Analysis for Mathematical Science

2 units (selection)

Atsuhito Kohda · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Mathematical theory and technique for analysis of engineering phenomena

**Outline)** Mathematical theory to analyze problems in engineering and its application, mainly theory and technique of differential equations

**Style)** Lecture

**Relational Lecture)** “Advanced applied analysis”(0.2, ⇒p.9), “Differential Equations”(0.2, ⇒p.8)

**Requirement)** If you like undergraduate-level mathematics, it will be sufficient.

**Goal)** To be familiar with mathematical theory, that helps engineering study.

**Schedule)** 1. Theory of sets and maps 2. Cardinal numbers and bijection 3. Equivalence relations and cryptography 4. Linear space and tensor 5. Vector analysis and differential form 6. Cauchy's theorem and vector analysis 7. Differential form and Cauchy's theorem 8. Projective plane 9. Quadratic curves and projective plane 10. All quadratic curves are circles? 11. The index of vector fields 12. Applications of the index:fundamental theorem of algebra 13. Vector fields on the unit sphere 14. Why there is the north pole on the earth 15. Mathematics and computers 16. Summary

**Webpage)** <http://math1.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216709>

**Contact)**

⇒ Kohda (A211, +81-88-656-7546, kohda@pm.tokushima-u.ac.jp) (Office Hour: 月曜 12:00~ 13:00)

## Solid State Ionics

2 units (selection)

Koichi Nakamura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces topics in solid state ionics, conduction mechanism in ionic conductors and techniques to study solid state ionics.

**Outline)** Basic experimental and theoretical approaches to understand solid state ionics are introduced and discussed in terms of “ion dynamic” in ionic/superionic conductors.

**Keyword)** ionic conductor, ionic diffusion, secondary battery

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand basic physical and chemical properties of ionic conductors.
2. To understand basic technique to study ionic conductors.

**Schedule)** 1. Introduction to solid state ionics 2. Band theory and conduction mechanism 3. Defect in ionic crystal 4. Diffusion in solid 5. Diffusion mechanism in solid 6. Solid electrolyte - Oxides, Silver halide - 7. Solid electrolyte - Li compounds - 8. Mixed conductor 9. Electrical conductivity measurement 10. Electrical conductivity in ionic conductors 11. Nuclear Magnetic Resonance 12. Basic model of NMR relaxation 13. NMR study on ionic conductors 14. Application - Ion secondary batteries - 15. Topics and Future in solid state ionics

**Evaluation Criteria)** Assignments count 100%.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216652>

**Contact)**

⇒ Nakamura (A216, koichi@pm.tokushima-u.ac.jp)

## Advanced Materials Design

2 units (selection)

Yasuhiko Kawamura · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Keiji Minagawa · ASSOCIATE PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand functions and design of various soft materials in relation to the molecular structure and properties.

**Outline)** This class introduces structures, properties, and functions of various soft materials including functional polymers.

**Style)** Lecture

**Keyword)** soft matter, functional polymer, properties of polymers

**Goal)**

1. To understand properties and functions of soft materials, especially polymers, in relation to the molecular structure.
2. To understand methods of molecular and material design for obtaining desired function.
3. To research and present topics related to functional polymers.

**Schedule)** 1. Introduction to soft materials 2. Structure of polymers 1 3. Structure of polymers 2 4. Properties of polymers 1 5. Properties of polymers 2 6. Functional polymers 1 7. Functional polymers 2 8. Hydrophilic polymers and hydrogels 9. Colloids 10. Amphiphilic molecules 11. Liquid crystals 12. Topics 1 13. Topics 2 14. Topics 3 15. Topics 4 16. Summary

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** 荒木孝二他著, 有機機能材料, 東京化学同人, 2006

**Reference)** Ian W. Hamley, Introduction to Soft Matter, John Wiley & Sons, New York, 2000

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216668>

**Contact)**

⇒ Minagawa (G612, +81-88-656-9153, minagawa@chem.tokushima-u.ac.jp)

## Advanced Organic Chemistry

2 units (selection)

Yasuhiko Kawamura · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Masaki Nishiuchi · ASSOCIATE PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This lecture intends to reconstruct knowledge of basic organic chemistry in view of structure and reactivity aspects and thus, aims at grasping essence shown in the real organic chemistry journals.

**Outline)** We wish to discuss 1) Basic concepts of organic photochemistry, 2) chemistry of reactive intermediates, 3) logical synthesis of organic molecules, and finally, 4) physical influence on organic reactions.

**Style)** Lecture

**Keyword)** structure and reactivity, reactive intermediates

**Fundamental Lecture)** “Organic Chemistry 3”(1.0), “Organic Chemistry 4”(1.0)

**Relational Lecture)** “Advanced Topics in Synthetic Chemistry”(0.5, ⇒p.37)

**Goal)**

1. Understanding essence of organic chemistry journals.
2. Ability to suggest or propose the way to solve various organic chemistry subjects.

**Schedule)** 1. Photochemistry: Basic Concept 2. Photochemistry: Application 3. Reactive Intermediates: Molecules in Excited States 4. Reactive Intermediates: Carbocations and Carbanions 5. Reactive Intermediates: Free Radicals 6. Reactive Intermediates: Carbenes and Nitrenes 7. Reactive Intermediates: Radical Ions 8. Interim Exam 9. Asymmetric Synthesis: Introduction 10. Asymmetric Synthesis: Basic Concept 11. Diastereoselective Reactions 12. Enantioselective Reactions 13. Asymmetric Catalysis 14. Asymmetric Synthesis: Application 15. Asymmetric Synthesis: Topics 16. Term Exam

**Evaluation Criteria)** Students are credited by the results of evaluation of their reports (50%) and scores of the final exam (50%).

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216898>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawamura (410 Chem Bldg, +81-88-656-7401, kawamura@chem.tokushima-u.ac.jp)

⇒ Nishiuchi (G409, +81-88-656-7400, nishiuch@chem.tokushima-u.ac.jp)

## Advanced Topics in Polymerization Reactions

2 units (selection)

Koichi Ute · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Tomohiro Hirano · ASSOCIATE PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The purpose of this class is to understand the principles of polymer syntheses and polymer characterizations.

**Outline)** In the first half of this course (#1-#8), the basic principles of solution properties and solid-state structures of polymers are lectured. In the second half (#9-#15), recent progress in polymerization chemistry is lectured.

**Style)** Lecture

**Keyword)** *living polymerization, stereospecific polymerization, coordination polymerization, property of polymer solution, solid-state properties of polymers*

**Fundamental Lecture)** “Polymer Chemistry 1”(1.0), “Polymer Chemistry 2”(1.0)

**Relational Lecture)** “Advanced Organic Chemistry”(0.5, ⇒p.34)

**Requirement)** Requires undergraduate level knowledge of chemistry.

**Notice)** Bring the textbook in the lectures #1 - #8.

**Goal)**

1. To understand the principles of polymer syntheses.
2. To understand relationship between monomer structure and reactivity in polymerization reaction.
3. To understand the basic principles of solution properties and molecular weight determination.
4. To understand the basic principles of solid-state properties and the experimental methods for crystal structure determination.

**Schedule)** 1. outline of macromolecular science, determination of molecular weight 2. properties of polymer solution 1 (membrane osmometry and the 2nd virial coefficient) 3. properties of polymer solution 2 (theory and experimental of light scattering) 4. properties of polymer solution 3 (viscometry) 5. properties of polymer solution 4 (chromatography of polymer) 6. solid-state structure of polymer 1 (crystal and non-crystal, experimental methods for solid-state properties of polymers) 7. solid-state structure of polymer 2 (crystal structure) 8. thermal properties of polymers 9. classification of polymerization reaction 10. stereospecific living anionic polymerization of methacrylates 11. characterization of polymers 12. Ziegler-Natta polymerization 13. single-site catalysts 14. metathesis polymerization 15. polymerization of acetylenes

**Evaluation Criteria)** Assignment counts 100% mainly based on the report submitted.

**Textbook)** 伊勢典夫他著「新高分子化学序論」化学同人

**Reference)**

- ◇ 佐藤恒之他著「高分子化学」朝倉書店
- ◇ 野瀬卓平他編「大学院高分子科学」講談社
- ◇ Silverstein 他著「有機化合物のスペクトルによる同定法」東京化学同人

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216696>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Ute (化学棟 406, +81-88-656-7402, ute@chem.tokushima-u.ac.jp) (Office Hour: Monday 15:00 - 17:00)
- ⇒ Hirano (G405, hirano@chem.tokushima-u.ac.jp)

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## Advanced Physical Chemistry

2 units (selection)

Yasuhiro Uosaki · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Yoshihisa Suzuki · ASSOCIATE PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The main goal of this class is to understand the relationship between the principle of physical chemistry and real phenomena. Solvation, crystal growth are the main topics of this class.

**Outline)** (Solvation phenomena) Many chemical reactions are studied in liquids. Although solvation process plays a key role in these reactions, it is hard to understand the solvation quantitatively. In this lecture, “solvation thermodynamics” based on statistical mechanics is introduced and the methods to understand the solvation theoretically are explained. (Crystal Growth) Concepts and technology of crystal growth play an important role in design of materials and structure analysis. The main goal of this class is to provide a solid introduction to the fundamentals of crystal growth that can be used to describe various phenomena involving equilibrium conditions, rate processes, surface or interface properties, etc.

**Style)** Lecture

**Keyword)** *solvation, crystal growth*

**Fundamental Lecture)** “Basic Physical Chemistry”(1.0)

**Relational Lecture)** “Advanced Topics in Materials Science”(0.5, ⇒p.37)

**Requirement)** Students are required to have a good understanding of undergraduate-level physical chemistry and related subjects.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand the fundamentals of solvation phenomena
2. To understand the fundamentals of crystal growth

**Schedule)** 1. Statistical mechanics and thermodynamics 2. Chemical potential 3. Solvation thermodynamics 4. Solvation energy 5. Ion solvation 6. Solubilities of solids in supercritical fluids 7. Solvation in supercritical fluids 8. Thermodynamics of phase transition 9. Nucleation 10. Ideal growth rate of crystal 11. Surface structure and roughening transition 12. Surface kinetics 13. Protein crystallization 14. Protein crystallography 15. Colloidal crystals

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be announced in the class

**Reference)** Yukio Saito, Statistical Physics of Crystal Growth, World Scientific, Singapore, 1996

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216869>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Uosaki (G510, +81-88-656-7417, uosaki@chem.tokushima-u.ac.jp) (Office Hour: Monday (17:00-18:00))

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## Advanced quantumchemistry

2 units (selection)

Eiji Kanazaki · PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Molecular science based quantum chemistry minded for current topics will be present both in experimental and theoretical fields with emphasis on molecular spectroscopy in relation to molecular structure and molecular properties

**Outline)** Basic studies on the electronic states of molecules are presented from aspects of molecular spectroscopy under outer stresses of electric, magnetic and of optical forces to molecules or molecular assemblies. Although discussion will be mainly focused onto some resonance conditions of the forces, their double resonance will be included if time is not pressed

**Style)** Lecture

**Keyword)** *molecular spectroscopy*

**Fundamental Lecture)** “Quantum Chemistry”(1.0), “Physical Chemistry”(1.0)

**Relational Lecture)** “Graduate Seminar in Chemical Science and Technology”(0.5, ⇒p.38), “Advanced experiments on chemical science and technology”(0.5, ⇒p.38)

**Goal)** To understand, at least, one of the current topics in quantum chemistry

**Schedule)** 1. about this lecture 2. basic concept of quantum chemistry 3. basic methods of quantum chemistry 4. advanced concept of quantum chemistry 5. advanced methods of quantum chemistry 6. basic concept for electronic states of molecule 7. advanced concept for electronic states of molecule 8. basic concept for the study in electronic states of molecule, a survey 9. basic methods for the study in electronic states of molecule 10. advanced concept for electronic states of molecule 11. introduction to interaction of molecules with outer field 12. basic concept for interaction of molecules with outer field 13. basic concept for calculation of interaction 14. advanced concept for calculation of interaction 15. more advanced concept for calculation of interaction 16. examination

**Evaluation Criteria)** レポート提出を求め、平常点を考慮して評価する

**Textbook)** ATKINS, PHYSICAL CHEMISTRY, 9th ed., 2010, Oxford University Press.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216910>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Kanazaki (G516, +81-88-656-9444, kanazaki@chem.tokushima-u.ac.jp) (Office Hour: refer to the official HP)

## Advanced Analytical and Environmental Chemistry

2 units (selection)

Mikito Yasuzawa · ASSOCIATE PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Tomoki Yabutani · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class introduces current status and topics in the academic field of analytical chemistry and global environmental problems in the world.

**Outline)** The outline of this class is an introduction of history and advances of analytical chemistry and environmental problems. The contents for analytical chemistry include sample preparation, separation method and principles of some important analytical instruments for characterizing environmental problems.

**Style)** Lecture

**Keyword)** *analytical chemistry, environmental analytical chemistry*

**Fundamental Lecture)** “Global Environmental Chemistry”(1.0)

**Requirement)** Students are required to have enough knowledges and trainings of analytical chemistry and environmental chemistry in undergraduate-level and related subjects.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をした上で授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand the current advance in analytical chemistry.
2. To understand of the earth environmental problems in the viewpoint of analytical chemistry.

**Schedule)** 1. Introduction 2. Influence of chemical compounds to human health 3. Introduction of analytical methods of chemical compounds in biological samples 4. Current topics of analysis of chemical compounds in biological samples 5. Current status of pollution in global environment by toxic chemical compounds 6. Introduction of urban atmospheric environment 7. Current status and topics in urban atmospheric environment 8. Global climate change by greenhouse gas 9. Introduction of aquatic environment 10. Current status and topics of aquatic environment 11. Introduction of soil and lithospheric environment 12. Current status of soil and lithospheric environment 13. Introduction of analytical method for environmental analysis 14. Current advances of analytical method for environmental analysis 15. Current topics of environmental chemistry

**Evaluation Criteria)** The No. 1 and No. 2 objectives of this class mentioned above are related with the lecture No. 2-4, 13, 14 and No. 1-15, respectively. The final grades will be determined numerically by averaging your scores with the following weights; homework reports 70% and quizzes 30%. The score will be described as 100-points scale. You will be passed for this class if you get over 60 point.

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216882>

**Contact)**

⇒ Yasuzawa (G512, +81-88-656-7421, mik@chem.tokushima-u.ac.jp) (Office Hour: 月曜日 16:30~17:30)  
⇒ Yabutani (G605, +81-88-656-7413, yabutani@chem.tokushima-u.ac.jp)

## Advanced Chemical Reaction Engineering

2 units (selection)

Shigeru Sugiyama · PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Ken-Ichiro Sotowa · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Keizo Nakagawa · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class introduces the most up-to-date analytical procedures of catalysts together with the optimization techniques that can be used for determining the optimal design and operating conditions of chemical processes.

**Outline)** The recent characterization techniques of catalysts such as XAFS and solid state NMR will be explained. Furthermore, basics of chemical reactor and process design and operation will be introduced using a chemical reaction process as an example.

**Style)** Lecture

**Keyword)** *catalyst, reactor, process design, optimization, reaction engineering*

**Fundamental Lecture)** “Differential Equations”(0.2, ⇒p.33), “Chemical Reaction Engineering”(0.8), “Quantum mechanics and advanced lecture in quantum physics”(0.4, ⇒p.33)

**Relational Lecture)** “Advanced Materials Science”(0.2, ⇒p.37), “Advanced Separation Technology”(0.2, ⇒p.36)  
**Requirement)** Students are required to have a good understanding of chemical engineering and related subjects in an undergraduate course.

**Notice)** Preparations for lessons review will be needed.

**Goal)**

1. To understand the advanced analytical procedures such as XAFS and solid state NMR from 1st to 7th.
2. To understand several basic optimization techniques for chemical processes from 8th to 15th.

**Schedule)** 1. XAFS (1) : Introduction 2. XAFS (2) : Transmission mode 3. XAFS (3) : Fluorescence mode 4. XAFS (4) : Case study 5. Solid state NMR (1) : Introduction 6. Solid state NMR (2) : CP MAS 7. Solid state NMR (3) : Case study 8. Introduction to optimization problem 9. Linear programming 10. Nonlinear programming 11. Steepest descent method and line search 12. Integer programming problem 13. pinch technology 14. Process design exercise 15. Recent topics on process optimization

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** All lecture documents will be opened through U-learning system.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216588>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Sugiyama (G309, +81-88-656-7432, sugiyama@chem.tokushima-u.ac.jp) (Office Hour: 月曜, 火曜, 16時から18時の間, また, 随時対応します。)  
⇒ Sotowa (Chemistry and biotechnology building, 307., sotowa@chem.tokushima-u.ac.jp) (Office Hour: 16:00-17:00, Monday and Tuesday. (can be contacted whenever available))  
⇒ Nakagawa (化学生物棟 310, +81-88-656-7430, knakagaw@chem.tokushima-u.ac.jp) (Office Hour: 月, 火:16:00 - 17:00 (この時間帯以外でも都合がつく時はいつでも OK))

## Advanced Separation Technology

2 units (selection)

Masahiro Katoh · ASSOCIATE PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Toshihide Horikawa · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The purpose of this class is to understand typical separation processes, the concepts and mathematical treatments for mass transfer.

**Outline)** Separations are prominent in manufacture of chemicals, pharmaceuticals, metals etc. Various separation methods have been developed in chemical industry. Separations are also needed for treatment of hazardous wastes and for pollution control, especially for recycle and recovery of resources. The following types of systems will be discussed: principal of various separation methods, fundamentals of mass transfer, separation with phase change, gas absorption with chemical reactions, extraction, adsorption and ion exchange, membrane separation, methods of continuous separation. Mathematical treatments will include methods of characteristics and moment analysis. To facilitate understanding and practical application, a practice or a report will be also imposed on every item.

**Style)** Lecture

**Keyword)** *mass transfer, separation processes*

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をした上で授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand several separation processes
2. To understand mathematical treatments for mass transfer

**Schedule)** 1. Several separation processes and the concepts 2. Mass transfer 3. Gas absorption, steady analysis 4. Gas absorption, unsteady analysis 5. Gas absorption with chemical reaction 6. Gas absorption apparatuses 7. Adsorption equilibrium 8. Adsorption velocity and diffusion 9. Chromatography 10. Moment analysis 11. The principle of membrane separation 12. Membrane permeability 13. Membrane separation process, module 14. Membrane separation process, gas separation 15. Continuous membrane separation process

**Evaluation Criteria)** Assignment counts 100% mainly based on the report submitted.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216883>

**Contact)**



⇒ Katoh (M304, +81-88-656-7429, katoh@chem.tokushima-u.ac.jp)

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### Advanced Materials Science

2 units (selection)

Toshihiro Moriga · PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Kei-ichiro Murai · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The purpose of this class is to understand the basic concepts of functional materials and the most up-to-date analytical procedures, which are necessary in developing new material science.

**Outline)** Recent development in the preparation, crystal structure, luminescence and applications of silicon-based oxynitride and nitride phosphors for white light-emitting diodes (LEDs) will be explained.

**Style)** Lecture

**Keyword)** *oxynitride, white LED, powder X-ray diffraction, XAFS*

**Fundamental Lecture)** “Physical Properties of Materials”(1.0), “Material Science”(1.0)

**Relational Lecture)** “Solid State Ionics”(0.5, ⇒p.34), “Advanced Environmental Technology on Chemistry”(0.5, ⇒p.32)

**Requirement)** Requires undergraduate level knowledge of materials chemistry.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

- To understand the basic concepts of oxynitride phosphors for white LEDs in the lectures from 1st to 8th.
- To understand the advanced analytical procedure such as XRD and XAFS in the lectures from 9th to 15th.

**Schedule)** 1. Introduction 2. Roles of phosphors in white LED 3. Classification and crystal chemistry of (oxy)nitride compounds 4. Green emitting phosphors 5. Yellow emitting phosphors 6. Red emitting phosphors 7. Synthesis of silicon-based (oxy)nitride phosphors 8. Epilogue 9. Principle of X-ray diffraction 10. Measurement and analysis of powder X-ray diffraction data 11. Crystallography for X-ray diffraction 12. Introduction to Reitveld analysis 13. Introduction to XAFS 14. Measurement of XAFS - transmission and fluorescence method - 15. Analysis of XAFS data

**Evaluation Criteria)** Assignment counts 100% mainly based on the reports submitted.

**Textbook)** To be announced in the class.

**Reference)** To be announced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216665>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Moriga (M603, +81-88-656-7423, moriga@chem.tokushima-u.ac.jp) (Office Hour: Monday 4:30pm—5:30pm for 1st semester, Thursday 4:30pm—5:30pm for 2nd semester)

⇒ Murai (機械棟 305, +81-88-656-7424, murai@chem.tokushima-u.ac.jp)

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### Advanced Topics in Synthetic Chemistry

1 unit (selection)

Part-time Lecturer

**Target)** To learn recent research topics on organic and synthetic chemistry.

**Outline)** Recent topics in reaction and syntheses in organic, organometallic, biomimetic, inorganic, and polymer chemistries.

**Style)** Lecture

**Keyword)** *organic chemistry, synthetic chemistry*

**Fundamental Lecture)** “Organic Chemistry 2”(1.0), “Organic Chemistry 4”(1.0), “Organic Chemistry 3”(1.0)

**Relational Lecture)** “Advanced Organic Chemistry”(0.5, ⇒p.34), “Advanced Topics in Polymerization Reactions”(0.5, ⇒p.34), “Advanced Materials Design”(0.5, ⇒p.34)

**Goal)** To be able to explain the importance and breakthrough in the research area.

**Evaluation Criteria)** To be announced by the lecturer in the class.

**Textbook)** To be announced in the class.

**Reference)** To be announced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216861>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawamura (410 Chem Bldg, +81-88-656-7401, kawamura@chem.tokushima-u.ac.jp)

⇒ Ute (化学棟 406, +81-88-656-7402, ute@chem.tokushima-u.ac.jp) (Office Hour: Monday 15:00 - 17:00)

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### Advanced Topics in Materials Science

1 unit (selection)

Part-time Lecturer

**Target)** To learn recent research topics on materials science

**Outline)** Basic theories of physical and chemical properties, and structure of materials will be lectured by an lecturer from other research institutions.

**Style)** Lecture

**Keyword)** *material, properties, chemical structure*

**Fundamental Lecture)** “Physical Chemistry”(1.0), “Inorganic Chemistry”(1.0)

**Relational Lecture)** “Advanced Physical Chemistry”(0.5, ⇒p.35), “Advanced Analytical and Environmental Chemistry”(0.5, ⇒p.36), “Advanced quantumchemistry”(0.5, ⇒p.35)

**Goal)** To be able to explain the importance and breakthrough in the research area

**Schedule)** To be announced by the lecturer

**Evaluation Criteria)** To be announced by the lecturer in the class.

**Textbook)** To be announced by the lecturer

**Reference)** To be announced by the lecturer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216860>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kanezaki (G516, +81-88-656-9444, kanezaki@chem.tokushima-u.ac.jp)

⇒ Uosaki (G510, +81-88-656-7417, uosaki@chem.tokushima-u.ac.jp) (Office Hour: Monday (17:00-18:00))

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### Advanced Topics in Chemical Process Engineering

1 unit (selection)

Part-time Lecturer

**Target)** To learn recent topics on chemical process engineering.

**Outline)** Recent trends in chemical engineering, process design and development will be explained by a lecturer from other research institutions.

**Style)** Lecture

**Keyword)** *chemical engineering, process engineering*

**Fundamental Lecture)** “Chemical Engineering Principles”(1.0), “Chemical Reaction Engineering”(1.0), “Separation Science and Technology”(1.0), “Material Science”(1.0)

**Relational Lecture)** “Advanced Chemical Reaction Engineering”(0.5, ⇒p.36), “Advanced Materials Science”(0.5, ⇒p.37), “Advanced Separation Technology”(0.5, ⇒p.36)

**Goal)** To be able to explain the importance and breakthrough in the research area.

**Schedule)** To be announced by the lecturer in the class

**Evaluation Criteria)** To be announced by the lecturer

**Textbook)** To be announced by the lecturer

**Reference)** To be announced by the lecturer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216589>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Sugiyama (G309, +81-88-656-7432, sugiyama@chem.tokushima-u.ac.jp)  
 ⇒ Moriga (M603, +81-88-656-7423, moriga@chem.tokushima-u.ac.jp) (Office Hour: Monday 4:30pm—5:30pm for 1st semester, Thursday 4:30pm—5:30pm for 2nd semester)

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**Advanced Lecture on Semiconductor Nanotechnology** 2 units (selection)  
 Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

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**Target)** This class introduces basic principles of the semiconductor nanotechnology and their application to the quantum devices.

**Outline)** Basics of semiconductor physics and quantum mechanics are introduced to understand material properties of quantum confined nanostructures. Recent progress in fabrication techniques and device applications of semiconductor nanostructures (quantum wells, wires and dots) will be reviewed.

**Style)** Lecture

**Keyword)** *quantum confined nanostructures, semiconductor nanoscience, electron devices, photonic devices*

**Requirement)** None.

**Notice)** None.

**Goal)** To understand basic properties of semiconductor nanostructures and quantum devices.

**Schedule)** **1.** Introduction to semiconductor nanostructures **2.** Electronic states in quantum confined structures **3.** Electrical properties of superlattices **4.** Fabrication technique of quantum wires and wells **5.** Characterization of heterointerfaces **6.** Characterization of nanostructures **7.** High-speed electron devices **8.** Optical properties of quantum wells **9.** Semiconductor laser diodes **10.** Quantum effect devices **11.** Fabrication technique of quantum dots **12.** Quantum dot devices **13.** Device application of quantum nano structures **14.** Recent topics of semiconductor nanotechnology (1) **15.** Recent topics of semiconductor nanotechnology (2)

**Evaluation Criteria)** Assignments count 100%

**Textbook)** None.

**Reference)** The Physics of Low-Dimensional Semiconductors, J.H. Davis, Springer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216818>

**Student)** Any students can attend the class.

**Contact)**

⇒ Isu (A224, +81-88-656-7670, t.isu@frc.tokushima-u.ac.jp) (Office Hour: Tue -Thu 10:00-14:00)  
 ⇒ Kitada (A224, +81-88-656-7671, kitada@frc.tokushima-u.ac.jp) (Office Hour: Mon. 10:00-14:00)

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**Engineering of Correlated Electron Matter** 2 units (selection)  
 Yu Kawasaki · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

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**Target)** Lecture would be given on the basic concept of magnetism and superconductivity in condensed matter with an introductory talk on strongly correlated electron system and its application to technology.

**Outline)** Some materials with strongly correlated electrons show interesting magnetic and electronic phenomenon such as high-transition temperature superconductivity, metal-insulator transition and giant magneto-resistance. After an introductory talk on the strongly correlated electron system and its application to technology, lecture would be given on the basic concept of magnetism and superconductivity in condensed matter.

**Keyword)** *strongly correlated electron system, magnetism, superconductivity*

**Notice)** 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために 必要である。

**Goal)** To understand the basic concept of magnetism and superconductivity in

**Schedule)** **1.** Correlated electron matters **2.** Introduction to magnetism **3.** Electronic states of atoms **4.** Magnetic ions in crystal **5.** Magnetic interaction **6.** Local-moment magnetism **7.** Local-moment magnetism **8.** Itinerant-electron magnetism **9.** Ferromagnet and its application to technology **10.** Superconducting phenomenology **11.** Electron-phonon interaction **12.** Magnetic ux quantum and SQUID **13.** Type II superconductor **14.** New type of superconductivity **15.** Manganese oxide and spintronics **16.** Examination

**Evaluation Criteria)** Examination

**Textbook)** no specific text

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=218253>

**Contact)**

⇒ Kawasaki (A217, +81-88-656-9878, yu@pm.tokushima-u.ac.jp)

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**Graduate Seminar in Chemical Science and Technology** 4 units (compulsory)  
 Teacher of course

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**Target)** To improve the skills in reading academic papers and in making presentation.

**Outline)** The students will read some academic papers and make presentation on the context. Through the presentation and discussion, the students will improve the skill in making presentations and learn how the research results can be applied to the industry.

**Style)** Lecture in combination with Portfolio

**Keyword)** *discussion, literature, presentation*

**Fundamental Lecture)** “Undergraduate Work”(1.0), “Seminar on Chemical Science and Technology”(1.0)

**Relational Lecture)** “Advanced experiments on chemical science and technology”(0.5, ⇒p.38)

**Evaluation Criteria)** 各指導教員が、発表、討論などを通じて総合的に評価する。輪講及び演習の課題を完了した者には 60 点を与える。指導教員が、自身の修士論文研究との関連性を把握している、プレゼンテーションがわかりやすい、英語の理解度、積極性など雑誌購読の達成度を評価シートに従って採点し、40 点満点で評価する。以上算出した評点を合計して輪講及び演習の評点とし、60 点以上をもって合格とする。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216587>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawamura (410 Chem Bldg, +81-88-656-7401, kawamura@chem.tokushima-u.ac.jp)

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**Advanced experiments on chemical science and technology** 8 units (compulsory)  
 Teacher of course

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**Target)** To learn how to conduct a research as an independent researcher

**Outline)** Students will conduct a research work related to the master's thesis, and acquire a broader knowledge of engineering.

**Keyword)** *research, thesis*

**Fundamental Lecture)** “Undergraduate Work”(1.0), “Seminar on Chemical Science and Technology”(1.0)

**Relational Lecture)** “Graduate Seminar in Chemical Science and Technology”(0.5, ⇒p.38)

**Evaluation Criteria)** 研究への取り組み、並びに研究を実行する中で各講座において計画される研究討論、中間報告など、さらに、M1 中間発表会における発表・質疑応答、提出された修士論文と、修士論文発表会での口頭発表審査によって評価する。修士論文に必要な手続き(修士論文提出・修士論文要旨提出等)を指示通りに行い修士論文発表会にて発表を行った者には 60 点を与える。但し、修士論文最終提出時までに所定の時間数以上を論文作成のための学習時間として費やしていることを条件とする。指導教員が、研究への取り組み状況など修士論文の達成度を評価シートに従って採点し、35 点満点で評価する。コース教員が、修士論文発表会の発表内容、発表技術に対して評価シートに従って採点し、5 点満点で評価する。以上算出した評点を合計して特別実験の評点とし、60 点以上をもって合格とする。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216586>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawamura (410 Chem Bldg, +81-88-656-7401, kawamura@chem.tokushima-u.ac.jp)

## Earth and Life Environmental Engineering — Biological Science and Technology

### SYLLABUS OF SUBJECTS

#### ● Integrated Subjects

<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和.....	39
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business.....	39
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer.....	40
<b>Long-term Internship (M)</b> ... Yamanaka .....	40
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · Part-time Lecturer.....	41
<b>International Advanced Technology and Science 1</b> ...Murakami.....	41
<b>International Advanced Technology and Science 2</b> ...Murakami.....	41
<b>Presentation Method (M)</b> ...Graduate School of Advanced Technology and Science.....	41
<b>Internship (M)</b> .....	42
<b>Venture Business (M)</b> .....	42

#### ● Common Subjects

<b>Advanced Environmental Technology on Chemistry</b> ...Teacher of course.....	42
<b>Engineering of Biological Environment</b> ...Nakamura.....	42
<b>Advanced Environmental Systems Engineering</b> ...Kidoguchi · Kozuki · Kondo · Hashimoto · Fujisawa · Okushima · Matsuo · Yamanaka · Tomita · SATO · Ito · Nada.....	43

#### ● Departmental Subjects

<b>Quantum mechanics and advanced lecture in quantum physics</b> ... Michihiro.....	43
<b>Superconductivity and superconducting materials</b> ...Kishimoto.....	43
<b>Advanced Computational Science</b> ...Takeuchi.....	43
<b>Methods for analysis of mathematical phenomena</b> ...Imai · Jin.....	44
<b>Biochemical Thermodynamics</b> ...Matsuki.....	44
<b>Advanced Biochemistry</b> ...Teacher of course.....	44
<b>Molecular Biotechnology</b> ...Noji · Ohuchi.....	45
<b>Cell Biotechnology</b> ...Nagamune · Tomoyasu.....	45
<b>Advanced Biophysical Chemistry</b> ...Matsuki.....	45
<b>Advanced Cell Physiology</b> ...Nakamura.....	46
<b>Advanced Microbiological Engineering</b> ...Omasa.....	46
<b>Biomolecular Design</b> ...Hori · Uto.....	46
<b>Advanced Biotechnology</b> ...Maseda.....	47
<b>Advanced Biomaterials</b> ...Tomoyasu · Nagamune.....	47
<b>Advanced enzyme engineering</b> ...Tsuji.....	47
<b>Technology for Bioreaction</b> ...Noji · Ohuchi.....	48
<b>Biological macromolecular chemistry</b> ...Uto · Hori.....	48
<b>Advanced Lecture on Semiconductor Nanotechnology</b> ...Isu · Kitada.....	48

#### ● Specialized Exercise and Experiments

<b>Practice for understanding scientific papers in biological technology</b> ...Teacher of course.....	49
<b>Seminar in Biological Technology</b> ...Teacher of course.....	49
<b>Biological science and technology laboratory</b> ...Teacher of course.....	49
<b>Internship in Biological science and technology</b> ...Teacher of course.....	50

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#### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Requirement)** No requirement

**Notice)** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは(藤井) 2. 知的所有権制度の概要(特許・商標等)(藤井) 3. 知的所有権制度の概要(意匠・著作権制度等)(藤井) 4. 特許発明と特許権侵害(藤井) 5. 特許発明と特許権侵害(事例)(藤井) 6. 知的所有権の管理とその活用(企業・大学・研究所)(藤井) 7. 今後の研究開発と知的所有権のあり方(藤井) 8. レポート課題・書式・提出方法の説明等(藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く-(山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項-(山内) 11. 技術開発の現場における知的財産(京和) 12. 研究と特許権侵害(矢野) 13. 知的財産の利用と活用(種苗法による育成者権含む)(飯田) 14. 知的財産の利用と活用(種苗法による育成者権含む)(飯田) 15. 知的財産の利用と活用(種苗法による育成者権含む)(飯田) 16. レポート課題・書式・提出方法の説明等(教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student)** For the course students and other graduate school students.

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

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#### Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee , Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成 14 から 16 年度にかけて「大学発ベンチャー 3 年 1000 社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もある。くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword)** management, management of technology

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.39), "Long-term Internship (M)"(0.5, ⇒p.40), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.41), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda","The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

### Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。 ・ビジネスモデルは、地域再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考:平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。 ○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ぐ奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり、90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(働いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有 (088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Advanced Environmental Technology on Chemistry

2 units (selection)  
Teacher of course

**Target)** The present situation and subjects on chemistry in view of environmental pollution will be introduced. Recent development in chemistry to attempt to solve those subjects will be explained.

**Outline)** Based on the historical background on environmental pollution, the recent progress on analytical chemistry, biochemistry, catalysis and chemical process engineering for environmental protection will be explained.

**Style)** Lecture and exercise

**Keyword)** *environment, analytical chemistry, biochemistry, catalyst, chemical process*

**Fundamental Lecture)** "Advanced Analytical and Environmental Chemistry"(1.0, ⇒p.36), "Advanced Physical Chemistry"(1.0, ⇒p.35), "Advanced Materials Science"(1.0, ⇒p.37)

**Relational Lecture)** "Engineering of Biological Environment"(0.5, ⇒p.42), "Advanced Environmental Systems Engineering"(0.5, ⇒p.43)

**Requirement)** Requires undergraduate level knowledge of chemistry and chemical engineering.

**Goal)**

1. To understand the present situation for environmental subjects on engineering.
2. To develop ability for solving the environmental subjects.

**Schedule)** 1. Endocrine disrupters 2. Microwave dielectric heating: Its application to chemical reaction 3. Environmental problem and crystal growth 4. Analysis of trace elements 5. Properties of supercritical fluids and their utilization 6. Recent advances in organic chemistry: Synthesis and Function 7. The mystery of natural rubber 8. Asymmetric synthesis 9. Polymer materials and environment 10. Biodegradable polymer 11. Introduction to engineering utilization of space environment 12. Utilization of adsorption phenomena 13. Approach using apatite to studies on energy and environment 14. Present situation of phosphors for white LEDs 15. Optimization of chemical processes

**Evaluation Criteria)** Assignments count 100% mainly based on the presentation and report submitted.

**Textbook)** To be announced in the class.

**Reference)** To be announced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216581>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Committee Member of School Affair

### Engineering of Biological Environment

2 units (selection)

Yoshitoshi Nakamura · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand recent studies on engineering of biological environment.

**Outline)** Advanced lectures for recent studies on engineering of biological environment

**Style)** Lecture

**Keyword)** *environment, biology, engineering*

**Requirement)** N/A

**Notice)** N/A

**Goal)**

1. To understand general concepts of biomass
2. To understand biomass conversion engineering
3. To understand general concepts of bioremediation

**Schedule)** 1. General concepts of biological environment 2. Characteristics of biomass and its effective utilization 3. Pretreatment of biomass by physical method 4. Pretreatment of biomass by chemical method 5. Pretreatment of biomass by biological method 6. Conversion of biomass into useful materials 7. Conversion of biomass into useful materials 8. Process system engineering for effective conversion of biomass 9. Reports 10. Classification, role, and application method of environmental organism 11. Bioremediation in water environment 12. Bioremediation in air environment 13. Bioremediation in soil environment 14. Environmental hormones, chemical pollutions and ethics 15. Recent topics and trend of industry for engineering of biological environment 16. Final Reports

**Evaluation Criteria)** Evaluation of Reports

**Textbook)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216734>

**Contact)**

⇒ Nakamura (720, +81-88-656-7518, ynakamu@bio.tokushima-u.ac.jp) (Office Hour: 水曜日 17:00-18:00)

**Note)** ◇When you take this class, it is necessary to do preparation for 2h and review for 1h every 2h class for your understanding and taking credit. ◇成績評価に対する平常点と試験の比率は 50:50 とする。平常点には講義への参加状況、演習への回答及びレポートの提出状況と内容を含み、試験は中間テストと最終試験の成績を含む。

## Advanced Environmental Systems Engineering

2 units (selection)

Yoshiyuki Kidoguchi · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shuichi Hashimoto · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shoichiro Fujisawa · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Masashi Okushima · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shigeki Matsuo · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Takuro Tomita · ASSISTANT PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Katsuya SATO · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shin-ichi Ito · ASSISTANT PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Yuzuru Nada · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand the present environmental problems and to acquire the advanced of the technique and the approach to solve problems on the point of the ecosystem engineering.

**Outline)** To explain the structure and function of environmental systems, the relationship between civil life and disaster prevention systems, and the changes of social system due to the technological revolution and the policy.

**Style)** Lecture

**Keyword)** *environmental policy, natural disaster, energy saving technology, welfare technology, miromechanical engineering*

**Goal)**

1. To understand the factor of environmental systems
2. To understand the structure of environmental systems
3. To understand the civil life and natural disaster prevention systems

**Schedule)** 1. The policy and natural disaster prevention measures (1) 2. The policy and natural disaster prevention measures (2) 3. The factor of environmental systems 4. Example of environmental systems 5. The structure of environmental systems 6. Example of structure of environmental systems 7. Civil life and nano-technology 1 8. Civil life and nano-technology 2 9. Midterm presentation 10. Well being technology 1 11. Well being technology 2 12. Ecosystem engineering 1 13. Ecosystem engineering 2 14. Hydrogen engine technology 15. Diesel engine engineering

**Evaluation Criteria)** Assignments count 100%

**Textbook)** To be introduced in th class

**Reference)** To be introduced in th class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216598>

**Contact)**

⇒ SATO (eco705, +81-88-656-2168, katsuyas@eco.tokushima-u.ac.jp)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Quantum mechanics and advanced lecture in quantum physics

2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the quantum mechanics.

**Outline)** Basics of quantum mechanics are introduced.

**Style)** Lecture

**Keyword)** *quantum mechanics*

**Goal)** To understand the outline of quantum mechanics.

**Schedule)** 1. Introduction 2. Variational method 3. Lagrangian 4. Hamiltonian 5. Poisson's bracket expression 6. Quantization 7. Operator 8. Wavefunction 9. Expectation value 10. Schrödinger equation 11. Example (1) the square well potential 12. Example (2) the linear harmonic oscillator 13. Angular momentum 14. Example (3) hydrogen atom 15. Heisenberg equation 16. Field quantization

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216867>

**Contact)**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

## Superconductivity and superconducting materials

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand basics and recent developments in superconductivity.

**Outline)** This class reviews quantum mechanics and introduces superconductivity and recent superconducting materials.

**Style)** Lecture

**Keyword)** *superconductivity, Cooper pair, superconducting energy gap, density of states, anisotropic superconductivity*

**Goal)** To understand the outline of superconductivity.

**Schedule)** 1. Introduction to superconductivity 2. Review of quantum mechanics (1), Schrödinger equation and wave function 3. Review of quantum mechanics (2), operators and expected values 4. Review of quantum mechanics (3), perturbation theory 5. Free electron model of metals 6. Phenomenological theory of superconductivity 7. To understand Meissner effect on the basis of quantum mechanics 8. Formation of Cooper pair 9. Formation of superconducting energy gap 10. Density of states, and energy gap at finite temperatures 11. Introduction to Nuclear Magnetic Resonance method 12. Frontier of superconductivity (1), strong coupling superconductor 13. Frontier of superconductivity (2), heavy Fermion superconductor 14. Frontier of superconductivity (3), copper oxide high Tc superconductor 15. Summary

**Evaluation Criteria)** Reports on several subjects in the class.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216769>

**Contact)**

⇒ Yutaka Kishimoto (A202)

## Advanced Computational Science

2 units (selection)

Toshiki Takeuchi · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class provides the basic technology for numerical calculation for the differential equation.

**Outline)** The numerical calculation methods for the differential equation are introduced.

**Style)** Lecture

**Keyword)** *numerical analysis, numerical computation, differential equation*

**Fundamental Lecture)** “Numerical Analysis”(1.0), “Basic Mathematics/微分積分学 I”(1.0), “Basic Mathematics/微分積分学 II”(1.0)

**Relational Lecture)** “Methods for analysis of mathematical phenomena”(1.0), “Numerical Analysis”(1.0)

**Requirement)** Students have to understand basic mathematics of undergraduate-level.

**Goal)** To understand principle of numerical calculation methods.

**Schedule)** 1. Introduction to numerical simulation 2. Mathematical model 3. Lagrange interpolation 4. Spline interpolation 5. Least squares method 6. Finite difference method 7. Arbitrary precision formula 8. Application to ordinary differential equation 9. Application to partial differential equation 10. Gauss-Seidel method 11. Successive Over-Relaxation method 12. Explicit method 13. Implicit method 14. Crank-Nicolson method 15. Numerical instabilities

**Evaluation Criteria)** Assignments count 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216627>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Takeuchi (A206, +81-88-656-7544, takeuchi@pm.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00-15:00)

### Methods for analysis of mathematical phenomena

2 units (selection)

Hitoshi Imai · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Cheng-Hai Jin · PROFESSOR / INTERNATIONAL CENTER

**Target)** To learn the to analyze the mathematical phenomena.

**Outline)** Methods used in analysis of mathematical phenomena are introduced. Especially, those in numerical analysis are focused on.

**Style)** Lecture

**Keyword)** *mathematics, numerical analysis*

**Fundamental Lecture)** “Numerical Analysis”(1.0)

**Relational Lecture)** “Advanced Computational Science”(0.5, ⇒p.55)

**Requirement)** Only the premise that have studied basic mathematics.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)** Being able to understand a numerical scheme to one-dimensional boundary value problems for the Poisson equation

**Schedule)** 1. Introduction to computer 2. Common sense in numerical computation 3. High-speed computation (Parallel computing) 4. Finite difference method I 5. Finite difference method II 6. Finite difference method III 7. Finite difference method IV 8. Finite element method I 9. Finite element method II 10. Finite element method III 11. Finite element method IV 12. Boundary element method I 13. Boundary element method II 14. Boundary element method III 15. Iterative method

**Evaluation Criteria)** Evaluation by the report.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216715>

**Contact)**

⇒ Imai(A220, +81-88-656-7541, The inquiry by means of the cellular phone or E-mail is not acceptable) (Office Hour: Office hours: Thursday 14:00-15:00)

### Biochemical Thermodynamics

2 units (selection)

Hitoshi Matsuki · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Thermodynamic treatments for molecular aggregates constructed by self-association of bio-related substances and effects of environmental variables such as temperature, pressure and additives on the aggregates are described.

**Outline)** The former part of this lecture reviews treatments for molecular aggregates such as monolayers, micelles and vesicles constructed by self-association of bio-related substances like surfactants, lipids and amphiphilic drugs from a thermodynamic viewpoint. The latter part describes various nature of these aggregates and structure changes of the aggregates by environmental variables such as temperature, pressure and additives. Further industrial application and utilization of molecular aggregates are also explained. This lecture deals with industrial subjects.

**Style)** Lecture

**Keyword)** *bio-related substance, molecular aggregate, thermodynamics, phase behavior, pressure*

**Fundamental Lecture)** “Physical Chemistry 2”(1.0), “Biophysical Chemistry 2”(1.0)

**Relational Lecture)** “Advanced Biophysical Chemistry”(0.5, ⇒p.45)

**Requirement)** Students are required to have a good understanding of undergraduate-level physical chemistry and biophysical chemistry and related subjects.

**Goal)**

1. To understand the thermodynamic treatments of molecular aggregates formed by bio-related substances.
2. To understand the nature for aggregates of bio-related substances and effects of environmental variables on the aggregates.

**Schedule)** 1. Thermodynamics of molecular aggregates (1) thermodynamics of adsorption at interfaces 1: surface and interfacial tension 2. Thermodynamics of molecular aggregates (2) thermodynamics of adsorption at interfaces 2: treatments of adsorbed film 3. Thermodynamics of molecular aggregates (3) phase transitions of monolayers 1: insoluble monolayers 4. Thermodynamics of molecular aggregates (4) phase transitions of monolayers 2: soluble monolayers 5. Thermodynamics of molecular aggregates (5) thermodynamics of self-association 1: phase separation model 6. Thermodynamics of molecular aggregates (6) thermodynamics of self-association 2: mass action model 7. Thermodynamics of molecular aggregates (7) micelle formation in dilute solutions 1: critical micelle concentration 8. Thermodynamics of molecular aggregates (8) micelle formation in dilute solutions 2: affecting factors 9. Structures and functions of molecular aggregates (1) solution behavior 1: Kraft point 10. Structures and functions of molecular aggregates (2) solution behavior 2: cloud point 11. Structures and functions of molecular aggregates (3) phase behavior of bilayers 1: saturated phospholipids 12. Structures and functions of molecular aggregates (4) phase behavior of bilayers 2: unsaturated phospholipids 13. Structures and functions of molecular aggregates (5) pressure effect on bilayers 1: volume change of transition 14. Structures and functions of molecular aggregates (6) pressure effect on bilayers 2: pressure-induced bilayer interdigitation 15. Structures and functions of molecular aggregates (7) phase behavior of bilayer mixtures: domain formation 16. Summary, inquiry and report preparations

**Evaluation Criteria)** More than 80% percentage of attendance and reports (100%).

**Textbook)** To be distributed materials adequately in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216731>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Matsuki (G607, +81-88-656-7513, matsuki@bio.tokushima-u.ac.jp) (Office Hour: Friday 16:20-17:50)

**Note)** ◇When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit. ◇Goal 1 is related to schedules 1-8 and goal 2 is related to schedules 9-15.

### Advanced Biochemistry

2 units (selection)

Teacher of course

**Target)** This class introduces biological regulations by signal transduction in multicellular organisms.

**Outline)** Biological regulations involving enzymes, substrates, and other macromolecules are introduced. Molecular mechanisms of expression of biological activities are especially focused.

**Style)** Lecture

**Keyword)** *signal transduction, signaling molecule, organelle*

**Fundamental Lecture)** “Biochemistry 1”(1.0), “Cell Biology”(1.0)

**Relational Lecture)** “Advanced enzyme engineering”(0.5, ⇒p.47), “Biological macromolecular chemistry”(0.5, ⇒p.48)

**Requirement)** Students are required to have a good understanding of undergraduate-level biochemistry.

**Goal)**

1. Understanding of regulatory mechanism of synthesis and secretion of signaling molecules.
2. Understanding of signal transduction and its regulatory factors in cells.

**Schedule)** 1. Cell structure and role of organelles 2. Biochemical techniques for studies of regulation of signal transduction 3. Imaging techniques for studies of regulation of signal transduction 4. Synthesis of peptide signaling molecules 5. Post-translational modifications of signaling molecules (1) Addition and processing of carbohydrate chains 6. Post-translational modifications of signaling molecules (2) Processing of polypeptides 7. Post-translational modifications of signaling molecules (3) Processing proteases and their substrates 8. Post-translational modifications of signaling molecules (4) Physiological functions of processing proteases 9. Regulation of secretion of signaling molecules 10. Quality control of signaling molecules (1) Intracellular transport 11. Quality control of signaling molecules (2) Intracellular degradation system 12. ER stress response 13. ER chaperones 14. Transcriptional regulation by ER stress 15. Development of new drugs targeting regulatory factors for signal transduction 16. Report preparation

**Evaluation Criteria)** Evaluation by report (100%)

**Textbook)** To be introduced in the class



**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216721>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ 生物事務室(M棟703)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

## Molecular Biotechnology

2 units (selection)

Sumihare Noji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Hideyo Ohuchi · ASSOCIATE PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand advanced technology for molecular biology

**Outline)** We will present recent topics on molecular biology and its applications for genetic engineering. 1) Molecular biology on insects and its applications (3), 2) Molecular biology on brain and neural systems (3), 3) Molecular biology on vertebrate development and its applications (4), 4) Molecular biology on human diseases (4).

**Style)** Lecture in combination with Portfolio

**Keyword)** *signalling pathways, transcription factors, genes and diseases*

**Relational Lecture)** “Technology for Bioreaction”(0.5, ⇒p.48), “Advanced Cell Physiology”(0.5, ⇒p.46), “Advanced Biotechnology”(0.5, ⇒p.47)

**Requirement)** N/A

**Notice)** N/A

**Goal)** To understand molecular mechanisms of development and diseases

**Schedule)** 1. Molecular biology of insects, early development 2. Molecular biology of insects, late development 3. Molecular biology of insects, regeneration 4. Molecular biology of insects, brain development 5. Molecular biology of insects, neural development 6. Molecular biology of insects, mutations 7. Molecular biology of vertebrates, early development 8. Molecular biology of vertebrates, late development 9. report for evaluation 10. Molecular biology of vertebrates, brain and neural development 11. Molecular biology of vertebrates, regeneration 12. Molecular biology of human diseases, limbs 13. Molecular biology of human diseases, eyes 14. Molecular biology of human diseases, muscles 15. Molecular biology of human diseases, general 16. Final report for evaluation

**Evaluation Criteria)** Evaluate two reports (50% each)

**Textbook)** N/A

**Reference)** Handouts

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216879>

**Student)** all

**Contact)**

⇒ Noji (G803, +81-88-656-7528, noji@bio.tokushima-u.ac.jp) (Office Hour: Monday 15:30-17:00)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

## Cell Biotechnology

2 units (selection)

Hideaki Nagamune · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Toshifumi Tomoyasu · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class aims to expand the knowledge on cell biotechnology and improve the skill of debate through the debate dealing with cell biotechnology and its applications.

**Outline)** Debates among students dealing with the latest reports on technology and application concerned with production of useful materials, medical assay, and medical treatment using various cells are held in order to deepen the knowledge on cell biotechnology and its peripheral field. Training on skills of debate and communication is simultaneously carried out.

**Style)** Lecture

**Keyword)** *cell, biotechnology, debate*

**Relational Lecture)** “Advanced Biochemistry”(0.8, ⇒p.44), “Molecular Biotechnology”(0.8, ⇒p.45), “Technology for Bioreaction”(0.8, ⇒p.48), “Biological macromolecular chemistry”(0.5, ⇒p.48), “Advanced enzyme engineering”(0.5, ⇒p.47)

**Requirement)** Students are required to have a good understanding of undergraduate-level of cell technology and related subjects

**Goal)**

1. To understand the latest cell biotechnology and its application examples

2. To gain the ability of debate on technologies concerned in cell biotechnology

**Schedule)** 1. Cell biotechnology on production of useful materials 1(Production of antibodies) 2. Cell biotechnology on production of useful materials 2(Production of enzymes) 3. Cell biotechnology on production of useful materials 3(Production of lymphokines) 4. Cell biotechnology on production of useful materials 4(Production of cytokines) 5. Cell biotechnology on production of useful materials 5(Production of bioactive proteins) 6. Cell biotechnology on medical or industrial assay 1(Measurement of cytotoxicity) 7. Cell biotechnology on medical or industrial assay 2(Analysis of signal transduction pathways) 8. Cell biotechnology on medical or industrial assay 3(Analysis of transcriptome) 9. Cell biotechnology on medical or industrial assay 4(Diagnostics of genome disorder/SNPs) 10. Cell biotechnology on medical or industrial assay 5(Diagnostics of intracellular bacteria/viruses) 11. Cell biotechnology on medical treatment 1(Artificial skin) 12. Cell biotechnology on medical treatment 2(Immune cell therapy) 13. Cell biotechnology on medical treatment 3(Cell transplant/Organ transplant) 14. Cell biotechnology on medical treatment 4(Techniques for clone development) 15. Cell biotechnology on medical treatment 5(ES cells/iPS cells)

**Evaluation Criteria)** Assignments count 50%, Presentation count 50%

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216662>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Nagamune (G707, +81-88-656-7525, nagamune@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** Preparation and review of two hours each are required for understanding of every class with two hours and taking the credits.

## Advanced Biophysical Chemistry

2 units (selection)

Hitoshi Matsuki · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Treatments of solutions containing biomolecules and analytical methods for interactions between biomolecular aggregates and physiologically active substances by means of the treatments are described.

**Outline)** The former part of this lecture describes solutions in which biomolecules reveal their actions from the macroscopic, microscopic and electrochemical viewpoints. The latter part deals with ligand partitioning into lipid bilayer membranes as examples of interactions between molecular aggregates formed by biomolecules and physiologically active substances. The molecular mechanisms of anesthesia until now are reviewed on the basis of the above subjects. Further industrial application of the interactions such as drug delivery systems is also explained. This lecture deals with industrial subjects.

**Style)** Lecture

**Keyword)** *solution, molecular aggregate, ligand, interaction, mechanism of anesthesia*

**Fundamental Lecture)** “Physical Chemistry 2”(1.0), “Biophysical Chemistry 2”(1.0)

**Relational Lecture)** “Biochemical Thermodynamics”(0.5, ⇒p.44)

**Requirement)** Students are required to have a good understanding of undergraduate-level physical chemistry and biophysical chemistry and related subjects.

**Goal)**

1. To understand the macroscopic, microscopic and electrochemical treatments of solutions.

2. To understand the partitioning modes of ligands into biomacromolecules and molecular mechanisms of anesthesia.

**Schedule** 1. Solution chemistry of bio-related substances (1) thermodynamics of solutions 1: basic equations of thermodynamics 2. Solution chemistry of bio-related substances (2) thermodynamics of solutions 2: theory of phase diagrams 3. Solution chemistry of bio-related substances (3) thermodynamics of solutions 3: equilibrium of solutions with gases, liquids and solids 4. Solution chemistry of bio-related substances (4) thermodynamics of solutions 4: interfacial phenomena 5. Solution chemistry of bio-related substances (5) statistical thermodynamics of solutions 1: basic equations of statistical mechanics 6. Solution chemistry of bio-related substances (6) statistical thermodynamics of solutions 2: ideal and regular solutions 7. Solution chemistry of bio-related substances (7) electrochemistry of solutions 1: ionic equilibrium 8. Solution chemistry of bio-related substances (8) electrochemistry of solutions 2: electrode reaction 9. Interactions between biomacromolecules and physiologically active substances (1) ligand partitioning into lipid membranes 1: nonspecific binding 10. Interactions between biomacromolecules and physiologically active substances (2) ligand partitioning into lipid membranes 2: specific binding 11. Interactions between biomacromolecules and physiologically active substances (3) effect of dissociation equilibrium of ligand 12. Interactions between biomacromolecules and physiologically active substances (4) mechanisms of anesthesia 1: introduction 13. Interactions between biomacromolecules and physiologically active substances (5) mechanisms of anesthesia 2: lipid membrane theories 14. Interactions between biomacromolecules and physiologically active substances (6) mechanisms of anesthesia 3: protein receptor theories 15. Interactions between biomacromolecules and physiologically active substances (7) action mechanisms of local anesthetics 16. Summary, inquiry and report preparations

**Evaluation Criteria** More than 80% percentage of attendance and reports (100%).

**Textbook** To be distributed materials adequately in the class.

**Reference**

◇ 本村欣士著「溶液化学」朝倉書店

◇ J. S. Rawlinson and F. L. Swinton "Liquids and Liquid Mixtures" Butterworths Scientific

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216738>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Matsuki (G607, +81-88-656-7513, matsuki@bio.tokushima-u.ac.jp) (Office Hour: Friday 16:20-17:50)

**Note** ◇When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit. ◇Goal 1 is related to schedules 1-8 and goal 2 is related to schedules 9-15.

## Advanced Cell Physiology

2 units (selection)

Yoshitoshi Nakamura · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** This class is intended to demonstrate how to use capable molecular viewers (PyMol & Coot) for protein structure, which can be used for detailed analyses of protein 3D-structure.

**Outline** This class (portfolio) introduces how the programs (PyMol & Coot) can be used, and what their capabilities are.

**Style** Portfolio

**Keyword** *protein 3D-structure, protein data bank, PyMol, Coot*

**Relational Lecture** "Biological macromolecular chemistry"(0.5, ⇒p.48)

**Requirement** Students are required to bring note-type PC, if necessary (Windows is better).

**Goal**

1. To understand protein coordinate file.
2. To understand operation of molecular viewers.

**Schedule** 1. Protein Data Bank and coordinate file 2. Installation of the programs 3. Getting started with mouse controls 4. Getting started with commands 5. Command syntax 6. Atom selection 7. Ray-tracing and stereo 8. Animation 9. Tutorial 1:basics 10. Tutorial 2:advanced techniques 11. Tutorial 3:example scripts 12. Exercise 1:editing of PDB file 13. Exercise 2:structural comparison 14. Exercise 3:DALI web server 15. Exercise 4: WHAT IF web server

**Evaluation Criteria** Drawing products with brief explanation (assignments count 100%)

**Textbook** To be introduced in the class

**Reference** To be introduced in the class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216663>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Administration Office(M703)

**Note** ◇When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit. ◇成績評価に対する平常点と試験の比率は 50:50 とする。平常点には講義への参加状況、演習への回答及びレポートの提出状況と内容を含み、試験は中間テストと最終試験の成績を含む。

## Advanced Microbiological Engineering

2 units (selection)

Takeshi Omasa · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** To learn bio-based production

**Outline** To understand basic engineering aspects from lab- to industrial-scale productions

**Style** Lecture

**Keyword** *biochemical engineering, bio-based production, separation and purification, environmental engineering*

**Fundamental Lecture** "Biomolecular Design"(0.4)

**Relational Lecture** "Advanced enzyme engineering"(0.4)

**Requirement** Undergraduate biotechnology is required

**Goal** To understand basic engineering aspects from lab- to industrial-scale productions. 1.bio-based production, 2.separation&purification, 3.environmental technology

**Schedule** 1. bioresources 2. bioinformatics-basic 3. bioinformatics-advanced 4. high throughput screening -basic 5. high throughput screening -basic 6. metabolic engineering -basic 7. metabolic engineering -advanced 8. kinetics of biocatalyst 9. bioreactor 10. separation of bioproducts 11. purification of bioproducts 12. sensing and control of bioprocess -basic 13. sensing and control of bioprocess -advanced 14. environmental biotechnology -basic 15. environmental biotechnology -advanced 16. term-end examination

**Evaluation Criteria** Presentation and discussion in each topics (70%), term end exam (30%)

**Textbook** コロナ社「バイオプロダクション —ものづくりのためのバイオテクノロジー—」化学工学会 バイオ部会編

**Reference** To be introduced in the class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216844>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Omasa (機械 813 (8 階), +81-88-656-7408, omasa@bio.tokushima-u.ac.jp) (Office Hour: Thu 12:00-13:30)

**Note** 2hr pre-and post-studies are required. Presentation in each topics is required.

## Biomolecular Design

2 units (selection)

Hitoshi Hori · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Yoshihiro Uto · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** 生体機能修飾物質 (特に生体活性物質や医薬品) の設計, 合成, 生体活性の基礎となる分子機能工学的概念としての "医薬品エレクトロノミクス medicinal electronics" について講述する。

**Outline** 分子機能工学に関する重要な基礎的な概念としての分子軌道論による生体機能修飾物質 (特に生体活性物質や医薬品) の生体機能分子設計について解説し, "医薬品エレクトロノミクス medicinal electronics" 的思考力を向上させる。

**Style** Lecture

**Keyword** *biomolecular functional design, molecular orbital theory*

**Relational Lecture** "Biological macromolecular chemistry"(0.5, ⇒p.48)

**Goal**

1. 分子機能工学手法としての分子軌道論を理解し, 実際, Hückel 法を使ってエチレンからベンゼンまでの分子軌道を手計算で求める。
2. medicinal electronics 的思考力の向上のため, 簡単な生体機能修飾作用物質の分子軌道計算を実践し, それらの物性や生体活性を定量的に論じることにより, 分子軌道論の果実を味わう。

**Schedule** 1. ) Biomolecular (functional) design and the concept of molecular orbital 2. Enzymatic reaction and molecular orbital 3. Quantum theory-based atomic structure and molecular bonds 4. Molecular structures and the concept of hybridized orbitals. Subject review report-1 5. Heteroatom containing structures. Discussion on subject review report-1 6. Structures of intermediates. Subject review report-2 7. Molecular orbital calculation-1: localized $\pi$ -bond. Discussion on subject review report-2 8. Molecular orbital calculation-2: localized $\pi$ -bond. Subject review report-3 9. ) Molecular orbital calculation-3: localized $\pi$ -bond. Discussion on subject review report-3 10. Molecular orbital calculation-4: delocalized $\pi$ -bond (butadiene) 11. Round-table discussion on subject review report-4 12. Molecular orbital calculation-5: delocalized $\pi$ -bond (cyclobutadiene). Subject review report-5 13. Round table discussion on subject review report-5 14. Another biomolecular design concepts: scaffold or "Ken-zan", pharmacophores, isosteres 15. Round table discussion on subject review report-6 16. Round-table discussion on this class "biomolecular design"

**Evaluation Criteria** 課した全課題レポート (100%) で評価する。 レポートはそれぞれ 100 点満点で評価し、すべてのレポートが 60 点以上の場合をもって合格とする。

**Textbook** Katsuhiro Saito "KozoYukikagaku(in Japanese)( Structural Organic Chemistry)"(Sankyo-Syuppan) and CD-ROM " WinMopac Version 3.0.3 (Trial) In Noriaki Hirayama, "Jissen Ryoshi-Kagaku (in Japanese: Practical Quantum Chemistry)"

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216878>

**Student** Able to be taken by student of other department

**Contact**

⇒ Hori (M821, +81-88-656-7514, hori@bio.tokushima-u.ac.jp) (Office Hour: Monday 11:55-12:50)

**Note** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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## Advanced Biotechnology

2 units (selection)

Hideaki Maseda · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** Acquire the fundamental, advanced and applied biotechnology

**Outline** Target and summary of this class is to understand applied microbiology, ecology, bioinstrumentation, food biotechnology, waste management and environmental biotechnology.

**Style** Lecture

**Keyword** *applied microbiology, food biotechnology, environmental biotechnology*

**Fundamental Lecture** "Engineering of Biological Environment"(0.4, ⇒p.42)

**Relational Lecture** "Advanced enzyme engineering"(0.4, ⇒p.47)

**Requirement** Students are required to have a good understanding of under graduate-level biotechnology and related subjects.

**Goal**

1. To understand the outline of biotechnology
2. To understand the outline of advanced biotechnology

**Schedule** 1. Outline of microbial bioengineering 2. basic and application of microbial bioengineering 3. Outline of biotechnology 4. basic and application of biotechnology 5. Ecology 6. Microbiological Ecology 7. Bioinstrumentation 8. new Bioinstrumentation 9. Outline of Food biotechnology 10. Basic Food biotechnology 11. Utilization of Food biotechnology 12. Outline of Waste management 13. Waste management 14. Outline of Environmental biotechnology 15. Environmental biotechnology 16. Final Examination

**Evaluation Criteria** Grade will be decided by the performance on the following: Final Exam (100%).

**Textbook** To be introduced in the class

**Reference** To be introduced in the class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216573>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Maseda (生物棟 814, +81-88-656-7524, maseda@bio.tokushima-u.ac.jp) (Office Hour: Friday 16:20-17:50)

**Note** For comprehending lectures and acquisition of credits, it is necessary to do a two-hour preparation lecture and a two-hour review every school hour of two hours.

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## Advanced Biomaterials

2 units (selection)

Toshifumi Tomoyasu · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Hideaki Nagamune · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** Study and investigate about the scientific background which produced the new technology.

**Outline** Students are required to investigate how the important discovery (which acquired the Nobel Prize as an example) were established and how improved our life and research activities by these accomplishments.

**Style** Lecture

**Keyword** *technology, biomolecules, research, application*

**Requirement** Required to have a good understanding of undergraduate-level biochemistry and molecularbiology.

**Goal**

1. Understand how the important discoveries in the scientific field were performed.
2. Investigate how the important discoveries are applied to our life and research.

**Schedule** 1. Orientation 2. Discoveries concerning the role played by the chromosome in heredity. T. Morgan. 3. The production of mutations by means of X-ray irradiation. H. Muller 4. Discovery of mobile genetic elements. B. McClintock. 5. The discovery of penicillin and its curative effect in various infectious diseases. A. Fleming, E. Chain, H. Florey. 6. Discovery of tumour-inducing viruses. P. Rous. 7. Interpretation of the genetic code and its function in protein synthesis. R. Holley, H. Khorana, M. Nirenberg. 8. The discovery of restriction enzymes and their application to problems of molecular genetics. H. Smith, W. Arber. 9. Contributions concerning the determination of base sequences in nucleic acids. W. Gilbert, F. Sanger. 10. The genetic principle for generation of antibody diversity. S. Tonegawa. 11. Contributions to the developments of methods within DNA-based chemistry. K. Mullis, M. Smith. 12. Discovery concerning the genetic control of early embryonic development. L. Lewis, C. Nüsslein-Volhard, E. Wieschaus. 13. Discovery of Prions - a new biological principle of infection. S. Prusiner. 14. The development of methods for identification and structure analyses of biological macromolecules. J. Fenn, K. Tanaka, K. Wüthrich. 15. Generalization of lectures

**Evaluation Criteria** Grades are judged about two attainment targets described above by a presentation (50 points) and a report (50 points). The student requires more than 60 points to a pass.

**Textbook** To be introduce in the class.

**Reference** To be introduce in the class.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216736>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Tomoyasu (G701, +81-88-656-9213, tomoyasu@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note** ◇Students require 2hrs preparation and 2hrs review per a lecture (2 hrs). ◇1-14th lectures contain both attainment targets 1 and 2.

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## Advanced enzyme engineering

2 units (selection)

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** This class introduces engineering of enzyme molecule for the medical application.

**Outline** Basics of design of enzyme and their inhibitor by chemical and gene technologies for medical application are introduced.

**Style** Lecture

**Keyword** *enzyme, medical application, protein engineering*

**Fundamental Lecture** "Biochemistry 1"(1.0), "Protein Engineering"(1.0)

**Relational Lecture** "Advanced Biochemistry"(0.5, ⇒p.44), "Biomolecular Design"(0.5, ⇒p.46), "Advanced Cell Physiology"(0.3, ⇒p.46)

**Requirement** Students are required to have a good understanding of undergraduate-level biochemistry.

**Goal**

1. Understanding of enzyme character required for therapeutic use.
2. Understanding of design of enzyme molecule for therapeutic use.

**Schedule**) 1. Introduction of medical application of enzyme 2. Basic of enzymology (1) Kinetics of enzyme reaction 3. Basic of enzymology (2) Regulation of enzyme activity 4. Therapeutic use of enzyme 5. Problem in therapeutic use of enzyme (1) Immunological problem 6. Problem in therapeutic use of enzyme (2) Drug delivery system. 7. Problem in therapeutic use of enzyme (3) Preparation of large quantity of enzyme 8. Example of design of enzyme for medical use 9. Example of design of enzyme for diagnosis 10. Engineered enzyme used for therapy of lysosome disease(1)Deficiency of beta glucosidase 11. Example of engineered enzyme used for therapy of lysosome disease (2) Deficiency of alpha glucosidase 12. Application of PEG-modified enzyme (1) Preparation of PEG asparaginase 13. Application of PEG-modified enzyme (2) Characterization of PEG asparaginase 14. Target enzyme for development of new drug 15. Engineering of enzyme inhibitor 16. Report preparation Presentation

**Evaluation Criteria**) Evaluation by report

**Textbook**) To be introduced in the class

**Reference**) To be introduced in the class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216646>

**Student**) Able to be taken by student of other department

**Contact**)

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note**) When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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## Technology for Bioreaction

2 units (selection)

Sumihare Noji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Hideyo Ohuchi · ASSOCIATE PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) Lectures for science and technology to use biological reactions. Especially, focusing on morphological formation of organisms, we will talk about how genomic information is decoded to build up body by bottom-up strategies.

**Outline**) We present lectures about technology for application of biological reactions, especially medical and engineering applications. We will focus on 1) genome projects, 2) application of genome information, 3) application of PCR to genetic analyses, 4) in situ hybridization for analysis of gene expression pattern, 5) application of in situ hybridization, 6) transgenic animals, 7) applications of transgenic animals, 8) knock-out animals, 9) applications of knock-out animals, 10) medical applications of knock-out animals

**Style**) Lecture in combination with Portfolio

**Keyword**) *genome science, RNA engineering, technology for developmental biology*

**Relational Lecture**) “Molecular Biotechnology”(0.5, ⇒p.45), “Molecular Biotechnology”(0.5, ⇒p.45), “Advanced Biochemistry”(0.5, ⇒p.44)

**Requirement**) N/A

**Notice**) N/A

**Goal**)

1. To understand structures of genomes and its analytical methods
2. To understand analytical methods for gene expression
3. To understand morphological genes and its structures
4. To understand mechanisms of developmental process

**Schedule**) 1. Evolution 2. Genomic structures and evolution 3. Transcription factors and gene expression 4. Cis-regulatory elements and regulation of gene expression 5. Gene expression patterns 6. Functions of RNAs 7. RNA interference 8. reports for evaluation 9. Homeobox genes 10. Genes for signalling pathways 11. Genes for cell-cell adhesion factors 12. Developmental mechanisms of *C. elegans* 13. Developmental mechanisms of insects 14. Developmental mechanisms of invertebrate 15. Developmental mechanisms of vertebrate 16. report for evaluation

**Evaluation Criteria**) Evaluate two reports (50% each).

**Textbook**) N/A

**Reference**) From DNA to Diversity

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216737>

**Student**) all students

**Contact**)

⇒ Noji (G803, +81-88-656-7528, noji@bio.tokushima-u.ac.jp) (Office Hour: Monday 15:30-17:00)

**Note**) When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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## Biological macromolecular chemistry

2 units (selection)

Yoshihiro Uto · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Hitoshi Hori · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) The goal is to understand the structure and function of biological macromolecules from the perspective of molecular recognition and interaction.

**Outline**) How do biological macromolecules recognize the target molecule and function? An introduction to the basic structural biology and stereochemistry of biological macromolecules. Topics include protein and nucleic acid structure. Students should make presentations focusing the molecular recognition and interaction of biological macromolecules based on the PDB data and their recent scientific papers with molecular modeling software “MacroModel”.

**Style**) Lecture

**Keyword**) *intermolecular interactions, molecular recognition, protein data bank, molecular modeling*

**Fundamental Lecture**) “Biomolecular Design”(0.5, ⇒p.46)

**Relational Lecture**) “Advanced Cell Physiology”(0.5, ⇒p.46), “Advanced enzyme engineering”(0.5, ⇒p.47)

**Requirement**) To understand the organic chemistry, medicinal chemistry, and the enzyme engineering

**Notice**) None

**Goal**)

1. To understand the principle of structure and function of biological macromolecule.
2. To understand the mechanisms of molecular recognition of biological macromolecule through PDB database search and molecular modeling software.

**Schedule**) 1. Orientation 2. Lecture 1: force interactions involved in the drug-protein complex 3. Exercise 1: search for a protein target for drug 4. Lecture 2: stereochemical interactions involved in the drug-protein complex 5. Exercise 2: search for 3D structures of targeting protein from the PDB 6. Lecture 3: mechanisms of enzyme catalysis 7. Exercise 3: conformational analysis of targeting protein 8. Lecture 4: drug design and drug action 9. Exercise 4: conformational analysis of drug 10. Lecture 5: Drug design with computational chemistry 11. Exercise 5: molecular modeling of drug 12. Lecture 6: Molecular modeling with MacroModel 13. Exercise 6: molecular modeling of protein 14. Exercise 7: molecular modeling of drug-protein complex 15. Exercise 8: evaluation of molecular modeling 16. Report

**Evaluation Criteria**) Only the student of the attendance rate 80% or more is evaluated by report(100%).

**Textbook**) R. B. Silverman; The ORGANIC CHEMISTRY of DRUG DESIGN and DRUG ACTION, ELSEVIER

**Reference**) T. L. Lemke, D. A. Williams, V. F. Roche, S. W. Zito; FOYE'S PRINCIPLES OF MEDICINAL CHEMISTRY, Lippincott Williams & Wilkins

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216730>

**Student**) Able to be taken by student of other department

**Contact**)

⇒ Uto (M820, +81-88-656-7522, uto@bio.tokushima-u.ac.jp) (Office Hour: 木曜日 16:20-17:50)

**Note**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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## Advanced Lecture on Semiconductor Nanotechnology

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target**) This class introduces basic principles of the semiconductor nanotechnology and their application to the quantum devices.

**Outline**) Basics of semiconductor physics and quantum mechanics are introduced to understand material properties of quantum confined nanostructures. Recent progress in fabrication techniques and device applications of semiconductor nanostructures (quantum wells, wires and dots) will be reviewed.

**Style**) Lecture

**Keyword)** *quantum confined nanostructures, semiconductor nanoscience, electron devices, photonic devices*  
**Requirement)** None.

**Notice)** None.

**Goal)** To understand basic properties of semiconductor nanostructures and quantum devices.

**Schedule)** **1.** Introduction to semiconductor nanostructures **2.** Electronic states in quantum confined structures **3.** Electrical properties of superlattices **4.** Fabrication technique of quantum wires and wells **5.** Characterization of heterointerfaces **6.** Characterization of nanostructures **7.** High-speed electron devices **8.** Optical properties of quantum wells **9.** Semiconductor laser diodes **10.** Quantum effect devices **11.** Fabrication technique of quantum dots **12.** Quantum dot devices **13.** Device application of quantum nano structures **14.** Recent topics of semiconductor nanotechnology (1) **15.** Recent topics of semiconductor nanotechnology (2)

**Evaluation Criteria)** Assignments count 100%

**Textbook)** None.

**Reference)** The Physics of Low-Dimensional Semiconductors, J.H. Davis, Springer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216818>

**Student)** Any students can attend the class.

**Contact)**

⇒ Isu (A224, +81-88-656-7670, [t.isu@frc.tokushima-u.ac.jp](mailto:t.isu@frc.tokushima-u.ac.jp)) (Office Hour: Tue -Thu 10:00-14:00)

⇒ Kitada (A224, +81-88-656-7671, [kitada@frc.tokushima-u.ac.jp](mailto:kitada@frc.tokushima-u.ac.jp)) (Office Hour: Mon. 10:00-14:00)

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### Practice for understanding scientific papers in biological technology 2 units (compulsory) Teacher of course

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**Target)** To learn how to read scientific papers for research

**Outline)** In order to obtain information on research and to learn how to present research results, students read papers related to their subjects of master thesis, present its contents, and discuss about contents of the paper.

**Style)** Lecture and exercise

**Keyword)** *reading of paper, presentation*

**Relational Lecture)** “Seminar in Biological Technology”(0.5, ⇒p.49), “Biological science and technology laboratory”(0.5, ⇒p.49)

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn how to read papers

**Schedule)** **1.** presentation and discussion 1 **2.** presentation and discussion 2 **3.** presentation and discussion 3 **4.** presentation and discussion 4 **5.** presentation and discussion 5 **6.** presentation and discussion 6 **7.** presentation and discussion 7 **8.** presentation and discussion 8 **9.** presentation and discussion 9 **10.** presentation and discussion 10 **11.** presentation and discussion 11 **12.** presentation and discussion 12 **13.** presentation and discussion 13 **14.** presentation and discussion 14 **15.** presentation and discussion 15 **16.** presentation and discussion 16

**Evaluation Criteria)** Mutual evaluation of presentation

**Textbook)** N/A

**Reference)** Related papers

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216747>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Administration Office(M703)

**Note)** Preparation and review of 1 hour each are required for understanding of every class with two hours and taking the credits.

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### Seminar in Biological Technology 2 units (compulsory) Teacher of course

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**Target)** The goal of this lecture is to acquire the knowledge necessary for research related to the Master's thesis.

**Outline)** Student elevates the reaseach ability and skill in the individual laboratory through presentation and active discussion as to the subject of study. In addition, the research skills in industrial and medical application reseaches should be acquired.

**Style)** Excercise

**Keyword)** *discussion for research work, oral presentation*

**Relational Lecture)** “生命テクノサイエンス研究論文”(0.5), “Biological science and technology laboratory”(0.5, ⇒p.49), “Practice for undrstanding scientific papers in bioogical technology”(0.5, ⇒p.49)

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn how to perform research

**Schedule)** **1.** Research presentation 1 and discussion **2.** Research presentation 2 and discussion **3.** Research presentation 3 and discussion **4.** Research presentation 4 and discussion **5.** Research presentation 5 and discussion **6.** Research presentation 6 and discussion **7.** Research presentation 7 and discussion **8.** Research presentation 8 and discussion **9.** Research presentation 9 and discussion **10.** Research presentation 10 and discussion **11.** Research presentation 11 and discussion **12.** Research presentation 12 and discussion **13.** Research presentation 13 and discussion **14.** Research presentation 14 and discussion **15.** Research presentation 15 and discussion **16.** Research presentation 16 and discussion

**Evaluation Criteria)** Evaluate master thesis

**Textbook)** N/A

**Reference)** Research papers

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216741>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Administration Office(M703)

**Note)** Preparation and review of 1 hour each are required for understanding of every class with two hours and taking the credits.

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### Biological science and technology laboratory 10 units (compulsory) Teacher of course

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**Target)** According to the subject of study, student carry out the research to obtain good ability and skill for reaseach and for presntation.

**Outline)** Students carry out each reseach according to the subject of study to elevate their reaseach ability and skill in the individual laboratory. In addition, they have to present their reseach reuslts for evaluation.

**Style)** Experiment

**Keyword)** *reseach work, presentation*

**Relational Lecture)** “Practice for undrstanding scientific papers in bioogical technology”(0.5, ⇒p.49), “Internship in Biological science and technology”(0.5, ⇒p.50)

**Requirement)** N/A

**Notice)** N/A

**Goal)** to learn how to perform experiments

**Schedule)** **1.** Experiments 1 **2.** Experiments 2 **3.** Experiments 3 **4.** Experiments 4 **5.** Experiments 5 **6.** Experiments 6 **7.** Experiments 7 **8.** Experiments 8 **9.** Experiments 9 **10.** Experiments 10 **11.** Experiments 11 **12.** Experiments 12 **13.** Experiments 13 **14.** Experiments 14 **15.** Experiments 15 **16.** Experiments 16

**Evaluation Criteria)** Evaluate rsearch papers for the master degree

**Textbook)** N/A

**Reference)** Research papers

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216746>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Administration Office(M703)

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**Internship in Biological science and technology**

2 units (selection)  
Teacher of course

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**Target**› To obtain knowledges and skills for practical works

**Outline**› To work in institutes, industries, and companies, students can learn practical skills, knowledges, researches, etc., by internship.

**Style**› Internship

**Keyword**› *internship*

**Relational Lecture**› “Practice for understanding scientific papers in biological technology”(0.5, ⇒p.49), “Biological science and technology laboratory”(0.5, ⇒p.49), “生命テクノサイエンス研究論文”(0.5)

**Requirement**› N/A

**Notice**› N/A

**Goal**› To learn what are practical knowledges, skills, and mind.

**Schedule**› **1.** Choose where to go to carry out the internship **2.** Schedules depend on the internship program **3.** Provide Reports

**Evaluation Criteria**› Evaluate Reports

**Textbook**› N/A

**Contents**› <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216743>

**Student**› Able to be taken by only specified class(es)

## Earth and Life Environmental Engineering — Ecosystem Engineering

### SYLLABUS OF SUBJECTS

#### ● Integrated Subjects

<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和	51
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee, Faculty of Engineering · First-line men with experience of practical business	52
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer	52
<b>Long-term Internship (M)</b> ... Yamanaka	52
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · Part-time Lecturer	53
<b>International Advanced Technology and Science 1</b> ... Murakami	53
<b>International Advanced Technology and Science 2</b> ... Murakami	53
<b>Presentation Method (M)</b> ... Graduate School of Advanced Technology and Science	54
<b>Internship (M)</b>	54
<b>Venture Business (M)</b>	54

#### ● Common Subjects

<b>Advanced Environmental Technology on Chemistry</b> ... Teacher of course	54
<b>Engineering of Biological Environment</b> ... Nakamura	54
<b>Advanced Environmental Systems Engineering</b> ... Kidoguchi · Kozuki · Kondo · Hashimoto · Fujisawa · Okushima · Matsuo · Yamanaka · Tomita · SATO · Ito · Nada	55

#### ● Departmental Subjects

<b>Advanced Computational Science</b> ... Takeuchi	55
<b>Topics of Analysis for Mathematical Science</b> ... Kohda	55
<b>Advanced applied analysis</b> ... Okamoto	55
<b>Quantum mechanics and advanced lecture in quantum physics</b> ... Michihiro	56
<b>Nano-material Engineering</b> ... Hashimoto	56
<b>Micromechanics</b> ... Matsuo	56
<b>Energy and Environmental Engineering</b> ... Kidoguchi	56
<b>Energy conversion systems</b> ... Nada	57
<b>Urban and Regional Planning</b> ... Kondo	57
<b>Information Engineering of Regional Environment</b> ... Okushima	57
<b>Principles of Disaster Risk</b> ... Kozuki · Yamanaka	57
<b>Well-being Technology for All</b> ... Fujisawa · SATO · Ito	58
<b>Design of Assistive Products</b> ... Fujisawa · SATO · Ito	58
<b>Chemistry and Technology for Recovery of Marine Resources</b> ... Hirotsu · Makita	58
<b>mitigation engineering</b> ... Yamanaka · Kozuki · Nakanishi · Hirai	59
<b>Advanced Environmental Ecology</b> ... Kamada · Kawaguchi	59

<b>City and Transport System Planning</b> ... Yamanaka · Sanada · WATANABE	59
<b>Actuator Control Theory</b> ... Miwa	59
<b>Measurement Science and Technology</b> ... Iwata · Ukida	60
<b>Optical properties of materials</b> ... Haraguchi	60
<b>Advanced Lecture on Semiconductor Nanotechnology</b> ... Isu · Kitada	60
<b>Web Programming</b> ... Shimomura · Ikeda	61
<b>Cell Biotechnology</b> ... Nagamune · Tomoyasu	61
<b>Advanced Biomaterials</b> ... Tomoyasu · Nagamune	61

#### ● Specialized Exercise and Experiments

<b>Advanced Ecosystem Engineering Seminar</b> ... Teacher of course	62
<b>Advanced Ecosystem Engineering Exercise</b> ... Teacher of course · Hosoi · Abe · Shimotsu · 新倉 · Asahi	62
<b>Ecosystem Engineering Laboratory</b> ... Teacher of course	62

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### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style** Lecture

**Keyword** *intellectual property, patent law, protect and use of intellectual property*

**Requirement** No requirement

**Notice** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student)** For the course students and other graduate school students.

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee , Faculty of Engineering / FACULTY OF ENGINEERING

First-line men with experience of practical business - PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成 14 から 16 年度にかけて「大学発ベンチャー 3 年 1000 社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もある。くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee , Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword) management, management of technology**

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.52), "Long-term Internship (M)"(0.5, ⇒p.52), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.53), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.

2. Ranking of the technology in management and that importance are appreciated.

3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumnuni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and



practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who register the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考:平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル)上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日)上勝学舎(第1回~第12回)○集中講義-2(ICTビジネスモデル) \* 12月21日(火)常三島キャンパス(第13回~第15回)○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ぐ奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松午(徳島大学教授) 11. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**  
⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)  
Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**  
1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)  
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Advanced Environmental Technology on Chemistry

2 units (selection)  
Teacher of course

**Target)** The present situation and subjects on chemistry in view of environmental pollution will be introduced. Recent development in chemistry to attempt to solve those subjects will be explained.

**Outline)** Based on the historical background on environmental pollution, the recent progress on analytical chemistry, biochemistry, catalysis and chemical process engineering for environmental protection will be explained.

**Style)** Lecture and exercise

**Keyword)** *environment, analytical chemistry, biochemistry, catalyst, chemical process*

**Fundamental Lecture)** "Advanced Analytical and Environmental Chemistry"(1.0, ⇒p.36), "Advanced Physical Chemistry"(1.0, ⇒p.35), "Advanced Materials Science"(1.0, ⇒p.37)

**Relational Lecture)** "Engineering of Biological Environment"(0.5, ⇒p.54), "Advanced Environmental Systems Engineering"(0.5, ⇒p.55)

**Requirement)** Requires undergraduate level knowledge of chemistry and chemical engineering.

**Goal)**  
1. To understand the present situation for environmental subjects on engineering.  
2. To develop ability for solving the environmental subjects.

**Schedule)** 1. Endocrine disrupters 2. Microwave dielectric heating: Its application to chemical reaction 3. Environmental problem and crystal growth 4. Analysis of trace elements 5. Properties of supercritical fluids and their utilization 6. Recent advances in organic chemistry: Synthesis and Function 7. The mystery of natural rubber 8. Asymmetric synthesis 9. Polymer materials and environment 10. Biodegradable polymer 11. Introduction to engineering utilization of space environment 12. Utilization of adsorption phenomena 13. Approach using apatite to studies on energy and environment 14. Present situation of phosphors for white LEDs 15. Optimization of chemical processes

**Evaluation Criteria)** Assignments count 100% mainly based on the presentation and report submitted.

**Textbook)** To be announced in the class.

**Reference)** To be announced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216581>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Committee Member of School Affair

### Engineering of Biological Environment

2 units (selection)  
Yoshitoshi Nakamura · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand recent studies on engineering of biological environment.

**Outline)** Advanced lectures for recent studies on engineering of biological environment

**Style)** Lecture

**Keyword)** *environment, biology, engineering*

**Requirement)** N/A

**Notice)** N/A

**Goal)**  
1. To understand general concepts of biomass  
2. To understand biomass conversion engineering  
3. To understand general concepts of bioremediation

**Schedule** 1. General concepts of biological environment 2. Characteristics of biomass and its effective utilization 3. Pretreatment of biomass by physical method 4. Pretreatment of biomass by chemical method 5. Pretreatment of biomass by biological method 6. Conversion of biomass into useful materials 7. Conversion of biomass into useful materials 8. Process system engineering for effective conversion of biomass 9. Reports 10. Classification, role, and application method of environmental organism 11. Bioremediation in water environment 12. Bioremediation in air environment 13. Bioremediation in soil environment 14. Environmental hormones, chemical pollutions and ethics 15. Recent topics and trend of industry for engineering of biological environment 16. Final Reports

**Evaluation Criteria**) Evaluation of Reports

**Textbook**) Prints

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216734>

**Contact**)

⇒ Nakamura (720, +81-88-656-7518, ynakamu@bio.tokushima-u.ac.jp) (Office Hour: 水曜日 17:00-18:00)

**Note**) ◇When you take this class, it is necessary to do preparation for 2h and revies for h every 2h class for your understanding and taking credit. ◇成績評価に対する平常点と試験の比率は 50:50 とする。平常点には講義への参加状況、演習への回答及びレポートの提出状況と内容を含み、試験は中間テストと最終試験の成績を含む。

## Advanced Environmental Systems Engineering

2 units (selection)

Yoshiyuki Kidoguchi · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shuichi Hashimoto · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shoichiro Fujisawa · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Masashi Okushima · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shigeki Matsuo · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Takuro Tomita · ASSISTANT PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Katsuya SATO · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Shin-ichi Ito · ASSISTANT PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Yuzuru Nada · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) To understand the present environmental problems and to acquire the advanced of the technique and the approach to solve problems on the point of the ecosystem engineering.

**Outline**) To explain the structure and function of environmental systems, the relationship between civil life and disaster prevention systems, and the changes of social system due to the technological revolution and the policy.

**Style**) Lecture

**Keyword**) *environmental policy, natural disaster, energy saving technology, welfare technology, miromechanical engineering*

**Goal**)

1. To understand the factor of environmental systems
2. To understand the structure of environmental systems
3. To understand the civil life and natural disaster prevention systems

**Schedule**) 1. The policy and natural disaster prevention measures (1) 2. The policy and natural disaster prevention measures (2) 3. The factor of environmental systems 4. Example of environmental systems 5. The structure of environmental systems 6. Example of structure of environmental systems 7. Civil life and nano-technology 1 8. Civil life and nano-technology 2 9. Midterm presentation 10. Well being technology 1 11. Well being technology 2 12. Ecosystem engineering 1 13. Ecosystem engineering 2 14. Hydrogen engine technology 15. Diesel engine engineering

**Evaluation Criteria**) Assignments count 100%

**Textbook**) To be introduced in th class

**Reference**) To be introduced in th class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216598>

**Contact**)

⇒ SATO (eco705, +81-88-656-2168, katsuyas@eco.tokushima-u.ac.jp)

**Note**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Advanced Computational Science

2 units (selection)

Toshiki Takeuchi · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) This class provides the basic technology for numerical calculation for the differential equation.

**Outline**) The numerical calculation methods for the differential equation are introduced.

**Style**) Lecture

**Keyword**) *numerical analysis, numerical computation, differential equation*

**Fundamental Lecture**) “Numerical Analysis”(1.0), “Basic Mathematics/微分積分学 I”(1.0), “Basic Mathematics/微分積分学 II”(1.0)

**Relational Lecture**) “Methods for analysis of mathematical phenomena”(1.0, ⇒p.8), “Numerical Analysis”(1.0)

**Requirement**) Students have to understand basic mathematics of undergraduate-level.

**Goal**) To understand principle of numerical calculation methods.

**Schedule**) 1. Introduction to numerical simulation 2. Mathematical model 3. Lagrange interpolation 4. Spline interpolation 5. Least squares method 6. Finite difference method 7. Arbitrary precision formula 8. Application to ordinary differential equation 9. Application to partial differential equation 10. Gauss-Seidel method 11. Successive Over-Relaxation method 12. Explicit method 13. Implicit method 14. Crank-Nicolson method 15. Numerical instabilities

**Evaluation Criteria**) Assignments count 100%

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216624>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Takeuchi (A206, +81-88-656-7544, takeuchi@pm.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00-15:00)

## Topics of Analysis for Mathematical Science

2 units (selection)

Atsuhito Kohda · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) Mathematical theory and technique for analysis of engineering phenomena

**Outline**) Mathematical theory to analyze problems in engineering and its application, mainly theory and technique of differential equations

**Style**) Lecture

**Relational Lecture**) “Advanced applied analysis”(0.2, ⇒p.9), “Differential Equations”(0.2, ⇒p.8)

**Requirement**) If you like undergraduate-level mathematics, it will be sufficient.

**Goal**) To be familiar with mathematical theory, that helps engineering study.

**Schedule**) 1. Theory of sets and maps 2. Cardinal numbers and bijection 3. Equivalence relations and cryptography 4. Linear space and tensor 5. Vector analysis and differential form 6. Cauchy's theorem and vector analysis 7. Differential form and Cauchy's theorem 8. Projective plane 9. Quadratic curves and projective plane 10. All quadratic curves are circles? 11. The index of vector fields 12. Applications of the index:fundamental theorem of algebra 13. Vector fields on the unit sphere 14. Why there is the north pole on the earth 15. Mathematics and computers 16. Summary

**Webpage**) <http://math1.pm.tokushima-u.ac.jp/lecture/>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216708>

**Contact**)

⇒ Kohda (A211, +81-88-656-7546, kohda@pm.tokushima-u.ac.jp) (Office Hour: 月曜 12:00~ 13:00)

## Advanced applied analysis

2 units (selection)

Kuniya Okamoto · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the functional analytic methods which are basic tools for mathematical sciences.

**Outline)** This subject provides basic theory of functional analysis which is considered as linear algebra in infinite-dimensional spaces. Functional analytic approaches to phenomena described by differential equations are introduced.

**Style)** Lecture

**Relational Lecture)** “Topics of Analysis for Mathematical Science”(0.5, ⇒p.55)

**Goal)** To apply the theory of modern analysis and recognize its significant role.

**Schedule)** 1. Differential equations and their solutions 2. Exponential of matrices 1 3. Uniqueness of solutions 4. Existence of solutions 5. Eigenvalues and eigenspaces 6. Projective representation 7. Exponential of matrices 2 8. Generalized eigenvalue problems 9. Dunford integrals 10. Holomorphic functions of matrices 11. Solution curve and stability 12. Stability of solutions 13. Ljapunov's method 14. Nonlinear case 15. Linear approximations 16. Summary

**Evaluation Criteria)** Evaluation by the report.

**Reference)** 『新微分方程式対話』 笠原皓司著, 日本評論社

**Webpage)** <http://math9.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216570>

**Contact)**

⇒ 岡本(A棟212室, TEL/FAX: 088-656-9441, E-mail: [okamoto@pm.tokushima-u.ac.jp](mailto:okamoto@pm.tokushima-u.ac.jp)) (Office Hour: 【WEB頁】のHPを参照のこと)

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### Quantum mechanics and advanced lecture in quantum physics

2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the quantum mechanics.

**Outline)** Basics of quantum mechanics are introduced.

**Style)** Lecture

**Keyword)** *quantum mechanics*

**Goal)** To understand the outline of quantum mechanics.

**Schedule)** 1. Introduction 2. Variational method 3. Lagrangian 4. Hamiltonian 5. Poisson's bracket expression 6. Quantization 7. Operator 8. Wavefunction 9. Expectation value 10. Schrödinger equation 11. Example (1) the square well potential 12. Example (2) the linear harmonic oscillator 13. Angular momentum 14. Example (3) hydrogen atom 15. Heisenberg equation 16. Field quantization

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216863>

**Contact)**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

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### Nano-material Engineering

2 units (selection)

Shuichi Hashimoto · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand the physical and chemical properties of materials at micro- and nano-scales for designing and assembling nano-structured materials with special consideration to environmental issues

**Outline)** Physical and chemical properties as well as characterization techniques of various materials will be discussed on the basis of micro- and nanostructure.

**Style)** Lecture

**Notice)** 授業中, 関数電卓等を用いて簡単な計算を行う場合がある.

**Goal)** 環境との相互作用を考慮しつつさまざまな材料の性質をミクロな視点から理解すること.

**Schedule)** 1. Introduction 2. Structure of solids 3. Structure of solids 4. Optical properties of solids 5. Optical properties of solids 6. Optical properties of solids 7. Optical properties of solids, assignment1 8. Evaluation technique of nano-materials 9. Evaluation technique of nano-materials 10. Evaluation technique of nano-materials 11. Evaluation technique of nano-materials, assignment2 12.

Application of nano-materials 13. Application of nano-materials 14. Current topics in nano-materials and nanotechnology 15. Current topics in nano-materials and nanotechnology 16. exam

**Evaluation Criteria)** assignment1 25% assignment2 25% exam 50%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216801>

**Student)** Able to be taken by student of other department and faculty

**Contact)**

⇒ Hashimoto (Eco405, +81-88-656-7389, [hashi@eco.tokushima-u.ac.jp](mailto:hashi@eco.tokushima-u.ac.jp))

**Note)** 授業を受ける際には, 2時間の授業時間毎に2時間の予習と2時間の復習をしようとして授業を受けることが, 授業の理解と単位取得のために必要である.

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### Micromechanics

2 units (selection)

Shigeki Matsuo · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand the science of micro-to-nanometer domain, and learn the techniques to investigate such a domain.

**Outline)** To study the methods for precise measurement and manufacturing, in addition, microsensors, micromachining, and microactuators. In addition, hot topics concerning science and technology will be referred and discussed at any time.

**Style)** Lecture

**Keyword)** *micro, nano*

**Goal)** To obtain basic knowledges on the micro-to-nanometer domain

**Schedule)** 1. Physics and chemistry in microdomain 2. Physics and chemistry in microdomain 3. Physics and chemistry in microdomain 4. Physics and chemistry in microdomain 5. Measurements in microdomain 6. Measurements in microdomain 7. Measurements in microdomain 8. Micromachining 9. Micromachining 10. Micromachining 11. Microsensors 12. Microsensors 13. Microsensors 14. Microactuators 15. Microactuators

**Evaluation Criteria)** Assignments count 100%.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216887>

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### Energy and Environmental Engineering

2 units (selection)

Yoshiyuki Kidoguchi · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class addresses to understand characteristics and background of the global warming problem and the depletion of energy resources for effective utilization system of energy resources.

**Outline)** Lecture on fossil fuels resources, environmental pollutant and environmental loading, principal of thermal energy conversion and conversion technology, nuclear energy and thermal reactor, the renewable energy and waste energy systems.

**Keyword)** *environmental problem, energy security, global warming, energy conversion*

**Requirement)** None

**Notice)** Basic subjects concerning the engineering

**Goal)** To understand characteristics and background of the global warming problem and the depletion of energy resources, and to master the ability solving the energy security on the point of engineering field.

**Schedule)** 1. Energy Fundamentals 2. Pollution of the Atmosphere 3. Principal of Thermal Energy Conversion 4. Thermal Energy Conversion System 5. Fossil Fuels Coal, Petroleum and Natural Gas 6. Combustion Method and System of Fossil Fuels 7. Hydroelectric and Thermal Power Generation 8. Nuclear Energy 9. Introduction of New Energy 10. Geothermal Energy System 11. Wind Energy and Solar Energy System 12. Fuel Cell 13. Biomass Energy System 14. Wastes Energy System 15. Hydrogen Energy System

**Evaluation Criteria)** Grading with attitude for lecture and some reports. Need to obtain 60 points out of 100 points for passing this lecture. Every lesson is planned to attain the targets of this lecture. Students' achievement of the targets is partly accessed by the reports.

**Textbook)** Energy Environment

**Reference)** To be introduced in the class

**Webpage**) <http://www.eco.tokushima-u.ac.jp/w3/miwa/index.html>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216566>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Kidoguchi (Eco502, +81-88-656-9633, kidog@eco.tokushima-u.ac.jp) (Office Hour: 随時)

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## Energy conversion systems

2 units (selection)

Yuzuru Nada · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) To understand principle of energy conversion and to consider improvement of energy conversion technologies on the point of saving energy consumption and decreasing environmental damages

**Outline**) About 90% of world primary energy demands are provided by fossil fuel that is converted into heat, electricity, and power by combustion. The lecture will give you some information and idea about the details of combustion phenomena, and then the latest technologies of energy production and the environmental problems accompanying with energy production will be denoted. This subject is concerned with industry.

**Style**) Lecture

**Keyword**) *energy conversion, energy resources, energy problem, climate change, combustion*

**Requirement**) None

**Notice**) None

**Goal**) To understand principle of energy conversion, environmental effect of energy conversion and present technologies of energy conversion, and to recognize the importance of improvement of energy conversion technologies against environmental protection

**Schedule**) 1. Present energy problem 2. Combustion chemistry 1 3. Combustion chemistry 2 4. Thermal and fluid dynamics in combustion phenomena 1 5. Thermal and fluid dynamics in combustion phenomena 2 6. Premixed combustion 1 7. Premixed combustion 2 8. Non-premixed combustion 1 9. Non-premixed combustion 2 10. Spray combustion 1 11. Spray combustion 2 12. Toxic emissions by combustion 1 13. Toxic emissions by combustion 2 14. Energy saving technologies (Present technologies) 15. Energy saving technologies (Future technologies)

**Evaluation Criteria**) Appraise the understanding of the content of the lecture by setting some reports

**Textbook**) Takashi Niioka, "fundamentals of Combustion Phenomena

**Reference**) None

**Webpage**) <http://www.eco.tokushima-u.ac.jp/w3/miwa/index.html>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216567>

**Student**) Any students other than this course can take this subject

**Contact**)

⇒ Nada (ynada@eco.tokushima-u.ac.jp)

**Note**) Need to submit some reports

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## Urban and Regional Planning

2 units (selection)

Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) The concept and technique to describe not only the vision but also design in the future urban and regional plan are lectured.

**Outline**) The technique of urban and regional planning is explained using various materials in practical planning. The debate is introduced to develop the ability in design of planning for students.

**Style**) Lecture and exercise

**Keyword**) *urban and regional planning, proposition of vision, planning design*

**Fundamental Lecture**) "Advanced Environmental Systems Engineering"(0.2, ⇒p.55)

**Relational Lecture**) "Information Engineering of Regional Environment"(0.8, ⇒p.57)

**Requirement**) 特になし

**Notice**) 特になし

**Goal**) To understand the concept and technique to describe the future urban and regional plan.

**Schedule**) 1. Guidance and purpose of this subject 2. Examples of urban planning 3. Examples of regional planning 4. Planning and law 5. Examples of application of law 6. Economic analysis in planning (Theory) 7. Economic analysis in planning (Application) 8. Concept of systems analysis in planning 9. Application of systems analysis in planning 10. Explanation of Exercise 11. Exercise of planning 1 12. Exercise of planning 2 13. Presentation of planning 14. Discussion about the future of region 15. Discussion about the vision of region

**Evaluation Criteria**) Assignments count 100%.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Webpage**) <http://www.eco.tokushima-u.ac.jp/w3/kondo/top/index.htm>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216799>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp) (Office Hour: 月曜日9-10校時)

**Note**) 特になし

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## Information Engineering of Regional Environment

2 units (selection)

Masashi Okushima · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) The information of regional environment, technique of analysis and information management are explained. The method and technique using for application of environmental information to development of regional policies are lectured.

**Outline**) The information of regional environment, technique of analysis, information management and geographic information system are explained using the various kinds of materials and examples in practical planning.

**Style**) Lecture and exercise

**Keyword**) *information of regional environment, technique of analysis*

**Relational Lecture**) "Urban and Regional Planning"(0.8, ⇒p.57), "Advanced Environmental Systems Engineering"(0.2, ⇒p.55)

**Requirement**) 特になし

**Notice**) Please download files for this lecture from u-learning system, print out and take to the lecture room. The materials are not distributed in the lecture.

**Goal**) To obtain the knowledge of the information of regional environment, technique in survey, information management and computer aid systems, and apply them to design of regional plan and political simulation.

**Schedule**) 1. Bayes&apos; theorem 2. discrete choice analysis 3. expert system 4. fuzzy reasoning 5. neural network 6. genetic algorithm 7. decision tree 8. analytic hierarchy process 9. fuzzy integration 10. game theory 11. evolution game theory 12. reinforcement learning 13. complex system 14. presentation of results of exercise : part 1 15. presentation of results of exercise : part 2

**Evaluation Criteria**) Evaluation of calculation exercises and final presentation count 100%.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Webpage**) <http://uls01.ulc.tokushima-u.ac.jp/>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216753>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Okushima (ECO 603, +81-88-656-7340, okushima@eco.tokushima-u.ac.jp)

**Note**) 特になし.

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## Principles of Disaster Risk

2 units (selection)

Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand concept of risk, risk management, damage reducing measure ability to natural disaster  
**Outline)** To understand historical earthquakes and tsunamis, characteristics of earthquake and tsunami, prediction of damage, to cultivate presentation skill and debate ability.

**Keyword)** *earthquakes and tsunamis, disaster prevention assessment, risk management*

**Relational Lecture)** "Principle of Environmental Risk"(0.5)

**Goal)** Training-up of technical knowledge to the natural disaster, the basic knowledge which can correspond to the risk management and the crisis management

**Schedule)** 1. Historical Earthquakes in Japan 2. Historical Tsunamis in Japan 3. Characteristics of Earthquake 4. Characteristics of Tsunami 5. Generation Characteristics of Nankai Earthquake 6. Generation Characteristics of Nankai Earthquake and Tsunami 7. Disaster Prevention for Earthquakes and Tsunamis 8. Disaster Prevention Assessment for Earthquakes and Tsunamis 9. What is Risk Management? 10. Practice of Risk Management for Earthquakes and Tsunamis(1) 11. Practice of Risk Management for Earthquakes and Tsunamis(2) 12. Presentation of Tsunami Risk Assessment 13. Study tour: The January 17, 1995 Hyogoken-Nambu earthquake 14. Study tour: Nankai Earthquake in Tokushima 15. Study tour: Tokushima Disaster Prevention Center

**Evaluation Criteria)** Assignments Count 100%

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216659>

**Student)** To be limited to students of course

**Contact)**

⇒ Kozuki (Eco505, +81-88-656-7335, kozuki@eco.tokushima-u.ac.jp) (Office Hour: 火曜日, 14:35 から 16:05, 18:00 から 19:30)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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## Well-being Technology for All

2 units (selection)

Shoichiro Fujisawa · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Katsuya SATO · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Shin-ichi Ito · ASSISTANT PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand the philosophy of welfare and the classification of disability, and to learn the importance of assistive technology.

**Outline)** The role and the necessity of assistive technology will be explained, and provisions and means to assist a person with disabilities in daily living will be lectured.

**Keyword)** *assistive technology, a person with disability, aged people, assistive products, assist of daily living*

**Goal)** To understand the role and the necessity of the well-being technology, and to understand technical provisions and means to assist a person with disability in daily living.

**Schedule)** 1. History of rehabilitation engineering 2. Statistics of persons with disabilities 3. Classification of disabilities (1) 4. Classification of disabilities (2) 5. Infrastructure for persons with sensory impairments 6. Infrastructure for persons with physical impairments 7. Infrastructure for persons with intellectual impairments 8. Objective of a white cane and how to use it 9. Experience of disability (1) : visual impairment 10. Experience of disability (2) : visual impairment 11. Assistive products for transfer and mobility 12. Dynamics of wheelchair 13. Experience of disability (3) : physical impairment 14. Experience of disability (4) : physical impairment 15. Conclusion

**Evaluation Criteria)** Understanding of lecture will be evaluated through reports submitted after each lesson.

**Textbook)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216909>

**Contact)**

⇒ Fujisawa (ECO704, +81-88-656-7537, s-fuji@eco.tokushima-u.ac.jp) (Office Hour: 水曜日 18:00~20:00)

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## Design of Assistive Products

2 units (selection)

Shoichiro Fujisawa · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Katsuya SATO · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Shin-ichi Ito · ASSISTANT PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** It aims to learn how to realize and how to keep the quality of assistive products in the view point of international marketing and to acquire the ability of designing of products used at office, working place and home in which the concept of adapting the device to the human being is installed.

**Outline)** Assistive technology for daily living of persons with disabilities in the society. Human factors and R & D of assistive products and services. Adapting the environment to the people instead of the people adapting to the environment. Evaluation of appropriateness of assistive technology system for a person.

**Style)** Lecture

**Keyword)** *assistive product, Japanese Industrial Standard, International Standard, ISO, outcome measure*

**Goal)** Objective of this lecture is to understand the current state of assistive products in the world and international standard of them, and to learn designing of them. Moreover, it aimed to learn the method of outcome measure of assistive products and to be able to consider the total arrangement of products at working place and at home.

**Schedule)** 1. Introduction : assistive products as industrial products, ergonomic approach 2. Situation of assistive technology in the world : North America, Europe and Japan 3. Assistive products as industrial products : Japanese Standard, International Standard and Guidelines for all people including elderly and people with disabilities 4. Human factors (1) : Decrease of physical function according to aging 5. Human factors (2) : Decrease of sensory function according to aging 6. Japan Industrial Standards of Assistive Products : Wheelchair (1) 7. Japan Industrial Standards of Assistive Products : Wheelchair (2) 8. Japan Industrial Standards of Assistive Products : Artificial Legs 9. Japan Industrial Standards of Assistive Products : Artificial Arms 10. Japan Industrial Standards of Assistive Products : Beds 11. Japan Industrial Standards of Assistive Products : Hoists 12. Personal environment control system : Smart House, ECS and Home bus system 13. Fitting of assistive products in daily living (1) : Methods of outcome measure 14. Fitting of assistive products in daily living (2) : Methods of outcome measure 15. Guideline for work place : Legislation and remodeling of work place

**Evaluation Criteria)** Results will be evaluated through the lecture and reports submitted after each lesson.

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216807>

**Contact)**

⇒ Fujisawa (ECO704, +81-88-656-7537, s-fuji@eco.tokushima-u.ac.jp) (Office Hour: 水曜日 18:00~20:00)

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## Chemistry and Technology for Recovery of Marine Resources

2 units (selection)

Takahiro Hirotsu · PROFESSOR / MARINE ENVIRONMENT SCIENCE AND ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Yoji Makita · ASSOCIATE PROFESSOR / MARINE ENVIRONMENT SCIENCE AND ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class describes the recovery of valuable elements in seawater that have not been utilized.

**Outline)** This class describes the advanced technology of recovery of valuable elements such as uranium and lithium in seawater and the remained subjects for practical use.

**Style)** Lecture

**Keyword)** *seawater, rare resources, recovery, uranium, lithium, adsorption, ion exchange, chelation*

**Goal)** understanding of the technology of recovery of valuable resources from seawater

**Schedule)** 1. Importance of recovery of valuable resources from seawater 2. Inorganic resources in seawater 3. Recovery methods of valuable resources in seawater 1 4. Recovery methods of valuable resources in seawater 2 5. Adsorption method 1 6. Adsorption method 2 7. Development of adsorbents 1: ion-exchangers 8. Development of adsorbents 2: ion-exchangers 9. Development of adsorbents 3: chelating resins 10. Development of adsorbents 4: chelating resins 11. Mechanism of ion-exchange of lithium ions 12. Recovery process of lithium from seawater 13. Mechanism of uptake of uranium 14. Recovery process of uranium 15. Recovery costs of uranium and lithium 16. Perspective of recovery of uranium and lithium from seawater

**Evaluation Criteria)** Evaluation of the degree of understanding by report of some essential subjects

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216679>

**Student)** Able to be taken by student of other department and faculty

**Contact)**

⇒ Hirotsu (National Institute of Advanced Industrial Science and Technology, +81-87-869-3562, takahiro-hirotsu@aist.go.jp) (Office Hour: 産業技術総合研究所, 087-869-3562, takahiro-hirotsu@aist.go.jp)

## mitigation engineering

2 units (selection)

Ryoichi Yamanaka · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Takashi Nakanishi · PART-TIME LECTURER / 総合科学科, Ken Hirai · PART-TIME LECTURER / 非常勤講師

**Target)** To understand the background and the significance of mitigation and to acquire fundamental principles of mitigation technique.

**Outline)** To explain concept, history, technology and examples of mitigation for national land development and global environment problems

**Style)** Lecture

**Keyword)** *mitigation, coastal environment, ecosystem, environmental restoration*

**Fundamental Lecture)** “Principles of Disaster Risk”(1.0, ⇒p.57), “Urban and Regional Planning”(1.0, ⇒p.57)

**Relational Lecture)** “Advanced Environmental Ecology”(0.5, ⇒p.11), “Advanced Environmental Systems Engineering”(0.5, ⇒p.55)

**Goal)** To acquire ideas and fundamental of mitigation

**Schedule)** 1. Introduction 2. Deterioration of coastal environment 3. Mitigation for coastal environment(1) 4. Mitigation for coastal environment(2) 5. Mitigation for coastal environment(3) 6. Mitigation for coastal environment(4) 7. Environmental Risk 8. Mitigation of global environment problems(1) 9. Mitigation of global environment problems(2) 10. Discussion: Mitigation for land development(1) 11. Discussion: Mitigation for land development(2) 12. Discussion: Mitigation for land development(3) 13. Discussion: Mitigation for land development(4) 14. Discussion: Mitigation for land development(5) 15. Examination 16. Discussion

**Evaluation Criteria)** Evaluate learning results by reports, debates and examination

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216894>

**Contact)**

⇒ Yamanaka (総合研究実験棟(エコ棟)504号室, +81-88-656-7334, yamanaka@eco.tokushima-u.ac.jp) (Office Hour: Tuesday 14:35-17:50)

**Note)** Preparation (2 hours) and review (2 hours) is required for each class.

## Advanced Environmental Ecology

4 units (selection)

Mahito Kamada · PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Yoichi Kawaguchi · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose is to develop the knowledge and skill for conservation and restoration of ecosystems.

**Outline)** Current situation of ecosystems and technical problems for conservation and restoration are explained. The way of ecosystem management is emphasized to improve ecosystem. All students must give a presentation to introduce their own activities.

**Style)** Lecture in combination with Portfolio

**Keyword)** *ecosystem management, environmental conservation, nature restoration*

**Goal)** Every student has basic knowledge and skill to improve ecosystem function in the actual society.

**Schedule)** 1. Guidance 2. Interdisciplinary aspects for ecosystem management 1 3. Interdisciplinary aspects for ecosystem management 2 4. Current situation and problems in ecosystem management 1 5. Current situation and problems in ecosystem management 2 6. Current situation and problems in ecosystem management 3 7. Current situation and problems in ecosystem management 4 8. View points to know the structure and function of ecosystems 1 9. View points to know the structure and function of ecosystems 2 10. View points to know the structure and function of ecosystems 3 11. View points to know the structure and function of ecosystems 4 12. Toward an adequate management of ecosystems 1 13. Toward an adequate management of ecosystems 2 14. Toward an adequate management of ecosystems 3 15. General discussion / Report

**Evaluation Criteria)** Result is evaluated by contents of the reports, which are set after every related lectures. Over 60% marks is necessary to pass.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216599>

**Student)** Able to be taken by student of other department and faculty

**Contact)**

⇒ Kamada (A306, +81-88-656-9134, kamada@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること。)

⇒ Kawaguchi (308, +81-88-656-9025, kawaguchi@ce.tokushima-u.ac.jp) (Office Hour: 金曜午後)

## City and Transport System Planning

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Junko Sanada · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Kojiro WATANABE · ASSISTANT PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Advanced course on concept and case study of social and public policies on urban, regional and transport planning. Study on contents and usage of measures on such planing fields.

**Outline)** Lectures on Systems approaches on city planning and transport planning, theories and usage of planning models and planning methods. A unit is consisted of three hours lecture and an hour training.

**Style)** Lecture and exercise

**Keyword)** *city planning, transport planning, GIS*

**Fundamental Lecture)** “Urban & Transport Planning”(1.0), “Project Evaluation Methods for Infrastructure Planning”(1.0)

**Relational Lecture)** “都市・地域計画論”(0.5), “Infrastructure Planning”(0.5)

**Goal)**

1. Understanding of problems and recent strategies on city and transport planning  
2. Understanding of consensus building method for developing city and transport strategies

**Schedule)** 1. Problems of City and Transport Systems 1 2. Problems of City and Transport Systems 2 3. Recent Planning Strategies of City and Transport System 1 4. Recent Planning Strategies of City and Transport System 2 5. Recent Planning Strategies of City and Transport System 3 6. Recent Planning Strategies of City and Transport System 4 7. Debate by group on transport strategies 8. City and Regional Planning 1 9. City and Regional Planning 2 10. City and Regional Planning 3 11. City and Regional Planning 4 12. Introduction of GIS 13. Practice on GIS for City and Transportation Planning 1 14. Practice on GIS for City and Transportation Planning 2 15. Practice on GIS for City and Transportation Planning 3

**Evaluation Criteria)** Achievement level of the each target is evaluated by the submitted essays and reports. Score of 60points or over is required to clear the target. Students are required to clear the both of targets. Total score is average of the scores of two targets.

**Textbook)** Textbook is introduced in the class. Related documents is distributed to students.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216796>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示を参照のこと)

⇒ Sanada (A411, +81-88-656-7578, sanajun@ce.tokushima-u.ac.jp)

⇒ WATANABE (kojiro@ce.tokushima-u.ac.jp) (Office Hour: See the department notice board every year)

## Actuator Control Theory

2 units (selection)

Masafumi Miwa · ASSOCIATE PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the characteristics of actuators, the design methods of servo system.

**Outline)** The structure and function of actuators or control valves, the design of servo system, PWM control method, the practical and intelligent control algorithm are explained.

**Style)** Lecture

**Keyword)** *actuator, servo system, control algorithm*

**Relational Lecture)** “Measurement Science and Technology”(0.5, ⇒p.26)

**Requirement)** Students are required to have a good understanding of undergraduate-level control engineering and related subjects.

**Goal)** To understand the design methods of servo system using actuators.

**Schedule)** 1. Outline of actuators 2. Micro-drive electromotive actuators 3. Electromotive actuators 4. Novel actuators 5. Hydraulic actuators 6. Hydraulic control valves 7. Hydraulic servo system 8. Pneumatic actuators 9. Pneumatic control valves 10. Pneumatic servo system 11. PWM control method 12. Model matching methods 13. Neural controller 14. Two-degree-of-freedom control method 15. Model driven control method 16. Examination

**Evaluation Criteria)** Assignments count 30 % and examination count 70 %.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216551>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Miwa (M420, +81-88-656-7387, miw@me.tokushima-u.ac.jp)

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## Measurement Science and Technology

2 units (selection)

Tetsuo Iwata · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

Hiroyuki Ukida · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

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**Target)** To understand importance of the Fourier transformation for developing various kinds of measurement techniques, measurement equipments, measurement systems.

**Outline)** Among the various measurement techniques used in the fundamental and applied research, optical measurement methods including their principles, methodologies, instrumentations, and evaluation methods are reviewed. In the lecture, emphasized is the importance of the concept of the Fourier transformation to understand and to deal with linear systems in the modern scientific measurement system. Practical methods of object inspections, distance measurements, and shape reconstructions using images are also lectured.

**Style)** Lecture

**Keyword)** *measurement techniques, measurement devices, Fourier transform*

**Relational Lecture)** “Micro-Nano Engineering”(0.5, ⇒p.27), “Digital Control Theory”(0.5, ⇒p.25), “Actuator Control Theory”(0.5, ⇒p.25)

**Goal)**

1. To understand Fourier series and Fourier transform.
2. To understand relations among Fourier transform and measurement principles of scientific instruments.
3. To understand techniques used with practicable various measurement devices.

**Schedule)** 1. Frequency response of the amplifier 2. Optical information processing 3. Fourier-transform infrared spectroscopy 4. Subfringe interferometry 5. Computed tomography 6. Sampling theorem and quantization theorem 7. Wavelet transformation 8. Lock-in amplifier and boxcar integrator 9. Optics for microscope 10. X-ray diffraction 11. Image measurement systems 12. Feature extraction from images 13. Binocular stereo method 14. Pattern projection 15. Shape from shading and texture 16. Examination

**Evaluation Criteria)** Assignments count 50% and examinations count 50%.

**Textbook)** Printed synopses are used.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216629>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Iwata (M427, +81-88-656-9743, iwata@me.tokushima-u.ac.jp)

⇒ Ukida (M424, +81-88-656-9448, ukida@me.tokushima-u.ac.jp) (Office Hour: 毎週金曜日 17:00~18:00)

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## Optical properties of materials

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

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**Target)** To understand the principle of optical response of atoms, molecules and crystals. To develop ability to apply such optical phenomena to applications.

**Outline)** With quantum mechanics, we lecture optical process of materials. This course will cover the following topics: optical properties of materials for engineering, classical electromagnetic theory and optical property, optical transitions and optical process of atoms, molecules and semiconductors.

**Style)** Lecture

**Keyword)** *quantum mechanics, condensed matter, optical process, semiconductor*

**Relational Lecture)** “Photonic Device”(0.5, ⇒p.68), “Lecture in Optical Materials and Devices, Part 1”(0.5, ⇒p.95)

**Requirement)** Students should have fundamental knowledges of quantum mechanics.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. Students can explain the optical processes of atoms and molecules.
2. Students can explain the optical processes in semiconductors.

**Schedule)** 1. Introduction 2. Optical response described by classical electro-magnetic theory 3. Schrodinger equation and wave function 4. Hydrogen atom model 5. spin angular momentum 6. Quantum mechanics of light 7. Transition induced by interaction between electron state and light 8. Light absorption and emission 9. Electron transition in atoms and molecules 10. Optical spectra of atoms and molecules 11. Optical spectra of organic molecules 12. Energy bands in condensed matters 13. Optical processes in semiconductors 14. Optical spectra of impurity atoms in a crystal 15. Optical process of P-N junction 16. Final Examination

**Evaluation Criteria)** Activity: 20%, Reports: 40% and Final Exam.:40%

**Textbook)** 中澤, 鎌田著, 光物性・デバイス工学の基礎, 培風館 1999

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216840>

**Contact)**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

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## Advanced Lecture on Semiconductor Nanotechnology

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

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**Target)** This class introduces basic principles of the semiconductor nanotechnology and their application to the quantum devices.

**Outline)** Basics of semiconductor physics and quantum mechanics are introduced to understand material properties of quantum confined nanostructures. Recent progress in fabrication techniques and device applications of semiconductor nanostructures (quantum wells, wires and dots) will be reviewed.

**Style)** Lecture

**Keyword)** *quantum confined nanostructures, semiconductor nanoscience, electron devices, photonic devices*

**Requirement)** None.

**Notice)** None.

**Goal)** To understand basic properties of semiconductor nanostructures and quantum devices.

**Schedule)** 1. Introduction to semiconductor nanostructures 2. Electronic states in quantum confined structures 3. Electrical properties of superlattices 4. Fabrication technique of quantum wires and wells 5. Characterization of heterointerfaces 6. Characterization of nanostructures 7. High-speed electron devices 8. Optical properties of quantum wells 9. Semiconductor laser diodes 10. Quantum effect devices 11. Fabrication technique of quantum dots 12. Quantum dot devices 13. Device application of quantum nano structures 14. Recent topics of semiconductor nanotechnology (1) 15. Recent topics of semiconductor nanotechnology (2)

**Evaluation Criteria)** Assignments count 100%

**Textbook)** None.

**Reference)** The Physics of Low-Dimensional Semiconductors, J.H. Davis, Springer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216818>

**Student)** Any students can attend the class.

**Contact)**

⇒ Isu (A224, +81-88-656-7670, t.isu@frc.tokushima-u.ac.jp) (Office Hour: Tue -Thu 10:00-14:00)

⇒ Kitada (A224, +81-88-656-7671, kitada@frc.tokushima-u.ac.jp) (Office Hour: Mon. 10:00-14:00)



## Web Programming

2 units (selection)

Takao Shimomura · PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Kenji Ikeda · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** This class provides the knowledge and skills necessary for efficiently developing Web applications in the Internet, and implementing the software of high quality.

**Outline)** This class introduces Web programming frameworks and Web programming techniques systematically necessary for efficiently developing Web applications of high quality, and then explains the development of some Web application systems as practical examples to teach the development skills such as Web design patterns.

**Style)** Lecture

**Keyword)** *Java, Servlet, JSP, Web applications*

**Fundamental Lecture)** “Programming Methodology”(1.0), “ソフトウェア工学”(1.0)

**Relational Lecture)** “System Administration”(0.5)

**Requirement)** Students are required to have a good understanding of undergraduate-level Java programming and related subjects.

**Goal)** To understand the system configuration of Web applications that consists clients and a server, and design flexible Web application systems

**Schedule)** 1. Web application 2. HTTP/Session 3. Database 4. JSP custom tags 5. Web services 6. Applets 7. JavaScript/AJAX 8. Flash/Flex 9. Web programming frameworks 10. BioPro 11. Internationalization 12. Web programming tips 13. Web programming design patterns 14. Introduction to NisWeb system 15. NisWeb system configuration 16. Assignment

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216559>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Shimomura (C402, +81-88-656-7503, simomura@is.tokushima-u.ac.jp) (Office Hour: Wed 15:00~ 8:00)

## Cell Biotechnology

2 units (selection)

Hideaki Nagamune · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Toshifumi Tomoyasu · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class aims to expand the knowledge on cell biotechnology and improve the skill of debate through the debate dealing with cell biotechnology and its applications.

**Outline)** Debates among students dealing with the latest reports on technology and application concerned with production of useful materials, medical assay, and medical treatment using various cells are held in order to deepen the knowledge on cell biotechnology and its peripheral field. Training on skills of debate and communication is simultaneously carried out.

**Style)** Lecture

**Keyword)** *cell, biotechnology, debate*

**Relational Lecture)** “Advanced Biochemistry”(0.8, ⇒p.44), “Molecular Biotechnology”(0.8, ⇒p.45), “Technology for Bioreaction”(0.8, ⇒p.48), “Biological macromolecular chemistry”(0.5, ⇒p.48), “Advanced enzyme engineering”(0.5, ⇒p.47)

**Requirement)** Students are required to have a good understanding of undergraduate-level of cell technology and related subjects

**Goal)**

1. To understand the latest cell biotechnology and its application examples
2. To gain the ability of debate on technologies concerned in cell biotechnology

**Schedule)** 1. Cell biotechnology on production of useful materials 1(Production of antibodies) 2. Cell biotechnology on production of useful materials 2(Production of enzymes) 3. Cell biotechnology on production of useful materials 3(Production of lymphokines) 4. Cell biotechnology on production of useful materials 4(Production of cytokines) 5. Cell biotechnology on production of useful materials 5(Production of bioactive proteins) 6. Cell biotechnology on medical or industrial assay 1(Measurement of cytotoxicity) 7. Cell biotechnology on medical or industrial assay 2(Analysis of signal transduction pathways) 8. Cell biotechnology on medical or industrial assay 3(Analysis of transcriptosome) 9. Cell biotechnology on medical or industrial assay 4(Diagnostics of genome disorder/SNPs) 10. Cell biotechnology on medical or industrial assay 5(Diagnostics of intracellular bacteria/viruses) 11. Cell biotechnology on medical treatment 1(Artificial skin) 12. Cell biotechnology on medical treatment 2(Immune cell therapy) 13. Cell biotechnology on medical treatment 3(Cell transplant/Organ transplant) 14. Cell biotechnology on medical treatment 4(Techniques for clone development) 15. Cell biotechnology on medical treatment 5(ES cells/iPS cells)

**Evaluation Criteria)** Assignments count 50%.Presentation count 50%

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216661>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Nagamune (G707, +81-88-656-7525, nagamune@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** Preparation and review of two hours each are required for understanding of every class with two hours and taking the credits.

## Advanced Biomaterials

2 units (selection)

Toshifumi Tomoyasu · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Hideaki Nagamune · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Study and investigate about the scientific background which produced the new technology.

**Outline)** Students are required to investigate how the important discovery (which acquired the Nobel Prize as an example) were established and how improved our life and research activities by these accomplishments.

**Style)** Lecture

**Keyword)** *technology, biomolecules, research, application*

**Requirement)** Required to have a good understanding of undergraduate-level biochemistry and molecularbiology.

**Goal)**

1. Understand how the important discoveries in the scientific field were performed.
2. Investigate how the important discoveries are applied to our life and research.

**Schedule)** 1. Orientation 2. Discoveries concerning the role played by the chromosome in heredity. T. Morgan. 3. The production of mutations by means of X-ray irradiation. H. Muller 4. Discovery of mobile genetic elements. B. McClintock. 5. The discovery of penicillin and its curative effect in various infectious diseases. A. Fleming, E. Chain, H. Florey. 6. Discovery of tumour-inducing viruses. P. Rous. 7. Interpretation of the genetic code and its function in protein synthesis. R. Holley, H. Khorana, M. Nirenberg. 8. The discovery of restriction enzymes and their application to problems of molecular genetics. H. Smith, W. Arber. 9. Contributions concerning the determination of base sequences in nucleic acids. W. Gilbert, F. Sanger. 10. The genetic principle for generation of antibody diversity. S. Tonegawa. 11. Contributions to the developments of methods within DNA-based chemistry. K. Mullis, M. Smith. 12. Discovery concerning the genetic control of early embryonic development. L. Lewis, C. Nüsslein-Volhard, E. Wieschaus. 13. Discovery of Prions - a new biological principle of infection. S. Prusiner. 14. The development of methods for identification and structure analyses of biological macromolecules. J. Fenn, K. Tanaka, K. Wüthrich. 15. Generalization of lectures

**Evaluation Criteria)** Grades are judged about two attainment targets described above by a presentation (50 points) and a report (50 points). The student requires more than 60 points to a pass.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216735>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Tomoyasu (G701, +81-88-656-9213, tomoyasu@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** ◇Students require 2hrs preparation and 2hrs review per a lecture (2 hrs). ◇1-14th lectures contain both attainment targets 1 and 2.

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**Advanced Ecosystem Engineering Seminar**

4 units (compulsory)  
Teacher of course

**Target)** To improve the skill of presentation, writing, reading and discussion regarding the ecosystem engineering by reading the current paper written in English

**Outline)** Students read the current paper written in English under the supervision of faculties and present orally their contents

**Style)** Portfolio

**Keyword)** *ecosystem engineering, peruse paper in English*

**Goal)** To obtain the fundamental knowledge regarding research theme and the presentation skill

**Schedule)** Seminar on research theme

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216565>

**Student)** Able to be taken by only specified class(es)

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**Advanced Ecosystem Engineering Exercise**

6 units (compulsory)  
Teacher of course, Yoshihiko Hosoi · PROFESSOR / TOTTORI UNIVERSITY, Hirofumi Abe · PROFESSOR / OKAYAMA UNIVERSITY  
Masateru Shimotsu · / BUNRI UNIVERSITY, . / 神奈川県警, Takeshi Asahi · PROFESSOR / ERIE UNIVERSITY

**Target)** To learn the current issue about the ecosystem engineering in the various kinds of fields and to improve the abilities to find and solve problems related to the research theme.

**Outline)** Faculties and external experts lecture on current issues about the ecosystem engineering. In addition, an opportunity is provided to experience social/environmental activity in ecosystem engineering.

**Style)** Lecture and exercise

**Keyword)** *ecosystem engineering*

**Notice)** Students have to take every lecture to acquire the credit of this subject.

**Goal)** To understand how to find and solve problems related to the research theme

**Schedule)** **1.** Guidance **2.** The current issue in the ecosystem engineering(1) **3.** The current issue in the ecosystem engineering(2) **4.** The current issue in the ecosystem engineering(3) **5.** The current issue in the ecosystem engineering(4) **6.** The current issue in the ecosystem engineering(5) **7.** social/environmental activity in ecosystem engineering (1): lecture **8.** social/environmental activity in ecosystem engineering (2): lecture **9.** social/environmental activity in ecosystem engineering (3): lecture **10.** social/environmental activity in ecosystem engineering (4): lecture **11.** social/environmental activity in ecosystem engineering (5): practical training **12.** social/environmental activity in ecosystem engineering (6): practical training **13.** social/environmental activity in ecosystem engineering (7): practical training **14.** social/environmental activity in ecosystem engineering (8): practical training **15.** social/environmental activity in ecosystem engineering (9): practical training

**Evaluation Criteria)** Assignment count 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216561>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ SATO (eco705, +81-88-656-2168, katsuyas@eco.tokushima-u.ac.jp)

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**Ecosystem Engineering Laboratory**

4 units (compulsory)  
Teacher of course

**Target)** To perform experiments toward Master's thesis

**Outline)** Students perform experiments towards their Master's thesis under the supervision of faculties.

**Style)** Lecture and exercise

**Keyword)** *ecosystem engineering, Master's thesis*

**Goal)** To summarize the results of experiments and to present the contents

**Schedule)** Experiments and research

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216564>

**Student)** Able to be taken by only specified class(es)

## Systems Innovation Engineering — Electrical and Electronic Engineering

### SYLLABUS OF SUBJECTS

● *Integrated Subjects*

<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和 .....	63
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	64
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer .....	64
<b>Long-term Internship (M)</b> ... Yamanaka .....	64
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · Part-time Lecturer .....	65
<b>International Advanced Technology and Science 1</b> ... Murakami .....	65
<b>International Advanced Technology and Science 2</b> ... Murakami .....	65
<b>Presentation Method (M)</b> ... Graduate School of Advanced Technology and Science .....	66
<b>Internship (M)</b> .....	66
<b>Venture Business (M)</b> .....	66

● *Common Subjects*

<b>Advanced Theory of Complex System Engineering</b> ... Ueta .....	66
<b>Advanced Theory of Semiconductors</b> ... Nishino .....	66
<b>Advanced Electrical Control System</b> ... Yasuno .....	67
<b>Advanced Theory of Electrical Communication</b> ... Oie .....	67
<b>Advanced Circuit Theory</b> ... Nishio · Uwate .....	67
<b>Human Sensing</b> ... Fukumi .....	68
<b>Photonic Device</b> ... Haraguchi .....	68
<b>Electronic display</b> ... Suyama .....	68

● *Departmental Subjects*

<b>Engineering of Correlated Electron Matter</b> ... Kawasaki .....	69
<b>Advanced Plasma Engineering</b> ... Ohya .....	69
<b>Advanced Theory of Electron Devices</b> ... Ohno · Ao .....	69
<b>Advanced Device Processing</b> ... Naoi .....	69
<b>Advance Theory of Electrical and Electronic Materials</b> ... Tominaga .....	69
<b>Advanced Optoelectronic Devices</b> ... Sakai .....	70
<b>Advanced Theory of Optoelectronics</b> ... Nagase .....	70
<b>Advanced High Voltage Engineering</b> ... Shimomura .....	70
<b>Erectric Power System</b> ... Shimomura · Teranishi .....	71
<b>Advanced Theory of Electric Power Engineering</b> ... Kawada .....	71
<b>Electromechanical Systems</b> ... Morita .....	71
<b>Advanced Power Electronics</b> ... Ohnishi · Hojo .....	72

<b>Advanced Control Theory</b> ... Kubo · Oya .....	72
<b>Advanced Theory of Digital Transmission</b> ... Takada .....	72
<b>Advanced Biological Engineering</b> ... Akutagawa .....	73
<b>Advanced Theory of Electronic Circuits</b> ... Hashizume · Yotsuyanagi .....	73
<b>Advanced Theory of Integrated Circuits</b> ... Konaka .....	73
<b>Advanced Lecture of Intelligent Information Processing</b> ... Shimamoto · Song .....	74
<b>Advanced Lecture on Semiconductor Nanotechnology</b> ... Isu · Kitada .....	74
<b>Advanced Theory of Electromagnetic Compatibility</b> ... Kawada .....	74
<b>Topics in Algebra</b> ... Mizuno .....	75
<b>Superconductivity and superconducting materials</b> ... Kishimoto .....	75
<b>Advanced applied analysis</b> ... Okamoto .....	75

● *Specialized Exercise and Experiments*

<b>Electrical and Electronic Engineering Seminar and Exercise</b> ... Teacher of course .....	75
<b>Electrical and Electronic Engineering Laboratory</b> ... Teacher of course .....	76

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### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Requirement)** No requirement

**Notice)** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による

育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student)** For the course students and other graduate school students.

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering/FACULTY OF ENGINEERING  
First-line men with experience of practical business - PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成 14 から 16 年度にかけて「大学発ベンチャー 3 年 1000 社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もある。くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword) management, management of technology**

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.64), "Long-term Internship (M)"(0.5, ⇒p.64), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.65), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月~木(10時~16時))

**Note)** This class invites seven Honda alumnuni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and

practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who register the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考:平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル)上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日)上勝学舎(第1回~第12回)○集中講義-2(ICTビジネスモデル) \* 12月21日(火)常三島キャンパス(第13回~第15回)○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ぐ奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松平(徳島大学教授) 11. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**  
⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)  
Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Advanced Theory of Complex System Engineering

2 units (selection)  
Tetsushi Ueta · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** comprehension and application of complex systems by using engineering methodologies

**Outline)** Complex systems are defined as compound dynamical systems whose behavior and features cannot be predicted because of their nonlinearities and connecting conditions. This emergence of behavior is not possible for a single dynamical system, therefore, connection, coupling, compounding are keywords of this theory. Emergence of rhythm in biological systems, self organization, chaotic properties in high degrees of freedom, learning and associative memory are example features of complex systems. In this lecture, based on physical systems which are ubiquitously found and treated by system engineering subjects, we study analytical methods to understand these phenomena, bifurcation theory of nonlinear and linear systems, applied extraction methods of valuable information from observed data, system design methods of compound dynamical systems.

**Style)** Lecture

**Keyword)** *complex systems, bifurcation, chaos, nonlinear phenomena*

**Fundamental Lecture)** "Differential Equations (II)"(1.0), "Transient Analysis"(1.0), "Industrial Basic Physics"(1.0)

**Relational Lecture)** "Advanced Electrical Control System"(0.5, ⇒p.67), "Advanced Theory of Electronic Circuits"(0.5, ⇒p.73)

**Requirement)** none

**Goal)**

1. understanding of the definition and target area of complex systems
2. understanding of qualitative approach for given dynamical system
3. understanding and application of bifurcation theory

**Schedule)** 1. examples of complex systems 2. relationship between bifurcation problems and complex systems 3. comptation of bifurcation parameter values 4. chaos and bifurcation phenomenon 5. chaotic itinerary 6. emergence mechanism of spatio temporal chaos and its clustering 7. phase transition and synchronization 8. spatio temporal intermittency and emergence of patterns 9. chaos neural network 10. neuronal circuits as complex systems 11. bifurcations in emergence systems 12. analysis of social systems 13. survey on complex systems 14. exercise 1 15. exercise 2 16. questions and answers

**Evaluation Criteria)** The total grade is evaluated by homework reports (70 %) and attendance of the class. (30 %)

**Textbook)** specified every class.

**Reference)** Chaotic Scenario of Complex Systems, Asakura-Shoten, 1996 (in Japanese)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216858>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ueta (AIT 507, +81-88-656-7501, tetsushi@ait.tokushima-u.ac.jp) (Office Hour: Wednesday, afternoon)

**Note)** ◇For comprehension of the lecture contents, a 2-hour preparation study and a 2-hour review are required. ◇All items in the lecture plan are evaluated by reports.

### Advanced Theory of Semiconductors

2 units (selection)  
Katsushi Nishino · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand semiconductor physics and fundamental device operations for various semiconductor devices

**Outline)** Semiconductor physics, especially behavior of carriers in semiconductor, is described. Properties of pn junction and Schottky barrier, including non-ideal case, are also lectured.

**Style)** Lecture

**Keyword)** *semiconductor, metal-semiconductor contact, pn junction diode*

**Relational Lecture)** “Advanced Device Processing”(0.5, ⇒p.69), “Advanced Theory of Electron Devices”(0.5, ⇒p.69), “Advanced Optoelectronic Devices”(0.5, ⇒p.70)

**Goal)**

1. To understand behavior of carries (such as scattering mechanisms) in semiconductor
2. To solve diffusion equations in simple conditions
3. To understand properties of pn junction and Schottky barrier

**Schedule)** 1. Crystal Structure 2. Energy Bands 3. Carrier Concentration at Thermal Equilibrium 4. Carrier Transport 5. Phonon 6. High-Field Effect 7. Continuity Equations and Diffusion Equations of Carriers 8. Band Structure of Metal-Semiconductor Contact 9. Current Transport Processes of Schottky Barrier 10. Characterization of Schottky Barrier Height 11. Ohmic Contact 12. Band Structure of pn Junction Diode 13. Capacitance-Voltage Characteristics of pn Junction Diode 14. Current-Voltage Characteristics of pn Junction Diode 15. Heterojunction 16. Examination

**Evaluation Criteria)** Report 50%, Examination 50%. More than 60% is required to pass this class.

**Textbook)** Physics of Semiconductor Devices, by S.M.Sze

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216816>

**Contact)**

⇒ Nishino (E棟2階南 A-5, +81-88-656-7464, nishino@ee.tokushima-u.ac.jp)

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## Advanced Electrical Control System

2 units (selection)

Takashi Yasuno · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the basic principle of making to high performance and the intelligence in control system used for an industrial machine. And the control design of various control systems is understood.

**Outline)** The control system configuration used for the industrial machine is described, and applications of intelligent control method using fuzzy reasoning and neural net works are introduced. Moreover, Current topics of fields mentioned above are introduced.

**Style)** Lecture and exercise

**Keyword)** *Motion control, Robotics, Fuzzy, Neural network, Genetic algorithm*

**Relational Lecture)** “Advanced Lecture of Intelligent Information Processing”(0.5, ⇒p.74), “Advanced Control Theory”(0.5, ⇒p.72)

**Notice)** The lecture form might be changed according to the number of attending a lecture.

**Goal)**

1. The configuration of the control system used for an industrial machine should be understood.
2. The intelligent control method should be understood.

**Schedule)** 1. Control object 2. Motion control system 3. Two degree-of-freedom control 4. Design method of feedback controller 5. Design method of feedforward controller 6. Fuzzy sets 7. Fuzzy reasoning method 8. Control system application of fuzzy reasoning 9. Artificial neuron model 10. Neural network 11. Learning algorithm of neural network 12. Control system application of neural networks 13. Genetic algorithm 14. Control system application of genetic algorithm 15. Conclusions 16. Return of report or examination

**Evaluation Criteria)** Total evaluation based on reports, examinations or presentations.

**Textbook)** The print is distributed.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216722>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yasuno (E棟2階北 B-5, +81-88-656-7458, yasuno@ee.tokushima-u.ac.jp) (Office Hour: Monday, 15:00-17:30)

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## Advanced Theory of Electrical Communication

2 units (selection)

Takahiro Oie · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding analysing techniques of the communication system and multi-nodes networks.

**Outline)** This lecture is concerned with the study of concept of computer networks which realize the multi-node communication. The contents of those articles related with computer networks are presented at seminars. (Lecture style)

**Style)** Lecture

**Keyword)** *digital communication, computer networks, network architecture*

**Fundamental Lecture)** “Communication Systems”(1.0), “Applied Communication Engineering”(1.0), “Computer Networks”(1.0)

**Requirement)** Students are required to have a good understanding of undergraduate-level communication engineering and related subjects.

**Goal)**

1. Understanding the control techniques and implementation of computer network application. (Week 1-8, 11-15)
2. Understanding the secure techniques of the communication system. (Week 9-16)

**Schedule)** 1. Overview of digital communication 2. Mathematical preparation 3. Network architecture 4. Physical layer in fixed and wireless networks 5. Datalink layer in fixed and wireless networks 6. Network layer and routing 7. Transport layer 8. Traffic control 9. Security in fixed and wireless networks 10. Symmetric cryptography and public key cryptography 11. Session layer 12. Presentation layer 13. Application layer 14. Implementation example of application layer (HTTP, SMTP) 15. Implementation example of application layer (DNS, SNMP) 16. Wireless networks

**Evaluation Criteria)** Evaluated by presentations and submitted materials in seminars.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216771>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Oie (E-3F-C-1, +81-88-656-7479, alex@ee.tokushima-u.ac.jp) (Office Hour: Tuesday 16:20~ 17:20, Thursday 16:50~ 17:50)

**Note)** Taking this class, it is necessary to do 2 hours preparation and 2 hours reviewing for every class (2 hours) in order for your understanding and taking credit.

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## Advanced Circuit Theory

2 units (selection)

Yoshifumi Nishio · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoko Uwate · ASSISTANT PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Analysis method of nonlinear circuits, and behavior of nonlinear oscillatory circuits and its applications are lectured.

**Outline)** Modeling of nonlinear devices, DC analysis and transient analysis of nonlinear circuits, and steady-state analysis are lectured. Synchronization and chaotic phenomena in nonlinear oscillatory circuits are introduced and their applications to information and communication engineering are discussed. (Style: Lecture)

**Style)** Lecture and exercise

**Keyword)** *nonlinear circuits, circuit analysis, oscillatory circuits*

**Fundamental Lecture)** “Electrical Circuit Theory (I) and Exercise”(0.7), “Electrical Circuit Theory (II) and Exercise”(0.5), “Network Analysis”(0.3)

**Relational Lecture)** “Advanced Theory of Complex System Engineering”(0.5, ⇒p.66)

**Requirement)** Students are required to know how to analyze basic linear circuits.

**Notice)** Course is taught in English.

**Goal)**

1. Understanding of analysis methods of nonlinear circuits.
2. Understanding of behavior of nonlinear circuits and its applications.

**Schedule** 1. Modeling of nonlinear devices. 2. DC analysis of nonlinear circuits by Newton method. 3. Transient analysis of nonlinear circuits. 4. Steady-state analysis of nonlinear circuits (for 4 lectures). 5. Synchronization phenomena in nonlinear oscillatory circuits (for 2 lectures). 6. Chaotic phenomena in nonlinear oscillatory circuits (for 2 lectures). 7. Engineering applications of nonlinear circuits (for 4 lectures). 8. Conclusions and final examination.

**Evaluation Criteria**) Final examination 80% and exercise 20%.

**Textbook**) None.

**Reference**)

- ◇ Akio Ushida and Mamoru Tanaka, "Nonlinear Circuit Simulations," Corona Publishing Co.
- ◇ S. Smale and M.W. Hirsch, "Differential Equations, Dynamical Systems, and Linear Algebra," Academic Press.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216580>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Nishio (D-7, E-3F-South, +81-88-656-7470, nishio@ee.tokushima-u.ac.jp)

**Note**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Human Sensing

2 units (selection)

Minoru Fukumi · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target**) This lecture aims to understand the latest topics in a field of Intelligent systems, and to obtain advanced knowledge and technologies.

**Outline**) This lecture teaches the advanced topics in intelligent systems. The main items in this lecture are softcomputing and human sensing, including face information processing and its computer practice and biological signal processing.

**Style**) Lecture and exercise

**Keyword**) *soft computing, human sensing, human information processing*

**Goal**)

1. To understand the latest topics on Intelligent systems.
2. To learn the trend of a domestic and foreign research on related topics.

**Schedule**) 1. Topics in Advanced Intelligent Systems 2. Topics in Advanced Intelligent Human Sensing 3. Topics in Brain Information Processing 4. Topics in Advanced Softcomputing techniques 5. Psychological Knowledge and Neural Network Model 6. Topics in Advanced Face Information Processing 7. Topics in Advanced Biosignal Processing 8. Topics on applications in Advanced Softcomputing techniques 9. Statistical Learning Algorithms 10. Topics in Eye Tracking and Its Applications 11. Topics in OpenCV applications 12. Topics in EMG and EEG researches 13. Exercise in Advanced Intelligent Systems 14. Exercise in Softcomputing 15. Exercise in Human Information Processing 16. Discussion

**Evaluation Criteria**) Attendance (30%), practice(10%), report (60%)

**Textbook**) no special book

**Reference**) 講義・演習中に指定する。

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216854>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Fukumi (D210, +81-88-656-7510, fukumi@is.tokushima-u.ac.jp) (Office Hour: 金曜日,15~18時)

**Note**) ◇ ゲストスピーカーを招聘して講義・演習を行う場合がある。 ◇ 授業目的の達成度は最終レポートにより評価する。

## Photonic Device

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) To understand the principle of the current optoelectronic devices, e.g., Light Emitting Diodes, Laser Diodes and so on. To develop ability to solve various problems in optical device application.

**Outline**) This course will cover topics on current optical and optoelectronic devices. Topics treated include Light Emitting Diode, Laser Diode, Solar Cell, Optical Modulator and Nonlinear Optical Devices.

**Style**) Lecture

**Keyword**) *optoelectronic device, optical device, light emitting diode, laser diode, optical modulator, Solar cell*

**Relational Lecture**) "Optical properties of materials"(0.5, ⇒p.93), "Lecture in Optical Materials and Devices, Part 1"(0.5, ⇒p.95)

**Requirement**) Students should have fundamental knowledges about semiconductor physics and devices for undergraduate students.

**Notice**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal**)

1. Students can explain the principle and structures for light emitting devices.
2. Students can explain the principle and structures for photodetector and solar cell.
3. Students can explain the principle of light modulators.
4. Students can explain the principle of nonlinear optical devices.

**Schedule**) 1. Introduction 2. Interaction between Light and dielectric materials 3. Semiconductors and other optical materials 4. Optical properties of semiconductors 5. Semiconductor PN-junction 6. Light Emitting Diode 7. Application of Light Emitting Diode 8. Laser Diode 9. Application of Laser Diode 10. Photoconductor Cells 11. pin photodiode 12. Solar cell and amorphous-semiconductor optoelectronic devices 13. Optical Modulator 14. Nonlinear optical devices 15. Integrated Optical Devices 16. Final Examination

**Evaluation Criteria**) Activity: 20%, Reports: 40% and Final Exam.:40%

**Textbook**) 中澤、鎌田著、光物性・デバイス工学の基礎、培風館1999

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216857>

**Contact**)

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

## Electronic display

2 units (selection)

Shiro Suyama · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) To understand the history of developments, technical trends, and technologies of electronic display.

**Outline**) This course will cover the history of developments, technical trends, recent topics, and technologies of an electronic display. This course is related to industries.

**Style**) Lecture

**Notice**) 光の性質、光学的な現象については、既知とする。

**Goal**)

1. To understand fundamental technologies of an electronic display
2. To understand fundamental technologies of devices for an electronic display
3. To understand a technical trend of an electronic display

**Schedule**) 1. 電子ディスプレイの概要、最近の動向 2. 電子ディスプレイおよび画像システムの概要 3. 直視型: 陰極線管(ブラウン管, CRT), テレビジョン 4. 直視型: 液晶の概要と液晶ディスプレイ(LCD)の基本動作 5. 直視型: 各種の液晶ディスプレイと特性改善 6. 直視型: プラズマディスプレイ(PDP) 7. 直視型: エレクトロルミネッセンス(EL)ディスプレイ 8. 直視型: フィールドエミッションディスプレイ(FED) 9. 超大型: 投射型ディスプレイ 10. 超大型: 最新の投射型ディスプレイ, 屋外用大型LEDディスプレイ 11. 電子ディスプレイの画質と視覚特性 12. 電子ディスプレイの画質とその評価 13. 立体ディスプレイ: 概要 14. 立体ディスプレイ: 2眼/多眼方式 15. 立体ディスプレイ: 超多眼方式などの最新の動向

**Evaluation Criteria**) Evaluation with report

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216773>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Suyama (opt409, +81-88-656-9425, suyama.shiro@opt.tokushima-u.ac.jp) (Office Hour: 17:00~18:00)

**Note**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。



## Engineering of Correlated Electron Matter

2 units (selection)

Yu Kawasaki · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Lecture would be given on the basic concept of magnetism and superconductivity in condensed matter with an introductory talk on strongly correlated electron system and its application to technology.

**Outline)** Some materials with strongly correlated electrons show interesting magnetic and electronic phenomenon such as high-transition temperature superconductivity, metal-insulator transition and giant magneto-resistance. After an introductory talk on the strongly correlated electron system and its application to technology, lecture would be given on the basic concept of magnetism and superconductivity in condensed matter.

**Style)** Lecture

**Keyword)** *strongly correlated electron, magnetism, superconductivity*

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)** To understand the basic concept of magnetism and superconductivity in condensed matter

**Schedule)** 1. Correlated electron matters 2. Introduction to magnetism 3. Electronic states of atoms 4. Magnetic ions in crystal 5. Magnetic interaction 6. Local-moment magnetism 1 7. Local-moment magnetism 2 8. Itinerant-electron magnetism 9. Ferromagnet and its application to technology 10. Superconducting phenomenology 11. Electron-phonon interaction 12. Magnetic flux quantum and SQUID 13. Type II superconductor 14. New type of superconductivity 15. Manganese oxide and spintronics 16. Examination

**Evaluation Criteria)** Examination

**Textbook)** no specific text

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216619>

## Advanced Plasma Engineering

2 units (selection)

Kaoru Ohya · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of the lecture is to give an introduction to the behavior of plasmas and its treatment.

**Outline)** The elements of plasma physics and chemistry are introduced in this lecture.

**Style)** Lecture and exercise

**Keyword)** *plasma, nuclear fusion*

**Goal)**

1. Understanding on properties of plasmas
2. Understanding on an introduction to theories of plasma physics

**Schedule)** 1. Single-particle motions (1) 2. Single-particle motions (2) 3. Single-particle motions (3) 4. Plasma as fluids (1) 5. Plasma as fluids (2) 6. Waves in plasmas (1) 7. Waves in plasmas (2) 8. Waves in plasmas (3) 9. Diffusion and resistivity (1) 10. Diffusion and resistivity (2) 11. Equilibrium and stability (1) 12. Equilibrium and stability (2) 13. Introduction to controlled nuclear fusion (1) 14. Introduction to controlled nuclear fusion (2) 15. Introduction to controlled nuclear fusion (3) 16. Conclusions and future problems

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216870>

**Contact)**

⇒ Ohya (E棟2階南 A-9, +81-88-656-7444, ohya@ee.tokushima-u.ac.jp)

## Advanced Theory of Electron Devices

2 units (selection)

Yasuo Ohno · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Jin-Ping Ao · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding of deep levels in compound semiconductor electron device performances

**Outline)** Semiconductor device physics for the analyses and design of semiconductor electron devices will be lectured. After teaching basic concepts of band diagram and fermi levels, carrier transport theory and device operation mechanisms will be presented. Various instable phenomena, which limit the device

performance, will also be presented with theoretical backgrounds. The topics include, silicon, GaAs and GaN as semiconductor materials, and MOSFET, HEMT and HBT as electron devices. The lecture items are, 1 Band diagram, 2 Electron transport, 3 Short channel effects, 4 Impurity levels, 5 Deep traps, 6 Semi-insulating substrate, 7 HEMT, 8 Side-gating effect, 9 Drain-lag and DLTS, and 10 Surface states and breakdown.

**Style)** Lecture

**Keyword)** *band diagram, HEMT*

**Goal)** Draw band diagrams including deep levels in non-thermal equilibrium

**Schedule)** 1. Band Diagram 2. Thermodynamics of Electron Transport 3. Short Channel Effects 4. Impurity Levels 5. Electrical Performance of Deep Levels 6. Semi-insulating Substrate 7. Hetero Junction Transistors 8. Side-Gating Effect 9. Drain Lag and DLTS 10. Surface States and Breakdown Voltage 11. Discussion 12. Midterm Examination 13. Wide-Gap Semiconductors 14. AlGaIn/GaN HFET 15. Discussion 16. Term Examination

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216786>

**Contact)**

⇒ Ohno (E棟2階南 A-7, +81-88-656-7438, ohno@ee.tokushima-u.ac.jp)

⇒ Ao (EE A-8, +81-88-656-7442, jpao@ee.tokushima-u.ac.jp)

**Note)** This lecture will be given in English.

## Advanced Device Processing

2 units (selection)

Yoshiki Naoi · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This course will covered topics related to device processing engineering and science, in semiconductor and dielectric devices.

**Outline)** Basic subjects such as physical chemistry, vacuum engineering, surface science, crystal growth technology and measurement methods for device evaluations will be lectured.

**Style)** Lecture

**Keyword)** *device processing, surface physics and chemistry, vacuum engineering*

**Fundamental Lecture)** “Advanced Theory of Semiconductors”(1.0, ⇒p.66), “Advanced Theory of Integrated Circuits”(1.0, ⇒p.73), “Advanced Theory of Electron Devices”(1.0, ⇒p.69)

**Relational Lecture)** “Advance Theory of Electrical and Electronic Materials”(0.5, ⇒p.69)

**Requirement)** なし.

**Notice)** なし.

**Goal)** To understand the physics of the device processing technology.

**Schedule)** 1. Semiconductor and devices. 2. Property of vacuum 3. Production of vacuum 4. Pressure measurement 5. Interaction of atoms and molecules with surface 6. Vapor pressure, application to crystal growth using vacuum technology 7. Physisorption and chemisorption 8. Plasma etching 9. Chemical etching and Physical etching 10. Physics of diffraction 11. Electron optics 12. Electron spectroscopy 13. Scanning Electron Microscopy 14. Transmission Electron Microscopy 15. Atomic Force Microscopy 16. Examination

**Evaluation Criteria)** Problem Sets: 50%, Paper: 50%

**Textbook)** none - references will be cited during lectures

**Reference)** S. M. Sze, Physics of Semiconductor Devices, Second Edition (John Wiley & Sons, 1981).

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216776>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Naoi (E棟2階南 A-4, +81-88-656-7447, naoi@ee.tokushima-u.ac.jp) (Office Hour: Th 5:00-6:00PM)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Advance Theory of Electrical and Electronic Materials

2 units (selection)

Kikuo Tominaga · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This course aims to improve the ability to develop new materials by learning the fundamentals of material science and the properties of various electrical and electronic materials.

**Outline)** Material science of metals, oxide semiconductors, superconductors, magnetic materials, dielectric materials are lectured for the students of electrical and electronic engineering. The fundamentals of these materials are explained at first as basic knowledge. Oxide semiconductors, superconductor, ferroelectric materials, ferromagnetic materials and ferrite are included. Dielectric and magnetic materials are stressed here. General outline of those materials are given at first. After that, magnetization mechanism of ferromagnetics and various properties of dielectrics are discussed mostly at the view-points of both solid state physics and applications. 1. Solid state physics of metals, 2. oxide semiconductors and transparent conductive oxides, 3. superconductors, 4. dielectrics and ferroelectric materials, 5. magnetization of the substance and magnetic domain structure, 6. ferrite and recent magnets, 7. piezoelectric materials and applications, 8. optoelectronic materials such as CCD, laser, and displays.

**Style)** Lecture and exercise

**Keyword)** material science, electrical and electronic engineering, dielectric material, magnetic material, semiconductor materials

**Relational Lecture)** "Advanced Theory of Semiconductors"(0.5, ⇒p.66), "Advanced Device Processing"(0.5, ⇒p.69), "Advanced Optoelectronic Devices"(0.5, ⇒p.70)

**Goal)** Understand the fundamentals in material science for electrical and electronic engineering.

**Schedule)** 1. Solid state physics of metals 2. Solid state physics of oxide semiconductors 3. Transparent conductive oxide films 4. Physics of superconductor 5. Superconductors and their applications 6. Piezoelectric materials 7. Various properties of ferroelectric materials 8. Magnetization of the substance 9. Ferromagnetic materials 10. Ferrite 11. Recent magnets(bond magnets) 12. Piezoelectric materials 13. Application of piezoelectric materials 14. Optoelectronic materials (1)(CCD, laser materials) 15. Optoelectronic materials (2)(display materials) 16. Exercise

**Evaluation Criteria)** Examination for each theme.

**Textbook)** 内野研二・石井孝明「強誘電体デバイス」森北出版

**Reference)**

- ◇ 電気電子材料 塩崎忠 共立出版, 森北出版, 高木豊・沢田正三「磁性体・誘電体の物性工学」オーム社, 塩崎忠「圧電材料とその応用」シーエムシー出版
- ◇ 表面科学の基礎と応用, 日本表面科学会編(宮崎栄三代表編集)NTS
- ◇ 超伝導材料, 堂山昌男・山本良一, 東京大学出版会
- ◇ 透明導電膜の技術(改訂2版), 日本学術振興会透明酸化物光・電子材料166委員会編, Ohmsha
- ◇ 薄膜作製応用ハンドブック, 権田俊一監修, エヌ・ティー・エス
- ◇ 電子材料シリーズ フェライト, 平賀貞太郎・奥谷克伸・尾島輝彦, 丸善

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216778>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Tominaga (E棟2階南 A-6, +81-88-656-7439, tominaga@ee.tokushima-u.ac.jp) (Office Hour: Thursday and Friday, pm.17:00-18:30)

**Note)** This lecture is carried out by the use of power point. Prepare electronic memory for the study in home.

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## Advanced Optoelectronic Devices

2 units (selection)

Shiro Sakai · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding of opt-electronic devices

**Outline)** I lecture on an optical amplification and its effect on a semiconductor laser and optical properties of semiconductors. Carrier and light confinements, reflection and guided mode stripe lasers, and the quantum confinement hetero-structure lasers are explained. Reports are required in each of the step, and it is bases of final grade. Lecture schedule are follows. 1. Optical confinement and wave-guide. 2. v-b curves and effective index. 3. Einstein's relation in a semiconductor and black body radiation. 4. Semiconductor light absorption, spontaneous and stimulated emission. 5. Matrix element and density of state of a semiconductor. 6. Optical amplification and the various model calculation in a semiconductor. 7. Optical amplification and semiconductor lasers. 8. The design of a semiconductor laser. 9. The growth of a semiconductor laser. 10. Summary.

**Keyword)** laser, semiconductor, light confinement

**Requirement)** Students are required to have a good understand undergraduate level physics of semiconductor.

**Goal)** To understand of the opto-electronic semiconductors

**Schedule)** 1. Optical confinement and wave-guide. 2. v-b curves and effective index 1. 3. v-b curves and effective index 2. 4. Einstein's relation in a semiconductor and black body radiation. 5. Semiconductor light absorption, spontaneous and stimulated emission. 6. Matrix element and density of state of a semiconductor 1. 7. Matrix element and density of state of a semiconductor 2. 8. Optical amplification and the various model calculation in a semiconductor 1. 9. Optical amplification and the various model calculation in a semiconductor 2. 10. Optical amplification and semiconductor lasers 1. 11. Optical amplification and semiconductor lasers 2. 12. The design of a semiconductor laser 1. 13. The design of a semiconductor laser 2. 14. The growth of a semiconductor laser 1. 15. The growth of a semiconductor laser 2. 16. Summary.

**Evaluation Criteria)** 講義に対する理解力の評価は、講義への参加状況、レポートの提出状況と内容、最終試験の成績を総合して行う。平常点と定期試験の比率は 40:60 とする。備考:1. 講義が終わるごとに演習問題やレポートを課す。これらにより、各授業項目の達成度を評価する。詳細は下記参照。2. 成績評価に対する平常点と試験の比率は 40:60 とする。平常点には講義への参加状況、レポートの提出状況と内容を含む。3. 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしようとして授業を受けることが、授業の理解と単位取得のために必要である。4. 他の授業計画(項目)を含めて授業目的の達成度は最終試験により評価する。

**Textbook)** Diode lasers and photonic integrated circuits, by L.A.Coldren, S.W.Corzine, John Wiley & sons, Inc., (1995) ISBN 0-471-11875-3

**Reference)** Hetero-structure lasers, by H.C.Casey, Jr, M.B.Panish, Academic Press, (1978), ISBN 0-12-163101

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216837>

**Contact)**

⇒ Sakai (E棟2階南 A-3, +81-88-656-7446, sakai@ee.tokushima-u.ac.jp)

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## Advanced Theory of Optoelectronics

2 units (selection)

Masao Nagase · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of this class is to understand principles of new devices based on semiconductor physics

**Outline)** Basis and applications of semiconductor devices fabricated using nanotechnology are introduced.

**Style)** Lecture

**Keyword)** nanotechnology, semiconductor physics, electron device

**Goal)**

1. understanding of semiconductor physics
2. understanding of nano-fabrication
3. understanding of nano-metrology
4. understanding of principles of nano-devices

**Schedule)** 1. Introduction(1 week) 2. Semiconductor physics (3 weeks) 3. Nano-fabrication (3 weeks) 4. Nano-metrology (3 weeks) 5. Nano-devices (4 weeks) 6. Future prospects of nano-electronics (2 weeks)

**Evaluation Criteria)** Examinations and portfolios

**Textbook)** Printed materials

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216820>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nagase (+81-88-656-9716, nagase@ee.tokushima-u.ac.jp)

**Note)** A lecture name will be changed to "Advanced Theory of Nanoelectronics".

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## Advanced High Voltage Engineering

2 units (selection)

Naoyuki Shimomura · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** It doesn't stay in the field of electric power engineering and the knowledge of the high voltage and large-current engineering is acquired. The latest use of the high voltage and large-current technology and the application will be learned.

**Outline)** The high-voltage engineering the large-current engineering has supported industries and the electric energy engineering and is still developing. In this lecture, the various physical phenomena involved in high voltage and large current as well as the phenomena of discharges and the characteristics of insulators are described in detail. Moreover, it lectures on the technology of the generation and the diagnostics of the high voltage and so on including the latest technology. In its applications, the new technology and application rather than the electric power system are introduced, as pulsed power and inertia confinement fusion. The current or upcoming topics such as environmental applications and medical applications will be discussed in the class.

**Style)** Lecture and exercise

**Keyword)** *high voltage, large current, pulsed power*

**Fundamental Lecture)** “High Voltage Engineering”(1.0)

**Goal)**

1. To understand fundamental phenomena of the discharge and mechanisms of the insulation
2. To understand fundamental phenomena of large current

**Schedule)** 1. The recent trends of technologies on high voltage and large current 2. The pulsed power technologies 3. The applications of pulsed power 4. The recent trends of pulsed power technologies and their applications 5. The state-of-the-art technologies for pulsed power 1 6. The state-of-the-art technologies for pulsed power 2 7. The state-of-the-art technologies for pulsed power 3 8. The state-of-the-art technologies for pulsed power 4 9. The state-of-the-art technologies for pulsed power 5 10. The state-of-the-art technologies for pulsed power 6 11. The state-of-the-art technologies for pulsed power 7 12. The state-of-the-art technologies for pulsed power 8 13. The state-of-the-art technologies for pulsed power 9 14. The state-of-the-art technologies for pulsed power 10 15. Term-end exam 16. The exposition about the exam

**Evaluation Criteria)** Participation and presentation:50%; Final examination:50%

**Textbook)** None

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216648>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ Shimomura (E 棟 2 階北 B-8, +81-88-656-7463, simomura@ee.tokushima-u.ac.jp) (Office Hour: (月) 16:00 - 19:00 ※掲示板で確認されたい.)

**Note)** Language in this subject may be English.

## Electric Power System

2 units (selection)

Naoyuki Shimomura · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Kenji Teranishi · ASSISTANT PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The electric power system becomes the attractive technical field recently from the viewpoints such as effective utilization of energy and emission reduction of the carbon dioxide in addition to the viewpoints such as stable supply of electric energy. In this lecture, the understanding of traditional technical contents as the power transmission and distribution of electrical energy is the objective of beginning. The second objective is the understanding of smart grid and its latest surrounding technology. The smart grid is an upcoming technology in fusing a wide range of technical fields. Also, this lecture expands knowledge about the energy transmission technology except the electric power field. The other objective is the understanding usage of electric and electronic circuit analysis program: EMTP which is more used for the analysis of electric power system.

**Outline)** From the viewpoints as the effective utilization with energy, the technical contents about the power transmission and distribution of electric energy will be described at first. The next is the learning about the smart grid. It consists of not only the learning about the smart grid but also the understanding the present state and problems of existing power-network, the trend of the dispersed power source and the characteristics and the latest trend of the energy storage equipment. Also, the energy transmission technology except the electric power fields, too, will be described. Finally, we will have a practice to use the electric and electronic circuit analysis program: EMTP, which is more used for the analysis of the electric power system. The learning is efficiently done with making reports, presentations and moreover the practice.

**Keyword)** *electrical power engineering, transmission and distribution of electric power, smart grid*

**Goal)**

1. The principle of the transmission and distribution technology can be understood for the efficient electric power transportation.
2. Smart grid and the surrounding technology can be understood
3. The electric and electronic circuit analysis program: EMTP can be used for the primary subject

**Schedule)** 1. Overview and Introduction of the electric power system theory 2. The history of electric energy 3. Voltage drop of power transmission and distribution line 4. Power transmission-and-distribution line and power factor of load 5. Smart grid power system 6. Technologies to support smart grid 7. Presenting the report about the smart grid power system: 1 8. Presenting the report about the smart grid power system: 2 9. Presenting the report about the smart grid power system: 3 10. Presenting the report about the smart grid power system: 4 11. EMTP: the electric and electronic circuit analysis program 12. Report about using EMTP: 1 13. Report about using EMTP: 2 14. Report about using EMTP: 3 15. Final examination 16. Conclusions

**Evaluation Criteria)** The score is evaluated with total point of presentation:30%, report:30% and examination: 40%. The evaluation of pass is more than 60% of total point.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216793>

**Contact)**

⇒ Shimomura (E 棟 2 階北 B-8, +81-88-656-7463, simomura@ee.tokushima-u.ac.jp) (Office Hour: (月) 16:00 - 19:00 ※掲示板で確認されたい.)

## Advanced Theory of Electric Power Engineering

2 units (selection)

Masatake Kawada · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To help the students understand the principles and the trends of technologies used in electric power engineering and the related environmental aspects. To improve the oral presentation skill of students by presenting the latest transaction or journal papers in this field in English.

**Outline)** This course presents the principles and trends of technologies used in electric power engineering and the related environmental aspects. Students are required to present the latest transaction or journal papers in this field in English.

**Style)** Lecture and exercise

**Keyword)** *electromagnetics, electrical circuits*

**Relational Lecture)** “Advanced Theory of Electromagnetic Compatibility”(0.5, ⇒p.74), “Electric Power System”(0.5, ⇒p.71), “Advanced High Voltage Engineering”(0.5, ⇒p.70)

**Requirement)** Prerequisites: electrical power engineering, energy engineering or equivalent in undergraduate.

**Goal)**

1. To understand the principles and the trends of technologies used in electric power engineering
2. To understand the environmental aspects of electric power engineering

**Schedule)** 1. Principles of electric power engineering 1 2. Principles of electric power engineering 2 3. Materials in electric power engineering 4. Instrumentation in electric power engineering 5. Generators 6. Transformers 7. Switchgear 8. Cable 9. Power system 10. Power quality and electromagnetic compatibility 11. Presentation of surveyed transaction or journal papers 1 12. Presentation of surveyed transaction or journal papers 2 13. Presentation of surveyed transaction or journal papers 3 14. Presentation of surveyed transaction or journal papers 4 15. Final Examination (Evaluation of Achievement 1 and 2). 16. Explanation for the Answers to Final Examination

**Evaluation Criteria)** Final examination 50%, Presentation 50% Attendance and participation in class are essential. Totally 60 % is required.

**Textbook)** D.F. Warne , Electrical Power Engineer's Handbook second edition, Newnes

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216794>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawada (E 棟 2 階北 B-10, +81-88-656-7460, kawada@ee.tokushima-u.ac.jp) (Office Hour: Wednesday 16:00-17:00, Thursday16:00-17:00)

**Note)** ◊Language: English ◊Self-study:Preparation 2 hours and review 2 hours for every class (2hours) .

## Electromechanical Systems

2 units (selection)

Ikuro Morita · PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of Electromechanical System is to understand the conceptual philosophy of new ac machine drive systems, which are found in a vast number of industries.

**Outline)** We discuss the mathematical modeling techniques of ac machines in the various reference frames, the vector control method using these modeling techniques and the sensorless control methods. Furthermore we introduce the configurations of power converter and the architectures of the control systems embedded the micro-controller LSI and DSP chips. By simulation analysis using "Mathematica" and "MATLAB" in the first half, and through the practical designs in the second half, the more theoretical and practical understandings are expected.

**Style)** Lecture and exercise

**Keyword)** *dq transformation, synchronous motor, induction motor, vector control, sensorless control*

**Relational Lecture)** "Advanced Power Electronics"(0.3, ⇒p.72)

**Requirement)** Prerequisites (preferable) : "Electrical machines (I),(II)" ,"Power electronics" and "Electrical machine dynamics and controls" in undergraduate.

**Goal)** To understand the conceptual philosophy of new ac machine drive control systems

**Schedule)** 1. Modeling of synchronous motors. 2. Modeling of induction motors. 3. Vector control of synchronous motors. 4. Vector control of induction motors (1). 5. Vector control of induction motors (2). 6. Sensorless vector control of synchronous motors. 7. Sensorless vector control of induction motors (1). 8. Sensorless vector control of induction motors (2). 9. Inverter circuits for ac motor drives. 10. LSI for ac motor drive controls. 11. DSP for ac motor drive controls. 12. Configuration of ac motor drive controls system (1). 13. Configuration of ac motor drive controls system (2). 14. Sum-up and conclusions. 15. Final examination. 16. Review of final examination.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216777>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Morita (E 棟 2 階北 B-3, +81-88-656-7451, morita@ee.tokushima-u.ac.jp)

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## Advanced Power Electronics

2 units (selection)

Tokuo Ohnishi · PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Masahide Hojo · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand and learn application technologies of power conversion control circuit using switching power devices.

**Outline)** Basic power electronics covers the basic operation and its characteristics of the static power conversion circuit by using switching power devices. In the advanced power electronics, how to generate the switching control signal for these power conversion circuit, how to construct the control system and how to apply the power converter to many apparatus are lectured and discussed. Subjects are as follows; harmonics analysis, rotating axes transformation, instantaneous active and reactive power, PWM control methods, Sinusoidal PWM control, PFC converter, interconnected inverter, active filter, reactive power compensator, sensorless controls.

**Style)** Lecture

**Keyword)** *inverter, power supply, motor drive, utility interconnection*

**Fundamental Lecture)** "Power Electronics"(1.0), "Electrical Machines (1)"(1.0), "Electrical Machines (II)"(1.0)

**Relational Lecture)** "Electrical Machine Dynamics and Controls"(0.5), "Electrical Machine Dynamics and Controls"(0.5)

**Requirement)** Prerequisites: power electronics in undergraduate

**Goal)**

1. Ability of theoretical analysis
2. Understanding the control operation of application circuit
3. Understanding the control system of application circuits
4. Understanding the operation of control systems

**Schedule)** 1. Harmonics analysis 2. Rotating axes transformation 3. Instantaneous active power and instantaneous reactive power 4. PWM switching methods 5. Sinusoidal PWM inverter 6. Power factor correction converter 7. Midterm test 8. Utility interconnecting inverter 9. Active power filter 10. Reactive power compensator 11. Variable speed control of DC motors 12. Variable speed control theory

of AC motors 13. Variable speed control system of AC motors 14. Application of power conversion for renewable energy 15. Final test 16. Explanation of the test and check of the results

**Evaluation Criteria)** Final examination 50%, Presentation (Participation) 50%

**Textbook)** None (Prints)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216814>

**Contact)**

⇒ Ohnishi (E 棟 2 階北 B-1, +81-88-656-7456, ohnishi@ee.tokushima-u.ac.jp)  
⇒ Hojo (E 棟 2 階北 B-2, +81-88-656-7452, hojo@ee.tokushima-u.ac.jp)

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## Advanced Control Theory

2 units (selection)

Tomohiro Kubo · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Hidetoshi Oya · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of this lecture is to explain the design theory of control systems based on the state space method. Furthermore, norms for signals and systems, systems analysis based on Linear Matrix Inequalities (LMIs) and robust control are outlined.

**Outline)** The state space method describes the dynamics of systems with the state equation, and it has a merit that it can deal with multi-input multi-output systems as well as single-input single-output systems. In this lecture, among the design methods belonging to the state space method, the linear-quadratic regulator is demonstrated. In addition, norms for signals and systems and calculation of norms for systems are presented. Furthermore, systems analysis for dynamical systems based on Linear Matrix Inequalities (LMIs) and the concept of robust control are outlined. (lecture style)

**Style)** Lecture

**Keyword)** *optimal regulator, robust control, norms for signals and systems, linear matrix inequalities*

**Fundamental Lecture)** "Basic Theory of Systems"(1.0)

**Relational Lecture)** "Control Theory (II)"(0.5), "Control System Design"(0.5, ⇒p.156)

**Requirement)** Basic knowledge about the linear algebra and differential equations is required to attend this lecture.

**Notice)** Take notes carefully. Preparation and review are essential.

**Goal)**

1. To understand the notion of the system structure in the state space method (Lectures 2-5)
2. To master the design method of the linear-quadratic regulator (Lectures 1,6,7)
3. To understand the notion of norms for signals and systems (Lectures 9-12)
4. To master the analysis method of dynamical systems via Linear Matrix Inequalities (LMIs) (Lectures 13-15)

**Schedule)** 1. What is the linear-quadratic regulator? 2. Eigenvalues, eigenvectors and diagonalization of matrix 3. Quadratic form and positive definiteness of matrix 4. Controllability 5. State variable transformation and equivalence of systems 6. Linear-quadratic regulator 7. Solving Riccati equation 8. Examination for the first half (for goals 1 and 2) 9. Norms and normed space 10. Norms for signals and systems 11. Calculation of norms for systems 12. Norms for systems and design specifications 13. Linear Matrix Inequalities (LMIs) 14. Systems analysis via Linear Matrix Inequalities (LMIs) 15. Robust control 16. Examination for the second half (for goals 3 and 4)

**Evaluation Criteria)** Mainly by the examination.

**Textbook)** Not used.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216724>

**Contact)**

⇒ Kubo (E 棟 3 階北 C-8, +81-88-656-7466, kubo@ee.tokushima-u.ac.jp) (Office Hour: 月曜日 8:30~ 9:30, 木曜日 17:00~ 18:00)  
⇒ Oya (E-building (C-7), +81-88-656-7467, hide-o@ee.tokushima-u.ac.jp)

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## Advanced Theory of Digital Transmission

2 units (selection)

Atsushi Takada · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding analysis of digital transmission system and primary design techniques of a transmission system.

**Outline)** For understanding practical digital wireless/cable transmission systems, transmission theory on coding, digital modulation/demodulation, equalization, noise, error generation is given. Furthermore, optical fiber transmission systems are discussed. Style Lecture.

**Style)** Lecture

**Keyword)** *digital modulation, data transmission, transmission system, optical fiber transmission*

**Fundamental Lecture)** "Communication Systems"(1.0), "Applied Communication Engineering"(1.0), "Computer Networks"(1.0)

**Relational Lecture)** "Advanced Theory of Electrical Communication"(0.5, ⇒p.67)

**Requirement)** Students are required to have a good understanding of undergraduate-level communication engineering and related subjects.

**Notice)** have preparation and review for 2 hours on every lecture.

**Goal)**

1. Understanding theory and architecture of digital transmission system and limiting factors of transmission performance.
2. Understanding the techniques designing simple digital transmission system.

**Schedule)** 1. Overview of digital transmission 2. Source coding and coding noise 3. Digital multiplexing 4. Transmission code 5. Repeated transmission and code error 6. Digital modulation/demodulation 7. Shot noise and thermal noise 8. Noise and code error rate 9. Basic technology of optical transmission 10. Noise in optical transmission 11. Optical amplification 12. Wavelength division multiplexing (WDM) transmission 13. Limiting factors of WDM transmission system performance 14. Waveform equalization and error rate 15. Examination 16. Summary

**Evaluation Criteria)** reports 25%, examination 75%. Total of 60 % is required to pass the class.

**Textbook)** Prints

**Reference)**

- ◇ K. Miyauchi "Communication System"(Corona Pub.) in Japanese
- ◇ I. Kobayashi ed. "Optical fiber communications (1)(2)"(Corona Pub.) in Japanese

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216772>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ A. Takada(Bldg.E ;C-3, 656-7465, takada@ee) (Office Hour: Tue. 13:30-14:30, Thu.16:30-17:30)

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## Advanced Biological Engineering

2 units (selection)

Masatake Akutagawa · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding modeling and clarification of biological functions and their applications on engineering.

**Outline)** This lecture introduces fundamental technologies to apply engineering technologies for medical field, such as, diagnoses, treatment and function substitution; growth of engineering based on biological mechanisms; functional characteristics of biological systems and their information processing basics of application for control. The topics are 1. physiological characteristics of biological system, 2. biological measurement, 3. medical equipments for diagnosis or treatment, 4. equipments for replacement or assistance of biological functions, 5. functions of nerve system, 6. applications of artificial neural networks.

**Style)** Lecture

**Keyword)** *biomedical engineering, neural network, signal processing*

**Goal)**

1. Understanding of modeling of biological neural network function and its analysis
2. Understanding of modeling of biological control system and its analysis
3. Understanding of modeling of biological sensory system

**Schedule)** 1. Physiological functions of a neuron and their mathematical models 2. Modeling of neural networks 3. Functional analysis of artificial neural networks 4. Applications of artificial neural networks on engineering 5. Signal processing using artificial neural networks 6. Exercise in neural networks 7. Various modeling of neural networks 8. Modeling of biological control scheme 9. Analysis of biological control scheme 10. Information processing in biological visual system 11. Information processing in

biological auditory system 12. Introduction of biosensors 13. Introduction of biomedical engineering 14. Introduction of biomedical engineering 2 15. Introduction of biomedical engineering 3

**Evaluation Criteria)** レポートと出席状況より評価する。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216729>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Akutagawa (工学部電気棟 3階北 C-5, +81-88-656-7477, makutaga@ee.tokushima-u.ac.jp) (Office Hour: Thu. 18:00 - 20:00, Fri. 17:00 - 18:00)

**Note)** This lecture will be given in English.

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## Advanced Theory of Electronic Circuits

2 units (selection)

Masaki Hashizume · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Hiroyuki Yotsuyanagi · ASSOCIATE PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of this lecture is to understand advanced theory and the state-of-the-art technology for the IC implementation.

**Outline)** Electronic circuits have been implemented as VLSIs. This lecture introduces advanced theories and the state-of-the-art technologies for the VLSI implementation. The following are the topics: 1. Analysis and synthesis of logic circuits, 2. Design of integrated digital circuits, 3. Testing of VLSI 4. Design for testability, 5. Low power digital circuits

**Style)** Lecture and exercise

**Keyword)** *electronic circuits, IC implementation, integrated circuits, circuit design*

**Fundamental Lecture)** "Electronic Circuits"(1.0), "Computer Circuits"(1.0)

**Relational Lecture)** "Advanced Lecture of Intelligent Information Processing"(0.5, ⇒p.74), "Advanced Theory of Integrated Circuits"(0.3, ⇒p.73)

**Requirement)** Familiarity with electric circuit and IC technology

**Goal)** To understand advanced theories and the state-of-the-art technologies for IC implementation of electronic circuits.

**Schedule)** 1. Introduction of related topics 2. estimation of power consumption 3. low power design 4. testing of logic circuit 5. testing of SoC 6. design for testability for logic circuit 7. design for testability for SoC 8. Advanced topics of system LSI 9. design exercise (5wks) 10. Examination 11. The exposition about the examination

**Evaluation Criteria)** Attendance and presentation:30%; Final examination:70%

**Textbook)**

- ◇ STARC SoC design training courses text
- ◇ Exercises are introduced in the class

**Reference)** introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216783>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Hashizume (E棟3階南 D-2, +81-88-656-7473, tume@ee.tokushima-u.ac.jp)
- ⇒ Yotsuyanagi (E棟3階南 D-3, +81-88-656-9183, yanagi4@ee.tokushima-u.ac.jp) (Office Hour: 水・金 17:00~18:00)
- ⇒ Shimamoto (E棟3階南 D-5, +81-88-656-7483, simamoto@ee.tokushima-u.ac.jp) (Office Hour: 年度毎に学科の掲示, あるいは居室前の掲示を参照すること)
- ⇒ Song (E D-4, +81-88-656-7484, tiansong@ee.tokushima-u.ac.jp)

**Note)** This lecture will be given in English.

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## Advanced Theory of Integrated Circuits

2 units (selection)

Shinsuke Konaka · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the CMOS analog circuit designs for RF-CMOS integrated circuit applications. To understand the logic LSI design by introducing a case study of the previous development of high speed bipolar logic LSIs for a Gb/s optical Tx/Rx and a super-computers.

**Outline)** Main integrated circuit technologies are recently CMOS integrated circuits because of their low power dissipation, low voltage operation and high noise margin. Owing to the continuous scaling down, CMOS operation speed is improved to up to some GHz regions. The purposes of this lecture are to introduce CMOS analog circuit designs and a case study of the previous high speed logic LSIs for multi-Gb/s applications.

**Style)** Lecture and exercise

**Keyword)** *analog circuits, CMOS, circuit design*

**Fundamental Lecture)** "Advanced Theory of Electron Devices"(1.0, ⇒p.69)

**Relational Lecture)** "Advanced Theory of Electronic Circuits"(0.7, ⇒p.73)

**Goal)**

1. To understand MOS transistor models and device parameters for CMOS analog circuit design.
2. To understand CMOS single-ended amplifier, differential amplifier and current mirror circuits.
3. To understand high performance LSI designs by reviewing previous development samples of high speed logic LSIs

**Schedule)** 1. A review of integrated circuits and basic MOS transistors 2. CMOS process flow and second-order effects of MOS transistor 3. MOS Circuit models and device parameters of MOS transistors 4. Current-voltage characteristics of MOS transistor 5. Common-source single stage MOS amplifier 6. Common-source stage with source degeneration MOS amplifier 7. Designing common-source stage MOS amplifier 8. Common-gate stage MOS amplifier 9. Common-drain stage MOS amplifier 10. Differential MOS amplifier 11. Gilbert cell circuit 12. Current mirror circuit 13. High speed logic LSI using differential circuits (development example) 14. High speed macro-cell array logic LSI (development example) 15. Example of system LSI 16. Examination

**Evaluation Criteria)** Examination is 70% and reports are 30%. The passing score is not less than 60%.

**Textbook)** Design of Analog CMOS Integrated Circuits, Behzad Razavi, McGraw-Hill, ISBN 0-07-118815-0

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216697>

**Contact)**

⇒ Konaka (E 棟 3 階北 C-2, +81-88-656-7469, [konaka@ee.tokushima-u.ac.jp](mailto:konaka@ee.tokushima-u.ac.jp))

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### Advanced Lecture of Intelligent Information Processing

2 units (selection)

Takashi Shimamoto · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Tian Song · ASSOCIATE PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understand the importance of utilizing the methodology of system LSI design to make function design, synthesis, timing design and layout design. Be able to make use of CAD tools for system LSI design

**Outline)** The methodology of system LSI design will be discussed together with some practical exercises concerning the function design, synthesis, timing design and layout design with CAD tools.

**Style)** Lecture and exercise

**Keyword)** *system LSI, VLSI synthesis design, VLSI timing design, VLSI layout design*

**Fundamental Lecture)** "Computer Algorithm and Data Structure"(1.0)

**Relational Lecture)** "Advanced Theory of Electronic Circuits"(0.5, ⇒p.73)

**Goal)** To understand the basic problems and methodology of system LSI design. Can make use of CAD tools for system LSI design.

**Schedule)** 1. Introduction of the system LSI 2. The design flow of system LSI 3. Main issues of system LSI design 4. Function design (3 weeks) 5. Synthesis design (3 weeks) 6. Timing design (3 weeks) 7. Layout design (3 weeks) 8. Examination

**Evaluation Criteria)** Unit evaluation contains examination 70% and exercise 30%.

**Textbook)**

- ◇ STARC SoC design training courses text
- ◇ Exercises are introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216765>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Shimamoto (E 棟 3 階南 D-5, +81-88-656-7483, [simamoto@ee.tokushima-u.ac.jp](mailto:simamoto@ee.tokushima-u.ac.jp)) (Office Hour: 年度毎に学科の掲示, あるいは居室前の掲示を参照すること)

⇒ Song (E D-4, +81-88-656-7484, [tiansong@ee.tokushima-u.ac.jp](mailto:tiansong@ee.tokushima-u.ac.jp))

⇒ Hashizume (E 棟 3 階南 D-2, +81-88-656-7473, [tume@ee.tokushima-u.ac.jp](mailto:tume@ee.tokushima-u.ac.jp))

⇒ Yotsuyanagi (E 棟 3 階南 D-3, +81-88-656-9183, [yanagi4@ee.tokushima-u.ac.jp](mailto:yanagi4@ee.tokushima-u.ac.jp)) (Office Hour: 水・金 17:00~18:00)

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### Advanced Lecture on Semiconductor Nanotechnology

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target)** This class introduces basic principles of the semiconductor nanotechnology and their application to the quantum devices.

**Outline)** Basics of semiconductor physics and quantum mechanics are introduced to understand material properties of quantum confined nanostructures. Recent progress in fabrication techniques and device applications of semiconductor nanostructures (quantum wells, wires and dots) will be reviewed.

**Style)** Lecture

**Keyword)** *quantum confined nanostructures, semiconductor nanoscience, electron devices, photonic devices*

**Requirement)** None.

**Notice)** None.

**Goal)** To understand basic properties of semiconductor nanostructures and quantum devices.

**Schedule)** 1. Introduction to semiconductor nanostructures 2. Electronic states in quantum confined structures 3. Electrical properties of superlattices 4. Fabrication technique of quantum wires and wells 5. Characterization of heterointerfaces 6. Characterization of nanostructures 7. High-speed electron devices 8. Optical properties of quantum wells 9. Semiconductor laser diodes 10. Quantum effect devices 11. Fabrication technique of quantum dots 12. Quantum dot devices 13. Device application of quantum nano structures 14. Recent topics of semiconductor nanotechnology (1) 15. Recent topics of semiconductor nanotechnology (2)

**Evaluation Criteria)** Assignments count 100%

**Textbook)** None.

**Reference)** The Physics of Low-Dimensional Semiconductors, J.H. Davis, Springer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216818>

**Student)** Any students can attend the class.

**Contact)**

⇒ Isu (A224, +81-88-656-7670, [t.isu@frc.tokushima-u.ac.jp](mailto:t.isu@frc.tokushima-u.ac.jp)) (Office Hour: Tue -Thu 10:00-14:00)

⇒ Kitada (A224, +81-88-656-7671, [kitada@frc.tokushima-u.ac.jp](mailto:kitada@frc.tokushima-u.ac.jp)) (Office Hour: Mon. 10:00-14:00)

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### Advanced Theory of Electromagnetic Compatibility

2 units (selection)

Masatake Kawada · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To help the students understand electromagnetic compatibility (EMC), measurement and analysis methods related to EMC.

**Outline)** This course presents electromagnetic compatibility (EMC), measurement and analysis methods related to EMC.

**Style)** Lecture

**Keyword)** *electromagnetic compatibility, frequency spectrum, antenna*

**Fundamental Lecture)** "Advanced Circuit Theory"(1.0, ⇒p.67), "Advanced Theory of Electronic Circuits"(1.0, ⇒p.73), "Advanced Biological Engineering"(1.0, ⇒p.73)

**Relational Lecture)** "Electric Power System"(0.5, ⇒p.71), "Advanced Theory of Electric Power Engineering"(0.5, ⇒p.71)

**Requirement)** Prerequisites: Electrical Circuit Theory (Electrical Circuit Theory 1 and 2, and Exercise), Electromagnetics (Electromagnetics 1 and 2, Exercise)

**Goal)**

1. To understand overview of electromagnetic compatibility.
2. To understand the analysis methods related to EMC.
3. To understand the measurement methods related to EMC.

**Schedule)** 1. Introduction of Electromagnetic Compatibility (EMC). 2. Common EMC Units. 3. Power Loss in Cables. 4. EMC Requirements for Electronic Systems. 5. Fundamentals of Frequency Spectrum. 6. Spectra of Digital Waveforms. 7. Spectrum Analyzers. 8. Midterm Examination (Evaluation of Achievement 1) . 9. Explanation for the Answers to Midterm Examination. 10. Transmission Lines. 11. The Time-Domain Solution of the Transmission Lines. 12. Antenna. 13. Effects of Reflections. 14. Shielding. 15. Final Examination (Evaluation of Achievement 2 and 3) . 16. Explanation for the Answers to Final Examination.

**Evaluation Criteria)** Assignments 20%, Midterm Examination 30%, and Final Examination 50%. Totally 60% is required. Attendance and participation in class are essential.

**Textbook)** Clayton R. Paul, Introduction to Electromagnetic Compatibility, Wiley-Interscience

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216784>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawada (E 棟 2 階北 B-10, +81-88-656-7460, kawada@ee.tokushima-u.ac.jp) (Office Hour: (水)(木) 16:00-17:00)

**Note)** ◊Language: English ◊Self-study:Preparation 2 hours and review 2 hours for every class (2hours) .

## Topics in Algebra

2 units (selection)

Yoshinori Mizuno · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To learn some combinatorial techniques based on the theory of partitions.

**Outline)** A partition of a natural number  $n$  is any non-increasing sequence of natural numbers whose sum is  $n$ . For example, there are three partitions of 3, because  $3=2+1=1+1+1$ . This class introduces some combinatorial techniques and tools such as generating functions based on several topics from the theory of partitions.

**Style)** Lecture

**Keyword)** *integer partition, generating function*

**Fundamental Lecture)** “Basic Mathematics/Calculus 1”(1.0)

**Goal)** To learn some combinatorial techniques and tools such as generating functions.

**Schedule)** 1. Some terms from set theory 2. Euler's identity 3. Ferrers graph 4. Generating function 5. Euler's theorem 6. Two variable generating function 7. Euler's pentagonal number theorem 8. Congruences 9. The Rogers-Ramanujan identities I 10. Formulas of partition functions 11.  $q$ -binomial coefficients 12.  $q$ -binomial theorem 13. Jacobi's triple product identity 14. The Rogers-Ramanujan identities II 15. Applications 16. Summary

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** Integer partitions. George Andrews, Kimmo Eriksson, Cambridge University Press

**Reference)** An introduction to the theory of numbers. G. H. Hardy, E. M. Wright, Oxford University Press

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216751>

**Contact)**

⇒ Mizuno (A204, +81-88-656-7542, mizuno@pm.tokushima-u.ac.jp) (Office Hour: 水曜 17:00 から 18:00)

## Superconductivity and superconducting materials

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand basics and recent developments in superconductivity.

**Outline)** This class reviews quantum mechanics and introduces superconductivity and recent superconducting materials.

**Style)** Lecture

**Keyword)** *superconductivity, Cooper pair, superconducting energy gap, density of states, anisotropic superconductivity*

**Goal)** To understand the outline of superconductivity.

**Schedule)** 1. Introduction to superconductivity 2. Review of quantum mechanics (1), Schrödinger equation and wave function 3. Review of quantum mechanics (2), operators and expected values 4. Review of quantum mechanics (3), perturbation theory 5. Free electron model of metals 6. Phenomenological theory of superconductivity 7. To understand Meissner effect on the basis of quantum mechanics 8. Formation of Cooper pair 9. Formation of superconducting energy gap 10. Density of states, and energy gap at finite temperatures 11. Introduction to Nuclear Magnetic Resonance method 12. Frontier of superconductivity (1), strong coupling superconductor 13. Frontier of superconductivity (2), heavy Fermion superconductor 14. Frontier of superconductivity (3), copper oxide high  $T_c$  superconductor 15. Summary

**Evaluation Criteria)** Reports on several subjects in the class.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=218254>

**Contact)**

⇒ Kishimoto (A202, +81-88-656-7548, yutaka@pm.tokushima-u.ac.jp) (Office Hour: 金曜日 16:00-17:30)

## Advanced applied analysis

2 units (selection)

Kuniya Okamoto · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the functional analytic methods which are basic tools for mathematical sciences.

**Outline)** This subject provides basic theory of functional analysis which is considered as linear algebra in infinite-dimensional spaces. Functional analytic approaches to phenomena described by differential equations are introduced.

**Style)** Lecture

**Relational Lecture)** “Topics of Analysis for Mathematical Science”(0.5, ⇒p.9)

**Goal)** To apply the theory of modern analysis and recognize its significant role.

**Schedule)** 1. Differential equations and their solutions 2. Exponential of matrices 1 3. Uniqueness of solutions 4. Existence of solutions 5. Eigenvalues and eigenspaces 6. Projective representation 7. Exponential of matrices 2 8. Generalized eigenvalue problems 9. Dunford integrals 10. Holomorphic functions of matrices 11. Solution curve and stability 12. Stability of solutions 13. Ljapunov's method 14. Nonlinear case 15. Linear approximations 16. Summary

**Evaluation Criteria)** Evaluation by the report.

**Reference)** 『新微分方程式対話』 笠原皓司著, 日本評論社

**Webpage)** <http://math9.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=218255>

**Contact)**

⇒ 岡本(A棟212室, TEL/FAX: 088-656-9441, E-mail: okamoto@pm.tokushima-u.ac.jp) (Office Hour: 【WEB頁】のHPを参照のこと)

## Electrical and Electronic Engineering Seminar and Exercise

4 units (compulsory)

Teacher of course

**Target)** To get wide knowledge on your reaserach topics.

**Outline)** Students read scientific papers relating to your research and get wide knowledge on your reaserach topics.

**Style)** Lecture in combination with Portfolio

**Keyword)** *reading references, presentation skill, discussion*

**Requirement)** N/A

**Goal)**

1. To get skills to collect scientific references and knowledge relating your research topic
2. To get skills on discussion about a scientific topic
3. To get presentation skills

**Schedule)** 1. Continue the followings. 2. Select text books and/or collect references. 3. Summarize the contents of a reference and/or a text book and present them. 4. Discuss about the contents of the presentation.

**Evaluation Criteria)** Evaluated with portfolios and/or examinations

**Textbook)** Text books and references will be specified by your supervisors at the first class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216782>

**Student)** Able to be taken by only specified class(es)

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### Electrical and Electronic Engineering Laboratory

6 units (compulsory)  
Teacher of course

**Target)** To obtain wide knowledge on your research topics by experiments.

**Outline)** Do experiments relating your Master Degree's thesis.

**Style)** Portfolio

**Keyword)** *research skill, acquisition of professional knowledge, presentation skill*

**Requirement)** N/A

**Notice)** N/A

**Goal)**

1. To acquire professional knowledge on your research topics by experiments
2. To get presentation skills

**Schedule)** 1. Continue the followings 2. Plan your experiments and collect basic knowledge 3. Do experiments according to your plan 4. Summarize experimental results, present them and discuss about them.

**Evaluation Criteria)** Evaluation with portfolios

**Textbook)** Text books will be introduced by your supervisor at the beginning.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216781>

**Student)** Able to be taken by only specified class(es)



## Systems Innovation Engineering — Information Science and Intelligent Systems

### SYLLABUS OF SUBJECTS

#### • Integrated Subjects

<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和 .....	77
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	77
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer .....	78
<b>Long-term Internship (M)</b> ... Yamanaka .....	78
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · Part-time Lecturer .....	79
<b>International Advanced Technology and Science 1</b> ... Murakami .....	79
<b>International Advanced Technology and Science 2</b> ... Murakami .....	79
<b>Presentation Method (M)</b> ... Graduate School of Advanced Technology and Science .....	79
<b>Internship (M)</b> .....	80
<b>Venture Business (M)</b> .....	80

#### • Common Subjects

<b>Advanced Theory of Complex System Engineering</b> ... Ueta .....	80
<b>Advanced Theory of Semiconductors</b> ... Nishino .....	80
<b>Advanced Electrical Control System</b> ... Yasuno .....	81
<b>Advanced Theory of Electrical Communication</b> ... Oie .....	81
<b>Advanced Circuit Theory</b> ... Nishio · Uwate .....	81
<b>Human Sensing</b> ... Fukumi .....	81
<b>Photonic Device</b> ... Haraguchi .....	82
<b>Electronic display</b> ... Suyama .....	82

#### • Departmental Subjects

<b>Topics of Analysis for Mathematical Science</b> ... Kohda .....	82
<b>Methods for analysis of mathematical phenomena</b> ... Imai .....	83
<b>Quantum mechanics and advanced lecture in quantum physics</b> ... Michihiro .....	83
<b>Language Modeling</b> ... Kita · Shishibori .....	83
<b>Autonomous Intelligent Systems</b> ... Ono · Mogami .....	83
<b>Information and Communication Network</b> ... Oohama · Tokushige .....	84
<b>Applied Image Processing</b> ... Terada · Karungaru .....	84
<b>Web Programming</b> ... Shimomura · Ikeda .....	84
<b>Natural Language Understanding</b> ... Aoe · Fuketa · Morita .....	84
<b>Intelligent CAI</b> ... Ogata · Mitsuahara · Kanenishi · Matsuura · Ito .....	85
<b>Advanced Machine Translation</b> ... Ren .....	85
<b>代数学特論</b> ... Mizuno .....	85

#### • Specialized Exercise and Experiments

<b>Seminar and Exercise in Information Science</b> ... Suzuki · Matsumoto · Shishibori · Mogami · Tokushige · Watanabe · Karungaru · Ikeda · Fuketa · Morita · Ogata · Mitsuahara · Kashihara · Ito · Sano · Matsuura .....	86
<b>Laboratory in Information Science</b> ... Teacher of course .....	86

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#### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style** Lecture

**Keyword** *intellectual property, patent law, protect and use of intellectual property*

**Requirement** No requirement

**Notice** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basical practical use of intellectual property.

**Schedule** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook** To be used textbooks made by lecturers.

**Reference** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student** For the course students and other graduate school students.

**Contact**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

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#### Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14から16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もある。くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword)** management, management of technology

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.77), "Long-term Internship (M)"(0.5, ⇒p.78), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.79), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.

2. Ranking of the technology in management and that importance are appreciated.

3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda","The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

### Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。 ・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。 <<参考:平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。 ○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-笠松和市(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ぐ奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり、90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(働いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有 (088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Advanced Theory of Complex System Engineering

2 units (selection)

Tetsushi Ueta · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** comprehension and application of complex systems by using engineering methodologies

**Outline)** Complex systems are defined as compound dynamical systems whose behavior and features cannot be predicted because of their nonlinearities and connecting conditions. This emergence of behavior is not possible for a single dynamical system, therefore, connection, coupling, compounding are keywords of this theory. Emergence of rhythm in biological systems, self organization, chaotic properties in high degrees of freedom, learning and associative memory are example features of complex systems. In this lecture, based on physical systems which are ubiquitously found and treated by system engineering subjects, we study analytical methods to understand these phenomena, bifurcation theory of nonlinear and linear

systems, applied extraction methods of valuable information from observed data, system design methods of compound dynamical systems.

**Style)** Lecture

**Keyword)** *complex systems, bifurcation, chaos, nonlinear phenomena*

**Fundamental Lecture)** "Differential Equations (II)"(1.0), "Transient Analysis"(1.0), "Industrial Basic Physics"(1.0)

**Relational Lecture)** "Advanced Electrical Control System"(0.5, ⇒p.81), "Advanced Theory of Electronic Circuits"(0.5, ⇒p.73)

**Requirement)** none

**Goal)**

1. understanding of the definition and target area of complex systems
2. understanding of qualitative approach for given dynamical system
3. understanding and application of bifurcation theory

**Schedule)** 1. examples of complex systems 2. relationship between bifurcation problems and complex systems 3. computation of bifurcation parameter values 4. chaos and bifurcation phenomenon 5. chaotic itinerary 6. emergence mechanism of spatio temporal chaos and its clustering 7. phase transition and synchronization 8. spatio temporal intermittency and emergence of patterns 9. chaos neural network 10. neuronal circuits as complex systems 11. bifurcations in emergence systems 12. analysis of social systems 13. survey on complex systems 14. exercise 1 15. exercise 2 16. questions and answers

**Evaluation Criteria)** The total grade is evaluated by homework reports (70 %) and attendance of the class. (30 %)

**Textbook)** specified every class.

**Reference)** Chaotic Scenario of Complex Systems, Asakura-Shoten, 1996 (in Japanese)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216858>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ueta (AIT 507, +81-88-656-7501, [tetsushi@ait.tokushima-u.ac.jp](mailto:tetsushi@ait.tokushima-u.ac.jp)) (Office Hour: Wednesday, afternoon)

**Note)** ◇For comprehension of the lecture contents, a 2-hour preparation study and a 2-hour review are required. ◇All items in the lecture plan are evaluated by reports.

### Advanced Theory of Semiconductors

2 units (selection)

Katsushi Nishino · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand semiconductor physics and fundamental device operations for various semiconductor devices

**Outline)** Semiconductor physics, especially behavior of carriers in semiconductor, is described. Properties of pn junction and Schottky barrier, including non-ideal case, are also lectured.

**Style)** Lecture

**Keyword)** *semiconductor, metal-semiconductor contact, pn junction diode*

**Relational Lecture)** "Advanced Device Processing"(0.5, ⇒p.69), "Advanced Theory of Electron Devices"(0.5, ⇒p.69), "Advanced Optoelectronic Devices"(0.5, ⇒p.70)

**Goal)**

1. To understand behavior of carries (such as scattering mechanisms) in semiconductor
2. To solve diffusion equations in simple conditions
3. To understand properties of pn junction and Schottky barrier

**Schedule)** 1. Crystal Structure 2. Energy Bands 3. Carrier Concentration at Thermal Equilibrium 4. Carrier Transport 5. Phonon 6. High-Field Effect 7. Continuity Equations and Diffusion Equations of Carriers 8. Band Structure of Metal-Semiconductor Contact 9. Current Transport Processes of Schottky Barrier 10. Characterization of Schottky Barrier Height 11. Ohmic Contact 12. Band Structure of pn Junction Diode 13. Capacitance-Voltage Characteristics of pn Junction Diode 14. Current-Voltage Characteristics of pn Junction Diode 15. Heterojunction 16. Examination

**Evaluation Criteria)** Report 50%, Examination 50%. More than 60% is required to pass this class.

**Textbook)** Physics of Semiconductor Devices, by S.M.Sze

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216816>

**Contact)**

⇒ Nishino (E棟2階南 A-5, +81-88-656-7464, nishino@ee.tokushima-u.ac.jp)

### Advanced Electrical Control System

2 units (selection)

Takashi Yasuno · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the basic principle of making to high performance and the intelligence in control system used for an industrial machine. And the control design of various control systems is understood.

**Outline)** The control system configuration used for the industrial machine is described, and applications of intelligent control method using fuzzy reasoning and neural net works are introduced. Moreover, Current topics of fields mentioned above are introduced.

**Style)** Lecture and exercise

**Keyword)** *Motion control, Robotics, Fuzzy, Neural network, Genetic algorithm*

**Relational Lecture)** “Advanced Lecture of Intelligent Information Processing”(0.5, ⇒p.74), “Advanced Control Theory”(0.5, ⇒p.72)

**Notice)** The lecture form might be changed according to the number of attending a lecture.

**Goal)**

1. The configuration of the control system used for an industrial machine should be understood.
2. The intelligent control method should be understood.

**Schedule)** 1. Control object 2. Motion control system 3. Two degree-of-freedom control 4. Design method of feedback controller 5. Design method of feedforward controller 6. Fuzzy sets 7. Fuzzy reasoning method 8. Control system application of fuzzy reasoning 9. Artificial neuron model 10. Neural network 11. Learning algorithm of neural network 12. Control system application of neural networks 13. Genetic algorithm 14. Control system application of genetic algorithm 15. Conclusions 16. Return of report or examination

**Evaluation Criteria)** Total evaluation based on reports, examinations or presentations.

**Textbook)** The print is distributed.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216722>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yasuno (E棟2階北 B-5, +81-88-656-7458, yasuno@ee.tokushima-u.ac.jp) (Office Hour: Monday, 15:00-17:30)

### Advanced Theory of Electrical Communication

2 units (selection)

Takahiro Oie · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding analysing techniques of the communication system and multi-nodes networks.

**Outline)** This lecture is concerned with the study of concept of computer networks which realize the multi-node communication. The contents of those articles related with computer networks are presented at seminars. (Lecture style)

**Style)** Lecture

**Keyword)** *digital communication, computer networks, network architecture*

**Fundamental Lecture)** “Communication Systems”(1.0), “Applied Communication Engineering”(1.0), “Computer Networks”(1.0)

**Requirement)** Students are required to have a good understanding of undergraduate-level communication engineering and related subjects.

**Goal)**

1. Understanding the control techniques and implementation of computer network application. (Week 1-8, 11-15)
2. Understanding the secure techniques of the communication system. (Week 9-16)

**Schedule)** 1. Overview of digital communication 2. Mathematical preparation 3. Network architecture 4. Physical layer in fixed and wireless networks 5. Datalink layer in fixed and wireless networks 6. Network layer and routing 7. Transport layer 8. Traffic control 9. Security in fixed and wireless networks 10. Symmetric cryptography and public key cryptography 11. Session layer 12. Presentation

layer 13. Application layer 14. Implementation example of application layer (HTTP, SMTP) 15. Implementation example of application layer (DNS, SNMP) 16. Wireless networks

**Evaluation Criteria)** Evaluated by presentations and submitted materials in seminars.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216771>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Oie (E-3F-C-1, +81-88-656-7479, alex@ee.tokushima-u.ac.jp) (Office Hour: Tuesday 16:20~ 17:20, Thursday 16:50~ 17:50)

**Note)** Taking this class, it is necessary to do 2 hours preparation and 2 hours reviewing for every class (2 hours) in order for your understanding and taking credit.

### Advanced Circuit Theory

2 units (selection)

Yoshifumi Nishio · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoko Uwate · ASSISTANT PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Analysis method of nonlinear circuits, and behavior of nonlinear oscillatory circuits and its applications are lectured.

**Outline)** Modeling of nonlinear devices, DC analysis and transient analysis of nonlinear circuits, and steady-state analysis are lectured. Synchronization and chaotic phenomena in nonlinear oscillatory circuits are introduced and their applications to information and communication engineering are discussed. (Style: Lecture)

**Style)** Lecture and exercise

**Keyword)** *nonlinear circuits, circuit analysis, oscillatory circuits*

**Fundamental Lecture)** “Electrical Circuit Theory (I) and Exercise”(0.7), “Electrical Circuit Theory (II) and Exercise”(0.5), “Network Analysis”(0.3)

**Relational Lecture)** “Advanced Theory of Complex System Engineering”(0.5, ⇒p.80)

**Requirement)** Students are required to know how to analyze basic linear circuits.

**Notice)** Course is taught in English.

**Goal)**

1. Understanding of analysis methods of nonlinear circuits.
2. Understanding of behavior of nonlinear circuits and its applications.

**Schedule)** 1. Modeling of nonlinear devices. 2. DC analysis of nonlinear circuits by Newton method. 3. Transient analysis of nonlinear circuits. 4. Steady-state analysis of nonlinear circuits (for 4 lectures). 5. Synchronization phenomena in nonlinear oscillatory circuits (for 2 lectures). 6. Chaotic phenomena in nonlinear oscillatory circuits (for 2 lectures). 7. Engineering applications of nonlinear circuits (for 4 lectures). 8. Conclusions and final examination.

**Evaluation Criteria)** Final examination 80% and exercise 20%.

**Textbook)** None.

**Reference)**

- ◇ Akio Ushida and Mamoru Tanaka, “Nonlinear Circuit Simulations,” Corona Publishing Co.
- ◇ S. Smale and M.W. Hirsch, “Differential Equations, Dynamical Systems, and Linear Algebra,” Academic Press.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216580>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishio (D-7, E-3F-South, +81-88-656-7470, nishio@ee.tokushima-u.ac.jp)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

### Human Sensing

2 units (selection)

Minoru Fukumi · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** This lecture aims to understand the latest topics in a field of Intelligent systems, and to obtain advanced knowledge and technologies.

**Outline)** This lecture teaches the advanced topics in intelligent systems. The main items in this lecture are softcomputing and human sensing, including face information processing and its computer practice and biological signal processing.

**Style)** Lecture and exercise

**Keyword)** *soft computing, human sensing, human information processing*

**Goal)**

1. To understand the latest topics on Intelligent systems.
2. To learn the trend of a domestic and foreign research on related topics.

**Schedule)** 1. Topics in Advanced Intelligent Systems 2. Topics in Advanced Intelligent Human Sensing 3. Topics in Brain Information Processing 4. Topics in Advanced Softcomputing techniques 5. Psychological Knowledge and Neural Network Model 6. Topics in Advanced Face Information Processing 7. Topics in Advanced Biosignal Processing 8. Topics on applications in Advanced Softcomputing techniques 9. Statistical Learning Algorithms 10. Topics in Eye Tracking and Its Applications 11. Topics in OpenCV applications 12. Topics in EMG and EEG researches 13. Exercise in Advanced Intelligent Systems 14. Exercise in Softcomputing 15. Exercise in Human Information Processing 16. Discussion

**Evaluation Criteria)** Attendance (30%), practice(10%), report (60%)

**Textbook)** no special book

**Reference)** 講義・演習中に指定する。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216854>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Fukumi (D210, +81-88-656-7510, fukumi@is.tokushima-u.ac.jp) (Office Hour: 金曜日,15~18時)

**Note)** ◇ ゲストスピーカーを招聘して講義・演習を行う場合がある。 ◇ 授業目的の達成度は最終レポートにより評価する。

## Photonic Device

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the principle of the current optoelectronic devices, e.g., Light Emitting Diodes, Laser Diodes and so on. To develop ability to solve various problems in optical device application.

**Outline)** This course will cover topics on current optical and optoelectronic devices. Topics treated include Light Emitting Diode, Laser Diode, Solar Cell, Optical Modulator and Nonlinear Optical Devices.

**Style)** Lecture

**Keyword)** *optoelectronic device, optical device, light emitting diode, laser diode, optical modulator, Solar cell*

**Relational Lecture)** “Optical properties of materials”(0.5, ⇒p.93), “Lecture in Optical Materials and Devices, Part 1”(0.5, ⇒p.95)

**Requirement)** Students should have fundamental knowledges about semiconductor physics and devices for undergraduate students.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしようとして授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. Students can explain the principle and structures for light emitting devices.
2. Students can explain the principle and structures for photodetector and solar cell.
3. Students can explain the principle of light modulators.
4. Students can explain the principle of nonlinear optical devices.

**Schedule)** 1. Introduction 2. Interaction between Light and dielectric materials 3. Semiconductors and other optical materials 4. Optical properties of semiconductors 5. Semiconductor PN-junction 6. Light Emitting Diode 7. Application of Light Emitting Diode 8. Laser Diode 9. Application of Laser Diode 10. Photoconductor Cells 11. pin photodiode 12. Solar cell and amorphous-semiconductor optoelectronic devices 13. Optical Modulator 14. Nonlinear optical devices 15. Integrated Optical Devices 16. Final Examination

**Evaluation Criteria)** Activity: 20%, Reports: 40% and Final Exam.:40%

**Textbook)** 中澤, 鎌田著, 光物性・デバイス工学の基礎, 培風館 1999

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216857>

**Contact)**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

## Electronic display

2 units (selection)

Shiro Suyama · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the history of developments, technical trends, and technologies of electronic display.

**Outline)** This course will cover the history of developments, technical trends, recent topics, and technologies of an electronic display. This course is related to industries.

**Style)** Lecture

**Notice)** 光の性質, 光学的な現象については, 既知とする。

**Goal)**

1. To understand fundamental technologies of an electronic display
2. To understand fundamental technologies of devices for an electronic display
3. To understand a technical trend of an electronic display

**Schedule)** 1. 電子ディスプレイの概要, 最近の動向 2. 電子ディスプレイおよび画像システムの概要 3. 直視型: 陰極線管(ブラウン管, CRT), テレビジョン 4. 直視型: 液晶の概要と液晶ディスプレイ(LCD)の基本動作 5. 直視型: 各種の液晶ディスプレイと特性改善 6. 直視型: プラズマディスプレイ(PDP) 7. 直視型: エレクトロルミネッセンス(EL)ディスプレイ 8. 直視型: フィールドエミッションディスプレイ(FED) 9. 超大型: 投射型ディスプレイ 10. 超大型: 最新の投射型ディスプレイ, 屋外用大型LEDディスプレイ 11. 電子ディスプレイの画質と視覚特性 12. 電子ディスプレイの画質とその評価 13. 立体ディスプレイ: 概要 14. 立体ディスプレイ: 2眼/多眼方式 15. 立体ディスプレイ: 超多眼方式などの最新の動向

**Evaluation Criteria)** Evaluation with report

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216773>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Suyama (opt409, +81-88-656-9425, suyama.shiro@opt.tokushima-u.ac.jp) (Office Hour: 17:00~18:00)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしようとして授業を受けることが、授業の理解と単位取得のために必要である。

## Topics of Analysis for Mathematical Science

2 units (selection)

Atsuhito Kohda · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Mathematical theory and technique for analysis of engineering phenomena

**Outline)** Mathematical theory to analyze problems in engineering and its application, mainly theory and technique of differential equations

**Style)** Lecture

**Relational Lecture)** “Advanced applied analysis”(0.2, ⇒p.9), “Differential Equations”(0.2, ⇒p.8)

**Requirement)** If you like undergraduate-level mathematics, it will be sufficient.

**Goal)** To be familiar with mathematical theory, that helps engineering study.

**Schedule)** 1. Theory of sets and maps 2. Cardinal numbers and bijection 3. Equivalence relations and cryptography 4. Linear space and tensor 5. Vector analysis and differential form 6. Cauchy's theorem and vector analysis 7. Differential form and Cauchy's theorem 8. Projective plane 9. Quadratic curves and projective plane 10. All quadratic curves are circles? 11. The index of vector fields 12. Applications of the index: fundamental theorem of algebra 13. Vector fields on the unit sphere 14. Why there is the north pole on the earth 15. Mathematics and computers 16. Summary

**Webpage)** <http://math1.pm.tokushima-u.ac.jp/lecture/>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216711>

**Contact)**

⇒ Kohda (A211, +81-88-656-7546, kohda@pm.tokushima-u.ac.jp) (Office Hour: 月曜 12:00~ 13:00)

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### Methods for analysis of mathematical phenomena 2 units (selection)

Hitoshi Imai · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the to analyze the mathematical phenomena.

**Outline)** Methods used in analysis of mathematical phenomena are introduced. Especially, those in numerical analysis are focused on.

**Style)** Lecture

**Keyword)** *mathematics, numerical analysis*

**Fundamental Lecture)** “Numerical Analysis”(1.0)

**Relational Lecture)** “Advanced Computational Science”(0.5, ⇒p.55)

**Requirement)** Only the premise that have studied basic mathematics.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)** Being able to understand a numerical scheme to one-dimensional boundary value problems for the Poisson equation

**Schedule)** 1. Introduction to computer 2. Common sense in numerical computation 3. High-speed computation (Parallel computing) 4. Finite difference method I 5. Finite difference method II 6. Finite difference method III 7. Finite difference method IV 8. Finite element method I 9. Finite element method II 10. Finite element method III 11. Finite element method IV 12. Boundary element method I 13. Boundary element method II 14. Boundary element method III 15. Iterative method

**Evaluation Criteria)** Evaluation by the report.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216716>

**Contact)**

⇒ Imai(A220, +81-88-656-7541, The inquiry by means of the cellular phone or E-mail is not acceptable) (Office Hour: Office hours: Thursday 14:00-15:00)

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### Quantum mechanics and advanced lecture in quantum physics 2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the quantum mechanics.

**Outline)** Basics of quantum mechanics are introduced.

**Style)** Lecture

**Keyword)** *quantum mechanics*

**Goal)** To understand the outline of quantum mechanics.

**Schedule)** 1. Introduction 2. Variational method 3. Lagrangian 4. Hamiltonian 5. Poisson's bracket expression 6. Quantization 7. Operator 8. Wavefunction 9. Expectation value 10. Schrödinger equation 11. Example (1) the square well potential 12. Example (2) the linear harmonic oscillator 13. Angular momentum 14. Example (3) hydrogen atom 15. Heisenberg equation 16. Field quantization

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216868>

**Contact)**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

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### Language Modeling 2 units (selection)

Kenji Kita · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Masami Shishibori · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** The course introduces some probabilistic models of natural language.

**Outline)** Due to the availability of large text corpora, probabilistic approaches to modeling natural language text have become dominant in recent years. This lecture gives an overview of probabilistic modeling of natural language, including n-gram models, hidden Markov models, probabilistic grammars, and maximum entropy models, as well as their applications to natural language processing and information retrieval.

**Style)** Lecture in combination with Portfolio

**Keyword)** *natural language, probabilistic model, n-gram model, probabilistic grammar*

**Fundamental Lecture)** “Automata and Formal Languages”(1.0)

**Relational Lecture)** “Natural Language Understanding”(0.5, ⇒p.84), “Advanced Machine Translation”(0.5, ⇒p.85)

**Goal)** To acquire effective techniques for modeling natural language texts using probabilistic models.

**Schedule)** 1. Overview of the course 2. Modeling natural language 3. Estimation and evaluation of probabilistic models 4. N-gram model 5. Hidden Markov model 6. Maximum entropy model 7. Probabilistic grammar 8. Partitions of numbers and Young diagram 9. Symmetric group and its action on polynomials 10. Symmetric form and Young diagram 11. Bumping game 12. Sliding game 13. Product operations on Young tableaux 14. Word problem 15. Recent topics 16. Assignment

**Evaluation Criteria)** Assignment count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216636>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kita (Dr503, +81-88-656-7496, kita@is.tokushima-u.ac.jp) (Office Hour: Tuesday 12:50 - 14:20)

**Note)** Invited talk by a part-time lecturer will be given.

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### Autonomous Intelligent Systems 2 units (selection)

Norihiko Ono · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Yoshio Mogami · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** As effective design methods of autonomous intelligent systems, the reinforcement learning algorithms have received much attention that allow the systems to obtain appropriate decision policies by trial and error even in environments with delayed rewards. This class provides the basic concepts and theories concerning the algorithms as well as their application techniques.

**Outline)** While top-down approaches to intelligent systems design problems have exposed various limitations, bottom up approaches have been proposed and studied that allow intelligent systems to improve their own performance autonomously and incrementally during the course of interactions with the environments. This class covers those bottom-up approaches mainly focused upon the reinforcement learning algorithms.

**Style)** Lecture

**Keyword)** *autonomous agents, emergent systems design, reinforcement learning, robotics, multi-agent systems*

**Fundamental Lecture)** “Intelligent Systems”(0.5), “Optimization Theory”(0.5)

**Relational Lecture)** “Advanced Machine Translation”(0.5, ⇒p.85), “Language Modeling”(0.5, ⇒p.83), “Natural Language Understanding”(0.5, ⇒p.84)

**Goal)** Recently, bottom-up approaches to the intelligent systems designs problems have been proposed based on various reinforcement learning algorithms. This class aims at the understanding of the theory of the algorithms as well as their potentials and limitations through the applications to small-scale systems design problems.

**Schedule)** 1. Introduction 2. Reinforcement learning: basic concepts (1) 3. Reinforcement learning: basic concepts (2) 4. Basic reinforcement learning algorithms (1) 5. Basic reinforcement learning algorithms (2) 6. Basic reinforcement learning algorithms (3) 7. Reinforcement learning considering application to real-world tasks (1) 8. Reinforcement learning considering application to real-world tasks (2) 9. Reinforcement learning based on evolution strategies 10. Reinforcement learning based on evolutionary computation 11. Reinforcement learning based on genetic programming 12. Reinforcement learning and robotics (1) 13. Reinforcement learning and robotics (2) 14. Reinforcement learning and multi-agent systems (1) 15. Reinforcement learning and multi-agent systems (2)

**Evaluation Criteria**) Attendance (30%), report (70%)

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216704>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Ono (D106, +81-88-656-7509, ono@is.tokushima-u.ac.jp) (Office Hour: 金曜日 15:00~ 17:30)

⇒ Mogami (D102, +81-88-656-7505, moga@is.tokushima-u.ac.jp) (Office Hour: Mon. 15:00~18:00  
(Refer to the notice of the department in every year.))

**Note**) ◦ 講義に関連する資料は Web(u-Learning システム) を用いて配信する。 ◦ 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。 ◦ 授業計画 1~15 に関しては、期末レポートにより達成度評価を行なう。

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## Information and Communication Network

2 units (selection)

Yasutada Oohama · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Hitoshi Tokushige · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

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**Target**) This class provides the knowledge necessary for understanding architecture and fundamental technics of information and communication network.

**Outline**) This lecture is focused on architecture of information and communication network and its fundamental technologies. Particular, methods of multimedia data transmitting, network architecture and network security are explained in this lecture.

**Style**) Lecture

**Keyword**) *information and communication network, digital data transmission, network architecture, network security*

**Requirement**) 特になし

**Notice**) 特になし

**Goal**)

1. Architecture of Information and communication network can be learned
2. Fundamental technics for Information and communication network can be learned

**Schedule**) 1. Information and communication systems 2. Fundamental technologies of data transmission 3. Digital data transmission (1) 4. Digital data transmission (2) 5. Error control 6. Network architecture 7. Communication line 8. Network security 9. Cryptography Algorithm 10. Digital signature 11. Communication security 12. Authentication protocol 13. Mobile communication systems (1) 14. Mobile communication systems (2) 15. Broadcast systems 16. Assignment

**Evaluation Criteria**) Result is decided by attendance(20%) and Assignment (80%).

**Textbook**) Printed synopses of lecture are distributed.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216702>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Oohama (C302, +81-88-656-9446, oohama@is.tokushima-u.ac.jp)

⇒ Tokushige (C303, +81-88-656-9447, tokusige@is.tokushima-u.ac.jp) (Office Hour: 月曜日, 火曜日 (16:00-18:00))

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## Applied Image Processing

2 units (selection)

Kenji Terada · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Stephen Karungaru-Githinji · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

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**Target**) This class provides the skills and the knowledge of basic and advanced image processing in the industrial field and the robot field.

**Outline**) This class introduces the techniques and applications of image processing necessary for control system and inspection system. This class explains the hardware and software about image I/O systems, high-speed image processing methods and robot vision.

**Style**) Lecture

**Keyword**) *image processing, pattern recognition, computer vision*

**Fundamental Lecture**) “Image Processing”(1.0), “Pattern Recognition”(1.0)

**Goal**) 工業用画像処理システムを構築する際に必要な実用的な技術とロボットの視覚技術等についての知識の習得

**Schedule**) 1. concept of industrial image processing 2. image acquisition system 3. principle of lens and light source device 4. hardware of image processing(1) 5. hardware of image processing(2) 6. three dimensional image feature extraction(1) 7. three dimensional image feature extraction(2) 8. shift and shape recognition(1) 9. shift and shape recognition(2) 10. inspection system(1) 11. inspection system(2) 12. robot vision 13. mobile robot 14. micro robot 15. trend of robotics 16. Report

**Evaluation Criteria**) Result is decided by attendance(20%) and reports(80%).

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216595>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Terada (Dr.802, +81-88-656-7499, terada@is.tokushima-u.ac.jp) (Office Hour: 月, 水曜日 15:00~ 17:00(年度ごとに学科の掲示を参照すること))

**Note**) ◦ 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。 ◦ 授業計画 1~15 は、各講義の最後に行なわれる演習および最終試験により達成度評価を行なう。

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## Web Programming

2 units (selection)

Takao Shimomura · PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kenji Ikeda · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

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**Target**) This class provides the knowledge and skills necessary for efficiently developping Web applications in the Internet, and implementing the software of high quality.

**Outline**) This class introduces Web programming frameworks and Web programming techniques systematically necessary for efficiently developing Web applicatins of high quality, and then explains the development of some Web application systems as practical examples to teach the development skills such as Web design patterns.

**Style**) Lecture

**Keyword**) *Java, Servlet, JSP, Web applications*

**Fundamental Lecture**) “Programming Methodology”(1.0), “ソフトウェア工学”(1.0)

**Relational Lecture**) “System Administration”(0.5)

**Requirement**) Students are required to hava a good understanding of undergraduate-level Java programming and related subjects.

**Goal**) To understand the system configuration of Web applications that consists clients and a server, and design flexible Web application systems

**Schedule**) 1. Web application 2. HTTP/Session 3. Database 4. JSP custom tags 5. Web services 6. Applets 7. JavaScript/AJAX 8. Flash/Flex 9. Web programming frameworks 10. BioPro 11. Internationalization 12. Web programming tips 13. Web programming design patterns 14. Introduction to NisWeb system 15. NisWeb system configuration 16. Assignment

**Evaluation Criteria**) Assignments count 100%.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216560>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Shimomura (C402, +81-88-656-7503, simomura@is.tokushima-u.ac.jp) (Office Hour: Wed 15:00~ 18:00)

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## Natural Language Understanding

2 units (selection)

Jun-ichi Aoe · PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Masao Fuketa · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kazuhiro Morita · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

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**Target)** This lecture is focused on methods of Natural Language Understanding for human-communication and intelligent text search applications. Particularly, syntax analysis algorithms and semantic analysis technics for various kinds of applications are explained in this lecture.

**Outline)** Understanding is most important technics for the human-communication and the intelligent text search. Efficiency of the technics depend on the relationships between knowledge dictionaries and analysis algorithms. In this lecture, case-structure with semantic informations and case-analysis algorithms is explained. Moreover, the newest Natural Language Processing systems are introduced with detailed examples. Exercises include Trie structure for the semantic dictionary, understanding for formal document, and understanding for patent documents. This subject of lecture belongs to industrial field.

**Style)** Lecture in combination with Portfolio

**Keyword)** *dialogue understanding, intention understanding, knowledge dictionary, morphological analysis, patent document*

**Fundamental Lecture)** “自然言語処理”(1.0), “データマイニング”(1.0)

**Relational Lecture)** “Advanced Machine Translation”(0.5, ⇒p.85), “Language Modeling”(0.5, ⇒p.83)

**Goal)**

1. Technics of Natural Language Understanding, Dialogue Understanding and Intention Understanding can be learned.
2. Key search methods in Natural Language Processing can be learned.
3. Technics of Morphological Analysis and Kana-Kanji Translation can be learned.
4. How to describe technical document and patent document based on Language Understanding can be learned.

**Schedule)** 1. Introduction 2. Dialogue Understanding 3. Intention Understanding, Report 4. New Information on Composition 5. Design of Composition Structure, Report 6. Knowledge Dictionary 7. Key Search Algorithm 8. Trie Structure, Report 9. Morphological Analysis 10. Kana-Kanji Translation, Report 11. Understanding of Technical Document 12. Exercise for Understanding of Technical Document, Report 13. Understanding of Technical Document 14. Understanding of Patent Document 15. Exercise for Understanding of Patent Document, Report 16. Report

**Evaluation Criteria)** Result is decided by attendance(20%) and reports(80%).

**Textbook)** Printed synopses of lecture are distributed.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216684>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Aoe (Dr604, +81-88-656-7486, aoe@is.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00~ 17:00(年度ごとに学科の掲示を参照すること))

## Intelligent CAI

2 units (selection)

Hiroaki Ogata · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
 Hiroyuki Mitsuhashi · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
 Kazuhide Kanenishi · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
 Kenji Matsuura · ASSOCIATE PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
 Teruaki Ito · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This course aims to instruct the design methods for intelligent systems from the point of view of new Ergonomics and knowledge engineering.

**Outline)** Computers are being used in Education. In this course, we will instruct about intelligent CAI (Computer Assisted Instruction). Especially, we will talk about the difference between traditional CAI and intelligent one and the applications of ICAI, and user interfaces and teaching strategies based on theories and practices.

**Style)** Lecture

**Keyword)** *educational technology, learning science*

**Fundamental Lecture)** “Web Programming”(1.0, ⇒p.84), “Information and Communication Network”(1.0, ⇒p.84), “Autonomous Intelligent Systems”(1.0, ⇒p.83)

**Relational Lecture)** “Venture Business (D)”(0.5, ⇒p.105), “Natural Language Understanding”(0.5, ⇒p.84), “Presentation Method (D)”(0.5, ⇒p.104)

**Goal)** You will acquire how to design and implement the system of Intelligent CAI.

**Schedule)** 1. Overview of Intelligent CAI, History and theories of CAI 2. Intelligent CAI 3. ITS 4. Learner model, Tutoring model, Theories of CAI 5. Web Based Learning Environment 6. Adaptive Hypermedia, Personalization 7. Game-based Learning 8. CSCL(Theories) 9. CSCL(Systems) 10. Knowledge Management, SNS and Education Support System 11. Mobile Learning Environment(Theories) 12. Mobile Learning Environment(Systems) 13. Ubiquitous Learning Environment(Theories) 14. Ubiquitous Learning Environment(Systems) 15. Summary of Educational Technologies 16. examination

**Evaluation Criteria)** We will grade based on reports (30 points) and examinations (70 points). But this is subject to change.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216757>

**Contact)**

⇒ Ogata (C507, +81-88-656-7498, ogata@is.tokushima-u.ac.jp) (Office Hour: 月曜日 ~ 金曜日:午後 5 時 ~ 6 時)

⇒ Ito (M316, +81-88-656-2150, ito@me.tokushima-u.ac.jp)

**Note)** ◇ 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。◇ 授業計画 1~15 は、各講義のレポートおよび最終試験により達成度評価を行なう。

## Advanced Machine Translation

2 units (selection)

Fuji Ren · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** As a research and development field, machine translation (MT) is among the oldest among the various subdisciplines and applications of computer science to the study of natural language. This lecture aims to understand the basic MT technologies and to learn the latest MT theory and new approaches to develop MT system.

**Outline)** This lecture teaches the theory of machine translation (MT) and the technologies of MT systems. Main items in the lecture are syntax analysis, semantic analysis, knowledge processing, world knowledge model, natural-language-processing function, super-function, multilingual processing, etc.

**Style)** Lecture

**Keyword)** *machine translation, syntax analysis, semantic analysis, super function*

**Fundamental Lecture)** “自然言語処理”(1.0)

**Relational Lecture)** “Natural Language Understanding”(0.5, ⇒p.84)

**Goal)**

1. To understand the basic theory of machine translation (MT).
2. To Master the technique of developing a MT system.
3. To grasp the newest trend of machine translation research.

**Schedule)** 1. Introduction 2. Machine translation system 3. Morphological analysis I 4. Morphological analysis II 5. Syntax analysis I 6. Syntax analysis II 7. Semantic analysis I 8. Semantic analysis II 9. Semantic analysis III 10. Context analysis 11. Dictionary 12. Super-Function based MT I 13. Super-Function based MT II 14. Super-Function based MT III 15. Ontology and machine translation 16. Examination

**Evaluation Criteria)** Attendance (30%), report (30%), examination (40%)

**Textbook)** no special book

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216608>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ren (C204, +81-88-656-9684, ren@is.tokushima-u.ac.jp) (Office Hour: 16:00-15:00 Tuesday, 16:00-17:00 Thursday)

## 代数学特論

2 units (selection)

Yoshinori Mizuno · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To learn some combinatorial techniques based on the theory of partitions.

**Outline)** A partition of a natural number n is any non-increasing sequence of natural numbers whose sum is n. For example, there are three partitions of 3, because  $3=2+1=1+1+1$ . This class introduces some

combinatorial techniques and tools such as generating functions based on several topics from the theory of partitions.

**Style)** Lecture

**Keyword)** *integer partition, generating function*

**Goal)** To learn some combinatorial techniques and tools such as generating functions.

**Schedule)** 1. Some terms from set theory 2. Euler's identity 3. Ferrers graph 4. Generating function 5. Euler's theorem 6. Two variable generating function 7. Euler's pentagonal number theorem 8. Congruences 9. The Rogers-Ramanujan identities I 10. Formulas of partition functions 11. q-binomial coefficients 12. q-binomial theorem 13. Jacobi's triple product identity 14. The Rogers-Ramanujan identities II 15. Applications 16. Summary

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** Integer partitions. George Andrews, Kimmo Eriksson, Cambridge University Press

**Reference)** An introduction to the theory of numbers. G. H. Hardy, E. M. Wright, Oxford University Press

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=218256>

**Contact)**

⇒ Mizuno (A204, +81-88-656-7542, mizuno@pm.tokushima-u.ac.jp) (Office Hour: 水曜 17:00 から 18:00)

## Seminar and Exercise in Information Science

6 units (compulsory)

Motoyuki Suzuki	ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Kazuyuki Matsumoto	ASSISTANT PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Masami Shishibori	ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Yoshio Mogami	ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Hitoshi Tokushige	ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Shun Watanabe	ASSISTANT PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Stephen Karungaru-Githinji	ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Kenji Ikeda	ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Masao Fuketa	ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Kazuhiro Morita	ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Hiroaki Ogata	ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Hiroyuki Mitsuhashi	ASSOCIATE PROFESSOR / INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
	Koji Kashihara	ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE
Momoyo Ito	ASSISTANT PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Masahiko Sano	ASSOCIATE PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	
Kenji Matsuura	ASSOCIATE PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING	

**Target)** Improve presentation skill, writing technique, discussion ability, and basic knowledge about the information technology.

**Outline)** (1) Students groups present the research theses of their research groups and basic of information related to them, (2) Each student introduces information technology and others in English, and (3) Each student presents his/her master's thesis.

**Style)** Practice, Exercise

**Goal)**

1. Development of knowledge of information technology.
2. Improvement of writing skill.
3. Improvement of presentation skill.

**Schedule)** 1. Orientation 2. Introduction to the research topics of each reaserach group (1) 3. Introduction to the research topics of each reaserach group (2) 4. Introduction to the research topics of each reaserach group (3) 5. Introduction to the research topics of each reaserach group (4) 6. Introduction to the research topics of each reaserach group (5) 7. Introduction to the research topics of each reaserach group (6) 8. Introduction to the research topics of each reaserach group (7) 9. Introduction to the research topics of each reaserach group (8) 10. Introduction to the research topics of each reaserach group (9) 11. Introduction to the research topics of each reaserach group (10) 12. Introduction to the research topics of each reaserach group (11) 13. Introduction to the research topics of each reaserach group (12) 14. Introduction to the research topics of each reaserach group (13) 15. Introduction to the research topics of each reaserach group (14) 16. Information technology on the reserach topics of each

reaserch group (1) 17. Information technology on the reserach topics of each reaserch group (2) 18. Information technology on the reserach topics of each reaserch group (3) 19. Information technology on the reserach topics of each reaserch group (4) 20. Information technology on the reserach topics of each reaserch group (5) 21. Information technology on the reserach topics of each reaserch group (6) 22. Information technology on the reserach topics of each reaserch group (7) 23. Information technology on the reserach topics of each reaserch group (8) 24. Information technology on the reserach topics of each reaserch group (9) 25. Information technology on the reserach topics of each reaserch group (10) 26. Information technology on the reserach topics of each reaserch group (11) 27. Information technology on the reserach topics of each reaserch group (12) 28. Information technology on the reserach topics of each reaserch group (13) 29. Information technology on the reserach topics of each reaserch group (14) 30. Poster presentation of Master's thesis 31. Orientation of English presentation 32. English presentation (1) 33. English presentation (2) 34. English presentation (3) 35. English presentation (4) 36. English presentation (5) 37. English presentation (6) 38. English presentation (7) 39. English presentation (8) 40. English presentation (9) 41. English presentation (10) 42. English presentation (11) 43. English presentation (12) 44. English presentation (13) 45. English presentation (14) 46. Orientation of oral presentation of master's thesis 47. Presentation of master's thesis (1) 48. Presentation of master's thesis (2) 49. Presentation of master's thesis (3) 50. Presentation of master's thesis (4) 51. Presentation of master's thesis (5) 52. Presentation of master's thesis (6) 53. Presentation of master's thesis (7) 54. Presentation of master's thesis (8) 55. Presentation of master's thesis (9) 56. Presentation of master's thesis (10) 57. Presentation of master's thesis (11) 58. Presentation of master's thesis (12) 59. Presentation of master's thesis (13) 60. Presentation of master's thesis (14)

**Evaluation Criteria)** 各期毎の課題の総合点を評価とする。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216762>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ikeda (C403, +81-88-656-7504, ikeda@is.tokushima-u.ac.jp) (Office Hour: Wed. 15:00–18:00)

## Laboratory in Information Science

10 units (compulsory)

Teacher of course

**Target)** To conduct research leading to the awarding of masters degrees.

**Outline)** To conduct research in the Natural Language Understanding, Document Processing, Multimedia Information Retrieval, Image Processing, Movie Image Processing, Voice Recognition, Autonomous Agents Design, Internet Security, Intelligent Software, etc (seminars, portfolios etc).

**Style)** Lecture in combination with Portfolio

**Keyword)** *information science, software engineering*

**Notice)** Course plan differs depending on the laboratory you choose.

**Goal)** To present the results of your research related conferences, departmental research meetings, etc.

**Schedule)** 1. After the student selects the subjects, research can be carried out at the laboratory. However, the course contents are as shown below. 2. 中韓機械翻訳におけるスーパー関数の構築について 3. 音声による姓名漢字入力インタフェースに関する研究 4. WWW 画像検索システムにおける有害画像フィルタリング手法に関する研究 5. カラー画像からの標識の自動認識 6. 進化計算による多峰性関数最適化に関する研究 7. blog を対象とした探索収集に関する研究 8. Web カメラを用いた遠隔会議支援システムの開発 9. カラーヒストグラムの情報を用いたカラー画像の局所的な露出補正 10. デザインパターンに基づくリファクタリング方式の研究 11. Web ページの焦点分析技術に関する研究 12. 感情を表現する音声合成の韻律制御に関する研究 13. 時間変化を考慮した語彙と表現の傾向分析に関する研究 14. 競合的情報共有アプローチによる Web 教材オーサリングシステム 15. 感性共有に基づく協調的音楽鑑賞支援に関する研究 16. ユビキタスゲーム型英語学習環境における問題文自動生成に関する研究

**Textbook)** None

**Reference)** Using papers for each research field.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216761>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Committee Member of School Affair

## Systems Innovation Engineering — Optical Systems Engineering

### SYLLABUS OF SUBJECTS

● *Integrated Subjects*

<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和.....	87
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business.....	88
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer.....	88
<b>Long-term Internship (M)</b> ... Yamanaka .....	88
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · Part-time Lecturer.....	89
<b>International Advanced Technology and Science 1</b> ... Murakami.....	89
<b>International Advanced Technology and Science 2</b> ... Murakami.....	89
<b>Presentation Method (M)</b> ... Graduate School of Advanced Technology and Science.....	90
<b>Internship (M)</b> .....	90
<b>Venture Business (M)</b> .....	90

● *Common Subjects*

<b>Advanced Theory of Complex System Engineering</b> ... Ueta.....	90
<b>Advanced Theory of Semiconductors</b> ... Nishino .....	90
<b>Advanced Electrical Control System</b> ... Yasuno .....	91
<b>Advanced Theory of Electrical Communication</b> ... Oie.....	91
<b>Advanced Circuit Theory</b> ... Nishio · Uwate.....	91
<b>Human Sensing</b> ... Fukumi .....	92
<b>Photonic Device</b> ... Haraguchi.....	92
<b>Electronic display</b> ... Suyama.....	92

● *Departmental Subjects*

<b>Superconductivity and superconducting materials</b> ... Kishimoto.....	93
<b>Methods for analysis of mathematical phenomena</b> ... Imai .....	93
<b>Advanced Computational Science</b> ... Takeuchi.....	93
<b>Optical properties of materials</b> ... Haraguchi .....	93
<b>Advanced lecture on optical communication system</b> ... Goto.....	93
<b>Macromolecular Design</b> ... Tanaka.....	94
<b>Advanced Materials Chemistry</b> ... Tezuka.....	94
<b>Optical computing</b> ... Yamamoto.....	94
<b>Virtual Reality</b> ... Niki.....	95
<b>Three-dimensional Image Processing</b> ... Kawata.....	95
<b>Lecture in Optical Materials and Devices, Part 1</b> ... Haraguchi · Part-time Lecturer.....	95
<b>Lecture in Optical Materials and Devices, Part 2</b> ... Goto.....	95

<b>Lecture in Optical Materials and Devices, Part 3</b> ... Tanaka · Part-time Lecturer.....	96
<b>Lecture in Optical Information Systems, Part 1</b> ... Suyama · Undecided .....	96
<b>Lecture in Optical Information Systems, Part 2</b> ... Niki.....	96
<b>lecture in optical system engineering</b> ... Part-time Lecturer .....	96
<b>Practice of presentation</b> ... Teacher of course.....	96
<b>Intellectual Production Technology Seminar</b> ... Teacher of course .....	97
<b>Advanced Lecture on Semiconductor Nanotechnology</b> ... Isu · Kitada.....	97
<b>Advanced Lecture in Statistical Mechanics and Thermodynamics</b> ... Mori.....	97
<b>Differential Equations</b> ... Fukagai.....	97

● *Specialized Exercise and Experiments*

<b>Optical System Engineering Seminar, Part 1</b> ... Teacher of course.....	98
<b>Optical System Engineering Seminar, Part 2</b> ... Teacher of course.....	98
<b>Optical System Engineering Laboratory</b> ... Teacher of course.....	98

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### Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Requirement)** No requirement

**Notice)** 延べ4日間の集中講義となり、各集中講義には全時間の出席を要する。

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的財産とは (藤井) 2. 知的財産制度の概要 (特許・商標等) (藤井) 3. 知的財産制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的財産の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的財産のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方-特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識-特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216756>

**Student)** For the course students and other graduate school students.

**Contact)**  
⇒ School Affairs (Office Hour: 月曜から金曜:8時30分から17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business -PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14年から16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** 遅刻や授業中の私語は厳禁とする。悪質な場合は、退場処分とし、以後の受講を認めない場合もあるので、くれぐれも注意すること。講師の都合により、多少変更の可能性はある。

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216805>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**  
⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Keyword) management, management of technology**

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.88), "Long-term Internship (M)"(0.5, ⇒p.88), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.89), "Project Management"(0.5, ⇒p.7)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda," "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216616>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the doctor former term course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

- ⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)  
⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## Long-term Internship (M)

6 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and

practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216767>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nishida (The Center for Innovation and Creativity Development, +81-88-656-7619, nishida@opt.tokushima-u.ac.jp) (Office Hour: (創成学習開発センター, 088-656-7619, nishida@opt.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who register the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

Part-time Lecturer

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等が決定したら掲示およびHPにて公表するので注意すること。<<参考:平成22年度ビジネスモデル特論>>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル)上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日)上勝学舎(第1回~第12回)○集中講義-2(ICTビジネスモデル) \* 12月21日(火)常三島キャンパス(第13回~第15回)○交流会 \* 11月27日(土)20:15-21:45月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)**

1. 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。
2. すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(榎原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ぐ奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「榎原の棚田」の景観価値:平井松午(徳島大学教授) 11. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** 授業中に数冊紹介する予定。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216843>

**Student)** The person who finished "Introduction to new business" or "Advanced Lecture in management Theory of new business" in all the students enrolled in the course. And, the number of taking lecture people is restricted to do intensive learning. (20-25 people will be made an upper limit.) It is selected with some means in case of a taking lecture person many.

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示板を参照のこと)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**  
⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

### Presentation Method (M)

2 units (selection)  
Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216874>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Internship (M)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216612>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Venture Business (M)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216597>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

### Advanced Theory of Complex System Engineering

2 units (selection)  
Tetsushi Ueta · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** comprehension and application of complex systems by using engineering methodologies

**Outline)** Complex systems are defined as compound dynamical systems whose behavior and features cannot be predicted because of their nonlinearities and connecting conditions. This emergence of behavior is not possible for a single dynamical system, therefore, connection, coupling, compounding are keywords of this theory. Emergence of rhythm in biological systems, self organization, chaotic properties in high degrees of freedom, learning and associative memory are example features of complex systems. In this lecture, based on physical systems which are ubiquitously found and treated by system engineering subjects, we study analytical methods to understand these phenomena, bifurcation theory of nonlinear and linear systems, applied extraction methods of valuable information from observed data, system design methods of compound dynamical systems.

**Style)** Lecture

**Keyword)** *complex systems, bifurcation, chaos, nonlinear phenomena*

**Fundamental Lecture)** "Differential Equations (II)"(1.0), "Transient Analysis"(1.0), "Industrial Basic Physics"(1.0)

**Relational Lecture)** "Advanced Electrical Control System"(0.5, ⇒p.91), "Advanced Theory of Electronic Circuits"(0.5, ⇒p.73)

**Requirement)** none

**Goal)**

1. understanding of the definition and target area of complex systems
2. understanding of qualitative approach for given dynamical system
3. understanding and application of bifurcation theory

**Schedule)** 1. examples of complex systems 2. relationship between bifurcation problems and complex systems 3. comptation of bifurcation parameter values 4. chaos and bifurcation phenomenon 5. chaotic itinerary 6. emergence mechanism of spatio temporal chaos and its clustering 7. phase transition and synchronization 8. spatio temporal intermittency and emergence of patterns 9. chaos neural network 10. neuronal circuits as complex systems 11. bifurcations in emergence systems 12. analysis of social systems 13. survey on complex systems 14. exercise 1 15. exercise 2 16. questions and answers

**Evaluation Criteria)** The total grade is evaluated by homework reports (70 %) and attendance of the class. (30 %)

**Textbook)** specified every class.

**Reference)** Chaotic Scenario of Complex Systems, Asakura-Shoten, 1996 (in Japanese)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216858>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ueta (AIT 507, +81-88-656-7501, tetsushi@ait.tokushima-u.ac.jp) (Office Hour: Wednesday, afternoon)

**Note)** ◇For comprehension of the lecture contents, a 2-hour preparation study and a 2-hour review are required. ◇All items in the lecture plan are evaluated by reports.

### Advanced Theory of Semiconductors

2 units (selection)  
Katsushi Nishino · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand semiconductor physics and fundamental device operations for various semiconductor devices

**Outline)** Semiconductor physics, especially behavior of carriers in semiconductor, is described. Properties of pn junction and Schottky barrier, including non-ideal case, are also lectured.

**Style)** Lecture

**Keyword)** *semiconductor, metal-semiconductor contact, pn junction diode*

**Relational Lecture)** “Advanced Device Processing”(0.5, ⇒p.69), “Advanced Theory of Electron Devices”(0.5, ⇒p.69), “Advanced Optoelectronic Devices”(0.5, ⇒p.70)

**Goal)**

1. To understand behavior of carries (such as scattering mechanisms) in semiconductor
2. To solve diffusion equations in simple conditions
3. To understand properties of pn junction and Schottky barrier

**Schedule)** 1. Crystal Structure 2. Energy Bands 3. Carrier Concentration at Thermal Equilibrium 4. Carrier Transport 5. Phonon 6. High-Field Effect 7. Continuity Equations and Diffusion Equations of Carriers 8. Band Structure of Metal-Semiconductor Contact 9. Current Transport Processes of Schottky Barrier 10. Characterization of Schottky Barrier Height 11. Ohmic Contact 12. Band Structure of pn Junction Diode 13. Capacitance-Voltage Characteristics of pn Junction Diode 14. Current-Voltage Characteristics of pn Junction Diode 15. Heterojunction 16. Examination

**Evaluation Criteria)** Report 50%, Examination 50%. More than 60% is required to pass this class.

**Textbook)** Physics of Semiconductor Devices, by S.M.Sze

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216816>

**Contact)**

⇒ Nishino (E 棟 2 階南 A-5, +81-88-656-7464, nishino@ee.tokushima-u.ac.jp)

## Advanced Electrical Control System

2 units (selection)

Takashi Yasuno · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the basic principle of making to high performance and the intelligence in control system used for an industrial machine. And the control design of various control systems is understood.

**Outline)** The control system configuration used for the industrial machine is described, and applications of intelligent control method using fuzzy reasoning and neural net works are introduced. Moreover, Current topics of fields mentioned above are introduced.

**Style)** Lecture and exercise

**Keyword)** *Motion control, Robotics, Fuzzy, Neural network, Genetic algorithm*

**Relational Lecture)** “Advanced Lecture of Intelligent Information Processing”(0.5, ⇒p.74), “Advanced Control Theory”(0.5, ⇒p.72)

**Notice)** The lecture form might be changed according to the number of attending a lecture.

**Goal)**

1. The configuration of the control system used for an industrial machine should be understood.
2. The intelligent control method should be understood.

**Schedule)** 1. Control object 2. Motion control system 3. Two degree-of-freedom control 4. Design method of feedback controller 5. Design method of feedforward controller 6. Fuzzy sets 7. Fuzzy reasoning method 8. Control system application of fuzzy reasoning 9. Artificial neuron model 10. Neural network 11. Learning algorithm of neural network 12. Control system application of neural networks 13. Genetic algorithm 14. Control system application of genetic algorithm 15. Conclusions 16. Return of report or examination

**Evaluation Criteria)** Total evaluation based on reports, examinations or presentations.

**Textbook)** The print is distributed.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216722>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yasuno (E 棟 2 階北 B-5, +81-88-656-7458, yasuno@ee.tokushima-u.ac.jp) (Office Hour: Monday, 15:00-17:30)

## Advanced Theory of Electrical Communication

2 units (selection)

Takahiro Oie · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding analysing techniques of the communication system and multi-nodes networks.

**Outline)** This lecture is concerned with the study of concept of computer networks which realize the multi-node communication. The contents of those articles related with computer networks are presented at seminars. (Lecture style)

**Style)** Lecture

**Keyword)** *digital communication, computer networks, network architecture*

**Fundamental Lecture)** “Communication Systems”(1.0), “Applied Communication Engineering”(1.0), “Computer Networks”(1.0)

**Requirement)** Students are required to have a good understanding of undergraduate-level communication engineering and related subjects.

**Goal)**

1. Understanding the control techniques and implementation of computer network application. (Week 1-8, 11-15)
2. Understanding the secure techniques of the communication system. (Week 9-16)

**Schedule)** 1. Overview of digital communication 2. Mathematical preparation 3. Network architecture 4. Physical layer in fixed and wireless networks 5. Datalink layer in fixed and wireless networks 6. Network layer and routing 7. Transport layer 8. Traffic control 9. Security in fixed and wireless networks 10. Symmetric cryptography and public key cryptography 11. Session layer 12. Presentation layer 13. Application layer 14. Implementation example of application layer (HTTP, SMTP) 15. Implementation example of application layer (DNS, SNMP) 16. Wireless networks

**Evaluation Criteria)** Evaluated by presentations and submitted materials in seminars.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216771>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Oie (E-3F-C-1, +81-88-656-7479, alex@ee.tokushima-u.ac.jp) (Office Hour: Tuesday 16:20~ 17:20, Thursday 16:50~ 17:50)

**Note)** Taking this class, it is necessary to do 2 hours preparation and 2 hours reviewing for every class (2 hours) in order for your understanding and taking credit.

## Advanced Circuit Theory

2 units (selection)

Yoshifumi Nishio · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoko Uwate · ASSISTANT PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Analysis method of nonlinear circuits, and behavior of nonlinear oscillatory circuits and its applications are lectured.

**Outline)** Modeling of nonlinear devices, DC analysis and transient analysis of nonlinear circuits, and steady-state analysis are lectured. Synchronization and chaotic phenomena in nonlinear oscillatory circuits are introduced and their applications to information and communication engineering are discussed. (Style: Lecture)

**Style)** Lecture and exercise

**Keyword)** *nonlinear circuits, circuit analysis, oscillatory circuits*

**Fundamental Lecture)** “Electrical Circuit Theory (I) and Exercise”(0.7), “Electrical Circuit Theory (II) and Exercise”(0.5), “Network Analysis”(0.3)

**Relational Lecture)** “Advanced Theory of Complex System Engineering”(0.5, ⇒p.90)

**Requirement)** Students are required to know how to analyze basic linear circuits.

**Notice)** Course is taught in English.

**Goal)**

1. Understanding of analysis methods of nonlinear circuits.
2. Understanding of behavior of nonlinear circuits and its applications.

**Schedule** 1. Modeling of nonlinear devices. 2. DC analysis of nonlinear circuits by Newton method. 3. Transient analysis of nonlinear circuits. 4. Steady-state analysis of nonlinear circuits (for 4 lectures). 5. Synchronization phenomena in nonlinear oscillatory circuits (for 2 lectures). 6. Chaotic phenomena in nonlinear oscillatory circuits (for 2 lectures). 7. Engineering applications of nonlinear circuits (for 4 lectures). 8. Conclusions and final examination.

**Evaluation Criteria**) Final examination 80% and exercise 20%.

**Textbook**) None.

**Reference**)

- ◇ Akio Ushida and Mamoru Tanaka, "Nonlinear Circuit Simulations," Corona Publishing Co.
- ◇ S. Smale and M.W. Hirsch, "Differential Equations, Dynamical Systems, and Linear Algebra," Academic Press.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216580>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Nishio (D-7, E-3F-South, +81-88-656-7470, nishio@ee.tokushima-u.ac.jp)

**Note**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Human Sensing

2 units (selection)

Minoru Fukumi · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target**) This lecture aims to understand the latest topics in a field of Intelligent systems, and to obtain advanced knowledge and technologies.

**Outline**) This lecture teaches the advanced topics in intelligent systems. The main items in this lecture are softcomputing and human sensing, including face information processing and its computer practice and biological signal processing.

**Style**) Lecture and exercise

**Keyword**) *soft computing, human sensing, human information processing*

**Goal**)

1. To understand the latest topics on Intelligent systems.
2. To learn the trend of a domestic and foreign research on related topics.

**Schedule**) 1. Topics in Advanced Intelligent Systems 2. Topics in Advanced Intelligent Human Sensing 3. Topics in Brain Information Processing 4. Topics in Advanced Softcomputing techniques 5. Psychological Knowledge and Neural Network Model 6. Topics in Advanced Face Information Processing 7. Topics in Advanced Biosignal Processing 8. Topics on applications in Advanced Softcomputing techniques 9. Statistical Learning Algorithms 10. Topics in Eye Tracking and Its Applications 11. Topics in OpenCV applications 12. Topics in EMG and EEG researches 13. Exercise in Advanced Intelligent Systems 14. Exercise in Softcomputing 15. Exercise in Human Information Processing 16. Discussion

**Evaluation Criteria**) Attendance (30%), practice(10%), report (60%)

**Textbook**) no special book

**Reference**) 講義・演習中に指定する。

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216854>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Fukumi (D210, +81-88-656-7510, fukumi@is.tokushima-u.ac.jp) (Office Hour: 金曜日,15~18時)

**Note**) ◇ ゲストスピーカーを招聘して講義・演習を行う場合がある。 ◇ 授業目的の達成度は最終レポートにより評価する。

## Photonic Device

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) To understand the principle of the current optoelectronic devices, e.g., Light Emitting Diodes, Laser Diodes and so on. To develop ability to solve various problems in optical device application.

**Outline**) This course will cover topics on current optical and optoelectronic devices. Topics treated include Light Emitting Diode, Laser Diode, Solar Cell, Optical Modulator and Nonlinear Optical Devices.

**Style**) Lecture

**Keyword**) *optoelectronic device, optical device, light emitting diode, laser diode, optical modulator, Solar cell*

**Relational Lecture**) "Optical properties of materials"(0.5, ⇒p.93), "Lecture in Optical Materials and Devices, Part 1"(0.5, ⇒p.95)

**Requirement**) Students should have fundamental knowledges about semiconductor physics and devices for undergraduate students.

**Notice**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal**)

1. Students can explain the principle and structures for light emitting devices.
2. Students can explain the principle and structures for photodetector and solar cell.
3. Students can explain the principle of light modulators.
4. Students can explain the principle of nonlinear optical devices.

**Schedule**) 1. Introduction 2. Interaction between Light and dielectric materials 3. Semiconductors and other optical materials 4. Optical properties of semiconductors 5. Semiconductor PN-junction 6. Light Emitting Diode 7. Application of Light Emitting Diode 8. Laser Diode 9. Application of Laser Diode 10. Photoconductor Cells 11. pin photodiode 12. Solar cell and amorphous-semiconductor optoelectronic devices 13. Optical Modulator 14. Nonlinear optical devices 15. Integrated Optical Devices 16. Final Examination

**Evaluation Criteria**) Activity: 20%, Reports: 40% and Final Exam.:40%

**Textbook**) 中澤、鎌田著、光物性・デバイス工学の基礎、培風館1999

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216857>

**Contact**)

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

## Electronic display

2 units (selection)

Shiro Suyama · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) To understand the history of developments, technical trends, and technologies of electronic display.

**Outline**) This course will cover the history of developments, technical trends, recent topics, and technologies of an electronic display. This course is related to industries.

**Style**) Lecture

**Notice**) 光の性質、光学的な現象については、既知とする。

**Goal**)

1. To understand fundamental technologies of an electronic display
2. To understand fundamental technologies of devices for an electronic display
3. To understand a technical trend of an electronic display

**Schedule**) 1. 電子ディスプレイの概要、最近の動向 2. 電子ディスプレイおよび画像システムの概要 3. 直視型: 陰極線管(ブラウン管, CRT), テレビジョン 4. 直視型: 液晶の概要と液晶ディスプレイ(LCD)の基本動作 5. 直視型: 各種の液晶ディスプレイと特性改善 6. 直視型: プラズマディスプレイ(PDP) 7. 直視型: エレクトロルミネッセンス(EL)ディスプレイ 8. 直視型: フィールドエミッションディスプレイ(FED) 9. 超大型: 投射型ディスプレイ 10. 超大型: 最新の投射型ディスプレイ, 屋外用大型LEDディスプレイ 11. 電子ディスプレイの画質と視覚特性 12. 電子ディスプレイの画質とその評価 13. 立体ディスプレイ: 概要 14. 立体ディスプレイ: 2眼/多眼方式 15. 立体ディスプレイ: 超多眼方式などの最新の動向

**Evaluation Criteria**) Evaluation with report

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216773>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Suyama (opt409, +81-88-656-9425, suyama.shiro@opt.tokushima-u.ac.jp) (Office Hour: 17:00~18:00)

**Note**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。



## Superconductivity and superconducting materials

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand basics and recent developments in superconductivity.

**Outline)** This class reviews quantum mechanics and introduces superconductivity and recent superconducting materials.

**Style)** Lecture

**Keyword)** *superconductivity, Cooper pair, superconducting energy gap, density of states, anisotropic superconductivity*

**Goal)** To understand the outline of superconductivity.

**Schedule)** 1. Introduction to superconductivity 2. Review of quantum mechanics (1), Schrödinger equation and wave function 3. Review of quantum mechanics (2), operators and expected values 4. Review of quantum mechanics (3), perturbation theory 5. Free electron model of metals 6. Phenomenological theory of superconductivity 7. To understand Meissner effect on the basis of quantum mechanics 8. Formation of Cooper pair 9. Formation of superconducting energy gap 10. Density of states, and energy gap at finite temperatures 11. Introduction to Nuclear Magnetic Resonance method 12. Frontier of superconductivity (1), strong coupling superconductor 13. Frontier of superconductivity (2), heavy Fermion superconductor 14. Frontier of superconductivity (3), copper oxide high Tc superconductor 15. Summary

**Evaluation Criteria)** Reports on several subjects in the class.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216770>

**Contact)**

⇒ Yutaka Kishimoto (A202)

## Methods for analysis of mathematical phenomena

2 units (selection)

Hitoshi Imai · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To learn the to analyze the mathematical phenomena.

**Outline)** Methods used in analysis of mathematical phenomena are introduced. Especially, those in numerical analysis are focused on.

**Style)** Lecture

**Keyword)** *mathematics, numerical analysis*

**Fundamental Lecture)** “Numerical Analysis”(1.0)

**Relational Lecture)** “Advanced Computational Science”(0.5, ⇒p.55)

**Requirement)** Only the premise that have studied basic mathematics.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)** Being able to understand a numerical scheme to one-dimensional boundary value problems for the Poisson equation

**Schedule)** 1. Introduction to computer 2. Common sense in numerical computation 3. High-speed computation (Parallel computing) 4. Finite difference method I 5. Finite difference method II 6. Finite difference method III 7. Finite difference method IV 8. Finite element method I 9. Finite element method II 10. Finite element method III 11. Finite element method IV 12. Boundary element method I 13. Boundary element method II 14. Boundary element method III 15. Iterative method

**Evaluation Criteria)** Evaluation by the report.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216717>

**Contact)**

⇒ Imai(A220, +81-88-656-7541, The inquiry by means of the cellular phone or E-mail is not acceptable) (Office Hour: Office hours: Thursday 14:00-15:00)

## Advanced Computational Science

2 units (selection)

Toshiki Takeuchi · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class provides the basic technology for numerical calculation for the differential equation.

**Outline)** The numerical calculation methods for the differential equation are introduced.

**Style)** Lecture

**Keyword)** *numerical analysis, numerical computation, differential equation*

**Fundamental Lecture)** “Numerical Analysis”(1.0), “Basic Mathematics/微分積分学 I”(1.0), “Basic Mathematics/微分積分学 II”(1.0)

**Relational Lecture)** “Methods for analysis of mathematical phenomena”(1.0), “Numerical Analysis”(1.0)

**Requirement)** Students have to understand basic mathematics of undergraduate-level.

**Goal)** To understand principle of numerical calculation methods.

**Schedule)** 1. Introduction to numerical simulation 2. Mathematical model 3. Lagrange interpolation 4. Spline interpolation 5. Least squares method 6. Finite difference method 7. Arbitrary precision formula 8. Application to ordinary differential equation 9. Application to partial differential equation 10. Gauss-Seidel method 11. Successive Over-Relaxation method 12. Explicit method 13. Implicit method 14. Crank-Nicolson method 15. Numerical instabilities

**Evaluation Criteria)** Assignments count 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216628>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Takeuchi (A206, +81-88-656-7544, takeuchi@pm.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00-15:00)

## Optical properties of materials

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the principle of optical response of atoms, molecules and crystals. To develop ability to apply such optical phenomena to applications.

**Outline)** With quantum mechanics, we lecture optical process of materials. This course will cover the following topics: optical properties of materials for engineering, classical electromagnetic theory and optical property, optical transitions and optical process of atoms, molecules and semiconductors.

**Style)** Lecture

**Keyword)** *quantum mechanics, condensed matter, optical process, semiconductor*

**Relational Lecture)** “Photonic Device”(0.5, ⇒p.92), “Lecture in Optical Materials and Devices, Part 1”(0.5, ⇒p.95)

**Requirement)** Students should have fundamental knowledges of quantum mechanics.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. Students can explain the optical processes of atoms and molecules.

2. Students can explain the optical processes in semiconductors.

**Schedule)** 1. Introduction 2. Optical response described by classical electro-magnetic theory 3. Schroedinger equation and wave function 4. Hydrogen atom model 5. spin angular momentum 6. Quantum mechanics of light 7. Transition induced by interaction between electron state and light 8. Light absorption and emission 9. Electron transition in atoms and molecules 10. Optical spectra of atoms and molecules 11. Optical spectra of organic molecules 12. Energy bands in condensed matters 13. Optical processes in semiconductors 14. Optical spectra of impurity atoms in a crystal 15. Optical process of P-N junction 16. Final Examination

**Evaluation Criteria)** Activity: 20%, Reports: 40% and Final Exam.:40%

**Textbook)** 中澤, 鎌田著, 光物性・デバイス工学の基礎, 培風館 1999

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216841>

**Contact)**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

## Advanced lecture on optical communication system

2 units (selection)

Nobuo Goto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Development and future prospect of broadband large-capacity networks are studied. In particular, photonic network and its key elements such as photonic router and switch are discussed with their principle.

**Outline)** 1. Optical network, 2. Optical communication technology, 3. Development of bandwidth and speed in optical networks, 4. Network layer model and protocol, 5. Routing algorithm, 6. Router, 7. Photonic networks

**Style)** Lecture

**Goal)** 1. Understanding of architecture of optical network and functions of its elements, 2. Understanding of fundamental technology in optical fiber amplifiers and wavelength division multiplexing, 3. Understanding of hierarchical model and protocol for network, 4. Understanding of functions in routers, 5. Understanding of development in photonic networks.

**Schedule)** 1. Feature of optical network 2. Optical transmission system 3. Optical fiber amplifiers 4. Wavelength division multiplexing technology 5. Development of electronic devices and its rules 6. Internet and broadband networks 7. Wavelength division multiplexing and wavelength routing 8. Development of information networks 9. Hierarchical model and protocol 10. Fundamental functions of router 11. Development of high-speed routers 12. Protocol and algorithm in IP routing 13. Photonic networks 14. Photonic routing technology 15. Summary 16. Report hand in

**Evaluation Criteria)** Attitude toward lecture (40%), Report (60%). More than 60% of the total score is required.

**Textbook)** Y. Suematsu and K. Iga, Introduction to optical fiber communication, Ohm-sha, 2006

**Reference)** Y. Suematsu and K. Kobayashi, Photonics-Optical electronics and its development, Ohm-sha, 2007

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216830>

**Contact)**

⇒ Goto (opt408, +81-88-656-9415, goto@opt.tokushima-u.ac.jp) (Office Hour: 8:30-17:00)

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## Macromolecular Design

2 units (selection)

Hitoshi Tanaka · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the generation and functionality of natural and synthetic polymers, in molecular scale, with a view to designing a functional polymer precisely.

**Outline)** Chemical macromolecular (polymer) design at an advanced level will be covered in this course. Emphasis is on the analysis, in atomic scale, of the factors which fulfill the unique polymerizations and the speciality of polymers on the basis of the recognition of polymerization-polymer microstructure-polymer functionality relationships. Application of the analytical information to macromolecular design and recent topics in the design will also be provided in this course.

**Keyword)** *macromolecular design, polymer chemistry, functional polymer*

**Relational Lecture)** "Lecture in Optical Materials and Devices, Part 3"(0.5, ⇒p.96)

**Requirement)** Students are required to have a good understanding of undergraduate-level polymer chemistry

**Notice)** You have to prepare for next lesson and review that day's lesson for 2 hrs respectively against 2 hr lesson to understand the lesson and acquire the credits.

**Goal)**

1. To understand the control of polymerization and polymer structure
2. To understand the characterization and functionality of polymer

**Schedule)** 1. Introduction to macromolecular design 2. Generation and functionality of natural polymers (1) 3. Generation and functionality of natural polymers (2) 4. Generation and functionality of natural polymers (3) 5. Preparation and functionality of synthetic polymers (1): optical polymers 6. Preparation and functionality of synthetic polymers (2): optical polymers 7. Preparation and functionality of synthetic polymers (3): photo and biodegradable polymers 8. Preparation and functionality of synthetic polymers (4): photo and biodegradable polymers 9. Preparation and functionality of synthetic polymers (5): magnetic polymers 10. Preparation and functionality of synthetic polymers (6): magnetic polymers 11. Nanomaterials (1) 12. Nanomaterials (2) 13. Topics in macromolecular design (1) 14. Topics in macromolecular design (2) 15. Topics in macromolecular design (3)

**Evaluation Criteria)** Evaluation by a term paper.

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216649>

**Contact)**

⇒ H. Tanaka (Opti. Build. Room 211, Phone & Fax: 088-656-9420, E-mail: tanaka@opt.tokushima-u.ac.jp)

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## Advanced Materials Chemistry

2 units (selection)

Yoshihiko Tezuka · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This course intends to develop the knowledge of materials in physics, chemistry, crystallography, polymer, and semiconductors, which has been acquired in undergraduate, through the rearrangement of these knowledge in terms of the electronic states, constituting atoms and molecules, and interactions between them. The objective of the course is to develop ability to understand materials from the viewpoints of various fields.

**Outline)** Structures, properties, functions and synthesis of various materials will be explained in term of chemistry to understand materials chemistry which constitutes one of the bases of materials science. Fullerenes and their derivatives will be taken up as recent topics to explain the relationship between molecular structures and physical properties.

**Goal)**

1. to enable a student to develop applications of materials by the estimation of their properties from the atoms and molecules constituting them.
2. to enable a student to develop applications of materials by the estimation of their electric and electronic properties from the electronic states.

**Schedule)** 1. Introduction to materials and chemistry 2. Classification of materials according to their crystalline states and molecular aggregation states 3. Crystalline materials 4. Amorphous materials (glass, silicone, metals) 5. Molecular aggregate (micelle, liquid crystalline, gels) 6. Classification of materials according to their electronic states 7. Experimental methods for the evaluation of electric properties of materials 8. Dielectric materials (1): ceramics 9. Dielectric materials (2): polymers 10. Electrochemical properties of semiconductors (1): inorganic semiconductors 11. Electrochemical properties of semiconductors (2): organic semiconductors 12. Electronic interactions between metals and semiconductors 13. Electronic interactions between semiconductors and redox species in solutions 14. Carbon materials: molecular structures and electronic states of fullerenes 15. Carbon nanotubes 16. A term examination

**Evaluation Criteria)** Reports worth a total of 50% of the course grade will be given. A term examination (50%) will be given as in-class closed-book examination.

**Textbook)** will be introduced in the lecture.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216859>

**Contact)**

⇒ Tezuka (Opt.307, +81-88-656-9423, ytezuka@opt.tokushima-u.ac.jp)

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## Optical computing

2 units (selection)

Hirotsugu Yamamoto · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand analog optical computing. To understand digital optical computing. To understand optoelectronic computing.

**Outline)** We study fundamental technologies of architectures, implementation, and packaging in analog and digital optical processing, and prototype system developed with these technologies. We also study recent technologies in related photonics, electronics, and other technologies.

**Style)** Lecture

**Goal)**

1. To understand optical computing
2. To create new information photonics

**Schedule)** 1. Fundamentals of optical computing (1) 2. Fundamentals of optical computing (2) 3. Fundamentals of optical computing (3) 4. Light source and detector in optical computing 5. Optical modulator in optical computing 6. Analog optical computing (1) 7. Analog optical computing (2)

8. Digital optical computing (1) 9. Digital optical computing (2) 10. Optica memory 11. Optica communication 12. Recent optical computing technology (1) 13. Recent optical computing technology (3) 14. Recent optical computing technology (3) 15. Recent optical computing technology (4)

**Evaluation Criteria)** Evaluated with reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216825>

**Student)** Able to be taken by only specified class(es)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Virtual Reality

2 units (selection)

Noboru Niki · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Introduction to the fundamental concepts of virtual reality.

**Outline)** Virtual Reality is a combination of human interface, graphics, sensor technology, high performance computing, and networking. It allows the user to interact with an artificial environment created by computers. Using these technologies, one has the feeling of total immersion in a new environment. Here, these technologies and several VR simulations are described.

**Requirement)** It is desired to finish a course of digital signal processing, image processing, and pattern recognition .

**Goal)**

1. To understand fundamentals of virtual reality.
2. To understand various techniques for realizing virtual environments.

**Schedule)** 1. 1. Introduction 2. Mathematical Fundamentals (Image Processing) 3. Mathematical Fundamentals (Pattern Recognition) 4. Computer Graphics 5. Three-dimensional Coordinate System 6. Geometrical Modeling 7. Hidden Line and Surface Removal Methods 8. Advanced Rendering Topics 9. Real Time Computer Graphics 10. Image Processing of Motion Pictures 11. Image Sensing Technology 12. Virtual Reality Systems 13. Augmented Reality Systems 14. Advanced Applications of Virtual Reality 1 15. Advanced Applications of Virtual Reality 2 16. Final Examination

**Evaluation Criteria)** Project Report 60%, Final Examination 40%

**Textbook)** Reference books are introduced to each topic.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216813>

**Note)** Preparation (2hrs) and Review (2hrs) are required to take this lecture (2hrs).

## Three-dimensional Image Processing

2 units (selection)

Yoshiki Kawata · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Introduce the fundamental concepts of 3-D image processing.

**Outline)** This course is intended to introduce the fundamentals of three-dimensional image processing which covers basic concepts as image restoration, image segmentation, registration, shape representation, and computational geometry etc. The class begins with a brief overview of the various technologies used to analyze medical and industrial images. The focus then shifts to in-depth descriptions of individual algorithms beginning with a description of the mathematical technique of image processing. The course emphasizes the design, analysis, and implementation of algorithms in the context of 3-D medical images.

**Keyword)** 3-D image processing, medical image analysis, 工業計測

**Relational Lecture)** “Virtual Reality”(0.5, ⇒p.95)

**Requirement)** It is desired to finish a course of digital signal processing, image processing, and programming (C or C++).

**Goal)**

1. To understand fundamentals of 3-D image processing.
2. To understand various 3-D image processing algorithms used to obtain medical and industrial fields

**Schedule)** 1. Introduction to 3-D image processing 2. Signal Processing Fundamentals 3. 3-D imaging technology 4. 3-D image smoothing 5. 3-D image enhancement 6. Edge / region based segmentation 7. Deformable model segmentation 8. Graph cut segmentation 9. Geometrical properties of 3-D images- local feature of a connected component- 10. Geometrical properties of 3-D images- Calculation of the

Euler number- 11. Surface/axis thinning algorithm 12. Morphology filter 13. Distance transformation 14. 3-D differential features 15. 3-D registration

**Evaluation Criteria)** Computer Project Report 100%

**Textbook)** 3 , 2002

**Reference)**

- ◇ Medial Imaging Signals and Systems, J.L. Prince, J.M. Links, 2006
- ◇ image Processing, Analysis, and Machin Vision, M. Sonka, V. Hlavac, R. R. Boyle, Thomson, 2008

**Webpage)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=197132>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216673>

**Contact)**

⇒ Kawata (Opt.508, +81-88-656-9431, kawata@opt.tokushima-u.ac.jp)

**Note)** ◇The computer projects should be done in C or C++. ◇Preparation (2hrs) and Review (2hrs) are required to take this lecture (2hrs).

## Lecture in Optical Materials and Devices, Part 1

1 unit (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING, Part-time Lecturer

**Target)** To understand the current trends of the optical and/or optoelectronic materials and devices.

**Outline)** This course will cover several several topics on the current trends of the optical and/or optoelectronic materials and devices. Topics treated are focused on the latest fabrication technology and the research for the device application.

**Style)** Lecture

**Keyword)** semiconductor, LED, laser diode

**Relational Lecture)** “Photonic Device”(0.5, ⇒p.92), “Optical properties of materials”(0.5, ⇒p.93)

**Requirement)** Students must have enough knowledges of semiconductor physics comparable to contents in lectures on semiconductor physics for undergraduate students.

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. To understand advantages of Nitride semiconductors compared with other semiconductors.
2. To understand the outline of technologies for fabrication process of optoelectronic devices
3. To understand trends of developments and researches for optoelectronic devices

**Schedule)** 1. guidance 2. semiconductor materials for optoelectronic devices 3. Advantages of Nitride semiconductor 4. Fabrication of optoelectronic devices by Nitride semiconductor 5. Principle of light emitting diode and laser diode 6. History of development for semiconductor light emitting deices 7. Characteristics of power LED 8. Trends on the development of high power light emitting diode 9. Trends on the development of UV light emitting diode 10. Applications of light emitting diode 11. Trends on the development of UV and Blue laser diodes 12. Development of Green Laser Diode 13. Applications of laser diode 14. Market of semiconductor light emitting devices 15. Market and Corporate strategy

**Evaluation Criteria)** Activity and attendance 40%, reports 60%

**Textbook)** no text

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216821>

**Contact)**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:10~ 18:00)

## Lecture in Optical Materials and Devices, Part 2

1 unit (selection)

Nobuo GOTO · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Optical devices are key elements for optical information processing systems and optical communication systems. It is important to understand the basic effects and principle used in optical wave control. In this lecture, mathematical description of optical passive devices, optical circuits, interaction between optical waves and materials, and nonlinear optical effects is discussed. Basic technology for designing of optical devices and optical circuits is described.

**Outline)** 1. Optical passive circuits, 2. Interaction between optical waves and materials, 3. Control of optical waves, 4. Optical nonlinear effects

**Style)** Lecture

**Keyword)** *optical waveguide, optical functional device, optical wave control*

**Fundamental Lecture)** “Advanced lecture on optical communication system”(1.0, ⇒p.93)

**Relational Lecture)** “Photonic Device”(0.5, ⇒p.92)

**Goal)** 1. Understanding of mathematical description of materials for optical wave control, 2. Understanding of mathematical analysis of optical waves in materials, 3. Understanding of description and analysis of optical devices and circuits.

**Schedule)** **1.** Optical waveguide and optical wave propagation **2.** Analysis of directional coupled waveguides **3.** Analysis of optical passive circuits consisting of coupled waveguides **4.** Analysis of Bragg reflection waveguides **5.** Electro-optic effects and wave control in crystal **6.** Magneto-optic effect and wave control **7.** Acousto-optic effect and wave diffraction **8.** Optical nonlinear effect

**Evaluation Criteria)** Attitude toward lecture (40%), Report (60%). More than 60% of the total score is required.

**Textbook)** T. Jinpo ed., Optical electronics, Ohm-sha, 1997.

**Reference)**

- ◇ Y. Suematsu and K. Iga, Introduction to optical fiber communication, Ohm-sha, 2006.
- ◇ T. Kurokawa, Optical functional device, Kyoritsu, 2004.
- ◇ H. Nishihara, M. Haruna and T. Suhara, Optical integrated circuits, Ohm-sha, 1985.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216822>

**Student)** Able to be taken by student of other faculty and university

**Contact)**

⇒ Goto (opt408, +81-88-656-9415, goto@opt.tokushima-u.ac.jp) (Office Hour: 8:30-17:00)

### Lecture in Optical Materials and Devices, Part 3

1 unit (selection)

Hitoshi Tanaka · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING, Part-time Lecturer

**Target)** This class addresses the recognition of the optical materials and devices from a chemical point of view.

**Outline)** This course will focus on the fundamentals and current topics in chemical preparation, reaction, structure, and functionality of the optical materials and devices.

**Keyword)** *photo-functional materials*

**Relational Lecture)** “Macromolecular Design”(0.5, ⇒p.94)

**Requirement)** Students are required to have a good understanding of undergraduate-level photochemistry.

**Notice)** You have to prepare for next lesson and review that day's lesson for 2 hrs respectively against 2 hr lesson to understand the lesson and acquire the credits.

**Goal)**

1. To understand the exact nature of the optical properties of materials.
2. To understand the precise procedure to design and evaluate the optical materials and devices.

**Schedule)** **1.** Introduction to optical materials and devices for this class **2.** Photo and thermal reactions **3.** Photochemical process **4.** Photophysicalchemistry **5.** Interaction between light and media (1) **6.** Interaction between light and media (2) **7.** Interaction between light and media (3) **8.** Final test, summary

**Evaluation Criteria)** Final test: 100%

**Textbook)** Hikarikinoubunshi no Kagaku ed. by K. Horie and H. Ushiki (Kodansha)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216824>

**Contact)**

⇒ H. Tanaka (Opti. Build. Room 211, Phone & Fax: 088-656-9420, E-mail: tanaka@opt.tokushima-u.ac.jp)

### Lecture in Optical Information Systems, Part 1

1 unit (selection)

Shiro Suyama · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING, Undecided

**Target)** Introduction to recent topics on optical information processing.

**Outline)** This course introduces recent technical information on optical information processing and the required future technology.

**Keyword)** *infomation photonics, optical computing*

**Goal)**

1. To understand the recent topics of optical information systems
2. To consider a next generation of optical information systems

**Schedule)** **1.** History of the development of optcail information instruments **2.** Recent topics of optical disk systems (1) **3.** Recent topics of optical disk systems (2) **4.** Recent topics of optical disk systems (3) **5.** Recent topics of optical disk systems (4) **6.** Recent topics of display systems (1) **7.** Recent topics of display systems (2) **8.** Recent topics of display systems (3) **9.** Recent topics of display systems (4) **10.** Recent topics of optical information systems (1) **11.** Recent topics of optical information systems (2) **12.** Recent topics of optical information systems (3) **13.** Recent topics of optical information systems (4) **14.** Next generation of optical information systems (1) **15.** Next generation of optical information systems (2)

**Evaluation Criteria)** Report 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216834>

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

### Lecture in Optical Information Systems, Part 2

1 unit (selection)

Noboru Niki · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Introduction to recent topics on imaging technologies and intelligent image processing.

**Outline)** This course introduces recent technical information on imaging technologies and intelligent image processing and describes their future directions.

**Keyword)** *imaging technologies, intelligent image processing*

**Relational Lecture)** “Three-dimensional Image Processing”(0.5, ⇒p.95), “Virtual Reality”(0.5, ⇒p.95)

**Goal)** To understand the recent topics on imaging technologies and intelligent image processing.

**Schedule)** **1.** Recent topics of three-dimensional CT technologies (1) **2.** Recent topics of three-dimensional CT technologies (2) **3.** Recent topics of three-dimensional CT technologies (3) **4.** Recent topics of three-dimensional CT technologies (4) **5.** Recent topics of three-dimensional CT technologies (5) **6.** Recent topics of MR imaging technologies (1) **7.** Recent topics of MR imaging technologies (2) **8.** Recent topics of MR imaging technologies (3) **9.** Recent topics of MR imaging technologies (4) **10.** Recent topics of MR imaging technologies (5) **11.** Recent topics of intelligent image processing (1) **12.** Recent topics of intelligent image processing (2) **13.** Recent topics of intelligent image processing (3) **14.** Recent topics of intelligent image processing (4) **15.** Recent topics of intelligent image processing (5)

**Evaluation Criteria)** Report 100%

**Textbook)** Reference books are introduced to each topic.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216835>

**Note)** Preparation (2hrs) and Review (2hrs) are required to take this lecture (2hrs).

### lecture in optical system engineering

1 unit (selection)

Part-time Lecturer

**Target)** topics in optical technology

**Outline)** Lecure on the trend in optical technologies such as nano-technology, bio-technology, and information communication, and medical science.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216833>

### Practice of presentation

1 unit (selection)

Teacher of course

**Target)** Learning a skill of presentation

**Outline)** Fundamental skills for the presentation are learned such as (1) to explain the contents of research, (2) to adjust the contents with audience's level, (3) to create the original drawing, and (4) the way of answering against a question etc.

**Keyword)** oral presentation

**Goal)** Learning a fundamental skill for presentation

**Schedule)** 1. Presentation (1) 2. Presentation (2) 3. Presentation (3) 4. Presentation (4) 5. Presentation (5) 6. Presentation (6) 7. Presentation (7) 8. Presentation (8) 9. Presentation (9) 10. Presentation (10) 11. Presentation (11) 12. Presentation (12) 13. Presentation (13) 14. Presentation (14) 15. Presentation (15)

**Evaluation Criteria)** Presentation skill (80%), Attitude(20%)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216872>

**Student)** Able to be taken by only specified class(es)

## Intellectual Production Technology Seminar

1 unit (selection)  
Teacher of course

**Target)** To master skills for novel intellectual production

**Outline)** As one of technique for novel intellectual production, practice methods those are the combination of brainstorming and KJ method

**Goal)**

1. To understand what is intellectual production technology
2. To use an intellectual production technology that is combination of brainstorming and KJ method

**Schedule)** 1. necessary 2. How to practice 3. what is brainstorming 4. practice of brainstorming 5. case studies 6. what is KJ method 7. practice of KJ method 8. practice of KJ method 9. practice of KJ method 10. case studies 11. practice of KJ method 12. practice of KJ method 13. practice of KJ method 14. case studies 15. presentation 16. 予備日

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216758>

## Advanced Lecture on Semiconductor Nanotechnology

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target)** This class introduces basic principles of the semiconductor nanotechnology and their application to the quantum devices.

**Outline)** Basics of semiconductor physics and quantum mechanics are introduced to understand material properties of quantum confined nanostructures. Recent progress in fabrication techniques and device applications of semiconductor nanostructures (quantum wells, wires and dots) will be reviewed.

**Style)** Lecture

**Keyword)** quantum confined nanostructures, semiconductor nanoscience, electron devices, photonic devices

**Requirement)** None.

**Notice)** None.

**Goal)** To understand basic properties of semiconductor nanostructures and quantum devices.

**Schedule)** 1. Introduction to semiconductor nanostructures 2. Electronic states in quantum confined structures 3. Electrical properties of superlattices 4. Fabrication technique of quantum wires and wells 5. Characterization of heterointerfaces 6. Characterization of nanostructures 7. High-speed electron devices 8. Optical properties of quantum wells 9. Semiconductor laser diodes 10. Quantum effect devices 11. Fabrication technique of quantum dots 12. Quantum dot devices 13. Device application of quantum nano structures 14. Recent topics of semiconductor nanotechnology (1) 15. Recent topics of semiconductor nanotechnology (2)

**Evaluation Criteria)** Assignments count 100%

**Textbook)** None.

**Reference)** The Physics of Low-Dimensional Semiconductors, J.H. Davis, Springer

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216818>

**Student)** Any students can attend the class.

**Contact)**

⇒ Isu (A224, +81-88-656-7670, [t.isu@frc.tokushima-u.ac.jp](mailto:t.isu@frc.tokushima-u.ac.jp)) (Office Hour: Tue -Thu 10:00-14:00)

⇒ Kitada (A224, +81-88-656-7671, [kitada@frc.tokushima-u.ac.jp](mailto:kitada@frc.tokushima-u.ac.jp)) (Office Hour: Mon. 10:00-14:00)

## Advanced Lecture in Statistical Mechanics and Thermodynamics

2 units (selection)

Atsushi Mori · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The first purpose is to understand the fundamentals of the statistical mechanics and thermodynamics. Further, to acquire abilities to apply the statistical mechanics and thermodynamics is the second purpose. In the textbook it is written that thermodynamics, the statistical mechanics, and the kinematics are stems of the statistical physics; and those are the themes of the lecture.

**Outline)** 教科書に従い、「統計熱力学の原理」、「特別な系の平衡統計」、「運動論、輸送係数、ゆらぎ」の3項目を扱う。

**Keyword)** principle of statistical mechanics, equilibrium statistics, kinetics, transport coefficient, fluctuation

**Notice)** A two hour pre-study prior to a lecture and a two post-study after that are necessary to understand the lecture and success.

**Goal)** see, "target".

**Schedule)** 1. First law of thermodynamics 2. Gibbs-Boltzmann distribution law 3. Statistical justification of second law 4. Order way to second law 5. Thermodynamic exploitation of second law: mass transfer problem 6. Grand ensemble: classical statistics of independent particles 7. Statistics of perfect molecular gas 8. Examination 9. Thermal properties of crystals 10. Statistics of conduction electron in solids 11. Statistics of magnetism 12. Theory of dilute solutions 13. Transport properties of gases 14. Kinetics of charge carrier in solids and liquids 15. Fluctuation and Brownian motion 16. 試験

**Evaluation Criteria)** Final marks are evaluated on the basis of the examinations or alternatives, to which the evaluations of the exercise are added. Qualifications of candidacy for an examination are lost if there is no attendance of 60% or more.

**Textbook)** Statistical Physics, G. H. Wannier (Dover, New York) ISBN 0-486-65401

**Reference)** Because of the traditional field, there are many textbooks.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=218257>

**Contact)**

⇒ Mori (Opt.407, +81-88-656-9417, [mori@opt.tokushima-u.ac.jp](mailto:mori@opt.tokushima-u.ac.jp)) (Office Hour: オフィスアワーは、学科の掲示板等をご覧ください。)

**Note)** This class is for Double Degree. A supplementary lecture in Japanese will be given on the odd-numbered year; the formal lecture will be given in English on the even-numbered year.

## Differential Equations

2 units (selection)

Nobuyoshi Fukagai · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Introduction to mathematical theory of differential equations.

**Outline)** Boundary value problems of second order linear differential equations.

**Style)** Lecture

**Keyword)** 微分方程式の境界値問題, Sturm-Liouville 問題

**Goal)** To be familiar with Sturm-Liouville type equations.

**Schedule)** 1. Introduction 2. Helmholtz's equation 3. Eigenvalues and eigenfunctions 4. Green's function 5. Residue analysis 6. Expansion of Green's function 7. Fourier series 8. Existence theorem 9. Sturm-Liouville problems 10. Characteristic function 11. Solvability of boundary value problems 12. Basic estimates 13. Distribution of eigenvalues 14. Eigenfunction expansion 15. Review

**Evaluation Criteria)** Evaluation will be based on assignments.

**Reference)** 望月清・トルシン 『数理解物理の微分方程式』培風館

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=218258>

**Student)** Able to be taken by student of other department

**Contact)**

⇒ 工学部数学教室 (A棟219室) (Office Hour: 木曜日 15:00~ 16:00)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Optical System Engineering Seminar, Part 1

2 units (compulsory)  
Teacher of course

**Target)** Through seminars concerning the theme of the master's thesis, to learn the wide culture and professional knowledge, to have interest in unknown area, and to obtain ability to learn spontaneously knowledges which are lacked.

**Outline)** To discuss on the paper concerning the theme of the master's thesis in a seminar with professors, and make presentation on those contents and results under development in student's research work.

**Goal)**

1. to master wide varieties in culture in optical system engineering and ability to apply them
2. to master professional knowledges in optical system engineering and ability to apply them
3. to have interest in unknown area in optical system engineering and spontaneously learn knowledges which are lacked

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216831>

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### Optical System Engineering Seminar, Part 2

4 units (compulsory)  
Teacher of course

**Target)** Through seminars concerning the theme of the master's thesis, to learn the professional knowledges and skills, to obtain the ability to apply them, to obtain ability to learn spontaneously knowledges which are lacked, and furthermore to develop the communication and roles in the research work, and to obtain the ability to make management in collaboration project.

**Outline)** To discuss on the paper concerning the theme of the master's thesis, and make presentation in the student's research group.

**Goal)**

1. to master professional knowledges and skills in optical system engineering and ability to apply them
2. to learn knowledges which are lacked in optical system engineering
3. to develop the communication and role in the research work and to manage the collaboration project

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216832>

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### Optical System Engineering Laboratory

6 units (compulsory)  
Teacher of course

**Outline)** Experiment concerning master's thesis.

**Goal)**

1. to master knowledges and skills in engineering and ability to apply them
2. ability to find problems, set up, analyze, and solve
3. spontaneously learn knowledges if lacked

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216829>

## Chapter 2

# DOCTOR'S DEGREE

<b>Intelligent Structures and Mechanics Systems Engineering</b> .....	<b>101</b>
Civil and Environmental Engineering .....	101
Mechanical Engineering .....	111
<b>Earth and Life Environmental Engineering</b> .....	<b>123</b>
Chemical Science and Technology .....	123
Biological Science and Technology .....	131
Ecosystem Engineering .....	138
<b>Systems Innovation Engineering</b> .....	<b>147</b>
Electrical and Electronic Engineering .....	147
Information Science and Intelligent Systems .....	159
Optical Systems Engineering .....	167





## Intelligent Structures and Mechanics Systems Engineering — Civil and Environmental Engineering

### SYLLABUS OF SUBJECTS

• *Integrated Subjects*

<b>Human Factors</b> ...Yoshida .....	101
<b>Life Science</b> ...Takagi · Tsuji .....	101
<b>Social Science</b> ...yokohata .....	102
<b>Science and Technology Studies</b> ...Tanaka .....	102
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	102
<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和 .....	102
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	103
<b>Long-term Internship (D)</b> ...Yamanaka .....	103
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer .....	103
<b>International Advanced Technology and Science 1</b> ...Murakami .....	104
<b>International Advanced Technology and Science 2</b> ...Murakami .....	104
<b>Presentation Method (D)</b> ...Graduate School of Advanced Technology and Science .....	104
<b>Internship (D)</b> .....	104
<b>Venture Business (D)</b> .....	105

• *Specialized Subjects*

<b>Engineering of Correlated Electron Matter</b> ...Kishimoto · Kawasaki .....	105
<b>Quantum Theory of Materials</b> ...Michihiro .....	105
<b>Simulation Aided Mathematical Sciences</b> ...Imai · Takeuchi .....	105
<b>Nonlinear Analysis</b> ...Fukagai · Kohda .....	106
<b>Watershed Hydrologic Engineering</b> ...TAMURA .....	106
<b>Ecological Hydroengineering</b> ...Nakano · Kamada · Kawaguchi .....	106
<b>Geoenvironmental Design Theory</b> ...Teacher of course · Suzuki · Jiang .....	107
<b>Geoenvironment Control Engineering</b> ...Ueno · Mochizuki .....	107
<b>Urban System Analysis</b> ...Yamanaka · Namerikawa .....	107
<b>Wind Engineering</b> ...Nagao · Noda .....	107
<b>Advanced Structural Analysis</b> ...Nariyuki .....	108
<b>Earthquake Resistant Design</b> ...Mikami · Ohsumi .....	108
<b>Advanced Materials for Civil Works</b> ...Ueda .....	108
<b>Flow Mechanism and Control for Fresh Concrete</b> ...Hashimoto .....	109
<b>Advance Lecture of Political Simulation</b> ...Kondo · Hirose .....	109
<b>Advanced Lecture in Social Risk Engineering</b> ...Kozuki .....	109
<b>Advanced mitigation engineering</b> ...Ueshima .....	109

• *Specialized Exercise and Experiments*

<b>Advanced Exercise on Civil and Environmental Engineering</b> ...Teacher of course .....	110
<b>Advanced Research on Civil and Environmental Engineering</b> ...Teachers in other colleges or departments	110

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#### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Target)** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline)** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule)** **1.** What is Human Factors **2.** Historical Overview of Human Factors **3.** Multi-Disciplinary Aspect of Human Factors **4.** Health and Safty Issue of Human Factors **5.** Human Psychological Capability **6.** Task Analysis **7.** Human Error **8.** Universal Design **9.** Cognitive Artifact **10.** Visibility and Affordance **11.** Human-Computer Interaction **12.** Human Information Processing **13.** Knowledge and Mental Model **14.** Usability Paradigms and Principles **15.** Evaluation and Testing **16.** Making system that makes us smart

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Yoshida (+81-88-656-7897, [yos@ias.tokushima-u.ac.jp](mailto:yos@ias.tokushima-u.ac.jp))

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#### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Understanding of significance of protein in biotechnology

**Outline)** Basics of structure, function and application of protein are introduced

**Style)** Lecture

**Keyword)** *protein, enzyme, biotechnology*

**Goal)**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule)** **1.** Introduction of life science **2.** History of life science **3.** Structure and function of DNA and RNA **4.** mRNA is a template of protein **5.** Duplication of DNA **6.** Regulation of protein expression **7.** Human Genetics **8.** Genetic disease **9.** DNA diagnosis **10.** Structure and function of protein **11.** Principle of gene technology (1) **12.** Principle of gene technology (2) **13.** Protein engineering **14.** Future of life science (1) **15.** Future of life science (2) **16.** Preparation of report

**Evaluation Criteria)** Evaluation by report

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact)**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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## Social Science

2 units (selection)  
yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target)** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline)** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp)

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## Science and Technology Studies

(selection)  
Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文学の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 4. 馬力の発見—農業技術の革新とヨーロッパ社会 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業化社会 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

⇒ Tanaka . (Office Hour: tanaka@kenroku.kanazawa-u.ac.jp)

⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)  
Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

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## Introduction to Intellectual Property

2 units (selection)  
Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** intellectual property, patent law, protect and use of intellectual property

**Relational Lecture)** "Introduction to Intellectual Property"(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方・特許は明細書を中心に動く (山内) 10. 技術者が知っておくべき実務知識・特許法上の留意事項 (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

非常勤講師

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型「葉っぱビジネス」「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。 <参考:平成22年度ビジネスモデル特論> 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎 地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土)20:15-21:45 月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり)

り) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ぐ奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. 「学びは効果をもたらしたか?!」-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 「学びは効果をもたらしたか?!」-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** Several are introduced in class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student)** 徳島大学大学院先端技術科学教育部マスターコース, 及び, ドクターコースの学生

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who register the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style)** Lecture

**Keyword)** *management, management of technology*

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.102), "Long-term Internship (D)"(0.5, ⇒p.103), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.103)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

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## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be surthorized. The report and portfolion on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, profolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

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## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of thechnology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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## Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Internship (D)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfilment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Engineering of Correlated Electron Matter

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yu Kawasaki · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** In many solid-state materials, new phenomena evolve due to strong electron interactions. In this Lecture, review will be given on some advanced topics and their applications, including high temperature superconductivity, metal-insulator transition and strongly correlated electronics.

**Outline)** New types of superconducting and magnetic phenomena emerge in correlated electron matters. The term "correlated electron" represents the state of matter where many electrons are strongly interacting with each other. After an introductory talk on magnetism and superconductivity, review will be given on some advanced topics, including high temperature superconductivity, metal-insulator transition and colossalmagneto resistance. Potential application of correlated electron matters to technology is also presented focusing on spintronics or strongly correlated electronics.

**Style)** Lecture

**Keyword)** *strongly correlated electron systems, Mott insulator, colossalmagneto resistance, high temperature superconductor*

**Goal)** To understand basic concepts of correlated electron matter and its application

**Schedule)** 1. Introduction to correlated electron matters 2. Perspectives of magnetism and superconductivity in correlated electron matters 3. Electronic states of atoms and ions 4. Magnetic ions in crystal electric field 5. Introduction to superconductivity 6. How to probe rich properties in correlated electron matters 7. Mott insulator and metal-insulator transition 8. Spin, charge and orbital in transition metal oxides 9. Colossalmagneto resistance in transition metal oxides 10. Application of transition metal oxides with

correlated electrons 11. High temperature superconductivity 12. Heavy-fermion superconductivity 13. Electronic states of organic conductors 14. Application of superconductors with correlated electrons 15. Towards strongly correlated electronics

**Evaluation Criteria)** Reports on several subjects in lecture

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216620>

**Contact)**

⇒ Kishimoto (A202, +81-88-656-7548, yutaka@pm.tokushima-u.ac.jp) (Office Hour: 金曜日 16:00-17:30)

⇒ Kawasaki (A217, +81-88-656-9878, yu@pm.tokushima-u.ac.jp)

## Quantum Theory of Materials

2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the advanced quantum mechanics and quantum field theory.

**Outline)** Basics of advanced quantum mechanics and quantum field theory are introduced.

**Style)** Lecture

**Keyword)** *quantum mechanics, quantum field theory*

**Goal)** To understand the outline of advanced quantum mechanics and quantum field theory.

**Schedule)** 1. Introduction 2. Quantum mechanics (1) 3. Quantum mechanics (2) 4. Hartree-Fock approximation 5. Koopman's theorem 6. Density functional theory 7. Kohn-Sham equation 8. Local density approximation 9. Perturbation (1) 10. Perturbation (2) 11. Quantum field theory 12. Creation operator and annihilation operator 13. Field quantization (1) 14. Field quantization (2) 15. Phonon 16. Electron gas

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216906>

**Contact)**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

## Simulation Aided Mathematical Sciences

2 units (selection)

Hitoshi Imai · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Toshiki Takeuchi · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class provides the basic technology for advanced numerical simulation.

**Outline)** Basic technology for advanced numerical simulation is introduced.

**Style)** Lecture

**Keyword)** *numerical simulation, advanced*

**Fundamental Lecture)** "Numerical Analysis"(1.0)

**Relational Lecture)** "Methods for analysis of mathematical phenomena"(0.5, ⇒p.22), "Advanced Computational Science"(0.5, ⇒p.55)

**Requirement)** Students have to understand basic mathematics of undergraduate-level.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)** To understand principle of Infinite-Precision Numerical Simulation.

**Schedule)** 1. Introduction of computer science 2. Multiple precision arithmetic 1 3. Multiple precision arithmetic 2 4. Iteration method 1 5. Iteration method 2 6. Parallel computing 1 7. Parallel computing 2 8. Spectral method 1 9. Spectral method 2 10. Infinite-Precision Numerical Simulation 1 11. Infinite-Precision Numerical Simulation 2 12. Numerical simulation of free boundary problem 1 13. Numerical simulation of free boundary problem 2 14. Numerical simulation of inverse problem 1 15. Numerical simulation of inverse problem 2

**Evaluation Criteria)** Assignments count 100%.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216690>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Imai(A220, +81-88-656-7541, The inquiry by means of the cellular phone or E-mail is not acceptable) (Office Hour: Office hours: Thursday 14:00-15:00)  
⇒ Takeuchi (A206, +81-88-656-7544, takeuchi@pm.tokushima-u.ac.jp) (Office Hour: 木曜日 14:00-15:00)

## Nonlinear Analysis

2 units (selection)

Nobuyoshi Fukagai · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Atsuhito Kohda · ASSOCIATE PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Introduction to nonlinear functional analysis.

**Outline)** Methods of nonlinear analysis; fundamental mathematical theories and techniques of ordinary and partial differential equations.

**Style)** Lecture

**Goal)** To be familiar with mathematical concepts, ideas and tools involved in doing nonlinear mathematics.

**Schedule)** 1. Introduction 2. Mathematical modelling 1 3. Mathematical modelling 2 4. Mathematical modelling 3 5. General topology 6. Function space 1 7. Function space 2 8. Function space 3 9. Integral operator 10. Contraction mapping theorem 11. Example 12. Variational methods 1 13. Variational methods 2 14. Variational methods 3 15. Minimax principles

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216846>

**Contact)**

⇒ 工学部数学教室 (A棟211室,219室)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Watershed Hydrologic Engineering

2 units (selection)

Takao TAMURA · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this subject is to learn models and theories on hydrological and chemical cycles in a river watershed.

**Outline)** Watershed hydrologic system. Watershed hydrologic processes. Evaporation and transpiration processes. Lumped and distributed rainfall-runoff models. Canopy interception tank model. Heat-pulse transpiration model. Mathematical models of solute runoff process for forested watersheds. Water and solute budgets for forested watersheds. Management system of flood, water resources, and watershed environment.

**Style)** Lecture

**Keyword)** *forested basin, hydrological cycle, solute runoff, runoff model*

**Fundamental Lecture)** “Advanced Water Circulation Engineering”(0.5, ⇒p.9)

**Relational Lecture)** “Ecological Hydroengineering”(0.5, ⇒p.106)

**Requirement)** not specified

**Notice)** not specified

**Goal)**

1. Understand models and theories on hydrological cycles
2. Understand models and theories on chemical solute cycles

**Schedule)** 1. Hydrologic Cycle in a River Watershed 2. Rainfall Interception Process in a Forest Watershed 3. Transpiration Process in a Forest Watershed 4. Runoff Process in a Forest Watershed 5. Modeling of Overland flow 6. Distributed Runoff Models 7. Modeling of Hydrologic Cycle in a River Watershed (1) 8. Modeling of Hydrologic Cycle in a River Watershed (2) 9. Evaluation Index of Hydrologic Cycle in a River Watershed 10. Formation Process of Streamwater Chemistry in a Forest Watershed 11. Runoff Process of Chemical Solutes in Streamwater 12. Inference of Forest Change to Streamwater Chemistry 13. Mathematical Model of Solute Runoff in Streamwater (1) 14. Mathematical Model of Solute Runoff in Streamwater (2) 15. Modeling of Water and Solute Cycles in a River Watershed

**Evaluation Criteria)** Evaluated with the report by 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216900>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ TAMURA (A414, +81-88-656-9407, tamura@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

## Ecological Hydroengineering

2 units (selection)

Susumu Nakano · PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Mahito Kamada · PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Yoichi Kawaguchi · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Methods for conserving and improving riparian and coastal ecosystems in an actual way are developed, both from hydraulic and ecological perspectives.

**Outline)** Hydrodynamics of open-channel flow and wave in river, estuary. Mechanics of sediment transport by open-channel flow and wave. Theoretical and numerical analysis of hydro-geomorphic process. Influence of physical condition on ecological system. Interactive dynamics between hydro-geomorphic process and plant communities. Ecological assessment and restoration of riparian ecosystems. Landscape management in an ecological way.

**Style)** Lecture in combination with Portfolio, Portfolio

**Keyword)** *ecosystem, river, estuary, watershed, landscape management*

**Fundamental Lecture)** “Advanced Environmental Ecology”(1.0, ⇒p.11), “Advanced Disaster Reduction Engineering”(1.0, ⇒p.10)

**Relational Lecture)** “Advanced mitigation engineering”(0.5, ⇒p.143), “Watershed Hydrologic Engineering”(0.5, ⇒p.106)

**Requirement)** not specified

**Notice)** not specified

**Goal)**

1. Students understand mechanism and analysis technique for flow and sediment transport in the middle and upper reaches of a river.
2. Students understand analysis technique for flow and material transport in estuary, and are able to evaluate correctly the relation between physical phenomena and estuarine ecosystem.
3. Students have knowledge to evaluate ecosystem value, and are able to apply for ecosystem improvement.

**Schedule)** 1. Governing equation of hydro-geomorphic process 2. Numerical analysis of hydro-geomorphic process 3. Statistical analysis of hydro-geomorphic process 4. Interaction between hydro-geomorphic process and vegetation, report(1) 5. Flow analysis in estuary 6. Flow analysis in coastal zone 7. Wave analysis in coastal zone 8. Evaluation model of ecosystem in coastal zone, report(2) 9. Finding the limiting factors of ecosystem distribution 10. Mechanism for sustaining ecosystems 11. Pattern and process of ecosystem change 12. Mechanism of ecosystem alteration in relation to human activities 13. Ecological management of landscape and landscape ecology 1 14. Ecological management of landscape and landscape ecology 2 15. Ecological engineering for ecosystem management, report(3)

**Evaluation Criteria)** marks of report (1), (2) and (3) are summed with the weights of 3, 3 and 4, respectively, and the passing mark is 60%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216885>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nakano (A310, +81-88-656-7330, nakano@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示を参照のこと。)

⇒ Kamada (A306, +81-88-656-9134, kamada@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること。)

⇒ Kawaguchi (308, +81-88-656-9025, kawaguchi@ce.tokushima-u.ac.jp) (Office Hour: 金曜午後)

## Geoenvironmental Design Theory

2 units (selection)  
Teacher of course

Hisashi Suzuki · ASSOCIATE PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Jing-Cai Jiang · ASSOCIATE PROFESSOR / ENVIRONMENTAL CONSERVATION ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The purpose of this course is to present state-of-the-art theories of geomechanics which contribute to the well-balanced development and conservation of the geoenvironment. The course consists of two main parts: stability analyses and deformation theories of earth structures.

**Outline)** In the stability analyses, theories of limit equilibrium methods, limit analysis methods and slip line methods, as well as their applications to stability, bearing capacity and earth pressure problems are addressed. In the deformation theories, the original Cam Clay Model and the latest developments in critical state soil mechanics together with finite element methods are described.

**Style)** Lecture

**Keyword)** *stability problem, deformation problem*

**Fundamental Lecture)** “Advanced Soil Structure Earthquake Resistance Design”(1.0, ⇒p.10), “Advanced Soil Mechanics”(1.0, ⇒p.11)

**Relational Lecture)** “Geoenvironment Control Engineering”(0.5, ⇒p.107)

**Goal)**

1. To understand strength theories of earthen structures
2. To understand deformation theories of geo- materials

**Schedule)** 1. Introduction of stability problems 2. Limit equilibrium method (part 1) 3. Limit equilibrium method (part 2) 4. Limit analysis (part 1) 5. Limit analysis (part 2) 6. Slip line method (part 1) 7. Slip line method (part 2) 8. Progressive failure analysis of stability problems 9. Introduction of deformation problems and growth of Cam-clay theory 10. Existence of Critical State Line 11. Existence of Roscoe Surface 12. Existence of Hvorslev Surface 13. Elasto-plastic theory of saturated clay 14. Associate flow rule for yield surface of soil 15. Equation for State Boundary Surface of Cam-clay Model

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216688>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Teacher of course
- ⇒ Suzuki (A403, +81-88-656-7347, [suzuki@ce.tokushima-u.ac.jp](mailto:suzuki@ce.tokushima-u.ac.jp)) (Office Hour: 毎週水曜日 昼間 16:20~17:50 夜間 19:40~21:10)
- ⇒ Jiang (A311, +81-88-656-7346, [jiang@ce.tokushima-u.ac.jp](mailto:jiang@ce.tokushima-u.ac.jp)) (Office Hour: 年度ごとに学科の掲示を参照すること)

## Geoenvironment Control Engineering

2 units (selection)

Katsutoshi Ueno · ASSOCIATE PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Akitoshi Mochizuki · PART-TIME LECTURER

**Target)** This unit aims to cover basic concepts and technologies related to development and control of geoenvironment and ground-structure system for protection against natural and human-caused disasters. Interactive behaviours of over and under-ground structures under earthquake conditions as well as static conditions will be addressed employing results from numerical and physical models as well as those from field-observation data.

**Outline)** i) Learn framework of experimental apparatus and instruments for in-situ investigation and so forth. Then understand their basic principle, modification and basic concepts. ii) practice of the method how to review technical papers

**Keyword)** *Image analysis, Triaxial compression test*

**Goal)** To understand methodology of engineering, i.e. experiments, site investigation, and their verification by analysis, and to develop basic ability in development of experimental equipments and instruments.

**Schedule)** 1. Introduction 2. laboratory test, model test and site investigation 3. laboratory test, model test and site investigation 4. principle of measurements1 5. principle of measurements2 6. Image analysis 1

7. Model tests 8. Centrifuge model tests 9. Centrifuge model tests 10. Triaxial compression test1 11. Triaxial compression test2 12. Cyclic triaxial compression test 13. Discussion on English paper 14. Discussion on English paper 15. Discussion on English paper 16. Summary

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216687>

**Contact)**

- ⇒ Undecided
- ⇒ Ueno (A504, +81-88-656-7342, [ueno@ce.tokushima-u.ac.jp](mailto:ueno@ce.tokushima-u.ac.jp)) (Office Hour: 学科の掲示を参照のこと)

## Urban System Analysis

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Susumu Namerikawa · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Basic theories on modeling analysis for land use, transportation and environment systems in urban and regional areas. Design, planning, construction, and management systems for regions.

**Outline)** Yamanaka: Modeling, analysis methods, design and planning method for land use, transportation, and environment systems in urban/ regional areas. Namerikawa: Analysis models, building, management and maintenance methods for infrastructure and environment systems in urban/ regional areas

**Style)** Portfolio

**Keyword)** *landuse analysis, transport model, environment protection*

**Fundamental Lecture)** “City and Transport System Planning”(1.0, ⇒p.11), “Urban and Regional Planning”(1.0, ⇒p.13), “Project Management”(1.0, ⇒p.7)

**Relational Lecture)** “Advance Lecture of Political Simulation”(0.5, ⇒p.142), “Advanced Lecture in Social Risk Engineering”(0.5, ⇒p.142), “Social Science”(0.5, ⇒p.102)

**Goal)**

1. To understand the theories of modeling method for the analysis of landuse, transport, environments system in urban and regional areas.
2. To understand project management system in regional developments.

**Schedule)** 1. Discussion on choosing topics 1 2. Discussion on choosing topics 2 3. Review on related researches 1 4. Review on related researches 2 5. Review on related researches 3 6. Review on related researches 4 7. Review on related researches 5 8. Review on related researches 6 9. Case study using a analysis method 1 10. Case study using a analysis method 2 11. Case study using a analysis method 3 12. Case study using a analysis method 4 13. Case study using a analysis method 5 14. Discussion on summary of case study 1 15. Discussion on summary of case study 2

**Evaluation Criteria)** No paper is required. The portfolio of learning records and submitted reports are required to be evaluated.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216798>

**Student)** Able to be taken by student of other department

**Contact)**

- ⇒ Yamanaka (A410, +81-88-656-7350, [yamanaka@ce.tokushima-u.ac.jp](mailto:yamanaka@ce.tokushima-u.ac.jp)) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)
- ⇒ Namerikawa (A412, +81-88-656-9877, [namerikawa@ce.tokushima-u.ac.jp](mailto:namerikawa@ce.tokushima-u.ac.jp)) (Office Hour: オフィスアワー:年度ごとに学科の掲示を参照すること)

## Wind Engineering

2 units (selection)

Fumiaki Nagao · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Minoru Noda · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To understand the properties of strong wind, outline of structural behavior in strong wind and wind resistant design in civil engineering

**Outline)** Local strong wind; Occurrence mechanism and effect of geographic and topographic factors. Characteristics of fluctuating wind velocity. Steady and unsteady aerodynamic forces exerted on thin and bluff bodies. Aerodynamic response analyses of structures such as cables, tower-like structures, cable stayed bridges and suspension bridges. Rain-wind induced vibration. Effect of gusty wind on structural response. Wind resistant design in civil engineering; A state of the art and perspective.

**Style)** Lecture

**Keyword)** *properties of strong wind, structural behavior in strong wind, wind resistant design*

**Fundamental Lecture)** “Advanced Structural Dynamics”(1.0, ⇒p.6), “Advanced Structural Design”(1.0, ⇒p.13)

**Goal)** To understand the outline of structural behavior in strong wind and wind resistant design in civil engineering

**Schedule)** 1. Introduction 2. Occurrence mechanism of Local strong wind 3. Effect of geographic and topographic factors on Local Strong wind 4. Characteristics of fluctuating wind velocity 5. Steady aerodynamic forces exerted on thin and bluff bodies 6. Unsteady aerodynamic forces exerted on thin and bluff bodies 7. Forced vibrations of structures 8. Self-excited vibrations of structures 9. Aerodynamic response analyses of cables 10. Aerodynamic response analyses of tower-like structures 11. Aerodynamic response analyses of cable stayed bridges 12. Aerodynamic response analyses of suspension bridges 13. Effect of gusty wind on structural response 14. Wind resistant design in civil engineering 15. A state of the art and perspective

**Evaluation Criteria)** evaluated by attitude in class (50%) and reports (50%)

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216594>

**Contact)**

⇒ Nagao (A515, +81-88-656-9443, fumi@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

⇒ Noda (A514, +81-88-656-7323, noda@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

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## Advanced Structural Analysis

2 units (selection)

Yoshifumi Nariyuki · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Method of non-linear analysis of framed structures subjected to static and dynamic loads is studied.

**Outline)** Not only geometrical and material non-linear problems in structural analysis and analytical method of non-linear behavior of framed structures, but also computation of ultimate strength and stability of framed structures subjected to static load and dynamic load are discussed in portfolio.

**Style)** Portfolio

**Keyword)** *structural analysis of frames, material non-linear, geometrical non-linear, ultimate strength*

**Fundamental Lecture)** “Advanced Fracture and Structural Mechanics”(0.8, ⇒p.7)

**Relational Lecture)** “Earthquake Resistant Design”(0.5, ⇒p.108)

**Requirement)** Students are required to have a good understanding of structural mechanics.

**Notice)** Students are required to do two hours preparation and two hours review for each lesson.

**Goal)** To obtain the fundamental knowledge of non-linear analytical method of plane framed structures.

**Schedule)** 1. Guidance and purpose of this subject 2. Outline of analytical method of framed structures 3. Geometrical non-linear problems 1 4. Geometrical non-linear problems 2 5. Geometrical non-linear problems 3 / Report 1 6. Material non-linear problems 1 7. Material non-linear problems 2 8. Material non-linear problems 3 9. Material non-linear problems 4 10. Material non-linear problems 5 / Report 2 11. Combined non-linear problems 1 12. Combined non-linear problems 2 13. Combined non-linear problems 3 14. Combined non-linear problems 4 / Report 3 15. Discussion on assignments

**Evaluation Criteria)** Assignments count 100%

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216819>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nariyuki (A510, +81-88-656-7326, nariyuki@ce.tokushima-u.ac.jp) (Office Hour: Monday 16:20:17:50)

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## Earthquake Resistant Design

2 units (selection)

Atsushi Mikami · ASSOCIATE PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Tsuneo Ohsumi · PROFESSOR / GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To acquire methods of solving problems in seismic design of structures

**Outline)** Choose and discuss a topic from the problems including fault characterization, site response, attenuation relations, soil-structure interaction, seismic design of buildings/bridges, etc

**Style)** Portfolio

**Keyword)** *earthquake resistant design, earthquake ground motions, simulation of earthquake ground motions*

**Relational Lecture)** “Advanced Structural Analysis”(0.5, ⇒p.108)

**Requirement)** Non

**Notice)** Non

**Goal)** To acquire the method for resolving problems in earthquake resisting design of civil engineering structures.

**Schedule)** 1. To search topics in earthquake resistant design of civil engineering structures(1-3). 2. To investigate some themes out of the topics by references(4-12). 3. To prepare and submit the reports on the themes(13-15).

**Evaluation Criteria)** Evaluate 100% by report.

**Textbook)** To be introduced in the class.

**Reference)** Proceedings of World Conference on Earthquake Engineering

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216749>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Mikami (A512, +81-88-656-9193, amikami@ce.tokushima-u.ac.jp) (Office Hour: Friday, 16:00-19:00 (or by appointment))

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## Advanced Materials for Civil Works

2 units (selection)

Takao Ueda · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Acquisition of recent technique on concrete engineering particularly new concrete such as high performance concrete ,eco-concrete, etc., and maintenance engineering in civil works, in the view point of sustainable material cycling society.

**Outline)** Characteristics and performance of important materials used for civil works to construction infrastructure facilities and to manage environment. A concept of environment conscious materials and environmentally friendly concrete. Characteristics and designing method of environmentally mitigative concrete and organism adaptable concrete, such as porous concrete including many continuous voids and big holes, used for concrete structures and environmentally friendly materials to realize sustainable development.

**Style)** Lecture in combination with Portfolio

**Keyword)** *sustainable society, material cycling society, materials for civil works*

**Relational Lecture)** “Flow Mechanism and Control for Fresh Concrete”(0.5, ⇒p.109)

**Requirement)** No requirement.

**Notice)** This class is consisted of some lectures, some reporting for subjects and presentation and discussion class on the reports

**Goal)**

1. Understanding on a concept of sustainable material cycling society in civil works.
2. Understanding on materials having low environmental impact in civil works.

**Schedule)** 1. Guidance 2. Definition of eco-concrete 3. Properties of porous concrete(1) 4. Properties of porous concrete(2) 5. Proportioning method of porous concrete 6. Application example of porous concrete 7. Properties of recycled aggregate concrete(1) 8. Properties of recycled aggregate concrete(2) 9. Landscape of concrete structures 10. Properties of concrete admixing fly ash (1) 11. Properties of concrete admixing fly ash (2) 12. Properties of concrete admixing blast furnace slag 13. Durability of concrete admixing industrial by-products 14. Durability design and life cycle design (1) 15. Durability design and life cycle design (2)

**Evaluation Criteria)** Estimation using presentation and reports.

**Textbook)** Using photo copying materials, etc.



**Webpage**) <http://iji-lab.sakura.ne.jp/>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216692>

**Student**) Able to be taken by student of other department and faculty

**Contact**)

⇒ Ueda (A502, +81-88-656-2153, ueda@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること)

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### Flow Mechanism and Control for Fresh Concrete

2 units (selection)

Chikanori Hashimoto · PROFESSOR / STRUCTURAL ENGINEERING, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target**) The objective of this subject is to understand the recent technology on consistency of fresh concrete in process of mixing or flowing in the construction machine, such as concrete mixer, concrete pump or concrete agitator.

**Outline**) Mechanical behavior of concrete materials in process of mixing, conveying and compacting using the visualization technique of fresh concrete. Application of the rheology to fresh concrete. Design of self-compacting concrete and eco-concrete. Concept for construction design, which is the performance-based design. Basic concept for new types of structure such as partially prestressed concrete structures.

**Style**) Lecture in combination with Portfolio

**Keyword**) *visualizaion technique of fresh concrete, application of visualized analysis on fresh concrete, deformed pipe, agitator drum, diaphragm wall, consistency test, bi-axial forced mixing type mixer, vertical continuous mixer with gravity*

**Requirement**) It is necessary for students to learn the basic attainments on the concrete engineering.

**Goal**)

1. The purpose is to understand the visualization technique of fresh concrete.
2. The purpose is to understand the application of flow analysis in process of mixing or flowing in the construction machine.

**Schedule**) 1. Guidance 2. Visualization technique of fresh concrete (historical development). 3. Visualization technique of fresh concrete (materials used). 4. Visualization technique of fresh concrete (method of image analysis). 5. Visualization technique of fresh concrete (scale effect of model concrete). 6. Visualization technique of fresh concrete (problem to be solved). 7. Application of visualized analysis on fresh concrete flowing through the tapered pipe. 8. Application of visualized analysis on fresh concrete flowing through the bend pipe or bifurcated pipe. 9. Application of visualized analysis on fresh concrete discharging of agitator drum. 10. Application of visualized analysis on fresh concrete mixing in agitator drum. 11. Application of visualized analysis on fresh concrete placing for diaphragm wall. 12. Application of visualized analysis on fresh concrete flowing in the vessel of consistency test. 13. Application of visualized analysis on self-compacting concrete casting in the slab form. 14. Application of visualized analysis on fresh concrete in process of mixing in bi-axial forced mixing type mixer. 15. Application of visualized analysis on fresh concrete in process of mixing in vertical continuous mixer with gravity. 16. Preliminary

**Evaluation Criteria**) Evaluate by reports or presentations or each subject.

**Textbook**) Handout of phot copying materials for each subject.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216903>

**Note**) It is necessary getting the unit of lecture and understanding the lecture for 2 hours to prepare of the lecture for 2 hours. and review of the lecture for 2 hours

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### Advance Lecture of Political Simulation

2 units (selection)

Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING, Yoshinobu Hirose ·

**Target**) The technique of modelling of regional and environmental systems, and the concept and application method of prediction and evaluation models to political simulation are studied.

**Outline**) Not only the technique of modelling, but also the application method of prediction and evaluation models to political simulation is discussed in portfolio.

**Style**) Portfolio

**Keyword**) *political simulation, technique of modelling, prediction and evaluation*

**Requirement**) 特になし

**Notice**) 特になし

**Goal**) To obtain the knowledge of the technique of modelling and application method of prediction and evaluation models, apply them to political simulation.

**Schedule**) 1. Guidance and purpose of this subject 2. Systems of political simulation 3. Technique of modelling 1 4. Technique of modelling 2 5. Application of model : Prediction 1 6. Application of model : Prediction 2 7. Application of model : Evaluation of policy 1 8. Application of model : Evaluation of policy 2 9. Example of political simulation : Population policy 10. Example of political simulation : Urban transport policy 11. Example of political simulation : Landuse policy 12. Example of political simulation : Social policy 13. Example of political simulation : Environment policy 14. The technique of political simulation in the future 15. Regional policies in the 21st Century

**Evaluation Criteria**) Assignments count 100%.

**Textbook**) To be introduced in the class.

**Reference**) To be introduced in the class.

**Webpage**) <http://www.eco.tokushima-u.ac.jp/w3/kondo/top/index.htm>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216726>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp) (Office Hour: 月曜日9:10校時)

**Note**) 特になし

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### Advanced Lecture in Social Risk Engineering

2 units (selection)

Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) To understand concept of risk, to cultivate ability of measures how to reduce, avoid, compensate for various risks. the reducing, the evading of the risk, the compensation for it.

**Outline**) Technique of risk assessment and its communication for various social risks on risk management is lectured.

**Style**) Lecture in combination with Portfolio

**Keyword**) *social risks, risk management, crisis management*

**Goal**) To obtain the knowledge of risk management and application method of various social risks.

**Schedule**) 1. Guidance and purpose of this subject 2. Sources of various social risks 3. Evaluation of social risk(1) 4. Evaluation of social risk(2) 5. Risk management (1.risik perception) 6. Risk management(2.risik communication) 7. Risk management(3.evaluation standard) 8. Example of risk management(1.evacuation for natural disaster) 9. Example of risk management(2.evacuation for natural disaster) 10. Example of risk management(3.evacuation for natural disaster) 11. Example of risk management(4.avoidance of risik and insurance) 12. Presentaion and discusion for social risk(1) 13. Presentaion and discusion for social risk(2) 14. Presentaion and discusion for social risk(3) 15. Summary

**Evaluation Criteria**) Assignments Count 100%

**Textbook**) To be introduced in the class

**Reference**) To be introduced in the class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216694>

**Student**) To be limited to the students of the course

**Contact**)

⇒ Kozuki (Eco505, +81-88-656-7335, kozuki@eco.tokushima-u.ac.jp) (Office Hour: 火曜日, 14:35 から 16:05, 18:00 から 19:30)

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### Advanced mitigation engineering

2 units (selection)

Hideki Ueshima · PART-TIME LECTURER / 広島工業大学

**Target**) To obtain the abilities to find and solve environmental problems using for application of mitigation technique

**Outline**) To surveying of the latest news of mitigation and to understand its concept and examine the technique to mitigate the deterioration environment

**Style)** Lecture in combination with Portfolio

**Keyword)** *district improvement plan for disaster mitigation, coastal environment*

**Fundamental Lecture)** “Advanced Lecture in Social Risk Engineering”(1.0, ⇒p.109), “Advance Lecture of Political Simulation”(1.0, ⇒p.109)

**Goal)** To design and assess the mitigation plan for deterioration coastal environment

**Schedule)** 1. Guidance of this subject 2. Current topics about mitigation 1 3. Current topics about mitigation 2 4. Current topics about mitigation 3 5. Current topics about mitigation 4 6. Current topics about mitigation 5 7. Current topics about mitigation 6 8. Current topics about mitigation 7 9. Current topics about mitigation 8 10. Current topics about mitigation 9 11. Current topics about mitigation 10 12. Discussion on research theme1 13. Discussion on research theme2 14. Discussion on research theme3 15. Presentation

**Evaluation Criteria)** Assignments count 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216892>

**Contact)**

⇒ Ueshima (+81-823-72-1901, h-ueshima@aist.go.jp)

⇒ Kozuki (Eco505, +81-88-656-7335, kozuki@eco.tokushima-u.ac.jp) (Office Hour: 火曜日, 14:35 から 16:05, 18:00 から 19:30)

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### Advanced Exercise on Civil and Environmental Engineering

2 units (compulsory)

Teacher of course

**Target)** This subject is especially provided in order to deepen the study, and must be taken under the guidance of a faculty in major field of study.

**Outline)** Exercises related to research theme are performed.

**Style)** Portfolio

**Keyword)** *exercise, civil and environmental engineering*

**Goal)** To obtain deeper knowledge regarding research theme.

**Schedule)** 1. Guidance 2. Exercise 3. Report

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216641>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Teacher of course (Office Hour: Monday 11:0012:30)

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### Advanced Research on Civil and Environmental Engineering

2 units (compulsory)

Teachers in other colleges or departments

**Target)** To obtain broad information on recent engineering

**Outline)** To research a theme in a technology, which is different from the main technology in your field.

**Style)** Portfolio, Lecture, Lecture in combination with Portfolio

**Keyword)** *engineering, technology, different field*

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn a recent technology, which is different from the main technology in your field.

**Schedule)** Choose a theme on technology or engineering, which is different from that in your field.

**Evaluation Criteria)** Evaluated with portfolio or examination

**Textbook)** Ask to teachers.

**Reference)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216642>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Teacher of course (Office Hour: Friday 11:5512:50)

## Intelligent Structures and Mechanics Systems Engineering — Mechanical Engineering

### SYLLABUS OF SUBJECTS

• **Integrated Subjects**

<b>Human Factors</b> ...Yoshida .....	111
<b>Life Science</b> ...Takagi · Tsuji .....	111
<b>Social Science</b> ...yokohata .....	112
<b>Science and Technology Studies</b> ...Tanaka .....	112
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	112
<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和 .....	112
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	113
<b>Long-term Internship (D)</b> ...Yamanaka .....	113
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer .....	113
<b>International Advanced Technology and Science 1</b> ...Murakami .....	114
<b>International Advanced Technology and Science 2</b> ...Murakami .....	114
<b>Presentation Method (D)</b> ...Graduate School of Advanced Technology and Science .....	114
<b>Internship (D)</b> .....	114
<b>Venture Business (D)</b> .....	115

• **Specialized Subjects**

<b>Quantum Theory of Materials</b> ...Michihiro .....	115
<b>Radio Frequency Solid State Physics</b> ...Nakamura .....	115
<b>Controlling Physical Properties of Crystalline Materials</b> ...Okada .....	115
<b>Material Applications</b> ...Yoshida · Nishino · Takagi .....	115
<b>Material and Computational Mechanics</b> ...Oishi · Nagamachi .....	116
<b>Fluid Energy Control</b> ...Fukutomi .....	116
<b>Thermal Energy Control</b> ...Suekane · Kiyota .....	116
<b>レーザー光学特論</b> ...Deguchi .....	117
<b>Energy and Environment Engineering</b> ...Ishihara · Ichimiya .....	117
<b>Mechanical Systems Design</b> ...Hino .....	117
<b>Instrument and Control Engineering</b> ...Miwa .....	118
<b>Design of Dynamic Systems</b> ...Konishi .....	118
<b>Advanced Production Technology</b> ...Ishida · Tada .....	118
<b>Micro-Nano Engineering</b> ...Iwata .....	118
<b>Materials Surface Performance Control</b> ...Murakami · Yonekura .....	119
<b>Intelligent Information Systems</b> ...Ogata · Mitsuahara · Kanenishi · Ito .....	119
<b>Visual pattern processing</b> ...Terada · Karungaru .....	119
<b>Advanced conversion systems of resource energy</b> ...Kidoguchi .....	120
<b>Advanced Micro-Nano Engineering</b> ...Part-time Lecturer .....	120

• **Specialized Exercise and Experiments**

<b>Advanced Exercise on Mechanical Engineering</b> ...All teachers .....	120
<b>Advanced Research on Mechanical Engineering</b> ...Teachers in other colleges or departments .....	120

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### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Target)** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline)** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule)** 1. What is Human Factors 2. Historical Overview of Human Factors 3. Multi-Disciplinary Aspect of Human Factors 4. Health and Safty Issue of Human Factors 5. Human Psychological Capability 6. Task Analysis 7. Human Error 8. Universal Design 9. Cognitive Artifact 10. Visibility and Affordance 11. Human-Computer Interaction 12. Human Information Processing 13. Knowledge and Mental Model 14. Usability Paradigms and Principles 15. Evaluation and Testing 16. Making system that makes us smart

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Yoshida (+81-88-656-7897, [yos@ias.tokushima-u.ac.jp](mailto:yos@ias.tokushima-u.ac.jp))

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### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Understanding of significance of protein in biotechnology

**Outline)** Basics of structure, function and application of protein are introduced

**Style)** Lecture

**Keyword)** *protein, enzyme, biotechnology*

**Goal)**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule)** 1. Introduction of life science 2. History of life science 3. Structure and function of DNA and RNA 4. mRNA is a template of protein 5. Duplication of DNA 6. Regulation of protein expression 7. Human Genetics 8. Genetic disease 9. DNA diagnosis 10. Structure and function of protein 11. Principle of gene technology (1) 12. Principle of gene technology (2) 13. Protein engineering 14. Future of life science (1) 15. Future of life science (2) 16. Preparation of report

**Evaluation Criteria)** Evaluation by report

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact)**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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## Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target)** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline)** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp)

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## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文学の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 4. 馬力の発見—農業技術の革新とヨーロッパ社会 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業社会 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

⇒ Tanaka . (Office Hour: tanaka@kenroku.kanazawa-u.ac.jp)

⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING

First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

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## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER

Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** intellectual property, patent law, protect and use of intellectual property

**Relational Lecture)** "Introduction to Intellectual Property"(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方・特許は明細書を中心に動く (山内) 10. 技術者が知っておくべき実務知識・特許法上の留意事項 (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka・PROFESSOR/PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida・PROFESSOR/INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari・ASSISTANT PROFESSOR/CENTER FOR COMMUNITY REVITALIZATION

非常勤講師

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型「葉っぱビジネス」「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表する中で、注意すること。<参考:平成22年度ビジネスモデル特論>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎 地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土)20:15-21:45 月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-笠松和希(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり)

り) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクタール当たり1000万円稼ぐ奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. 「学びは効果をもたらしたか?」-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 「学びは効果をもたらしたか?」-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** Several are introduced in class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student)** 徳島大学大学院先端技術科学教育部マスターコース、及び、ドクターコースの学生

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka・PROFESSOR/PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who register the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka・PROFESSOR/PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto・ASSISTANT PROFESSOR/PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style)** Lecture

**Keyword)** *management, management of technology*

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.112), "Long-term Internship (D)"(0.5, ⇒p.113), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.113)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

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## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english .

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be surthorized. The report and portfolion on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, profolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

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## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of thechnology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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## Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Internship (D)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Quantum Theory of Materials

2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the advanced quantum mechanics and quantum field theory.

**Outline)** Basics of advanced quantum mechanics and quantum field theory are introduced.

**Style)** Lecture

**Keyword)** *quantum mechanics, quantum field theory*

**Goal)** To understand the outline of advanced quantum mechanics and quantum field theory.

**Schedule)** 1. Introduction 2. Quantum mechanics (1) 3. Quantum mechanics (2) 4. Hartree-Fock approximation 5. Koopman's theorem 6. Density functional theory 7. Kohn-Sham equation 8. Local density approximation 9. Perturbation (1) 10. Perturbation (2) 11. Quantum field theory 12. Creation operator and annihilation operator 13. Field quantization (1) 14. Field quantization (2) 15. Phonon 16. Electron gas

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216905>

**Contact)**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

## Radio Frequency Solid State Physics

2 units (selection)

Koichi Nakamura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces basis of NMR and applications to studies on superconductivity, magnetism and ionic diffusion in solid.

**Outline)** The spectrum, spin-lattice relaxation, spin-spin relaxation, chemical shift etc., which are obtained by NMR measurements, are introduced and discussed in connection with various physical properties of solids.

**Keyword)** *nuclear magnetic resonance, magnetism, diffusion*

**Goal)**

1. To understand basis of NMR.
2. To understand relationship between various problems in solid state physics and relaxation phenomena observed using NMR.

**Schedule)** 1. Introduction to nuclear magnetic resonance (NMR) 2. Zeeman interaction 3. Larmor precession 4. Magnetization 5. Motion of magnetization under magnetic field 6. Bloch equations 7. Dipole interaction 8. Magnetic interactions of nuclei with electrons 9. Electric quadrupole interaction 10. Spin-lattice relaxation and motional narrowing of resonance lines 11. Diffusion in solid and spin-lattice relaxation 12. Relaxation model for diffusion 13. NMR studies on lithium ionic conductors 14. NMR studies on protonic conductors 15. Application of NMR

**Evaluation Criteria)** Assignments count 100%.

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216788>

**Contact)**

⇒ Nakamura (A216, koichi@pm.tokushima-u.ac.jp)

## Controlling Physical Properties of Crystalline Materials

2 units (selection)

Tatsuya Okada · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Geometrical theories of grain boundary character in polycrystalline materials are described. Various methods to describe textures are also introduced.

**Outline)** Various geometric theories of grain boundaries and textures are introduced.

**Style)** Portfolio

**Keyword)** *grain boundary, geometrical theory, texture*

**Fundamental Lecture)** "Material Applications"(1.0, ⇒p.115)

**Notice)** 2-hour study before and after each lecture is necessary.

**Goal)**

1. CSL theory of geometrical character of grain boundaries must be understood.
2. Various methods to describe textures must be understood.

**Schedule)** 1. Dislocation theory of small angle grain boundaries 2. Dislocation theory of general boundaries 3. Extension of geometrical theory to interphase interfaces 4. O-lattice theory 5. CSL theory 6. Calculation of grain boundary dislocations 7. Miller indices and stereographic projection 8. Pole figure and inverse pole figure 9. Euler angles to describe crystallographic orientation 10. Orientation distribution function 11. Experimental analysis of textures 12. Deformed textures 13. Recrystallized textures 14. Textures and physical properties 1 15. Textures and physical properties 2

**Evaluation Criteria)** Evaluation is based on term papers.

**Reference)**

- ◇ Forwood and Clarebrough: Electron Microscopy of Interfaces in Metals and Alloys (Adam Hilger)
- ◇ Randle: Microstructure Determination and its Applications (The Institute of Materials)

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216635>

**Contact)**

⇒ Okada (M616, t-okada@me.tokushima-u.ac.jp)

## Material Applications

2 units (selection)

Kenichi Yoshida · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Hideo Nishino · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Hitoshi Takagi · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class acquires importance of the material evaluation using acoustic emission method and guided wave method that are prospective as advanced material evaluation methods in more serious environment. Also it acquires the development and the prospective trend since now of the green composite materials with natural fibers and biodegraded resin as one of the advanced composites.

**Outline)** Non-destructive methods are more important in the material evaluation methods that have been performed widely since then. This class introduces the measuring fundamentals and the analysis using the acoustic emission method and guided wave detecting method, and also the characteristics and the up-to-date development trend of green composites with less environmental burden.

**Style)** Lecture

**Keyword)** *acoustic emission(AE), guided wave analysis, green composite*

**Fundamental Lecture)** “Material Engineering”(0.2, ⇒p.23), “Physical properties of materials”(0.2, ⇒p.21)

**Requirement)** Students are required to have a good understanding of fundamental knowledge of materials engineering.

**Goal)**

1. To make clear the deformation and fracture dynamics of advanced materials by analysis of obtained AE signals.
2. To identify various types of defects and search for a plant life prediction using the guided wave propagating through materials.
3. To understand the high-performed and high-qualified green composite as one of the advanced materials with less environmental burden.

**Schedule)** 1. Introduction of AE method 2. AE source characterization 3. AE behavior during deformation in advanced materials and its deformation mechanism 4. AE behavior due to microcracking in advanced materials and its fracture prediction technology 5. Up-to-date trend of material evaluation technology with AE method 6. Propagation theory of ultrasonics in materials with viscoelasticity, anisotropy, piezoelectricity and non-linearity 7. Propagation simulation of ultrasonics 8. Fundamentals of guided wave with SH mode plate wave 9. Guided wave to circumferencial and axial directions 10. Up-to-date research trend of guided wave 11. Concept of advanced composite materials 12. Classification of advanced composite materials and its application 13. Characteristics of advanced composite materials 14. Advanced composite materials and global environment 15. Development trend of green composite

**Evaluation Criteria)** Assignments count 100%

**Textbook)** Not used

**Reference)** Will be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216664>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yoshida (M619, +81-88-656-7358, yoshida@me.tokushima-u.ac.jp) (Office Hour: Thursday and Friday, 17:00 to 18:00)

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## Material and Computational Mechanics

2 units (selection)

Atsuya Oishi · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Takuo Nagamachi · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** To understand both theory and computing system for computational mechanics of solving physical phenomena for natural and artificial objects

**Outline)** From theoretical aspects deformation theory of solids, FEM and numerical methods are discussed. From aspects of computing system, algorithm and high performance procedure are given of large scale computing system for designs and working of material, machine and structures, and controls.

**Style)** Lecture

**Keyword)** *nonlinear problem of solid mechanics, large scale system of computational mechanics*

**Fundamental Lecture)** “Solid Mechanics”(1.0, ⇒p.23)

**Relational Lecture)** “Advanced Exercise on Mechanical Engineering”(0.5, ⇒p.120), “Advanced Production Technology”(0.5, ⇒p.118)

**Goal)**

1. To understand mathematical theory and physics for nonlinear problems for solid
2. To construct large scale computing system and to simulate using them and understand of their results.

**Schedule)** 1. Tensor analysis 2. Weighted residual method and variational principles 3. Non-linear material problems 4. Geometrically non-linear problems 5. Time depending problems 6. Application to non-structural problems 7. Environment for parallel processing 8. Algorithm for parallel processing FEM analysis 9. Implementation of parallel processing FEM analysis 10. Basic theory of soft computing 11. Soft computing for CAE 12. Implicit method for statics 13. Explicit method for dynamics 14. Constitutive equations for non-ferrous metals 15. Method of high speed computing 16. Recent high precision method of FEM simulations

**Evaluation Criteria)** Assignments count 100%

**Textbook)** 矢川・吉村著, 有限要素法, 培風館

**Reference)** O. C. ツイエンキーヴィッツ, マトリックス有限要素法, 培風館

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216666>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Oishi (M622, +81-88-656-7365, oishi@me.tokushima-u.ac.jp)

⇒ Nagamachi (M524, ngmch@me.tokushima-u.ac.jp) (Office Hour: 毎週水曜日 17時～18時)

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## Fluid Energy Control

2 units (selection)

Junichiro Fukutomi · PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces hydrodynamic characteristics of turbomachinery, behavior of internal flow and problems with it.

**Outline)** Advanced concepts of fluid energy control and energy conversion. Performance characteristics, internal flow conditions and anomalous phenomena in fluid machinery. Performance improvement and noise reduction of turbo-machinery by flow control. Utilization of renewable fluid sources such as hydro-dams, wind, wave and tides.

**Keyword)** *energy conversion, turbomachinery, internal flow*

**Fundamental Lecture)** “Fluids Energy Conversion Engineering”(1.0, ⇒p.23)

**Goal)** To understand hydrodynamic characteristics of turbomachinery, behavior of internal flow and problems with it.

**Schedule)** 1. Theory of centrifugal turbomachinery 1 2. Theory of centrifugal turbomachinery 2 3. Theory of axial turbomachinery 1 4. Theory of axial turbomachinery 5. Quasi three-dimensional flow analysis of turbomachinery 6. Turbulence modeling and numerical flow simulation 1 7. Turbulence modeling and numerical flow simulation 2 8. Mid-term test 9. Characteristics of turbocharger for automobile 10. Noise of turbomachinery 1 11. Noise of turbomachinery 2 12. Anomalous phenomena of turbomachinery 1 (cavitation, water hammer) 13. Anomalous phenomena of turbomachinery 2 (surging, rotating stall) 14. Application technology of natural flow energy 1 (wind turbine) 15. Application technology of natural flow energy 1 (small hydro turbine) 16. Term test

**Evaluation Criteria)** As mid-term test of 50 points and term test of 50 points, it is made to be passing over sum total of 60 points.

**Textbook)** Not used

**Reference)** Will be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216901>

**Contact)**

⇒ Fukutomi (M519, +81-88-656-7367, fukutomi@me.tokushima-u.ac.jp)

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## Thermal Energy Control

2 units (selection)

Tetsuya Suekane · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Masanori Kiyota · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Aiming at the permanent use of resources and energy, basic principles of thermal energy, heat transmission, and characteristics of energy control devices and working fluid are discussed. Various usages of thermal energy flow are analyzed with exergy method.

**Outline)** Principle and characteristic about thermal energy, the control system, practical method and efficiency evaluation of thermal energy control. Energy flow analysis with heat, physical and chemical exergy.



**Keyword)** *thermal energy, energy conversion*

**Goal)** To use thermal energy effectively and to apply to environmental problems

**Schedule)** 1. Basics and characteristic of thermal energy 1 2. Basics and characteristic of thermal energy 2 3. Basics and characteristic of thermal energy 3, report problem 4. Characteristic of thermal energy control 1 5. Characteristic of thermal energy control 2 6. Characteristic of thermal energy control 3, report problem 7. Control elements of thermal energy 1 8. Control elements of thermal energy 2 9. Control elements of thermal energy 3, report problem 10. Control units of thermal energy 1 11. Control units of thermal energy 2 12. Control units of thermal energy 3, report problem 13. Evaluation of thermal energy control 1 14. Evaluation of thermal energy control 2 15. Evaluation of thermal energy control 3, report problem 16. Final test, oral examination

**Evaluation Criteria)** Scores of reports and final oral examination are used

**Textbook)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216809>

**Student)** Course students only

**Contact)**

⇒ Suekane (M521, [suekane@me.tokushima-u.ac.jp](mailto:suekane@me.tokushima-u.ac.jp))

⇒ Kiyota (M522, [kiyota@me.tokushima-u.ac.jp](mailto:kiyota@me.tokushima-u.ac.jp))

## レーザ分光学特論

2 units (selection)

Yoshihiro Deguchi · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces a new technology of advanced heat transfer and fluid mechanics that can be used for determining the optimal design and operating conditions of nuclear and geothermal power plants and also chemical plant.

**Outline)** Fundamental concepts of multiphase mixtures, Modeling flow-pattern transitions, Gas-liquid two-phase flow under microgravity, Film formation in annular flow, Flooding phenomena, Two-phase flow in micro-channel

**Style)** Lecture

**Keyword)** *fundamental concepts of multiphase mixtures, film formation in annular flow, flooding phenomena*

**Relational Lecture)** “Thermal Energy Control”(0.5, ⇒p.116), “Energy and Environment Engineering”(0.5, ⇒p.117), “Fluid Energy Control”(0.5, ⇒p.116)

**Requirement)** Students are required to have a good understanding of undergraduate-level heat transfer engineering, thermodynamics, hydrodynamics and related subjects.

**Goal)** To understand the outline of the transport phenomena in multiphase fluids

**Schedule)** 1. 1. Fundamental concepts of multiphase flow 2. 2. Flow pattern map 3. 3. Pressure drop, Void fraction 4. 4. Bubble flow 5. 5. Slug flow, Froth flow 6. 6. Annular flow, Mist flow 7. 7. Film formation in annular flow( No.1) 8. 8. Film formation in annular flow( No.2) 9. 9. Gas-liquid two-phase flow under microgravity(No.1) 10. 10. Gas-liquid two-phase flow under microgravity(No.2) 11. 11. Flooding phenomena(No.1) 12. 12. Flooding phenomena(No.2) 13. 13. Flooding phenomena(No.3) 14. 14. Two-phase flow in micro-channel(No.1) 15. 15. Two-phase flow in micro-channel(No.2) 16. 16. Discussion on multiphase fluids transport

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216656>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Teacher of course

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Energy and Environment Engineering

2 units (selection)

Kunihiko Ishihara · PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Masashi Ichimiya · ASSOCIATE PROFESSOR / MECHANICAL SYSTEMS, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Aeroacoustic represented to high speed Shinkansen is complex in its generation mechanism and is still in investigation. This class aims to understand the theory of the generation mechanism and turbulence phenomenon underlying it.

**Outline)** Latest energy and environment problems in Japan and the world. Alternative energy sources for fossil fuels which are origins of green house effects. Fluid energy transfer machines. Systems of nuclear and sustainable energy machine. Harmony of energy consumption and environment problem. Aerodynamic response of sound and vibration, and turbulent properties of fluid machines. Lecture in combination with Portfolio.(2unit)

**Style)** Lecture in combination with Portfolio

**Keyword)** *aeroacoustics, flow-induced vibration, viscous fluid, turbulence*

**Fundamental Lecture)** “Applied Fluid Dynamics”(1.0, ⇒p.20), “Fluids Energy Conversion Engineering”(1.0, ⇒p.23)

**Requirement)** Students are required to have a good understanding of fundamental knowledge of fluid mechanics.

**Goal)** This class aims to train researchers for universities and companies

**Schedule)** 1. Outline of aeroacoustic 2. What is a vortex sound? 3. Basic equations of fluid dynamics and acoustics 4. Green function for free space 5. Physical meanings of monopole, dipole and quadrupole 6. Lighthill's equation and Curle's equation 7. Radiation sound from compact body 8. Summary and intermediate test 9. Viscous fluid and boundary layer 10. Laminar flow, turbulent flow and transition 11. Description of turbulence 12. Fundamental equations for turbulence 13. Wall turbulence 14. Free turbulence 15. Homogeneous and isotropic turbulence 16. Final examination

**Evaluation Criteria)** Attitude for attending class (30%) and two examinations (70%) are evaluated.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216568>

**Contact)**

⇒ Ishihara (M518, +81-88-656-7366, [ishihara@me.tokushima-u.ac.jp](mailto:ishihara@me.tokushima-u.ac.jp)) (Office Hour: 木曜日 17:00~18:00)

⇒ Ichimiya (M520, +81-88-656-7368, [ichimiya@me.tokushima-u.ac.jp](mailto:ichimiya@me.tokushima-u.ac.jp)) (Office Hour: 毎週火曜日, 17:00~18:00)

## Mechanical Systems Design

2 units (selection)

Junichi Hino · PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The applied technologies of modeling, simulation, control and design methods for mechanical systems are made to master.

**Outline)** In mechanical systems, modelling and simulation by using modal analysis, semi-active and active vibration controls of mechanical systems, optimum design of active mass dampers for mechanical systems, intelligent vibration controls of mechanical systems, semi-active and active vehicle suspensions by modern control theory, and semi-active and active vehicle suspensions by intelligent methods are lectured.

**Style)** Lecture

**Keyword)** *modal analysis, vibration control*

**Requirement)** Students are required to have a good understanding of basic applied dynamics and vibration control

**Goal)**

1. To understand knowledge of dynamic design method of mechanical systems

2. To advance applied technologies for dynamic design method

**Schedule)** 1. Modeling and simulation by modal analysis method 1 2. Modeling and simulation by modal analysis method 2 3. Modeling and simulation by modal analysis method 3 4. Modeling and simulation by modal analysis method 4 5. Active and semi-active vibration control method 1 6. Active and semi-active vibration control method 2 7. Active and semi-active vibration control method 3 8. Vibration control by active mass damper 1 9. Vibration control by active mass damper 2 10. Vibration control by intelligent control methods 1 11. Vibration control by intelligent control methods 2 12. Design of active suspension of vehicles by modern control theory 1 13. Design of active suspension of vehicles by modern control theory 2 14. Design of active and semi-active suspension of vehicles by intelligent control theory 1 15. Design of active and semi-active suspension of vehicles by intelligent control theory 2

**Evaluation Criteria)** Assignments count 100%

**Textbook)** Printed synopses are used

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216602>

**Student)** 工学研究科博士課程 1, 2, 3 年次

**Contact)**

⇒ Hino (M422, +81-88-656-7384, hino@me.tokushima-u.ac.jp) (Office Hour: monday 17.00-18.00)

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## Instrument and Control Engineering

2 units (selection)

Masafumi Miwa · ASSOCIATE PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces the research results using control strategies, the application to the industrial plant of control technology.

**Outline)** Computer application to factory automation, control of industrial robot, digital process control, dynamic modeling of industrial chemical plant with neural network, dynamics of pneumatic actuators, two degree of freedom control and control of pneumatic actuators using intelligence strategies are lectured.

**Style)** Lecture

**Keyword)** *dynamic modeling, intelligent control*

**Relational Lecture)** “Mechanical Systems Design”(0.5, ⇒p.117), “Design of Dynamic Systems”(0.5, ⇒p.118)

**Requirement)** Students are required to have a good understanding of graduate-level control engineering and related subjects.

**Goal)** To understand the application to industrial plant of digital control theory, the intelligent control using actuators.

**Schedule)** 1. Outline of digital control theory 2. Outline of two-degree-of-freedom control method 3. Design of two-degree-of-freedom control system 4. Model predictive control 5. Application to chemical plant control of model predictive control 6. Auto tuning PID control of chemical plant(1) 7. Auto tuning PID control of chemical plant(2) 8. Application of generalized predictive control 9. The structure and function of actuators 10. Digital control and servo mechanism 11. Recent topics of intelligent control 12. Outline of neural network 13. Neural network compensator 14. Intelligent control using actuators 15. Application to plant of control theory(1) 16. Application to plant of control theory(2)

**Evaluation Criteria)** Assignments count 100 %

**Textbook)** Printed synopses are used.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216631>

**Contact)**

⇒ Miwa (M420, +81-88-656-7387, miw@me.tokushima-u.ac.jp) (Office Hour: monday 5:00PM-6:00PM)

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## Design of Dynamic Systems

2 units (selection)

Katsunobu Konishi · PROFESSOR / INTELLIGENT MACHINES, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces automatic control and image recognition techniques that can be used for autonomous control of mechanical systems.

**Outline)** Modeling and control for mechanical systems such as actuators, robotic manipulators and aerial vehicles are introduced in the first half of this class. In the second half, image processing and image recognition techniques are introduced in order to obtain environmental information necessary for autonomous control behaviour.

**Fundamental Lecture)** “Actuator Control Theory”(1.0, ⇒p.25), “System Design”(1.0, ⇒p.24), “Image Processing”(1.0)

**Relational Lecture)** “Visual pattern processing”(0.5, ⇒p.163)

**Requirement)** Students are required to have a good understanding of undergraduate-level automatic control theory and image processing.

**Goal)**

1. To understand the procedures and tools of control system design.
2. To understand the feature space analysis and object detection techniques.

**Schedule)** 1. Actuator 2. Sensor 3. Equation of motion (robot arm) 4. Equation of motion (aerial vehicle) 5. Modal analysis 6. Reduced order model 7. Vibration control 8. Trajectory control 9. Intermediate examination 10. Image processing (color space) 11. Image processing (filtering) 12. Image processing (bird view observation) 13. Brightness pattern analysis 14. Feature space analysis 15. Object detection 16. Final examination

**Evaluation Criteria)** Evaluate base on two examinations and reports.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216795>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Konishi (M423, +81-88-656-7383, konishi@me.tokushima-u.ac.jp)

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## Advanced Production Technology

2 units (selection)

Tohru Ishida · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

Yoshihiro Tada · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduce electrical discharge machining and plasticity theory for powder processings that can be used for advanced manufacturing and novel material fabrication.

**Outline)** In the former half of the class, the principles and fundamentals of electrical discharge machining and related machine tools are discussed. In the latter half of the class, powder forming processing and plasticity theories for compressive metals (porous metals) are discussed.

**Style)** Lecture

**Keyword)** *electrical discharge machining, electrical discharge machine, powder metallurgy, plasticity theory*

**Requirement)** Students are required to have a good understanding on fundamentals of machining and forming technologies, machine tools, physics, chemistry, and mathematics.

**Goal)**

1. To understand non-traditional machining technologies based on electrical discharge machining and related machine tools.
2. To understand powder forming processings and plasticity theory for compressive metals.

**Schedule)** 1. Fundamentals of electrical discharge machining and its machining characteristics 1 2. Fundamentals of electrical discharge machining and its machining characteristics 2 3. Electrical discharge machine 1 4. Electrical discharge machine 2 5. Micromachining and surface treatment based on electrical discharge machining 6. Electrical discharge machining for less- and non-conductive materials 7. Electrical discharge machining of holes with curved axis and holes with changing cross sections 8. Exercise 9. Introduction to powder forming processings 10. Consolidation characteristics of powder and forming characteristics of sintered preform 11. Yield criterion of porous metal 12. Plasticity theory for porous metal 13. Consolidation criterion of powder 14. Variational principle for porous metal 15. Upper bound theorem for porous metal 16. Examination

**Evaluation Criteria)** Assignments count 70%, exercises and examinations count 30%.

**Textbook)** Printed synopses are used.

**Reference)**

- ◇ For the first half: To be introduced in the class
- ◇ For the latter half: Advances in Powder Forming Processes and Related Technologies, Corona Publ. Co., ISBN4-339-04367-2

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216727>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ishida (M321 088-656-7379 ishida@me.tokushima-u.ac.jp)  
⇒ Tada (M319 088-656-7381 tada@me.tokushima-u.ac.jp)

**Note)** Students are required preparation (2 hours) and review (2 hours) for every two hours class work.

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## Micro-Nano Engineering

2 units (selection)

Tetsuo Iwata · PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces measurement techniques and instruments for analyzing and developing new materials.

**Outline)** Prof. Hanabusa lectures on the method of materials evaluation by means of X-ray diffraction: Principle of X-ray diffraction, macro and micro lattice strains, and residual stress measurement. Prof. Iwata reviews instrumental methods for extracting information on materials using optical and spectroscopic techniques: Scientific measurements, data processing, and instrumentation for chemical analysis.

**Style)** Portfolio

**Keyword)** *X-ray structure analysis, scientific measurements*

**Relational Lecture)** “Materials Surface Performance Control”(0.5, ⇒p.119), “Advanced Micro-Nano Engineering”(0.5, ⇒p.120), “Instrument and Control Engineering”(0.5, ⇒p.118)

**Requirement)** Students are required to have a good understanding of undergraduate-level related subjects.

**Goal)**

1. To understand x-ray diffraction method and its application for material science
2. To understand scientific measurements and instrumentation technology

**Schedule)** 1. Basics of X-rays 2. Lattices and crystal structures 3. Crystal axes and reciprocal lattice 4. Scattering by an atom 5. Diffraction by small crystal 6. Kinds of residual stresses 7. X-ray stress measurement 8. Instruments for scientific measurements 9. Instrumental methods for chemical analysis 10. Microscopy and near-field optics 11. Analytical instruments 1 12. Analytical instruments 2 13. Electronics for scientific measurements 14. Data-processing method for scientific measurements 15. System design for scientific measurements 16. Report and presentation

**Evaluation Criteria)** Assignments counts 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216886>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Iwata (M427, +81-88-656-9743, iwata@me.tokushima-u.ac.jp)
- ⇒ Hanabusa .

## Materials Surface Performance Control

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Daisuke Yonekura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** The nano processing of the material surface in the atomic and molecular level is carried out by the surface modification methods such as PVD or CVD. The material surface nano processing to manifest the new performance in the material surface and its evaluation is explained in this lecture. The development of the new functional materials and the precept to its application are given.

**Outline)** In this lecture, the surface micro processing which manifests new performance on the surface of material by processed under the atom or molecule level is explained, and its evaluation also is mentioned. How to be invested the transparency, electrical and electronic properties, photocatalytic materials and gas barrier by PVD or CVD methods is explained. Then, the effects of surface modification on the mechanical properties such as fatigue, friction-wear and corrosion of materials are discussed and then its evaluation is mentioned.

**Style)** Lecture

**Keyword)** *surface modification, PVD, CVD, functional thin film, surface engineering*

**Relational Lecture)** “Advanced Micro-Nano Engineering”(0.5, ⇒p.120), “Controlling Physical Properties of Crystalline Materials”(0.5, ⇒p.115), “Micro-Nano Engineering”(0.5, ⇒p.118)

**Requirement)** 特になし

**Goal)**

1. Understanding of functional materials development
2. Understanding of evaluation of material surface performance
3. Understanding of nano processing
4. Understanding of mechanical properties of functional materials

**Schedule)** 1. Function of material surface 2. Nano processing of material surface 3. Nano processing of material surface 4. Nano processing of material surface 5. Material surface modification by PVD and CVD 6. Material surface modification by PVD and CVD 7. Group discussion 8. Evaluation methods of material surface performance 9. Evaluation methods of material surface performance 10. Transparency 11. Electromagnetic wave shielding properties 12. Electric properties 13. Improvement of corrosive resistance 14. Improvement of friction and wear properties 15. Improvement of fatigue properties 16. Group discussion

**Evaluation Criteria)** Over 60% of group discussion, reports and Examination

**Textbook)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216856>

**Contact)**

- ⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

## Intelligent Information Systems

2 units (selection)

Hiroaki Ogata · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Hiroyuki Mitsuhashi · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Kazuhide Kanenishi · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Teruaki Ito · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** Learning the design methods of intelligent information systems such as educational software and interactive systems.

**Outline)** Intelligent systems and their mechanics. Intelligent CAI. Intelligent interface. Micro-worlds in intelligent CAI. Learner-teacher modelling. Knowledge acquisition models. Empirical and analytical machine learning, e. g., ID3, similarity-, explanation-, and case-based learning. Genetics-based machine learning, e. g., genetic evolution and co-evolution of production systems, finite state machines, recurrent neural networks, and strategic knowledge. Concepts of collaborative interface systems based on intelligent interactions, and their implementation for design support systems.

**Style)** Lecture and exercise

**Keyword)** *intelligent interface, intelligent educational systems, intelligent agents, CSCW, CSCL, interactive interface*

**Fundamental Lecture)** “Human Factors”(1.0)

**Relational Lecture)** “Applied Knowledge Systems”(0.5), “Autonomous Adaptive Systems Engineering”(0.5)

**Goal)** Acquisition of the design methods of educational systems and interactive systems

**Schedule)** 1. Overview of Intelligent Information Systems 2. Intelligent CAI 3. Cognitive model for Learning 4. Design of ITS(Intelligent Tutoring System) 5. ILE(Interactive Learning Environment) 6. CSCL 7. Ubiquitous and Mobile Learning Environment 8. Design of Intelligent Interactive System 9. Collaborative Interface 10. Design of Intelligent Information System (1) 11. Design of Intelligent Information System (2) 12. Design of Intelligent Information System (3) 13. Design of Intelligent Information System (4) 14. Design of Intelligent Information System (5) 15. Conclusion

**Evaluation Criteria)** We will grade based on reports and interactive presentation among students.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216763>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Ogata (C507, +81-88-656-7498, ogata@is.tokushima-u.ac.jp) (Office Hour: 月曜日 ~ 金曜日:午後 5 時 ~ 6 時)
- ⇒ Ito (M316, +81-88-656-2150, ito@me.tokushima-u.ac.jp)

**Note)** ◇ 授業計画 1~15 は、各講義のレポートおよび最終試験により達成度評価を行なう。 ◇ 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしようとして授業を受けることが、授業の理解と単位取得のために必要である。

## Visual pattern processing

2 units (selection)

Kenji Terada · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Stephen Karungaru-Githinji · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** The basic technologies which replace the visual pattern processing function of man by computer and their applied technologies are made to master.

**Outline)** The advanced processing techniques of visual pattern, i.e., the pre-processing techniques, the feature extraction techniques, the classification techniques of visual pattern, the processing techniques of color image and their application examples are lectured.

**Style)** Lecture in combination with Portfolio

**Keyword)** *pattern recognition, vision, image processing*

**Fundamental Lecture)** “Applied Image Processing”(1.0, ⇒p.84)

**Goal)** Acquisition of knowledge about the processing theories of visual pattern and their various applied technologies, and the processing technologies of color image

**Schedule)** 1. Concept of pattern recognition 2. Statistical pattern classification method 3. Statistical pattern classification method 4. Pattern classification method by the structural analysis technique 5. Pre-processing method of visual pattern 6. Feature extraction method of visual pattern 7. Feature extraction method of visual pattern 8. Segmentation method of visual pattern 9. Segmentation method of visual pattern 10. Pattern classification method by neural network 11. Pattern classification method by GA 12. Security image processing 13. Tracking of moving object 14. Texture analysis 15. The feature extraction method of color image and its application 16. Periodic examination

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216674>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Terada (Dr.802, +81-88-656-7499, [terada@is.tokushima-u.ac.jp](mailto:terada@is.tokushima-u.ac.jp)) (Office Hour: 月, 水曜日 15:00~ 17:00(年度ごとに学科の掲示を参照すること))

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Advanced conversion systems of resource energy

2 units (selection)

Yoshiyuki Kidoguchi · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To learn special knowledge concerning present energy resources and energy supplying systems, to understand principle and mechanism of energy conversion, and to improve thinking faculty for application of new energy and its conversion

**Outline)** To explain effective combustion technologies, reasonable utilization of energy and application of unused energy for saving consumption of fossil fuels and primary energy on the point of saving resources, energy and preserving the environment

**Style)** Portfolio

**Keyword)** *energy conversion, energy resources, utilization of energy, environmental protection, energy saving*

**Requirement)** None

**Notice)** None

**Goal)** To understand fundamentals of energy conversion and to consider effective utilization of energy and improvement of energy conversion technologies

**Schedule)** 1. Present state of energy resources 2. Energy and environmental problem 3. Future view of energy resources 4. Fundamentals of energy conversion (1) 5. Fundamentals of energy conversion (2) 6. Principle of energy conversion (1) 7. Principle of energy conversion (2) 8. Principle of energy conversion (3) 9. Technologies of energy conversion (1) 10. Technologies of energy conversion (2) 11. Technologies of energy conversion (3) 12. Approach to effective utilization of energy (1) 13. Approach to effective utilization of energy (2) 14. Application of new energy (1) 15. Application of new energy (2)

**Evaluation Criteria)** Appraise the understanding of the content of the lecture by setting some reports

**Textbook)** None

**Reference)** None

**Webpage)** <http://www.eco.tokushima-u.ac.jp/w3/miwa/index.html>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216674>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kidoguchi (Eco502, +81-88-656-9633, [kidog@eco.tokushima-u.ac.jp](mailto:kidog@eco.tokushima-u.ac.jp))

**Note)** ◇Need to submit some reports ◇Every lesson is planned to attain the targets of this lecture. Students' achievement of the targets is partly accessed by the reports.

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### Advanced Micro-Nano Engineering

2 units (selection)

Part-time Lecturer

**Target)** This class introduces micro-nano process, especially photo-induced processes

**Outline)** Basics of micro-nano engineering for the beginners.

**Requirement)** Students are required to have a good understanding of under-graduate level physics and related subjects.

**Goal)** To obtain advanced knowledge for performing a research project on micro-nano engineering using a laser.

**Schedule)** 1. Basics of micro-nano engineering 2. Various micro-nano process and photo-induced process 3. Laser radiation and oscillator 4. Optical components for laser systems 5. Laser induced phenomena 6. Heat conduction in laser processing 7. Laser welding 8. Laser drilling and cutting 9. Ultra-fast laser processing 10. Micro thermal process 11. Micro/nano processing in industry 12. Thermal inkjet process 13. Piezo inkjet process 14. Inkjet for biotechnology 15. Latest inkjet technology 16. Examination

**Evaluation Criteria)** Assignments counts 100%

**Textbook)** Norimitsu Hirai, Practical Laser Technology, Kyoritsu publishing ISBN4-320-08470-5 Takeshi Amari, Inkjet printer, CMC publishing ISBN4-88231-859-8 Electronic files on Web

**Reference)** Mitsuo Nakazawa, Practical Ultrafine Process and Measurement, NTS ISBN4-86043-035-2 Kenichi Iga, Basic Laser Optics, Ohm-sha ISBN4-274-02137-8 Kunihiko Sato, Yoshihiko Mukai, Masao Toyoda, Welding Engineering, Rikogaku-sha ISBN4-8445-2108-X

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216803>

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### Advanced Exercise on Mechanical Engineering

2 units (compulsory)

All teachers

**Target)** To obtain comprehensive insight in the field of mechanical engineering.

**Outline)** Advanced exercise on mechanical engineering.

**Style)** Portfolio, Lecture in combination with Portfolio

**Keyword)** *mechanical engineering, Doctor thesis*

**Requirement)** N/A

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216604>

**Student)** Able to be taken by only specified class(es)

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### Advanced Research on Mechanical Engineering

2 units (compulsory)

Teachers in other colleges or departments

**Target)** To obtain broad information on recent engineering.

**Outline)** To research a theme in a technology, which is different from the main technology in your field.

**Style)** Portfolio, Lecture in combination with Portfolio, Lecture and exercise

**Keyword)** *engineering, technology, different field*

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn a recent technology, which is different from the main technology in your field.

**Schedule)** Choose a theme on technology or engineering.

**Evaluation Criteria)** Evaluated with portfolio or examination.

**Textbook)** Ask to teachers.

**Reference)** Prints.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216605>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ 教務係.



## Earth and Life Environmental Engineering — Chemical Science and Technology

### SYLLABUS OF SUBJECTS

#### • Integrated Subjects

<b>Human Factors</b> ... Yoshida .....	123
<b>Life Science</b> ... Takagi · Tsuji .....	123
<b>Social Science</b> ... yokohata .....	123
<b>Science and Technology Studies</b> ... Tanaka .....	124
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee, Faculty of Engineering · First-line men with experience of practical business .....	124
<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和 .....	124
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	125
<b>Long-term Internship (D)</b> ... Yamanaka .....	125
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer .....	125
<b>International Advanced Technology and Science 1</b> ... Murakami .....	126
<b>International Advanced Technology and Science 2</b> ... Murakami .....	126
<b>Presentation Method (D)</b> ... Graduate School of Advanced Technology and Science .....	126
<b>Internship (D)</b> .....	126
<b>Venture Business (D)</b> .....	127

#### • Specialized Subjects

<b>Advanced Molecular Design</b> ... Ute · Hirano .....	127
<b>Advanced Molecular Transformations</b> ... Kawamura .....	127
<b>Chemical Process Design and Development</b> ... Sugiyama · Sotowa .....	127
<b>Functional Materials</b> ... Yabutani · Minagawa · Yasuzawa .....	128
<b>Materials Chemistry</b> ... Uosaki · Kanazaki .....	128
<b>Surface Science and Technology</b> ... Moriga · Murai .....	128
<b>Transport Process Engineering</b> ... Katoh · Horikawa .....	129
<b>Bioprocess Engineering</b> ... Suzuki .....	129
<b>Advanced Lecture on Quantum Nanostructure Semiconductors</b> ... Isu · Kitada .....	129

#### • Specialized Exercise and Experiments

<b>Advanced exercise on chemical science and technology</b> ... All teachers .....	130
<b>Advanced research on chemical science and technology</b> ... Teachers in other colleges or departments ...	130

**Target** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule** 1. What is Human Factors 2. Historical Overview of Human Factors 3. Multi-Disciplinary Aspect of Human Factors 4. Health and Safety Issue of Human Factors 5. Human Psychological Capability 6. Task Analysis 7. Human Error 8. Universal Design 9. Cognitive Artifact 10. Visibility and Affordance 11. Human-Computer Interaction 12. Human Information Processing 13. Knowledge and Mental Model 14. Usability Paradigms and Principles 15. Evaluation and Testing 16. Making system that makes us smart

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Yoshida (+81-88-656-7897, yos@ias.tokushima-u.ac.jp)

#### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** Understanding of significance of protein in biotechnology

**Outline** Basics of structure, function and application of protein are introduced

**Style** Lecture

**Keyword** *protein, enzyme, biotechnology*

**Goal**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule** 1. Introduction of life science 2. History of life science 3. Structure and function of DNA and RNA 4. mRNA is a template of protein 5. Duplication of DNA 6. Regulation of protein expression 7. Human Genetics 8. Genetic disease 9. DNA diagnosis 10. Structure and function of protein 11. Principle of gene technology (1) 12. Principle of gene technology (2) 13. Protein engineering 14. Future of life science (1) 15. Future of life science (2) 16. Preparation of report

**Evaluation Criteria** Evaluation by report

**Textbook** To be introduced in the class

**Reference** To be introduced in the class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

#### Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

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#### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp)

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## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文学の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 4. 馬力の発見—農業技術の革新とヨーロッパ社会 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業社会 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

⇒ Tanaka . (Office Hour: tanaka@kenroku.kanazawa-u.ac.jp)  
⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業

家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

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## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Relational Lecture)** "Introduction to Intellectual Property"(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.



**Schedule** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方 -特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識 -特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook** To be used textbooks made by lecturers.

**Reference** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

非常勤講師

**Target** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型“葉っぱビジネス”“いろどり”や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。 <参考:平成22年度ビジネスモデル特論> 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土):20:15-21:45 月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ぐ奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要な文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. 学びは効果をもたらしたか?!!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 学びは効果をもたらしたか?!!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference** Several are introduced in class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student** 徳島大学大学院先端技術科学教育部マスターコース、及び、ドクターコースの学生

**Contact**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有 (088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style** Lecture

**Keyword** management, management of technology

**Relational Lecture** "Management Theory of New Business"(0.5, ⇒p.124), "Long-term Internship (D)"(0.5, ⇒p.125), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.125)

**Notice** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook** It doesn't specially use. The summary and so on is distributed every time.

**Reference** Several are introduced in class.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

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### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target** This is an intensive course for advanced technology and science in English which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in English.

**Outline** In this course, an intensive course for advanced technology and science in English should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in English can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in English should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in English and then the power of expression and presentation in English would be improved.

**Evaluation Criteria** an enterprising behavior, portfolio and reports

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

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### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in English. The students also study advanced technology and science in

its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline** In this course, the students attend to intensive classes on advanced technology and science in English at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in English. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in English.

**Goal**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria** Enterprising behavior, reports and portfolio.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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### Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal** The lecture is aiming at having knowledge and experience of the presentation in international conferences.

**Evaluation Criteria** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student** Able to be taken by only specified class(es)

**Note** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Internship (D)

2 units (selection)

**Target** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student** Able to be taken by only specified class(es)

**Note** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Advanced Molecular Design

2 units (selection)

Koichi Ute · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Tomohiro Hirano · ASSOCIATE PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The purpose of this class is to understand the principles of precise synthesis and polymerization reactions from the viewpoint of ligand design, asymmetric induction, etc.

**Outline)** Advanced discussion of current aspects of molecular design. Organic reaction mechanism and molecular design. Polymer synthesis, polymerization mechanism, and macromolecular design. Supramolecular chemistry. Correlation between inter- or intramolecular structure and chemical reactivity or functionality.

**Style)** Portfolio

**Keyword)** *chain polymerization, living polymerization, stereospecific polymerization*

**Fundamental Lecture)** "Advanced Topics in Polymerization Reactions"(1.0, ⇒p.34)

**Relational Lecture)** "Functional Materials"(0.5, ⇒p.128)

**Requirement)** Requires undergraduate level knowledge of organic and polymer chemistry.

**Goal)**

1. To understand the principles of precise synthesis.
2. To understand the principles of precise polymerization.

**Schedule)** 1. organic radicals 2. radical structure and reactivity 3. radical structure and reactivity 4. molecular design based on radical mechanism 5. synthesis of functional polymers by radical polymerization 6. polymerization with heterogeneous catalysts 7. polymerization with homogeneous catalysts 8. polymerization with transition metal catalysts - stereocontrol 9. reaction control by Lewis acids 10. stereospecific polymerization 11. reaction field and molecular design 12. molecular assembly and molecular design 13. reaction control in asymmetric field 14. application of physical gels to polymerization reaction 15. molecular design and synthesis of dendritic polymers

**Evaluation Criteria)** Assignments counts 100% mainly based on the report submitted.

**Textbook)** Printed synopses will be distributed.

**Reference)** 野瀬卓平他編「大学院高分子科学」講談社

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216880>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ute (化学棟 406, +81-88-656-7402, [ute@chem.tokushima-u.ac.jp](mailto:ute@chem.tokushima-u.ac.jp)) (Office Hour: Monday 15:00 - 17:00)

⇒ Hirano (G405, [hirano@chem.tokushima-u.ac.jp](mailto:hirano@chem.tokushima-u.ac.jp))

## Advanced Molecular Transformations

2 units (selection)

Yasuhiko Kawamura · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Let students understand the latest synthetic methodology of highly functionalized organic molecules. The method enhances both the energy and atomic efficiency.

**Outline)** This lecture shows modern synthetic methodologies, i.e. reagents, synthetic design, and synthetic processes, etc., which are situated as a basic concept of the synthesis of biologically active molecules and of high functionalized organic molecules.

**Style)** Lecture in combination with Portfolio

**Keyword)** *biologically active molecule, organometallic compound, microwave, green sustainable chemistry, excited state chemistry*

**Fundamental Lecture)** "Advanced Organic Chemistry"(1.0, ⇒p.34)

**Relational Lecture)** "Advanced Molecular Design"(0.5, ⇒p.127)

**Requirement)** Students should have sound knowledge of organic chemistry of the master-course level.

**Goal)**

1. Understanding the synthetic method of biologically active molecules by microwave activation.
2. Understanding environmentally friendly and highly stereoselective organic syntheses by using organometallic reagents.
3. Understanding the organic reaction mechanism and basic computer chemistry.

**Schedule)** 1. Introduction to the microwave chemistry 2. Microwave excitation and its application 3. Application of the microwave excitation to the molecular conversion (1) 4. Application of the microwave excitation to the molecular conversion (2): 5. Introduction of the green, homogenous organometallic catalyst to the highly selective organic synthesis 6. Application of the green, homogenous organometallic catalyst to the highly selective organic synthesis 7. Introduction of the green, solid acidic catalyst to organic synthesis 8. Application of the green, solid acidic catalyst to organic synthesis 9. Application of the green, solid catalyst to the highly selective oxidation reaction 10. Molecular modelling: molecular orbital theory 1 11. Molecular modelling: molecular orbital theory 2 12. Excited state chemistry 1: Interaction of organic molecules with light 13. Excited state chemistry 2: Reaction mechanisms of the photoexcited organic molecules 14. Excited state chemistry 3: Reaction mechanisms of the photoexcited organic molecules 15. Excited state chemistry 4: Application of the photoexcited molecules

**Evaluation Criteria)** Credit is given to the students who earn the total 60% up scores. The score is assigned by evaluating the reports submitted.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216862>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawamura (410 Chem Bldg, +81-88-656-7401, [kawamura@chem.tokushima-u.ac.jp](mailto:kawamura@chem.tokushima-u.ac.jp))

## Chemical Process Design and Development

2 units (selection)

Shigeru Sugiyama · PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Ken-ichiro Sotowa · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The purpose of this class is to introduce the basic theory of both reaction engineering and plant engineering

**Outline)** The required properties of industrial catalysts, as well as their application to industrial processes will be explained. The recent techniques to analyze the local structure of active sites will also be introduced. An emphasis is placed on the application of XPS, EXAFS and solid NMR. Portfolio style is also available.

**Style)** Lecture in combination with Portfolio

**Keyword)** *catalyst, NMR, EXAFS, chemical reactor, microreactor*

**Fundamental Lecture)** "Surface Science and Technology"(0.5, ⇒p.128), "Advanced Molecular Transformations"(0.4, ⇒p.127)

**Relational Lecture)** "Advanced Molecular Design"(0.3, ⇒p.127), "Materials Chemistry"(0.3, ⇒p.128)

**Requirement)** Requires undergraduate level knowledge of catalyst chemistry and reaction engineering.

**Notice)** Preparations for lessons review will be needed.

**Goal)**

1. To understand the state of art of industrial catalysts and its industrial applications in the lectures from 1st to 5th and 11th to 13th.
2. To understand the advanced technique of analysing local structure of catalysts in the lectures from 6th to 10th and 14th to 15th.

**Schedule** 1. Industrial catalysts(1): State of art of reactors and catalysts 2. Industrial catalysts(2): Catalyst preparation 3. Industrial catalysts(3): Status and future of catalysts for chemicals' production 4. Industrial catalysts(4): Status and future of catalysts for environment protection 5. Industrial catalysts(5): Applications to industrial plants, including microreactors 6. Analysis of local structure (1): XPS 7. Analysis of local structure (2): Introduction to EXAFS 8. Analysis of local structure (3): Application of EXAFS 9. Analysis of local structure (4): Introduction to solid state NMR 10. Analysis of local structure (5): Application of solid state NMR 11. Case study (1): Application of EXAFS to catalysts 12. Case study (2): Application of EXAFS to environmental protection materials 13. Case study (3): Application of solid state NMR to catalysts 14. Case study (4): Application of solid state NMR to environmental protection materials 15. Case study (5): Summary. Submission of the report on the present course will be requested.

**Evaluation Criteria** Assignments counts 100% mainly based on the report submitted.

**Textbook** All lecture documents will be opened through U-learning system.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216877>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Sugiyama (G309, +81-88-656-7432, sugiyama@chem.tokushima-u.ac.jp) (Office Hour: 16:00-17:00 on Monday and Tuesday.)

⇒ Sotowa (Chemistry and biotechnology building, 307., sotowa@chem.tokushima-u.ac.jp) (Office Hour: 16:00-17:00 on Monday and Tuesday.)

## Functional Materials

2 units (selection)

Tomoki Yabutani · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Keiji Minagawa · ASSOCIATE PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Mikito Yasuzawa · ASSOCIATE PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** To understand functions and applications of various functional materials.

**Outline** This class introduces various materials based on functional polymers. The mechanism and design of physical and chemical functions of polymer materials are introduced in detail. Furthermore, this class involves a lecture for preparation and characterization of materials with electrochemical devices.

**Style** Portfolio

**Keyword** functional material, functional polymer, sensor material, soft matter, biocompatible material

**Goal**

1. To understand properties and applications of various functional materials.
2. To understand mechanisms of functions and application method of material design.

**Schedule** 1. Introduction to Functional Materials 2. Functional Polymers as Sensor Materials 3. Preparation of Various Sensors 4. Analysis of Sensor Properties 5. Evaluation of Sensor Properties 6. Characteristics and Preparation of Soft Matter 7. Properties of Polymer Solution 8. Thermosensitive Polymer Materials 9. Rheology of Soft Matter 10. Rheological Function of Materials 11. Design and Synthesis of Biocompatible Materials 12. Evaluation of Biocompatible Materials and its Application 13. Design and Synthesis of Electroconductive Polymers 14. Evaluation of Electroconductive Polymers and its Application 15. Surface Functional Modification 16. まとめ

**Evaluation Criteria** The No. 1 and No. 2 objectives of this class mentioned above are related with the lecture No. 1-15 and No. 6-10, respectively. The final grades will be determined numerically by averaging your scores with homework and reports. The score will be described as 100-points scale. You will be passed for this class if you get over 60 point.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216618>

**Contact**

⇒ Yabutani (G605, +81-88-656-7413, yabutani@chem.tokushima-u.ac.jp)  
⇒ Minagawa (G612, +81-88-656-9153, minagawa@chem.tokushima-u.ac.jp)  
⇒ Yasuzawa (G512, +81-88-656-7421, mik@chem.tokushima-u.ac.jp) (Office Hour: 月曜日 16:30~17:30)

## Materials Chemistry

2 units (selection)

Yasuhiro Uosaki · PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Eiji Kanazaki · PROFESSOR / PHYSICO-CHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** To understand the molecular aspects of solid-state properties and/or fluid properties of materials(Uosaki). To understand the structure and electronic states of molecular crystal including metal ions(Kanazaki).

**Outline** 無機、有機及び有機無機複合材料の機能設計、合成及び物性を分子論的立場から理解する為に必要な電気化学、量子化学、化学熱力学、表面化学、固体化学及び材料化学等における最近の発展を講述する。(魚崎) 流体(気体、液体)の物性を、ミクロレベルで理解し、集合系の特異な性質・機能の開発と応用について講述する。(金崎) イオン性結晶、分子性結晶及び非晶質等における固体化学の基礎や、材料化学の最近の展開を主として分子科学の観点から論ずる。

**Style** Lecture

**Keyword** material development, supercritical fluids

**Fundamental Lecture** "Advanced exercise on chemical science and technology"(1.0, ⇒p.130), "Advanced research on chemical science and technology"(1.0)

**Relational Lecture** "Advanced exercise on chemical science and technology"(0.5, ⇒p.130), "Advanced research on chemical science and technology"(1.0)

**Requirement** not particular needed

**Goal**

1. To understand the structures and properties of fluids and to develop an ability to apply supercritical fluids to environmental problems
2. ability for discussion properties of condensed phases from the aspect of molecules

**Schedule** 1. Structures of fluids 2. Properties of fluids 3. Physical properties of supercritical fluids (1) 4. Physical properties of supercritical fluids (2) 5. Applications of supercritical fluids 6. Nature of molecules(1) 7. Nature of molecules(2) 8. electronic states of molecules(1) 9. electronic states of molecules(2) 10. electronic states of molecules(3) 11. electronic states of molecules(4) 12. electronic states of molecules(5) 13. molecular assembly(1) 14. molecular assembly(2) 15. molecular assembly(3) 16. examination

**Evaluation Criteria** Evaluation is made by means of examination and presentation.

**Textbook** Will be introduced at the first lecture.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216670>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Uosaki (G510, +81-88-656-7417, uosaki@chem.tokushima-u.ac.jp) (Office Hour: Monday (17:00-18:00))  
⇒ Kanazaki (G516, +81-88-656-9444, kanazaki@chem.tokushima-u.ac.jp) (Office Hour: 年度毎に学科の掲示を参照すること)

## Surface Science and Technology

2 units (selection)

Toshihiro Moriga · PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Kei-ichiro Murai · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** The purpose of this class is to understand the basic characteristics of surface and bulk and their differences, which are necessary in developing new material science.

**Outline** This class will introduce surface structures and surface phenomena, governing the physical properties of combustion catalysts, electrode materials for fuel cell, transparent conducting materials, phosphors and oxynitrides for photocatalysts, and fundamentals of surface modifications for advanced functional materials.

**Style** Portfolio

**Keyword** bulk, surface, photocatalyst, transparent conducting oxide, solid oxide fuel cell, phosphor, X-ray photoelectron spectroscopy, X-ray absorption fine structure

**Fundamental Lecture** "Physical Properties of Materials"(0.2), "Materials Process Engineering"(0.2), "Material Science"(0.2), "Advanced Materials Science"(0.2, ⇒p.37)

**Relational Lecture** "Advanced exercise on chemical science and technology"(0.5, ⇒p.130), "Advanced research on chemical science and technology"(0.5)

**Requirement** Nothing special.

**Notice** Reports should be submitted within two weeks after the assignment.

**Goal** To understand the outline of materials in which their surface structures and surface phenomena are effectively used.

**Schedule**) 1. Orientation 2. Recent topics on metal oxynitrides for photocatalysts -1- 3. Recent topics on metal oxynitrides for photocatalysts -2- 4. Recent topics on transparent conducting oxides thin films -1- 5. Recent topics on transparent conducting oxides thin films -2- 6. Recent topics on transparent conducting oxides thin films -3- 7. Recent topics on X-ray spectroscopy -1- 8. Recent topics on X-ray spectroscopy -2- 9. Recent topics on X-ray spectroscopy -3- 10. Recent topics on phosphors for white LEDs -1- 11. Recent topics on phosphors for white LEDs -2- 12. Recent topics on combustion catalysts -1- 13. Recent topics on combustion catalysts -2- 14. Recent topics on electrode materials for fuel cells -1- 15. Recent topics on electrode materials for fuel cells -2- 16. Final reports, dissertational defense

**Evaluation Criteria**) Assignment counts 100% based on the reports submitted and on the result of dissertational defense.

**Textbook**) To be announced in the class.

**Reference**) To be announced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216855>

**Student**) Able to be taken by student of other department

**Contact**)

⇒ Moriga (M603, +81-88-656-7423, [moriga@chem.tokushima-u.ac.jp](mailto:moriga@chem.tokushima-u.ac.jp)) (Office Hour: Monday 4:30pm—5:30pm for 1st semester, Thursday 4:30pm—5:30pm for 2nd semester)

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## Transport Process Engineering

2 units (selection)

Masahiro Katoh · ASSOCIATE PROFESSOR / SYNTHETIC AND POLYMER CHEMISTRY, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Toshihide Horikawa · ASSOCIATE PROFESSOR / CHEMICAL PROCESS ENGINEERING, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) The purpose of this class is to understand the transport phenomena on the interface of differential phases (gas, liquid and solid) for production and environmental preservation processes.

**Outline**) Interfacial mass transfer analysis in various production and environmental processes, with an emphasis on the process systemization based on the manipulation of fluid flow near material surfaces and molecular transport in functional materials matrices. Analysis and design of chemical separation processes in terms of the molecular transport control within membranes and porous structures. Design of high functional porous micro-structured materials and spectroscopic analysis of molecular transfer phenomena in these materials.

**Style**) Portfolio

**Keyword**) *mass transfer, separation processes*

**Fundamental Lecture**) “Advanced Separation Technology”(1.0, ⇒p.36)

**Requirement**) Nothing special

**Notice**) 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をした上で授業を受けることが、授業の理解と単位取得のために必要である。

**Goal**)

1. To understand transport phenomena on interface of differential phases
2. To understand analysis method of the phenomena in micro porous for separation processes

**Schedule**) 1. The principle of mass transfer 2. Mass transfer on gas-liquid interface 3. Mass transfer on gas-solid interface 4. Mass transfer on solid-liquid interface 5. Mass transfer process using membrane 6. Adsorption separation processes 7. Adsorption velocity and diffusion 8. Porous materials 9. Synthesis of porous materials 10. Analysis of porous materials 11. Adsorption processes using zeolites 12. The control of molecular transfer in micro porous materials 13. High functionalized porous materials 14. Analysis of solid materials by IR spectroscopy 15. Spectroscopic analysis for phenomena in porous materials

**Evaluation Criteria**) Assignment counts 100% mainly based on the report submitted.

**Textbook**) To be announced in the class.

**Reference**) To be announced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216554>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Katoh (M304, +81-88-656-7429, [katoh@chem.tokushima-u.ac.jp](mailto:katoh@chem.tokushima-u.ac.jp))

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## Bioprocess Engineering

2 units (selection)

Yoshihisa Suzuki · ASSOCIATE PROFESSOR / PHYSICOCHEMISTRY AND MATERIAL SCIENCE, CHEMICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target**) This class introduces basic concepts and methods of protein crystallization.

**Outline**) Basic concepts, methods and recent developments of protein crystallization.

**Style**) Lecture

**Keyword**) *crystal growth, protein*

**Fundamental Lecture**) “Basic Physical Chemistry”(1.0)

**Relational Lecture**) “Advanced Physical Chemistry”(0.5, ⇒p.35)

**Requirement**) Students are required to have a good understanding of master course-level biochemical and biophysical sciences.

**Goal**) To understand the growth mechanisms of protein crystals

**Schedule**) 1. Structure analysis of protein molecules 2. Significance of protein crystallization 3. Fundamentals of crystal growth I : Solubility 4. Fundamentals of crystal growth II : Nucleation 5. Fundamentals of crystal growth III : Growth & Dissolution 6. Fundamentals of crystal growth IV : Characterization 7. Solubility of protein crystals 8. Nucleation of protein crystals 9. Growth of protein crystals 10. Surface morphologies of protein crystals 11. High pressure crystallization of protein molecules 12. Polymorphism of protein crystals 13. High pressure crystallography of protein molecules 14. Activation energy of the incorporation of protein molecules into crystals 15. Activation volume of the incorporation of protein molecules into crystals

**Evaluation Criteria**) Assignment counts 100%.

**Textbook**) To be announced in the class

**Reference**) To be announced in the class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216733>

**Contact**)

⇒ Suzuki (G514, +81-88-656-7415, [suzuki@chem.tokushima-u.ac.jp](mailto:suzuki@chem.tokushima-u.ac.jp))

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## Advanced Lecture on Quantum Nanostructure Semiconductors

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target**) This lecture aims at understanding basic concepts of the quantum effects of semiconductor nanostructures based on materials science and various technologies for device applications.

**Outline**) This lecture introduces characteristics of quantum structures and technologies of the device applications, based on quantum mechanics, semiconductor physics, materials science and photonics. Advanced technologies of fabrication and measurements and recent topics of the research are also introduced.

**Style**) Lecture

**Goal**) To understand materials science and application technologies of nano structure semiconductors

**Schedule**) 1. Electronic states in semiconductor quantum structures 2. Electronic properties of quantum structures 3. Optical properties of quantum structures 4. Fabrication technologies of semiconductor nanostructures 5. Evaluation technologies of crystals 6. Evaluation technologies of nanostructures 7. Analysis of electronic properties 8. Analysis of optical properties 9. Quantum effect devices 10. Nonlinear optical responses of semiconductors 11. Responses of optical micro cavity 12. Research progress in quantum nanostructure semiconductors 13. Ultrafast optical devices 14. Quantum information devices 15. Topics of recent advanced research (1) 16. Topics of recent advanced research (2)

**Evaluation Criteria**) Assignments

**Textbook**) None

**Reference**) To be introduced in the class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216907>

**Contact**)

⇒ Isu (A224, +81-88-656-7670, [t.isu@frc.tokushima-u.ac.jp](mailto:t.isu@frc.tokushima-u.ac.jp)) (Office Hour: Tue -Thu 10:00-14:00)

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**Advanced exercise on chemical science and technology**

2 units (compulsory)  
All teachers

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**Target)** To learn how to identify and solve problems in the engineering.

**Outline)** Students will conduct a research work in a field of engineering, and acquire competent knowledge of the field. Students will also learn how to find and solve an engineering problem as an independent researcher.

**Keyword)** *research, doctor thesis*

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216584>

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**Advanced research on chemical science and technology**

2 units (compulsory)  
Teachers in other colleges or departments

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**Target)** To obtain broad information on recent engineering

**Outline)** To research a theme in a technology, which is different from the main technology in your field.

**Style)** Portfolio, Lecture in combination with Portfolio, Lecture and exercise

**Keyword)** *engineering, technology, different field*

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn a recent technology, which is different from the main technology in your field

**Schedule)** Choose a theme on technology or engineering, which is different from that in your field

**Evaluation Criteria)** Evaluated with portfolio or examination

**Textbook)** Ask teachers

**Reference)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216585>

**Student)** Able to be taken by only specified class(es)

## Earth and Life Environmental Engineering — Biological Science and Technology

### SYLLABUS OF SUBJECTS

• **Integrated Subjects**

<b>Human Factors</b> ...Yoshida .....	131
<b>Life Science</b> ...Takagi · Tsuji .....	131
<b>Social Science</b> ...yokohata .....	131
<b>Science and Technology Studies</b> ...Tanaka .....	132
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	132
<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和 .....	132
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	133
<b>Long-term Internship (D)</b> ...Yamanaka .....	133
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer .....	133
<b>International Advanced Technology and Science 1</b> ...Murakami .....	134
<b>International Advanced Technology and Science 2</b> ...Murakami .....	134
<b>Presentation Method (D)</b> ...Graduate School of Advanced Technology and Science .....	134
<b>Internship (D)</b> .....	134
<b>Venture Business (D)</b> .....	135

• **Specialized Subjects**

<b>Biofunctional Design of Biomolecules</b> ...Hori · Uto .....	135
<b>Biomolecular Engineering</b> ...Omasa .....	135
<b>Engineering of Genetic Information</b> ...Noji · Ohuchi · Matsuo .....	135
<b>Cell Signaling System</b> ...Tsuji .....	136
<b>Technology of Enzyme Functions</b> ...Nakamura .....	136
<b>Biofunctional Engineering</b> ...Matsuki .....	136
<b>Molecular Pathogenic Microbiology</b> ...Nagamune · Tomoyasu .....	137

• **Specialized Exercise and Experiments**

<b>Advanced Exercise on Biological Science and Technology</b> ...Teacher of course .....	137
<b>Advanced Research on Biological Science and Technology</b> ...Teachers in other colleges or departments.	137

**Target)** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline)** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule)** 1. What is Human Factors 2. Historical Overview of Human Factors 3. Multi-Disciplinary Aspect of Human Factors 4. Health and Safty Issue of Human Factors 5. Human Psychological Capability 6. Task Analysis 7. Human Error 8. Universal Design 9. Cognitive Artifact 10. Visibility and Affordance 11. Human-Computer Interaction 12. Human Information Processing 13. Knowledge and Mental Model 14. Usability Paradigms and Principles 15. Evaluation and Testing 16. Making system that makes us smart

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Yoshida (+81-88-656-7897, yos@ias.tokushima-u.ac.jp)

### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Understanding of significance of protein in biotechnology

**Outline)** Basics of structure, function and application of protein are introduced

**Style)** Lecture

**Keyword)** *protein, enzyme, biotechnology*

**Goal)**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule)** 1. Introduction of life science 2. History of life science 3. Structure and function of DNA and RNA 4. mRNA is a template of protein 5. Duplication of DNA 6. Regulation of protein expression 7. Human Genetics 8. Genetic disease 9. DNA diagnosis 10. Structure and function of protein 11. Principle of gene technology (1) 12. Principle of gene technology (2) 13. Protein engineering 14. Future of life science (1) 15. Future of life science (2) 16. Preparation of report

**Evaluation Criteria)** Evaluation by report

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact)**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

### Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target)** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline)** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

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### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, [kondo@eco.tokushima-u.ac.jp](mailto:kondo@eco.tokushima-u.ac.jp))

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## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文学の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 4. 馬力の発見—農業技術の革新とヨーロッパ社会 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業社会 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

⇒ Tanaka . (Office Hour: [tanaka@kenroku.kanazawa-u.ac.jp](mailto:tanaka@kenroku.kanazawa-u.ac.jp))  
⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING  
First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業

家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

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## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Relational Lecture)** "Introduction to Intellectual Property"(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.



**Schedule** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方 -特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識 -特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook** To be used textbooks made by lecturers.

**Reference** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

### Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

非常勤講師

**Target** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型“葉っぱビジネス”“いろどり”や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。 <参考:平成22年度ビジネスモデル特論> 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土):20:15-21:45 月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ぐ奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要な文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference** Several are introduced in class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student** 徳島大学大学院先端技術科学教育部マスターコース、及び、ドクターコースの学生

**Contact**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有 (088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

### Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Iritani (Office Hour: 創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp)

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

### Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style** Lecture

**Keyword** management, management of technology

**Relational Lecture** "Management Theory of New Business"(0.5, ⇒p.132), "Long-term Internship (D)"(0.5, ⇒p.133), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.133)

**Notice** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook** It doesn't specially use. The summary and so on is distributed every time.

**Reference** Several are introduced in class.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー: 年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

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### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

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**Target** This is an intensive course for advanced technology and science in English which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in English.

**Outline** In this course, an intensive course for advanced technology and science in English should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in English can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in English should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in English and then the power of expression and presentation in English would be improved.

**Evaluation Criteria** an enterprising behavior, portfolio and reports

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

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### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

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**Target** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in English. The students also study advanced technology and science in

its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline** In this course, the students attend to intensive classes on advanced technology and science in English at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in English. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in English.

**Goal**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria** Enterprising behavior, reports and portfolio.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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### Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

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**Target** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal** The lecture is aiming at having knowledge and experience of the presentation in international conferences.

**Evaluation Criteria** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student** Able to be taken by only specified class(es)

**Note** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Internship (D)

2 units (selection)

**Target** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student** Able to be taken by only specified class(es)

**Note** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

**Venture Business (D)**

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

**Biofunctional Design of Biomolecules**

2 units (selection)

Hitoshi Hori · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Yoshihiro Uto · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Advanced review of concepts and strategies in biofunctional design of biomolecules based on philosophy of biomolecular mimetics.

**Outline)** 生体分子ミメティックスのモレキュラー・ディスクリプター (分子要素) としての具体的な生物活性分子の分子機能設計に関する戦略的メディシナルケミストリーの原理を学ぶ, その応用として医薬品開発の研究戦略についてケーススタディから実践力を養う, 更に Evo-Devo 的視点から病気を生涯発達における事象としてダイナミックに捉え, その視点に立った次世代治療薬の設計についても討議する.

**Style)** Lecture

**Keyword)** *biofunctional design, biomolecular mimetics, structure-activity-relationship*

**Goal)**

1. Advanced medicinal-chemistry based skills for biofunctional design of biomolecules based on biomolecular mimetics.
2. Advanced drug-design skills for drug discovery based on applied medicinal chemistry.
3. Advanced biomedical ethical skills for drug discovery for human disease.

**Schedule)** 1. 生体分子機能設計とは 2. 生体分子ミメティックスとそのモレキュラー・ディスクリプター (分子要素) 3. モレキュラー・ディスクリプターとしての生物活性分子の分子機能設計 4. 分子機能設計学としてのメディシナルケミストリーについて, 課題レポート 1 5. メディシナルケミストリー:リード化合物の発見 6. メディシナルケミストリー:構造活性相関, 課題レポート 2 7. 課題レポート 1 と 2 についての討論 8. メディシナルケミストリー:ファーマコフォアおよびファーマコフォア要素の決定 9. メディシナルケミストリー:ファーマコダイナミクスとファーマコカインेटィックス 10. メディシナルケミストリー:臨床試験 課題レポート 3 11. メディシナルケミストリー:課題レポート 3 について, 生命倫理を含めた討論 12. メディシナルケミストリー:ケーススタディ 1 (高脂血症薬) 13. メディシナルケミストリー:ケーススタディ 2 (癌治療薬) 14. メディシナルケミストリー:ケーススタディ 3 (次世代治療薬 "Boron Trace Drug" の夢), 課題レポート 4 15. 課題レポート 4 について, 生命倫理を含めた討論 16. 総合討論とまとめ

**Evaluation Criteria)** Subject review report 1-4 counts 100%.

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216732>

**Contact)**

⇒ Hori (M821, +81-88-656-7514, hori@bio.tokushima-u.ac.jp) (Office Hour: Monday 11:55-12:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

**Biomolecular Engineering**

2 units (selection)

Takeshi Omasa · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To learn recent progress of biomolecular engineering for bio-based production.

**Outline)** To learn recent progress of biomolecular engineering for next-generation bio-based production.

**Style)** Lecture

**Keyword)** *biotechnology, bio-based production, environment*

**Fundamental Lecture)** "Advanced Microbiological Engineering"(1.0)

**Relational Lecture)** "Technology of Enzyme Functions"(0.5, ⇒p.136)

**Requirement)** undergraduate biotechnology is required

**Goal)** To understand fundamental engineering aspects for bio-based production

**Schedule)** 1. mammalian cell cultivation for therapeutic antibody production 2. Production of functional lipids 3. Bio-based recycling technology 4. Metal biotechnology 5. Soil bacteria and its application 6. Bio-based production from biomass 7. Symbiosis and biotechnology 8. Color in biotechnology 9. Biotechnology in space 10. Algorisms in life 11. Biotechnology in global environment 12. Biotechnology in traditional medicine 13. Supercritical fluid in biotechnology 14. Food biotechnology 15. Cell processing technology 16. Term-end exam report

**Evaluation Criteria)** Term-end exam report (100%)

**Textbook)** To be introduced in the class

**Reference)** コロナ社「バイオプロダクション ーものつくりのためのバイオテクノロジーー」化学工学会 バイオ部会編

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216845>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Omasa (機械 813 (8 階), +81-88-656-7408, omasa@bio.tokushima-u.ac.jp) (Office Hour: Thr 12:00-13:30)

**Engineering of Genetic Information**

2 units (selection)

Sumihare Noji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Hideyo Ohuchi · ASSOCIATE PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

Yoshinori Matsuo · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Target)** To obtain information on recent genetic studies

**Outline)** Lectures on Advanced research on analysis of genetic information of Drosophila, mouse, and human. 2) Analysis of structure and function of the genes based on the genetic information: gene expression, loss of function and gain of function 3) Genetic engineering to create new biological functions. 4) Application of the genetic engineering to improve biological functions. 5) Advanced research on developmental and regeneration biology, focusing on limb development and regeneration. 6) Application of the developmental and regeneration biology to improve biological functions. 7) Recent topics of genetic engineering. 8) Recent topics of developmental biology and its application.

**Style)** Portfolio

**Keyword)** *genome science, molecular biology, genetic engineering*

**Relational Lecture)** "Cell Signaling System"(0.5, ⇒p.136), "Biofunctional Engineering"(0.5, ⇒p.136), "Technology of Enzyme Functions"(0.5, ⇒p.136)

**Requirement)** N/A

**Notice)** N/A

**Goal)** To understand recent information on genetics

**Schedule)** 1. Recent advance in genetics, insects 2. Recent advance in genetics, invertebrates 3. Recent advance in genetic engineering, invertebrates 4. Recent advance in genetics, chicken 5. Recent advance in genetic engineering, chicken 6. Recent advance in genetics, mouse 7. Recent advance in genetic engineering, mouse 8. report for evaluation 9. Recent advance in genetics, human 10. Recent advance in genetic engineering, human 11. Recent advance in genetics, plants 12. Recent advance in genetic engineering, plants 13. Recent advance in RNA engineering 14. Recent advance in detection of gene expression 15. Recent advance in recent topics 1 16. Recent advance in recent topics 2 17. Final report

**Evaluation Criteria)** Evaluate two reports (50% each)

**Textbook)** N/A

**Reference)** Handouts

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216553>

**Student)** Able to be taken by student of other department

**Contact)**  
⇒ Noji (G803, +81-88-656-7528, noji@bio.tokushima-u.ac.jp) (Office Hour: Monday 15:30-17:00)

## Cell Signaling System

2 units (selection)

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class introduces signaling system which regulates cell functions.

**Outline)** Structure of signaling molecule and cell signaling system are introduced.

**Style)** Lecture

**Keyword)** *growth/differentiation factor, receptor, signal transduction*

**Fundamental Lecture)** “Cell Biology”(0.5), “Biochemistry 2”(0.3), “Advanced Biochemistry”(0.3, ⇒p.44)

**Relational Lecture)** “Life Science”(0.2, ⇒p.131)

**Requirement)** Students are required to have a good understanding of undergraduate-level cell biology and biochemistry.

**Goal)**

1. Understanding of regulatory mechanism of biological activity of signaling molecule
2. Understanding of function of receptor and intracellular signaling system

**Schedule)** **1.** Introduction of cell signaling system **2.** Cell structure and function of organelle **3.** Post-translational modification of signaling molecule **4.** Structure of processing enzyme **5.** Function and regulation of processing enzyme **6.** Secretion of signaling molecule **7.** Structure and function of receptor **8.** Protein kinase and protein phosphatase **9.** Transcriptional regulation **10.** Regulation of cell function by AAA protein (1) **11.** Regulation of cell function by AAA protein (2) **12.** Recent research on signaling molecule (1) **13.** Recent research on signaling molecule (2) **14.** Significance of signaling molecule as target for drug design (1) **15.** Significance of signaling molecule as target for drug design (2) **16.** Preparation of report

**Evaluation Criteria)** Evaluation by report

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216660>

**Contact)**  
⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

## Technology of Enzyme Functions

2 units (selection)

Yoshitoshi Nakamura · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand recent progress in the research of enzyme functions

**Outline)** Genetic recombination, development and control of bioreactor for increasing enzyme functions

**Style)** Portfolio

**Requirement)** /

**Goal)** To understand recent progress in the research of genetic recombination, development and application of bioreactor for increasing enzyme functions

**Schedule)** **1.** Breeding and cultivation of genetic recombinant yeast having glucoamylase activity **2.** Breeding and cultivation of glucoamylase-producing recombinant yeast with inactivation of MAT locus **3.** Mathematical model for growth process of glucoamylase-producing recombinant yeast **4.** Mathematical model for growth process of immobilized glucoamylase-producing recombinant yeast **5.** Process analysis of continuous alcohol fermentation with glucoamylase-producing recombinant yeast **6.** Recombinant

Escherichia coli having over expression system of cloned gene for effective production of glucoamylase **7.** Efficient production of recombinant protein using salt-out effect protecting against proteolytic degradation **8.** Efficient production of recombinant protein using bioreactor with membrane filtration **9.** Mathematical model of diauxic growth based on synthesis mechanism of inducible enzyme **10.** Efficient production of inducible enzyme by exchange of substrates **11.** Stability analysis of steady state in a continuous culture with diauxic growth **12.** Mathematical model of immobilized cell culture with diauxic growth **13.** Screening and cultivation of basidiomycete fungi having enzyme degrading undegradable aromatic compounds **14.** Efficient production of enzyme degrading undegradable aromatic compounds by immobilized fungi **15.** Development and application of bioreactor with enzyme degrading undegradable aromatic compounds

**Evaluation Criteria)** Report (assignments count 100%)

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216647>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Nakamura (720, +81-88-656-7518, ynakamu@bio.tokushima-u.ac.jp) (Office Hour: 水曜日 17:00-18:00)

**Note)** ◇When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class time for your understanding and taking credit. ◇成績評価に対する平常点と試験の比率は 50:50 とする。平常点には講義への参加状況、演習への回答及びレポートの提出状況と内容を含み、試験は中間テストと最終試験の成績を含む。

## Biofunctional Engineering

2 units (selection)

Hitoshi Matsuki · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Biological membranes play an important role in structure formation and function revelation of cells. Characteristic properties owned by lipid membranes are mainly described and the structure and function of biological membranes are reviewed.

**Outline)** This lecture describes fundamental matters concerning self-association of biomolecules such as structure of water and hydrophobic effect, properties for molecular aggregates of amphiphilic molecules, after that various structure changes for molecular aggregates formed by lipids such as phase transitions, polymorphism, non-bilayer structure and domain formation are explained. Further, significant functions revealed in biological membranes like transport phenomena and mechanisms of drug action and so on are lectured. Portfolio lessons are also adapted depending on students.

**Style)** Lecture in combination with Portfolio

**Keyword)** *biological membrane, lipid, molecular aggregate, membrane structure, membrane function*

**Fundamental Lecture)** “Biochemical Thermodynamics”(1.0, ⇒p.44), “Advanced Biophysical Chemistry”(1.0, ⇒p.45)

**Requirement)** Students are required to have a good understanding of undergraduate- and postgraduate-level physical chemistry and biophysical chemistry and related subjects.

**Goal)**

1. To understand the structures and nature of molecular aggregates formed by lipids, which are components of biological membranes.
2. To understand the functions revealed by biological membranes such as material transport, signal transduction and drug action.

**Schedule)** **1.** Structures of biological membranes (1) structure of water and hydrophobic interaction **2.** Structures of biological membranes (2) self-association of amphiphilic molecules 1: monolayers **3.** Structures of biological membranes (3) self-association of amphiphilic molecules 2: micelles **4.** Structures of biological membranes (4) bilayer structure and phase transitions of lipid membranes **5.** Structures of biological membranes (5) stability and polymorphism of lipid membranes **6.** Structures of biological membranes (6) non-bilayer structure of lipid membranes **7.** Structures of biological membranes (7) mixed lipid membranes and domain formation **8.** Structures of biological membranes (8) fluidization and dynamics of lipid membranes **9.** Structures of biological membranes (9) surface and membrane potentials **10.** Functions of biological membranes (1) molecular recognition of lipid membranes **11.** Functions of biological membranes (2) ion transport (passive and active transport) **12.** Functions of biological

membranes (3) ion channel and nerve conduction **13.** Functions of biological membranes (4) mechanisms of drug action (specific binding) **14.** Functions of biological membranes (5) mechanisms of drug action (non-specific binding) **15.** Functions of biological membranes (6) cell functions and signal transduction **16.** Report preparation for structures and functions of biological membranes

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216728>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Matsuki (G607, +81-88-656-7513, matsuki@bio.tokushima-u.ac.jp) (Office Hour: Friday 16:20-17:50)

**Note)** Goal 1 is related to schedules 1-9 and goal 2 is related to schedules 10-15.

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### Molecular Pathogenic Microbiology

2 units (selection)

Hideaki Nagamune · PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Toshifumi Tomoyasu · ASSOCIATE PROFESSOR / BIOLOGICAL FUNCTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** This class aims to understand the latest findings on molecular feature and application of virulence factors expressed in pathogenic microorganisms.

**Outline)** The latest findings on virulence factors concerned with infectious diseases by pathogenic microorganisms are introduced in this class. Assignments on the introduced topics are set and marked in portfolio system.

**Style)** Lecture in combination with Portfolio

**Keyword)** *pathogenic microorganism, virulence factor, infection*

**Relational Lecture)** “Biomolecular Engineering”(0.9, ⇒p.135)

**Requirement)** Students are required to have a good understanding of undergraduate-level of microbiology and related subjects

**Goal)**

1. To understand the latest molecular information on virulence factors of pathogenic microorganisms
2. To understand the application technology of microbial virulence factors in molecular level

**Schedule)** **1.** Bacterial toxins 1: CDC pore-forming toxins **2.** Bacterial toxins 2: other pore-forming toxins **3.** Bacterial toxins 3: neuron-directed enzymatic toxins **4.** Bacterial toxins 4: gastrointestinal tissue-directed enzymatic toxins **5.** Bacterial toxins 5: translational step-directed enzymatic toxins **6.** Bacterial toxins 6: superantigens **7.** Plasmids carrying microbial-resistant genes **8.** Fungal toxins 1: small molecular toxins **9.** Fungal toxins 2: protein toxins **10.** Other Bacterial virulence factors 1: adherence factors **11.** Other Bacterial virulence factors 2: enzymes **12.** Other Bacterial virulence factors 3: secretion systems **13.** Viral virulence factors 1: adherence factors **14.** Viral virulence factors 2: enzymes **15.** Viral virulence factors 3: transcriptional factors

**Evaluation Criteria)** Assignments count 100%

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216881>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Nagamune (G707, +81-88-656-7525, nagamune@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** Preparation and review of two hours each are required for understanding of every class with two hours and taking the credits.

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### Advanced Exercise on Biological Science and Technology

2 units (compulsory)

Teacher of course

**Target)** To obtain broad information in addition to information on own field

**Outline)** To learn recent biological technology and experimental techniques

**Style)** Portfolio

**Keyword)** *biology, technology, experiment*

**Relational Lecture)** “Engineering of Genetic Information”(0.5, ⇒p.135), “Technology of Enzyme Functions”(0.5, ⇒p.136), “Cell Signaling System”(0.5, ⇒p.136)

**Requirement)** N/A

**Notice)** N/A

**Goal)** To understand recent biology and biotechnology

**Schedule)** To learn recent biotechnology under direction of a teacher working on bioengineering

**Evaluation Criteria)** Evaluated with portfolios

**Textbook)** Not specified

**Reference)** Provided by teachers

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216744>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Administration Office(M703)

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### Advanced Research on Biological Science and Technology

2 units (compulsory)

Teachers in other colleges or departments

**Target)** To obtain broad information on recent engineering

**Outline)** To research a theme in a technology, which is different from the main technology in your field.

**Style)** Portfolio, Lecture in combination with Portfolio, Lecture and exercise

**Keyword)** *engineering, technology, different field*

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn a recent technology, which is different from the main technology in your field

**Schedule)** Choose a theme on technology or engineering, which is different from that in your field.

**Evaluation Criteria)** Evaluated with portfolio or examination

**Textbook)** Ask to teachers

**Reference)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216745>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ 指導教員

## Earth and Life Environmental Engineering — Ecosystem Engineering

### SYLLABUS OF SUBJECTS

#### • Integrated Subjects

<b>Human Factors</b> ...Yoshida .....	138
<b>Life Science</b> ...Takagi · Tsuji .....	138
<b>Social Science</b> ...yokohata .....	138
<b>Science and Technology Studies</b> ...Tanaka .....	139
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	139
<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和 .....	139
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	140
<b>Long-term Internship (D)</b> ...Yamanaka .....	140
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer .....	140
<b>International Advanced Technology and Science 1</b> ...Murakami .....	141
<b>International Advanced Technology and Science 2</b> ...Murakami .....	141
<b>Presentation Method (D)</b> ...Graduate School of Advanced Technology and Science .....	141
<b>Internship (D)</b> .....	141
<b>Venture Business (D)</b> .....	142

#### • Specialized Subjects

<b>Advanced Topics in Atoms and/or Molecules Manipulation</b> ...Hashimoto · Matsuo .....	142
<b>Advanced conversion systems of resource energy</b> ...Kidoguchi .....	142
<b>Advance Lecture of Political Simulation</b> ...Kondo · Okushima .....	142
<b>Advanced Lecture in Social Risk Engineering</b> ...Kozuki .....	142
<b>Design for Adapting the Environment Instead of the Peop</b> ...Fujisawa .....	143
<b>Engineering on Circulation of Resources</b> ...Hirotsu .....	143
<b>Advanced mitigation engineering</b> ...Ueshima .....	143
<b>Advanced Lecture on Quantum Nanostructure Semiconductors</b> ...Isu · Kitada .....	143
<b>Quantum Theory of Materials</b> ...Michihiro .....	144
<b>Nonlinear Optical Devices</b> ...Haraguchi .....	144
<b>Applied Statistical Physics</b> ...Goto · Mori .....	144

#### • Specialized Exercise and Experiments

<b>Advanced Exercise on Ecosystem Engineering</b> ...All teachers .....	144
<b>Advanced Research on Ecosystem Engineering</b> ...Teachers in other colleges or departments .....	145

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#### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Target)** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline)** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule)** 1. What is Human Factors 2. Historical Overview of Human Factors 3. Multi-Disciplinary Aspect of Human Factors 4. Health and Safty Issue of Human Factors 5. Human Psychological Capability 6. Task Analysis 7. Human Error 8. Universal Design 9. Cognitive Artifact 10. Visibility and Affordance 11. Human-Computer Interaction 12. Human Information Processing 13. Knowledge and Mental Model 14. Usability Paradigms and Principles 15. Evaluation and Testing 16. Making system that makes us smart

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Yoshida (+81-88-656-7897, yos@ias.tokushima-u.ac.jp)

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#### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Understanding of significance of protein in biotechnology

**Outline)** Basics of structure, function and application of protein are introduced

**Style)** Lecture

**Keyword)** *protein, enzyme, biotechnology*

**Goal)**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule)** 1. Introduction of life science 2. History of life science 3. Structure and function of DNA and RNA 4. mRNA is a template of protein 5. Duplication of DNA 6. Regulation of protein expression 7. Human Genetics 8. Genetic disease 9. DNA diagnosis 10. Structure and function of protein 11. Principle of gene technology (1) 12. Principle of gene technology (2) 13. Protein engineering 14. Future of life science (1) 15. Future of life science (2) 16. Preparation of report

**Evaluation Criteria)** Evaluation by report

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact)**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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#### Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target)** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline)** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp)

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## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 2 4. 馬力の発見—農業技術の革新とヨーロッパ社会 3 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 2 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 3 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業化社会 2 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

⇒ Tanaka . (Office Hour: tanaka@kenroku.kanazawa-u.ac.jp)  
⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING

First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

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## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER

Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Relational Lecture)** “Introduction to Intellectual Property”(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方・特許は明細書を中心に動く (山内) 10. 技術者が知っておくべき実務知識・特許法上の留意事項 (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION  
非常勤講師

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、「ICT活用型」葉っぱビジネス”「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。 <参考>平成22年度ビジネスモデル特論 > 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ごう奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス

**Goal)** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求:-笠松和市(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ごう奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス

創出ワークショップ:山中英生(徳島大学教授) 13. ICT 演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT 演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT 演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** Several are introduced in class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student)** 徳島大学大学院先端技術科学教育部マスターコース、及び、ドクターコースの学生

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有 (088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resistor the coop-education program for “Pai-shape” engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as “research and development”, “production management”, “purchasing” and “quality control” “marketing” and “cross-cultural management”.

**Outline)** It learns about the production management. This time, “the automobile industry” specially takes up the production management of “Honda Motor Co.,Ltd. (following Honda)” even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style)** Lecture

**Keyword)** management, management of technology

**Relational Lecture)** “Management Theory of New Business”(0.5, ⇒p.139), “Long-term Internship (D)”(0.5, ⇒p.140), “Advanced Lecture in Theory of Business Models”(0.5, ⇒p.140)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**



1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

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## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in English which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in English.

**Outline)** In this course, an intensive course for advanced technology and science in English should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in English can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in English should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in English and then the power of expression and presentation in English would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

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## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in English. The students also study advanced technology and science in their country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in English at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in English. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in English.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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## Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentation in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Internship (D)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Advanced Topics in Atoms and/or Molecules Manipulation

2 units (selection)

Shuichi Hashimoto · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Shigeki Matsuo · ASSOCIATE PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** New methodologies for the manipulation of the atoms and molecules in materials will be presented and students are encouraged to gain skills to think about to solve problems in this field

**Outline)** New methodologies will be given for manipulating atoms and molecules, controlling physical and chemical properties, and fabricating micro- and nanostructures based upon optical/laser techniques

**Style)** Portfolio

**Goal)** To acquire knowledge of the properties of materials to the level of atoms and molecules

**Schedule)** 1. Photophysical processes 2. Photochemical processes 3. Photochemical processes 4. Photochemical Processes 5. Two-photon processes 6. laser trapping 7. laser trapping 8. laser ablation 9. laser ablation 10. laser micro processing 11. laser micro fabrication 12. photonic crystals 13. laser crystallization 14. New topics 15. New topics

**Evaluation Criteria)** Assignments counts 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216637>

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Advanced conversion systems of resource energy

2 units (selection)

Yoshiyuki Kidoguchi · PROFESSOR / RESOURCE CIRCULATORY ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To learn special knowledge concerning present energy resources and energy supplying systems, to understand principle and mechanism of energy conversion, and to improve thinking faculty for application of new energy and its conversion

**Outline)** To explain effective combustion technologies, reasonable utilization of energy and application of unused energy for saving consumption of fossil fuels and primary energy on the point of saving resources, energy and preserving the environment

**Style)** Portfolio

**Keyword)** *energy conversion, energy resources, utilization of energy, environmental protection, energy saving*

**Requirement)** None

**Notice)** None

**Goal)** To understand fundamentals of energy conversion and to consider effective utilization of energy and improvement of energy conversion technologies

**Schedule)** 1. Present state of energy resources 2. Energy and environmental problem 3. Future view of energy resources 4. Fundamentals of energy conversion 5. Typical Systems of energy conversion 6.

Principle of energy conversion 7. Important notices of energy conversion 8. Present Technologies of energy conversion 9. High Technologies of energy conversion 10. New technologies of energy conversion 11. Problems of energy conversion technology 12. Approach to effective utilization of energy 13. Systems of effective utilization of energy 14. Introduction of new energy 15. Application of new energy

**Evaluation Criteria)** Appraise the understanding of the content of the lecture by setting some reports

**Textbook)** None

**Reference)** None

**Webpage)** <http://www.eco.tokushima-u.ac.jp/w3/miwa/index.html>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216677>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kidoguchi (Eco502, +81-88-656-9633, kidog@eco.tokushima-u.ac.jp)

**Note)** ◇Need to submit some reports ◇Every lesson is planned to attain the targets of this lecture. Students' achievement of the targets is partly accessed by the reports.

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### Advance Lecture of Political Simulation

2 units (selection)

Akio Kondo · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING  
Masashi Okushima · ASSOCIATE PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The technique of modelling of regional and environmental systems, and the application method of prediction and evaluation models to political simulation are studied.

**Outline)** Not only the technique of modelling, but also the application method of prediction and evaluation models to political simulation is discussed in portfolio.

**Style)** Portfolio

**Keyword)** *political simulation, technique of modelling, prediction and evaluation*

**Requirement)** 特になし

**Notice)** 特になし

**Goal)** To obtain the knowledge of the technique of modelling and application method of prediction and evaluation models, and to apply them to political simulation.

**Schedule)** 1. Guidance and purpose of this subject 2. Systems of political simulation 3. Technique of modelling 1 4. Technique of modelling 2 5. Application of model : Prediction 1 6. Application of model : Prediction 2 7. Application of model : Evaluation of policy 1 8. Application of model : Evaluation of policy 2 9. Example of political simulation : Population policy 10. Example of political simulation : Urban transport policy 11. Example of political simulation : Landuse policy 12. Example of political simulation : Social policy 13. Example of political simulation : Environment policy 14. The technique of political simulation in the future 15. Regional policies in the 21st Century

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Webpage)** <http://www.eco.tokushima-u.ac.jp/w3/kondo/top/index.htm>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216725>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp) (Office Hour: 月曜日9-10校時)

**Note)** 特になし

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### Advanced Lecture in Social Risk Engineering

2 units (selection)

Yasunori Kozuki · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** To understand concept of risk, to cultivate ability of measures how to reduce, avoid, compensate for various risks. the reducing, the evading of the risk, the compensation for it.

**Outline)** Technique of risk assessment and its communication for various social risks on risk management is lectured.

**Style)** Lecture in combination with Portfolio

**Keyword)** *social risks, risk management, crisis management*

**Goal)** To obtain the knowledge of risk management and application method of various social risks.

**Schedule)** 1. Guidance and purpose of this subject 2. Sources of various social risks 3. Evaluation of social risk(1) 4. Evaluation of social risk(2) 5. Risk management (1.risik perception) 6. Risk management(2.risik communication) 7. Risk management(3.evaluation standard) 8. Example of risk management(1.evacuation for natural disaster) 9. Example of risk management(2.evacuation for natural disaster) 10. Example of risk management(3.evacuation for natural disaster) 11. Example of risk management(4.avoidance of risk and insurance) 12. Presentaion and discusion for social risk(1) 13. Presentaion and discusion for social risk(2) 14. Presentaion and discusion for social risk(3) 15. Summary

**Evaluation Criteria)** Assignments Count 100%

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216693>

**Student)** To be limited to the students of the course

**Contact)**

⇒ Kozuki (Eco505, +81-88-656-7335, kozuki@eco.tokushima-u.ac.jp) (Office Hour: 火曜日, 14:35 から 16:05, 18:00 から 19:30)

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## Design for Adapting the Environment Instead of the Peop

2 units (selection)

Shoichiro Fujisawa · PROFESSOR / SOCIAL ENVIRONMENT SYSTEMS ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** The objective of this lecture is to consider the role of assistive technology for the persons with disabilities living in the society and to learn on the development of assistive products in the view point of human factors and outcome measure in daily living with assistive products.

**Outline)** Assistive technology for a disabled individual living in the society. Human factors and R & D of assistive devices and services. Adapting the environment instead of the disabled people. Evaluation of appropriateness of assistive technology system for a person.

**Style)** Lecture

**Keyword)** *assistive products, outcome measure, persons with disability, research and development, ergonomics*

**Goal)** An expertise necessary to research and develop an actual assistive products is acquired. The method of outcome measure for assistive products will be mastered.

**Schedule)** 1. Guidance 2. Human factors in physical view point (1) 3. Human factors in anatomical view point (2) 4. Human factors in psychological view point (3) 5. Adapting the people to the environment 6. Adapting the environment insted of the people 7. Physical impairment and daily living support 8. Sensory impairment and daily living support 9. Intellectual impairment and daily living support 10. R&D of assistive products and ergonomic approach (1) 11. R&D of assistive products and ergonomic approach (2) 12. R&D of assistive products based on daily living (1) 13. R&D of assistive products based on daily living (2) 14. Outcome measure of assistive products (1) 15. Outcome measure of assistive products (2)

**Evaluation Criteria)** Results will be evaluated through the lecture and reports submitted after each lesson.

**Textbook)** To be introduced in th class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216808>

**Contact)**

⇒ Fujisawa (ECO704, +81-88-656-7537, s-fuji@eco.tokushima-u.ac.jp) (Office Hour: 水曜日 18:00~ 20:00)

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## Engineering on Circulation of Resources

2 units (selection)

Takahiro Hirotsu · PROFESSOR / MARINE ENVIRONMENT SCIENCE AND ENGINEERING, ECOSYSTEM ENGINEERING, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Learning advanced technology for circulation of resouces

**Outline)** Separation and utilization of unused inorganic resources, separation of isotopes of light elements, and design and synthesis of adsorbents for separation of isotopes.

**Style)** Lecture

**Keyword)** *recovery of resources, separation of materials, separation of isotopes*

**Goal)** understanding of an advanced technology for circulation of resources

**Schedule)** 1. What are resources? 2. Types and properties of substances 3. Separation of ions: ion-exchange method 1 4. Separation of ions: ion-exchange method 2 5. Separation of ions: ion-exchange method 3 6. Separation of ions: chelate exchange 1 7. Separation of ions: chelate exchange 2 8. Separation of ion: chelate exchange 3 9. Separation of isotopes by chemical-exchange method 10. Principle of separation of lithium-isotopes 11. Principle of separation fo boron-isotopes 12. Separation of isotopes by ion-exchange method 1 13. Separation of isotopes by ion-exchange method 2 14. Separation of isotopes by ion-exchange method 3 15. Separation of isotopes by ion-exchange method 4 16. Significance of advanced separation of substances in circulation of resources

**Evaluation Criteria)** Discussion in the class and description of ideas in the report

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216681>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Hirotsu (National Institute of Advanced Industrial Science and Technology, +81-87-869-3562, takahiro-hirotsu@aist.go.jp)

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## Advanced mitigation engineering

2 units (selection)

Hideki Ueshima · PART-TIME LECTURER / 広島工業大学

**Target)** To obtain the abilities to find and solve environmental problems using for application of mitigation technique

**Outline)** To surveying of the latest news of mitigation and to understand its concept and examine the technique to mitigate the deterioration environment

**Style)** Lecture in combination with Portfolio

**Keyword)** *district improvement plan for disaster mitigation, coastal environment*

**Fundamental Lecture)** “Advanced Lecture in Social Risk Engineering”(1.0, ⇒p.142), “Advance Lecture of Political Simulation”(1.0, ⇒p.142)

**Goal)** To design and assess the mitigation plan for deterioration coastal environment

**Schedule)** 1. Guidance of this subject 2. Current topics about mitigation 1 3. Current topics about mitigation 2 4. Current topics about mitigation 3 5. Current topics about mitigation 4 6. Current topics about mitigation 5 7. Current topics about mitigation 6 8. Current topics about mitigation 7 9. Current topics about mitigation 8 10. Current topics about mitigation 9 11. Current topics about mitigation 10 12. Discussion on research theme1 13. Discussion on research theme2 14. Discussion on research theme3 15. Presentation

**Evaluation Criteria)** Assignments count 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216891>

**Contact)**

⇒ Ueshima (+81-823-72-1901, h-ueshima@aist.go.jp)

⇒ Kozuki (Eco505, +81-88-656-7335, kozuki@eco.tokushima-u.ac.jp) (Office Hour: 火曜日, 14:35 から 16:05, 18:00 から 19:30)

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## Advanced Lecture on Quantum Nanostructure Semiconductors

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target)** This lecture aims at understanding basic concepts of the quantum effects of semiconductor nanostructures based on materials science and various technologies for device applications.

**Outline)** This lecture introduces characteristics of quantum structures and technologies of the device applications, based on quantum mechanics, semiconductor physics, materials science and photonics. Advanced technologies of fabrication and measurements and recent topics of the research are also introduced.

**Style)** Lecture

**Goal)** To understand materials science and application technologies of nano structure semiconductors

**Schedule** 1. Electronic states in semiconductor quantum structures 2. Electronic properties of quantum structures 3. Optical properties of quantum structures 4. Fabrication technologies of semiconductor nanostructures 5. Evaluation technologies of crystals 6. Evaluation technologies of nanostructures 7. Analysis of electronic properties 8. Analysis of optical properties 9. Quantum effect devices 10. Nonlinear optical responses of semiconductors 11. Responses of optical micro cavity 12. Research progress in quantum nanostructure semiconductors 13. Ultrafast optical devices 14. Quantum information devices 15. Topics of recent advanced research (1) 16. Topics of recent advanced research (2)

**Evaluation Criteria** Assignments

**Textbook** None

**Reference** To be introduced in the class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216907>

**Contact**

⇒ Isu (A224, +81-88-656-7670, t.isu@frc.tokushima-u.ac.jp) (Office Hour: Tue -Thu 10:00-14:00)

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## Quantum Theory of Materials

2 units (selection)

Yoshitaka Michihiro · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target** This class introduces the advanced quantum mechanics and quantum field theory.

**Outline** Basics of advanced quantum mechanics and quantum field theory are introduced.

**Style** Lecture

**Keyword** *quantum mechanics, quantum field theory*

**Goal** To understand the outline of advanced quantum mechanics and quantum field theory.

**Schedule** 1. Introduction 2. Quantum mechanics (1) 3. Quantum mechanics (2) 4. Hartree-Fock approximation 5. Koopman's theorem 6. Density functional theory 7. Kohn-Sham equation 8. Local density approximation 9. Perturbation (1) 10. Perturbation (2) 11. Quantum field theory 12. Creation operator and annihilation operator 13. Field quantization (1) 14. Field quantization (2) 15. Phonon 16. Electron gas

**Evaluation Criteria** Assignments count 100%.

**Textbook** To be introduced in the class.

**Reference** To be introduced in the class.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216904>

**Contact**

⇒ Yoshitaka Michihiro (A203) (Office Hour: 木曜日17時-18時)

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## Nonlinear Optical Devices

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target** To understand the principle, typical structure, advantages and disadvantages of current nonlinear optical devices. To develop ability to design new devices and solve various problems for applications.

**Outline** Physics of second-order and third-order nonlinear optical phenomena. Principles of electro-optics. Optical nonlinearities in fibers. Photorefractive materials. Nonlinear optical media. Anisotropic nonlinear optical media. Dispersive nonlinear optical media. Coupled-wave theory. Electro-optic and acousto-optic devices. Second-order and third-order nonlinear optical devices. Photonic switches. All-optical switches. Bistable optical devices. Optical connections.

**Style** Portfolio

**Keyword** *nonlinear optics, harmonic generation, nonlinear optical device, optical switch*

**Relational Lecture** "Optical and Functional Inorganic Materials"(0.5, ⇒p.152)

**Requirement** Student should have fundamental knowledge of electromagnetic theory, waveoptics, optical properties of materials and lasers.

**Notice** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal**

1. Possible to explain principles, structure and characteristics of optoelectric devices.

2. Possible to explain principles, structure and characteristics of the second-order nonlinear optical devices.

3. Possible to explain principles, structure and characteristics of the third-order nonlinear optical devices.

**Schedule** 1. Introduction & interview 2. nonlinear optical phenomena 3. Electrooptic effect and its applications 4. Magneto-optic effect and its applications 5. Acousto-optic effect and its applications 6. principle of second-order nonlinear effects 7. Second-order nonlinear optical materials 8. Second-order nonlinear optical devices 9. principle of third-order nonlinear effects 10. third-order nonlinear optical materials 11. Third-order nonlinear devices 12. Experiment for nonlinear optical phenomena 13. Current application of nonlinear devices 14. Photonic crystal 15. Integrated optical devices

**Evaluation Criteria** Activity:20%, reports:40% and oral examinations:40%

**Textbook** After interview, we will decide suitable text books.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216848>

**Contact**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

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## Applied Statistical Physics

2 units (selection)

Nobuo Goto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Atsushi Mori · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target** Learn to apply the statistical physics

**Outline** Concerning the mechanisms and phenomena in materials processing, lectures are given in method for analyzing the results on the basis of the statistical physics.

**Style** Lecture

**Notice** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal**

1. points of view in statistical physics

2. applying statistical physics to the practical problem

**Schedule** 1. Thermodynamics of non-equilibrium and non-uniform systems I 2. Thermodynamics of non-equilibrium and non-uniform systems II 3. Thermodynamics of non-equilibrium and non-uniform systems III 4. Advanced statistical mechanics I 5. Advanced statistical mechanics II 6. Advanced statistical mechanics III 7. Exercise I 8. Examination I 9. Advanced statistical mechanics IV 10. Advanced statistical mechanics V 11. Advanced statistical mechanics VI 12. Transport phenomena I 13. Transport phenomena II 14. Transport phenomena III 15. Exercise II 16. Examination II

**Evaluation Criteria** 60点以上を合格とする。

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216576>

**Contact**

⇒ Mori (Opt.407, +81-88-656-9417, mori@opt.tokushima-u.ac.jp) (Office Hour: オフィスアワーは、学科の掲示板等をご覧ください。)

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## Advanced Exercise on Ecosystem Engineering

2 units (compulsory)

All teachers

**Target** To conduct research leading to the awarding of doctoral degrees.

**Outline** To conduct research in Conversion Systems of Resource Energy, Resources Recycling Technology, Political Simulation, Social Risk Engineering, Design for Adapting the Environment Instead of the People and Engineering on Circulation of Resources.

**Style** Portfolio, Lecture in combination with Portfolio, Lecture and exercise

**Keyword** *ecosystem engineering*

**Notice** Course plan differs depending on the laboratory you choose.

**Goal** To present the results of your research related conferences, departmental research meetings, etc.

**Schedule** After the student selects the subjects, research can be carried out at the laboratory.

**Textbook** None

**Reference** Using papers for each research field.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216562>

**Student** Able to be taken by only specified class(es)

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**Advanced Research on Ecosystem Engineering**

2 units (compulsory)  
Teachers in other colleges or departments

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**Target**› To obtain broad information on recent engineering

**Outline**› To research a theme in a technology, which is different from the main technology in your field.

**Keyword**› *engineering, technology, different field*

**Goal**› To learn a recent technology, which is different from the main technology in your field.

**Schedule**› Choose a theme on technology or engineering, which is different from that in your field.

**Evaluation Criteria**› Evaluated with portfolio or examination

**Textbook**› Ask to teachers

**Reference**› Prints

**Contents**› <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216563>

**Student**› Able to be taken by only specified class(es)



## Systems Innovation Engineering — Electrical and Electronic Engineering

### SYLLABUS OF SUBJECTS

• *Integrated Subjects*

<b>Human Factors</b> ... Yoshida .....	147
<b>Life Science</b> ... Takagi · Tsuji .....	147
<b>Social Science</b> ... yokohata .....	148
<b>Science and Technology Studies</b> ... Tanaka .....	148
<b>Management Theory of New Business</b> ... Vice chairperson of School Affairs Committee, Faculty of Engineering · First-line men with experience of practical business .....	148
<b>Introduction to Intellectual Property</b> ... Fujii · Yano · Iida · Yamauchi · 京和 .....	149
<b>Advanced Lecture in Theory of Business Models</b> ... Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	149
<b>Long-term Internship (D)</b> ... Yamanaka .....	149
<b>Management of Technology</b> ... Yamanaka · Morimoto · Part-time Lecturer .....	150
<b>International Advanced Technology and Science 1</b> ... Murakami .....	150
<b>International Advanced Technology and Science 2</b> ... Murakami .....	150
<b>Presentation Method (D)</b> ... Graduate School of Advanced Technology and Science .....	150
<b>Internship (D)</b> .....	151
<b>Venture Business (D)</b> .....	151

• *Specialized Subjects*

<b>Topics in algebra and analysis</b> ... Mizuno .....	151
<b>Radio Frequency Solid State Physics</b> ... Nakamura .....	151
<b>Engineering of Correlated Electron Matter</b> ... Kishimoto · Kawasaki .....	151
<b>Plasma Science and Technology</b> ... Ohya .....	152
<b>Photonic Semiconductor Device Physics</b> ... Sakai · Naoi · Nishino .....	152
<b>Optical and Functional Inorganic Materials</b> ... Tominaga .....	152
<b>Nonlinear Optical Devices</b> ... Haraguchi .....	152
<b>Power System Electromagnetic Compatibility</b> ... Kawada · Shimomura .....	153
<b>Power Energy Conversion and Control Engineering</b> ... Ohnishi .....	153
<b>Semiconductor Device Physics</b> ... Ohno .....	154
<b>Advanced Theory of Electric Power Control Systems</b> ... Kawasaki · Takigawa .....	154
<b>Advanced Mechatronics Engineering</b> ... Morita · Yasuno .....	154
<b>Communication Systems</b> ... Takada · Oie .....	154
<b>Integrated System Design</b> ... Konaka .....	155
<b>Electronic Information System Design</b> ... Hashizume · Yotsuyanagi .....	155
<b>Multimedia Communication Theory and Technology</b> ... Oohama · Tokushige .....	155
<b>Integrated Information System Design</b> ... Fukumi · Shimamoto .....	156
<b>Advanced Nonlinear Circuit Technology</b> ... Nishio .....	156

<b>Control System Design</b> ... Kubo · Oya .....	156
<b>Nonlinear System Design</b> ... Ueta .....	157
<b>Medical and Biological Engineering</b> ... Akutagawa .....	157
<b>Medical Information Systems</b> ... Niki · Kawata .....	157
<b>Advanced Lecture on Quantum Nanostructure Semiconductors</b> ... Isu · Kitada .....	157

• *Specialized Exercise and Experiments*

<b>Special Exercise on Electrical and Electronic Systems Innovation Engineering</b> ... All teachers .....	158
<b>Advanced Research on Electrical and Electronic Engineering</b> ... Teachers in other colleges or departments	158

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#### Human Factors

2 units (selection)  
Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Target)** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline)** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule)** 1. What is Human Factors 2. Historical Overview of Human Factors 3. Multi-Disciplinary Aspect of Human Factors 4. Health and Safety Issue of Human Factors 5. Human Psychological Capability 6. Task Analysis 7. Human Error 8. Universal Design 9. Cognitive Artifact 10. Visibility and Affordance 11. Human-Computer Interaction 12. Human Information Processing 13. Knowledge and Mental Model 14. Usability Paradigms and Principles 15. Evaluation and Testing 16. Making system that makes us smart

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yoshida (+81-88-656-7897, yos@ias.tokushima-u.ac.jp)

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#### Life Science

2 units (selection)  
Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY  
Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Understanding of significance of protein in biotechnology

**Outline)** Basics of structure, function and application of protein are introduced

**Style)** Lecture

**Keyword)** *protein, enzyme, biotechnology*

**Goal)**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule**) 1. Introduction of life science 2. History of life science 3. Structure and function of DNA and RNA 4. mRNA is a template of protein 5. Duplication of DNA 6. Regulation of protein expression 7. Human Genetics 8. Genetic disease 9. DNA diagnosis 10. Structure and function of protein 11. Principle of gene technology (1) 12. Principle of gene technology (2) 13. Protein engineering 14. Future of life science (1) 15. Future of life science (2) 16. Preparation of report

**Evaluation Criteria**) Evaluation by report

**Textbook**) To be introduced in the class

**Reference**) To be introduced in the class

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact**)

⇒ Tsuji (G710, +81-88-656-7526, [tsuji@bio.tokushima-u.ac.jp](mailto:tsuji@bio.tokushima-u.ac.jp)) (Office Hour: Monday 16:20-17:50)

**Note**) When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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## Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target**) The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline**) Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

**Keyword**) *economic activities, structure and function, mathematical programming model*

**Goal**) To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule**) 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria**) Assignments count 100%.

**Textbook**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Kondo (ECO602, +81-88-656-7339, [kondo@eco.tokushima-u.ac.jp](mailto:kondo@eco.tokushima-u.ac.jp))

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## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target**) Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline**) 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文学の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style**) Lecture

**Goal**)

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule**) 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 2 4. 馬力の発見—農業技術の革新とヨーロッパ社会 3 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 2 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 3 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業社会 2 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook**) 資料を配付します。

**Reference**) 講義中に紹介します。

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student**) 大学院博士後期課程学生

**Contact**)

⇒ Tanaka . (Office Hour: [tanaka@kenroku.kanazawa-u.ac.jp](mailto:tanaka@kenroku.kanazawa-u.ac.jp))

⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING

First-line men with experience of practical business · PART-TIME LECTURER

**Target**) New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline**) 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement**) The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice**) Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal**) Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule**) 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria**) It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook**) The summary is distributed every time.

**Reference**) Several are introduced in the school hours.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student**) he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact**)

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering



**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Hida · PART-TIME LECTURER  
Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** intellectual property, patent law, protect and use of intellectual property

**Relational Lecture)** "Introduction to Intellectual Property"(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方・特許は明細書を中心に動く (山内) 10. 技術者が知っておくべき実務知識・特許法上の留意事項 (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜: 8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION  
非常勤講師

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型"葉っぱビジネス"「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。<参考:平成22年度ビジネスモデル特論>「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土)20:15-21:45 月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal)** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和市(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ぐ奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. 学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** Several are introduced in class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student)** 徳島大学大学院先端技術科学教育部マスターコース, 及び, ドクターコースの学生

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style)** Lecture

**Keyword)** *management, management of technology*

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.148), "Long-term Internship (D)"(0.5, ⇒p.149), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.149)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)  
⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english.

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized

knowledge for advanced technology and science in english can deeply be understood, the credit will be surthorized. The report and portfolion on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, profolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of thechnology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

## Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentaion in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Internship (D)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Topics in algebra and analysis

2 units (selection)

Yoshinori Mizuno · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** We will learn some important properties of a special function, which is called the Riemann zeta function. Further we will learn how to solve problems produced by this function.

**Outline)** We will learn development of mathematical tools in order to prove some properties of the Riemann zeta function, such as the special values, Euler product and the functional equation.

**Fundamental Lecture)** "Basic Mathematics/Calculus 1"(1.0), "Basic Mathematics/Calculus 2"(1.0), "Complex Analysis"(1.0)

**Relational Lecture)** "Numerical Analysis"(0.5)

**Goal)** We will learn fundamentals of modern abstract mathematics and realize its effectiveness.

**Schedule)** 1. Introduction 2. Zeta function 3. Leonhard Euler 4. Special values 5. Analytic continuation 6. Special values and analytic continuation 7. Euclid's proof 8. Fermat prime 9. Euler product 10. Prime number theorem I 11. Prime number theorem II 12. Prime number theorem III 13. Functional equation I 14. Functional equation II 15. Summation 16. Assignments

**Evaluation Criteria)** Evaluation will be based on assignments.

**Reference)** Dunham, William, "Euler: the Master of Us All", The Mathematical Association of America

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216750>

**Contact)**

⇒ Nagamachi (A205, +81-88-656-7554, shigeaki@pm.tokushima-u.ac.jp) (Office Hour: 水曜日 15 時から 16 時)

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## Radio Frequency Solid State Physics

2 units (selection)

Koichi Nakamura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This class introduces basis of NMR and applications to studies on superconductivity, magnetism and ionic diffusion in solid.

**Outline)** The spectrum, spin-lattice relaxation, spin-spin relaxation, chemical shift etc., which are obtained by NMR measurements, are introduced and discussed in connection with various physical properties of solids.

**Keyword)** *nuclear magnetic resonance, magnetism, diffusion*

**Goal)**

1. To understand basis of NMR.
2. To understand relationship between various problems in solid state physics and relaxation phenomena observed using NMR.

**Schedule)** 1. Introduction to nuclear magnetic resonance (NMR) 2. Zeeman interaction 3. Larmor precession 4. Magnetization 5. Motion of magnetization under magnetic field 6. Bloch equations 7. Dipole interaction 8. Magnetic interactions of nuclei with electrons 9. Electric quadrupole interaction 10. Spin-lattice relaxation and motional narrowing of resonance lines 11. Diffusion in solid and spin-lattice relaxation 12. Relaxation model for diffusion 13. NMR studies on lithium ionic conductors 14. NMR studies on protonic conductors 15. Application of NMR

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** なし

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216789>

**Contact)**

⇒ Nakamura (A216, koichi@pm.tokushima-u.ac.jp)

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## Engineering of Correlated Electron Matter

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Yu Kawasaki · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** In many solid-state materials, new phenomena evolve due to strong electron interactions. In this Lecture, review will be given on some advanced topics and their applications, including high temperature superconductivity, metal-insulator transition and strongly correlated electronics.

**Outline)** New types of superconducting and magnetic phenomena emerge in correlated electron matters. The term "correlated electron" represents the state of matter where many electrons are strongly interacting with each other. After an introductory talk on magnetism and superconductivity, review will be given on some advanced topics, including high temperature superconductivity, metal-insulator transition and colossalmagneto resistance. Potential application of correlated electron matters to technology is also presented focusing on spintronics or strongly correlated electronics.

**Style)** Lecture

**Keyword)** *strongly correlated electron systems, Mott insulator, colossalmagneto resistance, high temperature superconductor*

**Goal)** To understand basic concepts of correlated electron matter and its application

**Schedule)** 1. Introduction to correlated electron matters 2. Perspectives of magnetism and superconductivity in correlated electron matters 3. Electronic states of atoms and ions 4. Magnetic ions in crystal electric field 5. Introduction to superconductivity 6. How to probe rich properties in correlated electron matters 7. Mott insulator and metal-insulator transition 8. Spin, charge and orbital in transition metal oxides 9. Colossal magneto resistance in transition metal oxides 10. Application of transition metal oxides with correlated electrons 11. High temperature superconductivity 12. Heavy-fermion superconductivity 13. Electronic states of organic conductors 14. Application of superconductors with correlated electrons 15. Towards strongly correlated electronics

**Evaluation Criteria)** Reports on several subjects in lecture

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216621>

**Contact)**

⇒ Kishimoto (A202, +81-88-656-7548, yutaka@pm.tokushima-u.ac.jp) (Office Hour: 金曜日 16:00-17:30)  
⇒ Kawasaki (A217, +81-88-656-9878, yu@pm.tokushima-u.ac.jp)

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## Plasma Science and Technology

2 units (selection)

Kaoru Ohya · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The lecture aims to understand electronic, atomic and molecular collision processes in gases and solids and to present their various applications.

**Outline)** 1) Electronic, atomic and molecular collisions in gases and solid. Plasma physics and chemistry. Surface and materials science related to plasma-solid interactions. 2) Application to material processing technologies for electronic devices. Plasma-wall interactions in controlled thermonuclear fusion devices.

**Style)** Lecture in combination with Portfolio

**Keyword)** *plasma, collision theory, plasma-surface interaction, plasma applications*

**Goal)**

1. Understanding on collision processes in gases and solids
2. Understanding on applications to material processing technologies and plasma-wall interactions in controlled thermonuclear fusion devices.

**Schedule)** 1. Introduction to collision theory 2. Interaction potential 3. Elastic collision and nuclear stopping power 4. Inelastic collision and electronic stopping power 5. Inelastic processes in gases 6. Electron and Ion transport in gases 7. Reflection and thermal re-emission from solids 8. Collision mixing and diffusions in solids 9. Physical sputtering and chemical sputtering 10. Plasma chemical vapor deposition 11. Plasma-assisted etching 12. Other applications to material device processing 13. Plasma-wall interactions in nuclear fusion devices 14. Edge plasma physics 15. Hydrogen recycling and material erosion 16. Conclusions and future problems

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216871>

**Contact)**

⇒ Ohya (E 棟 2 階南 A-9, +81-88-656-7444, ohya@ee.tokushima-u.ac.jp)

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## Photonic Semiconductor Device Physics

2 units (selection)

Shiro Sakai · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoshiki Naoi · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Katsushi Nishino · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the device physics and fabrication technique of photonic semiconductor devices..

**Outline)** Interaction of photons and electrons in semiconductors, physics of superlattice semiconductors and their applications as photonic devices. Crystal growth of semiconductors and heteroepitaxy.

**Style)** Lecture

**Keyword)** *semiconductor, photonic device*

**Relational Lecture)** “Optical and Functional Inorganic Materials”(0.5, ⇒p.152)

**Goal)**

1. To understand device physics of photonic devices in terms of interaction of photons and electrons
2. To understand device physics of quantum effect devices
3. To understand crystal growth and related technologies for fabrication of photonic devices

**Schedule)** 1. Introduction 2. Energy band structure of semiconductors 3. Quantum statistics of electrons in semiconductors 4. Carrier transport in semiconductors 5. Quantum devices and superlattice 6. Light absorption in semiconductors (interaction of electrons and photons) 7. Photocinductivity, photovol and photodiode 8. Physics of light emission of semiconductors 9. Radiative recombination, non-radiative recombination, stimulated emission and spontaneous emission 10. Light emitting diodes and lasers 11. Devices for optical communication 12. Crystal growth of substrates for photonic semiconductor devices 13. MOCVD and MBE 14. Fabrication of Ohmic contact 15. Nano-photonic devices and fabrication technology 16. Examination

**Evaluation Criteria)** Report 50%, Examination 50%. More than 60% is required to pass this class.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216838>

**Contact)**

⇒ Sakai (E 棟 2 階南 A-3, +81-88-656-7446, sakai@ee.tokushima-u.ac.jp)

⇒ Naoi (E 棟 2 階南 A-4, +81-88-656-7447, naoi@ee.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること.)

⇒ Nishino (E 棟 2 階南 A-5, +81-88-656-7464, nishino@ee.tokushima-u.ac.jp)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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## Optical and Functional Inorganic Materials

2 units (selection)

Kikuo Tominaga · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This course aims to learn the fundamentals of material science of such as single crystals, polycrystals or amorphous films for optical and functional materials. At the same time, the synthesis methods of various films, their evaluation techniques and the propagating optical beam and acoustic waves in crystals are lectured.

**Outline)** Fundamentals of crystal science is lectured at first. Optical and electronic processes in optical and functional materials such as single crystals, polycrystals or amorphous films are followed. Advanced solid state physics of semiconductors, dielectric and ferroelectric materials are included. Synthesis methods of optical and functional crystals and films, evaluation methods of film properties are also contained. Electro-optical and piezo-electrical effects and solid state physics relating with their effects, characterization of crystals, symmetry elements of crystals and material constants, optical properties of crystals, electro-optical effects and nonlinear effects, piezoelectricity, acoustic waves in crystal, interaction of photons and phonons in crystal, synthesis methods of thin films (PVD method; electron beam evaporation, MBE, sputtering, laser ablation), film properties (characterizations of electrical, optical and mechanical properties) are included.

**Style)** Lecture and exercise

**Keyword)** *functional material, semiconductor device, crystal optics, thin film technology, deposition techniques of thin films*

**Relational Lecture)** “Photonic Semiconductor Device Physics”(0.5, ⇒p.152), “Nonlinear Optical Devices”(0.5, ⇒p.171)

**Goal)** Understanding of the solid state physics of piezoelectric materials and functional thin films

**Schedule)** 1. Characterization of crystals 2. Symmetry elements of crystals and material constants 1 3. Symmetry elements of crystals and material constants 2 4. Optical properties of crystals 1 5. Optical properties of crystals 2 6. Electro-optical effects and nonlinear effects 1 7. Electro-optical effects and nonlinear effects 2 8. Piezoelectricity 1 9. Piezoelectricity 2 10. Acoustic waves in crystal 1 11. Acoustic waves in crystal 2 12. Interaction of photons and phonons in crystal 13. Synthesis methods of thin films 1(PVD method; electron beam evaporation, MBE, sputtering, laser ablation) 14. Synthesis methods of thin films 2(PVD method; electron beam evaporation, MBE, sputtering, laser ablation) 15. Film properties (Characterizations of electrical, optical and mechanical properties) 16. Exercise

**Evaluation Criteria)** Reports for each theme and examination

**Textbook)** Tomoya Ogawa: Fundamentals in Crystal Engineering, Shoukabo (in Japanese) and Shunichi Gonda, Applied Handbook of Thin Film Depositions, (NTS) (in Japanese)

**Reference)**

- ◇ 荒川剛他, 無機材料化学 (第2版), 三共出版
- ◇ 日本学術振興会透明酸化物光・電子材料第16委員会編, 透明導電膜の技術 (改訂2版), Ohmsha
- ◇ 日本表面科学会編, 表面科学の基礎と応用, NTS
- ◇ 権田俊一監修, 薄膜作製応用ハンドブック, エヌ・ティー・エス
- ◇ 橋本和仁・大谷文章・工藤明彦編, 光触媒, エヌ・ティー・エス

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216895>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Tominaga (E 棟 2 階南 A-6, +81-88-656-7439, tominaga@ee.tokushima-u.ac.jp)

**Note)** This lecture will be given in English.

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## Nonlinear Optical Devices

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the principle, typical structure, advantages and disadvantages of current nonlinear optical devices. To develop ability to design new devices and solve various problems for applications.

**Outline)** Physics of second-order and third-order nonlinear optical phenomena. Principles of electro-optics. Optical nonlinearities in fibers. Photorefractive materials. Nonlinear optical media. Anisotropic nonlinear optical media. Dispersive nonlinear optical media. Coupled-wave theory. Electro-optic and acousto-optic devices. Second-order and third-order nonlinear optical devices. Photonic switches. All-optical switches. Bistable optical devices. Optical connections.

**Style)** Portfolio

**Keyword)** *nonlinear optics, harmonic generation, nonlinear optical device, optical switch*

**Relational Lecture)** "Optical and Functional Inorganic Materials"(0.5, ⇒p.152)

**Requirement)** Student should have fundamental knowledge of electromagnetic theory, waveoptics, optical properties of materials and lasers.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. Possible to explain principles, structure and characteristics of optoelectric devices.
2. Possible to explain principles, structure and characteristics of the second-order nonlinear optical devices.
3. Possible to explain principles, structure and characteristics of the third-order nonlinear optical devices.

**Schedule)** 1. Introduction & interview 2. nonlinear optical phenomena 3. Electrooptic effect and its applications 4. Magneto-optic effect and its applications 5. Acousto-optic effect and its applications 6. principle of second-order nonlinear effects 7. Second-order nonlinear optical materials 8. Second-order nonlinear optical devices 9. principle of third-order nonlinear effects 10. third-order nonlinear optical materials 11. Third-order nonlinear devices 12. Experiment for nonlinear optical phenomena 13. Current application of nonlinear devices 14. Photonic crystal 15. Integrated optical devices

**Evaluation Criteria)** Activity:20%, reports:40% and oral examinations:40%

**Textbook)** After interview, we will decide suitable text books.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216849>

**Contact)**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

## Power System Electromagnetic Compatibility

2 units (selection)

Masatake Kawada · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Naoyuki Shimomura · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** 1. To give the students understanding of the characteristics of electromagnetic compatibility in nature. 2. To give the students understanding of the characteristics of electromagnetic field generated from power system and the effect on biological system 3. To give the students understanding of the mechanisms of electromagnetic field generated from power system, the mitigation and the detection method. 4. To improve the presentation skill of students by presenting the latest transaction or journal papers in this filed in English.

**Outline)** Characteristics of artificial electromagnetic fields of DC, extremely low frequency (ELF) and high frequency (HF) arising from power systems are quantitatively explained as well as those of the fields from natural environments. Associate Prof. Shimomura gives lectures on how the electromagnetic fields are produced by power systems and on the management (characterization, reduction & mitigation and public education) of ELF electric and magnetic fields. Associate Prof. Kawada gives lectures on how the high frequency electromagnetic fields are produced by power systems and on the detection of VHF and UHF electromagnetic waves.

**Style)** Lecture in combination with Portfolio

**Keyword)** *electrical power engineering, electromagnetic compatibility, bioelectromagnetics*

**Relational Lecture)** "Advanced Theory of Electric Power Control Systems"(0.5, ⇒p.154)

**Requirement)** Understanding of electromagnetic compatibility

**Goal)**

1. To understand the characteristics of electromagnetic compatibility in nature.
2. To understand the characteristics of electromagnetic field generated from power system and the effect on biological system
3. To understand the mechanisms of electromagnetic field generated from power system, the mitigation and the detection method.

**Schedule)** 1. EMC in nature 1 (Electric field) 2. EMC in nature 2 (Magnetic field) 3. Characteristics of power system EMC 1 (Electric field) 4. Characteristics of power system EMC 2 (Magnetic field) 5. Characteristics of low frequency electromagnetic field generated from power system 1 6. Characteristics of low frequency electromagnetic field generated from power system 2 7. Effect of low frequency electromagnetic field generated from power system on biological system 1 8. Effect of low frequency electromagnetic field generated from power system on biological system 2 9. Mechanisms of electromagnetic field generated from power system. 10. Coupling mechanisms of electromagnetic field and biological system 11. Analysis method between electromagnetic field and biological system 12. Social effects on electromagnetic field generated from power system 13. Mechanisms of the high frequency electromagnetic field generated from power system 1 14. Mechanisms of the high frequency electromagnetic field generated from power system 2 15. Method to detect the high frequency electromagnetic field generated from power system 16. Conclusion of power system EMC

**Evaluation Criteria)** Assignment 50%, Presentation 50%. Totally 60% is required.

**Textbook)** printed material

**Reference)**

- ◇ D.F.Warne, Electrical Power Engineer's Handbook, Newnes
- ◇ J.Patrick Reilly, Applied Bioelectricity, Springer
- ◇ IEEE Trans on "Energy Conversion", "Power Delivery", "Electromagnetic Compatibility", and "Dielectrics and Electrical Insulation"

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216792>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kawada (E棟2階北 B-10, +81-88-656-7460, kawada@ee.tokushima-u.ac.jp) (Office Hour: (水)(木) 16:00-17:00)

**Note)** ◇Language: Engli ◇Self-study:Preparation 2 hours and review 2 hours for every class (2hours) .

## Power Energy Conversion and Control Engineering

2 units (selection)

Tokuo Ohnishi · PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To investigate and learn new energy conversion and control technologies in the fields of the electric power system and the renewable energy.

**Outline)** Power electronics technologies in utility interconnection systems such as HVDC (High-Voltage Direct-Current) transmission system, SVG (Static Var Generator), UPS (Uninterruptible Power Supply) and FACTS (Flexible AC Transmission System) and in renewable energy development system such as photovoltaic, wind and fuel cell power generation system.

**Keyword)** *energy conversion, energy control, utility interconnection control system, renewable energy*

**Fundamental Lecture)** "Advanced Power Electronics"(0.5, ⇒p.72)

**Relational Lecture)** "Advanced Theory of Electric Power Control Systems"(0.5, ⇒p.154), "Semiconductor Device Physics"(0.5, ⇒p.154)

**Requirement)** Prerequisites:It is preferable to have knowledge equal with power electronics in undergraduate and advanced power electronics in masters degree course.

**Goal)**

1. State of the Arts and Trends of The Utility Interconnection System using Power Electronics Technology
2. State of The Arts and Trends of The Renewable Energy Development using Power Electronics Technology

**Schedule)** 1. Introduction of Power Electronics Technology in Utility Interconnection System 2. High Voltage Direct Current Transmission System 3. Flexible AC Transmission System 4. Static Var Generator 5. Unified Power Flow Controller 6. Uninterruptible Power Supply 7. Introduction of Power Electronics Technology in Renewable Energy 8. Photovoltaic Power Generation System 9. Wind Power Generation System 10. Micro Gas Turbine System 11. Fuel Cell System 12. Charging and Discharging System for DC Battery 13. Hybrid Power Supply System 14. Distributed Generation System 15. Discussion for Reports

**Evaluation Criteria)** Report and presentation

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216815>

**Contact)**

⇒ Ohnishi (E棟2階北 B-1, +81-88-656-7456, ohnishi@ee.tokushima-u.ac.jp)

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## Semiconductor Device Physics

2 units (selection)

Yasuo Ohno · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of this lecture is to understand the background physics which governs the electrical performances of semiconductor devices.

**Outline)** The lecture gives carrier transport theory and equations based on which semiconductor electron devices including various types of transistors, high-field phenomena and short-channel effects in miniaturized transistors and deep levels which are the origin of various malfunctions in semiconductor devices.

**Style)** Lecture and exercise

**Keyword)** *device physics, semiconductor device*

**Fundamental Lecture)** “Advanced Theory of Electron Devices”(1.0, ⇒p.69)

**Relational Lecture)** “Photonic Semiconductor Device Physics”(0.5, ⇒p.152), “Optical and Functional Inorganic Materials”(0.5, ⇒p.152)

**Goal)** Understand the carrier transport in semiconductors based on the Boltzmann transport equation. 2. Understand the velocity saturation effects and 2-dimensional field distribution effects in miniaturized transistors. 3. Understand the electrical behavior of deep traps in semiconductors based on Shockley-Reed-Hall statistics.

**Schedule)** 1. デバイス物理の基本方程式 2. ボルツマン輸送方程式 3. 電子流と熱流 4. ホットキャリア効果 5. 電子ガスの粘性とMOS表面電子移動度 6. 短チャネル効果 7. デバイス微細化の限界 8. 大規模高速システムとデバイス特性 9. 深い準位に対するSRH統計 10. 電子トラップとホールトラップ 11. サイドゲート効果 12. 周波数分散 13. 化合物半導体とシリコンの比較 14. プロセスシミュレーション 15. デバイスシミュレーション 16. テスト

**Evaluation Criteria)** Reports for each theme and examination

**Textbook)** S. M. Sze, Kwok K. Ng, “Physics of Semiconductor Devices,” 3rd Ed.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216817>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ohno (E棟2階南 A-7, +81-88-656-7438, ohno@ee.tokushima-u.ac.jp)

**Note)** This lecture will be given in English.

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## Advanced Theory of Electric Power Control Systems

2 units (selection)

Kensuke Kawasaki · PROFESSOR / ELECTRIC POWER, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Kiyoshi Takigawa · ASSOCIATE PROFESSOR / ELECTRIC POWER, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The purpose of this lecture is to understand the characteristic of various power generation systems and electric power systems and to master new technologies on distributed power sources and electric power systems.

**Outline)** The principle of power generation in various kinds of power generation machines, the characteristic of electric power systems and the analysis technique are introduced. Moreover, the electric power control technology for a distributed power source using an inverter, and control techniques in electric power systems connecting power generation facilities whose output change will occur, such as solar systems, are introduced.

**Style)** Portfolio

**Keyword)** *electric power control, solar system, inverter*

**Requirement)** N/A

**Goal)**

1. To master analysis technique of power generation systems
2. To master analysis techniques of electric power systems
3. To understand control mechanism of distributed power generation systems
4. To master analysis techniques of distributed power generation systems

**Schedule)** 1. Energy transformation technique 2. Basic circuit equations for electric power systems 3. Analysis method 1 in electric power systems 4. Analysis method 2 in electric power systems 5. Analysis method 3 in electric power systems 6. Voltage and reactive power in electric power systems 7. Modeling of synchronous machines 8. Characteristics of synchronous machines 9. Modeling of distributed power generation systems 10. Stability of electric power systems 11. Control of electric power systems 12. Control of distributed power generation systems 13. Requirements for stability in distributed power generation systems 14. Advances analysis method 1 in electric power systems 15. Advances analysis method 1 in electric power systems 16. Examination

**Evaluation Criteria)** Evaluate with portfolio and examinations

**Textbook)** printed materials

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216791>

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## Advanced Mechatronics Engineering

2 units (selection)

Ikuro Morita · PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Takashi Yasuno · ASSOCIATE PROFESSOR / ELECTRIC ENERGY ENGINEERING, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the basic principle of the diagnosis technology and the control technique of the industrial machine system that uses an electric actuator.

**Outline)** The objective of this lecture is to give a course on the modeling methods, the sensor techniques, the signal processing methods, the intelligent control algorithms for industrial machines driven by electrical actuators. The applications of these advanced schemes are also included.

**Style)** Lecture in combination with Portfolio

**Keyword)** *diagnosis technology, control algorithm, intelligent*

**Relational Lecture)** “Control System Design”(0.5, ⇒p.156), “Power Energy Conversion and Control Engineering”(0.5, ⇒p.153)

**Goal)**

1. The modeling, the sensor technology, and the diagnosis technology of the control system are introduced.
2. Improvement performances of control system, and Control algorithm for intelligent are introduced.

**Schedule)** 1. Sensor technology for failure diagnosis. 2. Signal processing technology for failure diagnosis. 3. Modeling method of electrical machines. 4. Modeling method of electrical machines on faulty conditions. 5. Characteristics of electrical machines on faulty conditions. 6. Intelligent control method 7. Fuzzy reasoning 8. Control system using fuzzy reasoning 9. Neural networks 10. Control system using neural networks 11. Motion control system 12. Two degree-of-freedom control system 13. Design method of feedback controller for disturbance suppression 14. Design method of feedforward controller for improvement of responses 15. Responses of two degree-of-freedom control system 16. Return of report, and conclusions

**Textbook)** The print is distributed.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216897>

**Contact)**

⇒ Morita (E棟2階北 B-3, +81-88-656-7451, morita@ee.tokushima-u.ac.jp)

⇒ Yasuno (E棟2階北 B-5, +81-88-656-7458, yasuno@ee.tokushima-u.ac.jp)

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## Communication Systems

2 units (selection)

Atsushi Takada · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Takahiro Oie · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Understanding the designing and administrating scheme of wireless communication system and multi-nodes networks. And bring up faculty of designing original telecommunication system.

**Outline)** Timing detection and regeneration of a phase and a frequency using a linear filter, design of a digital PLL, digital modulation and demodulation, and multiple access technique, e. g. FDMA, TDMA, CDMA in wireless communications. Design of data transmission protocol over optical data transmission system and computer networks, network administration techniques, e. g. DNS, and implementation of application program for internetworking.(Portfolio style)

**Style)** Portfolio

**Keyword)** *phase locked loop, optical transmission system, optical transmission system using repeater-amplifier, photonic network system, computer networks, network architecture, network management*

**Fundamental Lecture)** “Advanced Theory of Digital Transmission”(1.0, ⇒p.72), “Advanced Theory of Fundamental Communication”(1.0, ⇒p.67)

**Relational Lecture)** “Photonic Semiconductor Device Physics”(0.5, ⇒p.152)

**Requirement)** Students are required to have a good understanding of communication engineering and related subjects up to master-level.

**Goal)**

1. Able to design the multiple-access wireless communication system (e.g. FDMA, TDMA, CDMA).(Lecture No. 8)
2. Able to design the wide-area data transmission network with repeaters).(Lecture No. 1-7)
3. Able to design the network architecture which satisfies the specified demands on multi-nodes network (e.g. computer networks).(Lecture No. 9-16)

**Schedule)** 1. Timing detection and regeneration of a phase 2. Phase-locked loops and its components 3. Response to linear frequency variation 4. Digital modulation and demodulation 5. Designing the optical transmission system 6. Designing the optical transmission system using repeater-amplifier 7. Photonic network system 8. Mobile communication system (FDMA, TDMA, CDMA) 9. Transmission protocol of computer networks (Ethernet, ATM) 10. Transmission protocol of computer networks (TCP, UDP) 11. Network administration technique (DNS) 12. Network administration technique (SNMP, MIB) 13. Implementation of network application 14. Designing the application protocol 15. Distributed database system 16. Designing the distributed system

**Evaluation Criteria)** Reports and presentation 100 %. More than 60 % is required to pass the class.

**Textbook)**

- ◇ Optical amplifiers and their applications
- ◇ Nonlinear fiber optics

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216701>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ A. Takada (Bldg. E-C3,656-7465, takada@ee) (Office Hour: A. Takada: Tue. 13:30-14:30, Thu. 16:30-17:30)
- ⇒ Oie (E-3F-C-1, +81-88-656-7479, alex@ee.tokushima-u.ac.jp) (Office Hour: Tuesday 16:20~ 17:20, Thursday 16:50~ 17:50)

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## Integrated System Design

2 units (selection)

Shinsuke Konaka · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** High frequency design method and theory for GHz/Gbit high speed integrated circuits are lectured and discussed.

**Outline)** High frequency circuit design methodology using circuit simulator and 3D electromagnetic simulator is lectured by using high speed bipolar/MOS transistor parameters and high frequency circuit models of wire, poly-silicon resistor, MIM capacitor and spiral inductor.

**Style)** Lecture and exercise

**Keyword)** *RF analog circuit design, AC device parameters, high frequency integrated circuits*

**Relational Lecture)** “Integrated System Design”(0.5, ⇒p.155)

**Goal)**

1. To understand high frequency circuit models of transistor, wire, resistor, MIM capacitor and spiral inductor.
2. To understand high frequency circuit design and measurement.

**Schedule)** 1. Bipolar/MOS transistor device models 2. AC equivalent circuit models of a wire, resistor, MIM capacitor and spiral inductor 3. S parameter measurements and AC device parameter extractions 4. High frequency stability design 5. Case studies of high frequency integrated circuits

**Evaluation Criteria)** Report 100%. The passing mark is not less than 60%.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216698>

**Contact)**

- ⇒ Konaka (E 棟 3 階北 C-2, +81-88-656-7469, konaka@ee.tokushima-u.ac.jp)

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## Electronic Information System Design

2 units (selection)

Masaki Hashizume · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Hiroyuki Yotsuyanagi · ASSOCIATE PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the techniques and the recent topics related to the design and test of logic circuits.

**Outline)** Performance analysis methods of digital circuits in information systems, high speed logic circuit design, low power circuit design and optimized logic circuit design for high performance information system, testing and testable design of digital and analog circuits for realizing high reliable information system.

**Style)** Lecture in combination with Portfolio

**Keyword)** *system design for integrated circuits, testing of integrated circuits, synthesis for testability*

**Fundamental Lecture)** “Advanced Theory of Electronic Circuits”(1.0, ⇒p.73)

**Relational Lecture)** “Integrated Information System Design”(0.5, ⇒p.156), “Integrated System Design”(0.2, ⇒p.155)

**Requirement)** Familiarity with switching theory

**Goal)**

1. To understand system design techniques for integrated circuits
2. To understand test technologies for integrated circuits
3. To understand design for testability techniques for integrated circuits

**Schedule)** 1. compositions of information systems 2. integrated process of logic circuits 3. logic synthesis for combinational circuits 4. design process of sequential circuits 5. principle of dynamic logic circuits 6. design of dynamic logic circuits 7. hardware description language 8. circuit design using HDL 9. test process of logic circuits 10. test technologies for combinational logic circuits 11. test technologies for sequential logic circuits 12. design for testability 13. test technologies using design for testability 14. techniques of design for testability 15. Built-in self test for logic circuits 16. Final examination

**Evaluation Criteria)** Participation and presentation:30%; Final examination:70%

**Textbook)** specified in the first class

**Reference)** introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216785>

**Student)** Able to be taken by only specified class(es)

**Contact)**

- ⇒ Hashizume (E 棟 3 階南 D-2, +81-88-656-7473, tume@ee.tokushima-u.ac.jp)
- ⇒ Yotsuyanagi (E 棟 3 階南 D-3, +81-88-656-9183, yanagi4@ee.tokushima-u.ac.jp) (Office Hour: 水・金 17:00~ 18:00)

**Note)** This subject will be given in English.

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## Multimedia Communication Theory and Technology

2 units (selection)

Yasutada Oohama · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Hitoshi Tokushige · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** This class provides the knowledge necessary to understand fundamental techniques for multimedia information and communication systems, such as coding method of multimedia data, information security, network security, user authentication, cryptology

**Outline)** This lecture is focused on multimedia communication theory and technology. Particularly, Internet Technology, Computer Networks, Satellite Communications, Information Security and Cryptology, Multimedia Coding Theory and Its Applications are explained in this lecture.

**Style)** Lecture

**Keyword)** *Internet technology, computer networks, satellite communications, information security, multimedia coding theory*

**Fundamental Lecture)** “Advanced Exercise on Intelligent Science”(1.0)

**Requirement)** 特になし

**Goal)**

1. fundamental technics for multimedia information and communication systems can be learned
2. Development method for multimedia information and communication systems can be learned

**Schedule**) 1. Multimedia Communication Theory and Technology 2. Coding Theory for Multimedia data (1) 3. Coding Theory for Multimedia data (2) 4. Coding Theory for Multimedia data (3) 5. Digital data Transmission (1) 6. Digital data Transmission (2) 7. Cryptology (1) 8. Cryptology (2) 9. Cryptology (3) 10. Information Security 11. Network Security (1) 12. Network Security (2) 13. Contents Protection for Multimedia Data 14. User Authentication 15. Digital Signature 16. Assignment

**Evaluation Criteria**) Assignments count 100%.

**Textbook**) Printed synopses of lecture are distributed.

**Reference**) To be introduced in the class.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216889>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Oohama (C302, +81-88-656-9446, oohama@is.tokushima-u.ac.jp)

⇒ Tokushige (C303, +81-88-656-9447, tokushige@is.tokushima-u.ac.jp) (Office Hour: 月曜日, 火曜日 (16:00-18:00))

## Integrated Information System Design

2 units (selection)

Minoru Fukumi · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Takashi Shimamoto · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) The aim of this lecture is to master the modern design technologies of very large scale integrated circuits.

**Outline**) Very large scale integrated circuit (V-LSI) design and production method. Using CAD technology, VLSI logic design, testing and fabrication are explained. Design of high-speed algorithm and parallel distributed processing system. Neural network and genetic algorithm for integrated circuit design.

**Style**) Lecture and exercise

**Requirement**) It is necessary to get the unit of the mos integrated circuits in master course.

**Notice**) In order to get the unit of this lecture, the graduate course students should have learned the-state-of-the-art of the modern hardware technology, especially C-MOS integrated circuits.

**Goal**) This lecture is designed to provide engineers and scientists with an introduction to the field of VLSI neurocomputing.

**Schedule**) 1. Embedded software architecture 2. Real-time schedule method 3. System description language 4. Application specific integrated circuits 5. Power consumption and speed of very large scale integrated circuits 6. Shared memory and communication method 7. Cache memory and main memory 8. System modeling and documentation 9. Partitioning and performance 10. data flow graph and finite state machine 11. Behavior description language and Spec C 12. Control data-flow graph and function synthesis 13. Neural computing board diagram using EEPROM-style programmable synapses 14. Layout pattern example 15. Gate-sizing wiring and timing driven 16. Boundary scan and delay estimation

**Evaluation Criteria**) Unit evaluation contains test and design of VLSI

**Textbook**) Hardware Annealing in Analog VLSI Neurocomputing, Kluwer Academic Publishers

**Reference**) Electronics Circuits, written by Norio Akamatsu

**Webpage**) <http://titan.is.tokushima-u.ac.jp/~fukumi>

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216700>

**Student**) Able to be taken by student of other department and faculty

**Contact**)

⇒ Fukumi (D210, +81-88-656-7510, fukumi@is.tokushima-u.ac.jp) (Office Hour: 原則として, 水曜日 15時 ~ 18時, ただし年度により異なる場合があるので講義の際に指定する.)

**Note**) Lecturer will show the schedule of this lecture and design technologies.

## Advanced Nonlinear Circuit Technology

2 units (selection)

Yoshifumi Nishio · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) Nonlinear circuits technology is lectured.

**Outline**) Various nonlinear circuits from communication circuits such as oscillators and modulators to large scale analog circuits including neural networks are utilized in recent technology. In this course, analysis methods, design methods and simulation methods of these nonlinear circuits are lectured. Furthermore, recent development of nonlinear circuit technology is introduced and future applications are discussed. (Style: Lecture)

**Style**) Lecture and exercise

**Keyword**) *nonlinear circuits, neural network, chaotic circuits*

**Fundamental Lecture**) “Advanced Circuit Theory”(0.7, ⇒p.67), “Advanced Theory of Complex System Engineering”(0.5, ⇒p.66)

**Relational Lecture**) “Nonlinear System Design”(0.5, ⇒p.157)

**Requirement**) Students are required to know how to analyze basic linear circuits.

**Notice**) Course is taught in English.

**Goal**)

1. Understanding of importance of nonlinear circuit technology.
2. Learning of technique dealing nonlinear circuit technology.

**Schedule**) 1. Nonlinear circuits in engineering systems. 2. Oscillators. 3. Communication circuits. 4. Neural networks. 5. Chaotic circuits. 6. Ultra-high speed integrated circuits. 7. Analysis of nonlinear circuits. 8. Design of nonlinear circuits. 9. Simulation methods of nonlinear circuits. 10. Recent development of nonlinear circuits (for 2 lectures). 11. Future applications of nonlinear circuits (for 3 lectures). 12. Conclusions. 13. Final examination.

**Evaluation Criteria**) Final examination 80% and exercise 20%.

**Textbook**) None.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216847>

**Student**) Able to be taken by only specified class(es)

**Contact**)

⇒ Nishio (D-7, E-3F-South, +81-88-656-7470, nishio@ee.tokushima-u.ac.jp)

**Note**) 授業を受ける際には, 2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが, 授業の理解と単位取得のために必要である.

## Control System Design

2 units (selection)

Tomohiro Kubo · PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Hidetoshi Oya · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target**) To learn the control theory, mainly the robust control.

**Outline**) When a control system is synthesized, it is important to take the uncertainty of the plant model and the disturbances into account. The design methods to obtain robust control systems against these effects are demonstrated.(lecture or portfolio style)

**Style**) Lecture in combination with Portfolio

**Keyword**) *robust control*

**Fundamental Lecture**) “Advanced Control Theory”(1.0, ⇒p.72)

**Relational Lecture**) “Advanced Control Theory”(0.5, ⇒p.72)

**Requirement**) Knowledge about the control system design method based on the state space method and the transfer function method is required to attend this lecture.

**Notice**) Preparation and review are essential.

**Goal**)

1. Mastering the classical robust control (Lecture 1-8).
2. Mastering the  $H_\infty$  control (Lecture 9-16).

**Schedule**) 1. What is the robust control? 2. Stability of linear systems 3. Sensitivity 4. Expression of uncertainty 5. Quadratic stabilization 6. Stability margin of LQ regulator 7. Insensitivity of LQ regulator 8. Review of the first half 9. Singular value and  $H_\infty$  norm 10. Robust stabilization 11. Sensitivity reduction 12. Standard  $H_\infty$  problem 13. Solution (state feedback) 14. Solution (output feedback) 15. Review of the second half 16. Grand review

**Evaluation Criteria**) Mainly by the report for each goal.

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216723>

**Contact**)



⇒ Kubo (E棟3階北 C-8, +81-88-656-7466, kubo@ee.tokushima-u.ac.jp) (Office Hour: 月曜日 8:30~9:30, 木曜日 17:00~18:00)  
⇒ Oya (E-building (C-7), +81-88-656-7467, hide-o@ee.tokushima-u.ac.jp)

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## Nonlinear System Design

2 units (selection)

Tetsushi Ueta · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** For various nonlinear phenomena observed in physical, chemical, and biological systems, construction methodologies of numerical models describing their dynamical behavior are discussed. Analysis and design methods are also studied.

**Outline)** Analysis and design of nonlinear dynamical systems are discussed: 1) description and characterization of dynamical systems, 2) qualitative theory of ordinary differential equations, 3) numerical method of analysis, 4) analysis of chaotic states and bifurcations 5) controlling chaos. Typical nonlinear phenomena are illustrated and analyzed by qualitative and numerical methods. Nonlinear system design problems are also discussed.

**Style)** Lecture

**Keyword)** *nonlinear dynamical system, bifurcation, system design*

**Fundamental Lecture)** “Advanced Theory of Complex System Engineering”(1.0, ⇒p.66), “Topics of Analysis for Mathematical Science”(1.0, ⇒p.9), “Advanced Circuit Theory”(1.0, ⇒p.67)

**Relational Lecture)** “Control System Design”(0.5, ⇒p.156), “Advanced Nonlinear Circuit Technology”(0.5, ⇒p.156)

**Requirement)** None

**Notice)** A lecture “Advanced Theory of Complex System Engineering,” available for the Master’s course is mutually cooperated with this lecture.

**Goal)** acquisition of techniques for deriving model equations and proceeding bifurcation analyses.

**Schedule)** 1. Introduction to dynamical systems 2. Fixed points, equilibria and their stability 3. Periodic solution and its stability 4. Analytic approaches for periodic solutions 5. Numerical approaches for periodic solutions 6. Local bifurcations 7. Calculation of bifurcation parameter values 8. Global bifurcations and its numerical analysis 9. Deriving model equations 1 10. Deriving model equations 2 11. Symmetry and its applications to calculations 12. Various bifurcation phenomena and chaos 13. Existence and numerical indices for chaos 14. practice 1 15. practice 2 16. answers and survey

**Evaluation Criteria)** The total grade is evaluated by homework reports (70 %) and attendance of the class. (30 %)

**Textbook)** not specified.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216851>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ueta (AIT 507, +81-88-656-7501, tetsushi@ait.tokushima-u.ac.jp) (Office Hour: Wednesday, afternoon)

**Note)** ◇This lecture is given in English. ◇This lecture requires a 2-hour preparation study and a 2-hour review for comprehension. ◇The achievement of every subject in the plan is evaluated by reports.

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## Medical and Biological Engineering

2 units (selection)

Masatake Akutagawa · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Various applications of electronic technologies to medical fields are described.

**Outline)** Fundamental approaches to apply engineering such as electronics to medical fields including diagnosis, treatment and alternative function are described in relation to life sciences such as physiology, biomechanics and so forth. Typical systems of medical instruments are introduced. The development of new technologies based on the intelligent functions of living bodies are presented. Functional characteristics of the nervous system and their application to information processing and control are discussed.

**Style)** Lecture in combination with Portfolio

**Goal)** 1 Biological signal measurement 2 Biological signal processing 3 Medical systems

**Schedule)** 1. Introduction of medical engineering 2. Introduction of measurement of biological signal 3. Electrical measurement methods 4. Magnetic measurement methods 5. Ultrasonic measurement methods 6. Other measurement methods 7. Biological signal processing methods 8. Examples of biological signal processing 9. Biological system identification 10. Measurement of brain functions 11. Measurement of other functions 12. Biological monitor 13. Analysis of electrical properties of tissue 14. Examples of medical diagnosis technology 15. Examples of medical treatment technology 16. Medical prosthesis technology

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216557>

**Contact)**

⇒ Akutagawa (工学部電気棟3階北 C-5, +81-88-656-7477, makutaga@ee.tokushima-u.ac.jp) (Office Hour: Thu. 18:00 - 20:00, Fri. 17:00 - 18:00)

**Note)** This lecture will be given in English.

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## Medical Information Systems

2 units (selection)

Noboru Niki · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoshiki Kawata · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the fundamental concepts of digital environment for medical diagnosis. To learn the design methods of medical information systems.

**Outline)** This course introduces the design and the implementation of digital environment for medical diagnosis based on the various technologies including medical image data acquisition and retrieval, computer aided diagnosis using multimodal medical data sets.

**Style)** Portfolio

**Keyword)** *imaging technology, computed-aided diagnosis systems, digital environment for medical diagnosis*

**Relational Lecture)** “Medical and Biological Engineering”(0.5, ⇒p.157)

**Goal)**

1. To understand medical imaging techniques.
2. To understand various techniques of computer-aided diagnosis.
3. To understand the fundamentals of digital environment for medical diagnosis.

**Schedule)** 1. Introduction 2. Imaging techniques 3. Image processing techniques 4. Pattern recognition techniques 5. Visualization techniques 6. Virtual reality/Mixed reality techniques 7. Design of computer-aided diagnosis systems 8. Implementation of computer-aided diagnosis systems 9. Design and implementation of fundamentals of digital environment for medical diagnosis and therapy 10. Design of medical information systems (1) 11. Design of medical information systems (2) 12. Design of medical information systems (3) 13. Design of medical information systems (4) 14. Design of medical information systems (5) 15. Advanced medical information systems

**Evaluation Criteria)** Report 100%

**Textbook)** Reference books are introduced to each topics.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216555>

**Contact)**

⇒ Niki (Opt.507, +81-88-656-9430, niki@opt.tokushima-u.ac.jp)  
⇒ Kawata (Opt.508, +81-88-656-9431, kawata@opt.tokushima-u.ac.jp)

**Note)** Preparation (2hrs) and Review (2hrs) are required to take this lecture (2hrs).

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## Advanced Lecture on Quantum Nanostructure Semiconductors

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target)** This lecture aims at understanding basic concepts of the quantum effects of semiconductor nanostructures based on materials science and various technologies for device applications.

**Outline)** This lecture introduces characteristics of quantum structures and technologies of the device applications, based on quantum mechanics, semiconductor physics, materials science and photonics. Advanced technologies of fabrication and measurements and recent topics of the research are also introduced.

**Style)** Lecture

**Goal)** To understand materials science and application technologies of nano structure semiconductors

**Schedule)** 1. Electronic states in semiconductor quantum structures 2. Electronic properties of quantum structures 3. Optical properties of quantum structures 4. Fabrication technologies of semiconductor nanostructures 5. Evaluation technologies of crystals 6. Evaluation technologies of nanostructures 7. Analysis of electronic properties 8. Analysis of optical properties 9. Quantum effect devices 10. Nonlinear optical responses of semiconductors 11. Responses of optical micro cavity 12. Research progress in quantum nanostructure semiconductors 13. Ultrafast optical devices 14. Quantum information devices 15. Topics of recent advanced research (1) 16. Topics of recent advanced research (2)

**Evaluation Criteria)** Assignments

**Textbook)** None

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216907>

**Contact)**

⇒ Isu (A224, +81-88-656-7670, t.isu@frc.tokushima-u.ac.jp) (Office Hour: Tue -Thu 10:00-14:00)

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### Special Exercise on Electrical and Electronic Systems Innovation Engineering

2 units (compulsory)

All teachers

**Target)** To obtain wide knowledge on electric and electronic engineering and research skills.

**Outline)** To make research on your research topics with your adviser through discussions and readings of references.

**Style)** Portfolio

**Keyword)** *research skill, acquisition of professional knowledge*

**Requirement)** none

**Notice)** none

**Goal)**

1. To obtain professional knowledge on your research topics
2. To get research skills
3. To get presentation skills

**Schedule)** 1. Determine your research topics 2. Read references on your research topics 3. Make research 4. Presentation and discussion

**Evaluation Criteria)** Evaluation with portfolio and examination

**Textbook)** Text books will be introduced by your supervisor at the beginning of this exercise.

**Reference)** References may be introduced by your supervisor.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216779>

**Student)** Able to be taken by only specified class(es)

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### Advanced Research on Electrical and Electronic Engineering

2 units (compulsory)  
Teachers in other colleges or departments

**Target)** To obtain wide knowledge on recent engineering

**Outline)** To make research on a technology, which is different from your main research field.

**Style)** Portfolio

**Keyword)** *engineering, technology, different field*

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn a recent technology, which is different from the main technology in your field

**Schedule)** Choose a research theme on technology or engineering, which is different from yours.

**Evaluation Criteria)** Evaluate with a portfolio and/or examinations.

**Textbook)** Ask to teachers

**Reference)** printed materials

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216780>

**Student)** Students belonging an other departments or colleges

## Systems Innovation Engineering — Information Science and Intelligent Systems

### SYLLABUS OF SUBJECTS

• **Integrated Subjects**

<b>Human Factors</b> ...Yoshida .....	159
<b>Life Science</b> ...Takagi · Tsuji .....	159
<b>Social Science</b> ...yokohata .....	159
<b>Science and Technology Studies</b> ...Tanaka .....	160
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	160
<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和 .....	160
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	161
<b>Long-term Internship (D)</b> ...Yamanaka .....	161
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer .....	161
<b>International Advanced Technology and Science 1</b> ...Murakami .....	162
<b>International Advanced Technology and Science 2</b> ...Murakami .....	162
<b>Presentation Method (D)</b> ...Graduate School of Advanced Technology and Science .....	162
<b>Internship (D)</b> .....	162
<b>Venture Business (D)</b> .....	163

• **Specialized Subjects**

<b>Autonomous Adaptive Systems Engineering</b> ...Ono · Mogami .....	163
<b>Visual pattern processing</b> ...Terada · Karungaru .....	163
<b>Multimedia Communication Theory and Technology</b> ...Oohama · Tokushige .....	163
<b>Integrated Information System Design</b> ...Fukumi · Shimamoto .....	164
<b>Parallel and Distributed Processing Systems</b> ...Shimomura · Ikeda · Sano .....	164
<b>Applied Knowledge Systems</b> ...Aoe · Kita · Shishibori · Fuketa · Morita .....	164
<b>Intelligent Information Systems</b> ...Ogata · Mitsuhara · Kanenishi · Ito .....	165
<b>Multimedia Systems and Applications</b> ...Ueta .....	165
<b>Advanced Affective Computing</b> ...Ren · Suzuki .....	165

• **Specialized Exercise and Experiments**

<b>Advanced Exercise on Intelligent Science</b> ...All teachers .....	166
<b>Advanced Research on Intelligent Science</b> ...Teachers in other colleges or departments .....	166

**Target** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule** 1. What is Human Factors 2. Historical Overview of Human Factors 3. Multi-Disciplinary Aspect of Human Factors 4. Health and Safty Issue of Human Factors 5. Human Psychological Capability 6. Task Analysis 7. Human Error 8. Universal Design 9. Cognitive Artifact 10. Visibility and Affordance 11. Human-Computer Interaction 12. Human Information Processing 13. Knowledge and Mental Model 14. Usability Paradigms and Principles 15. Evaluation and Testing 16. Making system that makes us smart

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Yoshida (+81-88-656-7897, yos@ias.tokushima-u.ac.jp)

### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target** Understanding of significance of protein in biotechnology

**Outline** Basics of structure, function and application of protein are introduced

**Style** Lecture

**Keyword** *protein, enzyme, biotechnology*

**Goal**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule** 1. Introduction of life science 2. History of life science 3. Structure and function of DNA and RNA 4. mRNA is a template of protein 5. Duplication of DNA 6. Regulation of protein expression 7. Human Genetics 8. Genetic disease 9. DNA diagnosis 10. Structure and function of protein 11. Principle of gene technology (1) 12. Principle of gene technology (2) 13. Protein engineering 14. Future of life science (1) 15. Future of life science (2) 16. Preparation of report

**Evaluation Criteria** Evaluation by report

**Textbook** To be introduced in the class

**Reference** To be introduced in the class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

### Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIKOKU UNIVERSITY

**Target** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

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### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp)

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## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文学の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 4. 馬力の発見—農業技術の革新とヨーロッパ社会 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業社会 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

⇒ Tanaka . (Office Hour: tanaka@kenroku.kanazawa-u.ac.jp)

⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

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## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING

First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業

家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

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## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER

Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Relational Lecture)** "Introduction to Intellectual Property"(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方 -特許は明細書を中心に動く- (山内) 10. 技術者が知っておくべき実務知識 -特許法上の留意事項- (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook** To be used textbooks made by lecturers.

**Reference** Nobuhiro Nakayama:Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION

非常勤講師

**Target** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生・集落再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型“葉っぱビジネス”“いろどり”や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。 <参考:平成22年度ビジネスモデル特論> 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) ○集中講義-2(ICTビジネスモデル) \* 12月21日(火) 常三島キャンパス(第13回~第15回) ○交流会 \* 11月27日(土):20:15-21:45 月ヶ谷温泉にて交流会を行う。参加自由(参加費3,000円)

**Goal** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求-:笠松和(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ぐ奇跡, 千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要な文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference** Several are introduced in class

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student** 徳島大学大学院先端技術科学教育部マスターコース、及び、ドクターコースの学生

**Contact**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有 (088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Part-time Lecturer

**Target** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style** Lecture

**Keyword** management, management of technology

**Relational Lecture** "Management Theory of New Business"(0.5, ⇒p.160), "Long-term Internship (D)"(0.5, ⇒p.161), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.161)

**Notice** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook** It doesn't specially use. The summary and so on is distributed every time.

**Reference** Several are introduced in class.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student** Able to be taken by only specified class(es)

**Contact**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note** This class invites seven Honda alumni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

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### International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

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**Target** This is an intensive course for advanced technology and science in English which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in English.

**Outline** In this course, an intensive course for advanced technology and science in English should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in English can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in English should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in English and then the power of expression and presentation in English would be improved.

**Evaluation Criteria** an enterprising behavior, portfolio and reports

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

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### International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

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**Target** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in English. The students also study advanced technology and science in

its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline** In this course, the students attend to intensive classes on advanced technology and science in English at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in English. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in English.

**Goal**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria** Enterprising behavior, reports and portfolio.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

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### Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

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**Target** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal** The lecture is aiming at having knowledge and experience of the presentation in international conferences.

**Evaluation Criteria** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student** Able to be taken by only specified class(es)

**Note** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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### Internship (D)

2 units (selection)

**Target** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student** Able to be taken by only specified class(es)

**Note** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Autonomous Adaptive Systems Engineering

2 units (selection)

Norihiko Ono · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Yoshio Mogami · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** This class provides the knowledge and skills necessary for understanding the basic concepts, theories and application techniques concerning the emergent systems design methodologies for autonomous and adaptive intelligent agent systems.

**Outline)** Recently, autonomous adaptive systems have been studied that are able to improve their own performance autonomously, adaptively and incrementally during the course of interactions with the environments, and those design methodologies have been explored for the systems. This class covers the emergent design methodologies for autonomous adaptive agents and multi-agent systems, mainly based on machine learning and evolutionary computation.

**Style)** Portfolio

**Keyword)** *autonomous adaptive systems, emergent systems design, reinforcement learning, evolutionary computation, multi-agent systems*

**Fundamental Lecture)** "Autonomous Intelligent Systems"(0.5, ⇒p.83)

**Relational Lecture)** "Applied Knowledge Systems"(0.5, ⇒p.164)

**Goal)** This class aims at the understanding of an overview of the emergent design methodologies for autonomous adaptive agents and multi-agent systems, mainly based on reinforcement learning, evolutionary computation, genetic programming, and neural networks, as well as the applicabilities and limitations of the methodologies.

**Schedule)** 1. Emergent systems design methodologies 2. Foundations of emergent systems design: reinforcement learning (1) 3. Foundations of emergent systems design: reinforcement learning (2) 4. Foundations of emergent systems design: evolutionary computation (1) 5. Foundations of emergent systems design: evolutionary computation (2) 6. Foundations of emergent systems design: genetic programming 7. Foundations of emergent systems design: neural networks 8. Emergent systems design methodologies based on reinforcement learning (1) 9. Emergent systems design methodologies based on reinforcement learning (2) 10. Emergent systems design methodologies based on neuro-evolution (1) 11. Emergent systems design methodologies based on neuro-evolution (2) 12. Emergent systems design methodologies based on genetic programming 13. Emergent systems design methodologies based on co-evolution 14. Emergent systems design methodologies for multi-agent systems (1) 15. Emergent systems design methodologies for multi-agent systems (2)

**Evaluation Criteria)** Assignment count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216705>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ono (D106, +81-88-656-7509, [ono@is.tokushima-u.ac.jp](mailto:ono@is.tokushima-u.ac.jp)) (Office Hour: 金曜日 15:00~ 17:30)

⇒ Mogami (D102, +81-88-656-7505, [moga@is.tokushima-u.ac.jp](mailto:moga@is.tokushima-u.ac.jp)) (Office Hour: Mon. 15:00~18:00 (Refer to the notice of the department in every year.))

**Note)** ◇ 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。◇ 授業計画1~15に関しては、レポートにより達成度評価を行なう。

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## Visual pattern processing

2 units (selection)

Kenji Terada · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Stephen Karungaru-Githinji · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** The basic technologies which replace the visual pattern processing function of man by computer and their applied technologies are made to master.

**Outline)** The advanced processing techniques of visual pattern, i.e., the pre-processing techniques, the feature extraction techniques, the classification techniques of visual pattern, the processing techniques of color image and their application examples are lectured.

**Style)** Lecture in combination with Portfolio

**Keyword)** *pattern recognition, vision, image processing*

**Fundamental Lecture)** "Applied Image Processing"(1.0, ⇒p.84)

**Goal)** Acquisition of knowledge about the processing theories of visual pattern and their various applied technologies, and the processing technologies of color image

**Schedule)** 1. Concept of pattern recognition 2. Statistical pattern classification method 1 3. Statistical pattern classification method 2 4. Pattern classification method by the structural analysis technique 5. Pre-processing method of visual pattern 6. Feature extraction method of visual pattern 1 7. Feature extraction method of visual pattern 2 8. Segmentation method of visual pattern 1 9. Segmentation method of visual pattern 2 10. Pattern classification method by neural network 11. Pattern classification method by GA 12. Security image processing 13. Tracking of moving object 14. Texture analysis 15. The feature extraction method of color image and its application 16. Periodic examination

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216675>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Terada (Dr.802, +81-88-656-7499, [terada@is.tokushima-u.ac.jp](mailto:terada@is.tokushima-u.ac.jp)) (Office Hour: 月, 水曜日 15:00~ 17:00(年度ごとに学科の掲示を参照すること))

**Note)** ◇ 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。◇ 授業計画1~15は、各講義の最後に行なわれる演習および最終試験により達成度評価を行なう。

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## Multimedia Communication Theory and Technology

2 units (selection)

Yasutada Oohama · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Hitoshi Tokushige · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** This class provides the knowledge necessary to understand fundamental technics for multimedia information and communication systems, such as coding method of multimedia data, information security, network security, user authentication, cryptology

**Outline)** This lecture is focused on multimedia communication theory and technology. Particularly, Internet Technology, Computer Networks, Satellite Communications, Information Security and Cryptology, Multimedia Coding Theory and Its Applications are explained in this lecture.

**Style)** Lecture

**Keyword)** *Internet technology, computer networks, satellite communications, information security, multimedia coding theory*

**Fundamental Lecture)** "Advanced Exercise on Intelligent Science"(1.0, ⇒p.166)

**Requirement)** 特になし

**Goal)**

1. fundamental technics for multimedia information and communication systems can be learned
2. Development method for multimedia information and communication systems can be learned

**Schedule)** 1. Multimedia Communication Theory and Technology 2. Coding Theory for Multimedia data (1) 3. Coding Theory for Multimedia data (2) 4. Coding Theory for Multimedia data (3) 5. Digital data Transmission (1) 6. Digital data Transmission (2) 7. Cryptology (1) 8. Cryptology (2) 9. Cryptology (3) 10. Information Security 11. Network Security (1) 12. Network Security (2) 13. Contents Protection for Multimedia Data 14. User Authentication 15. Digital Signature 16. Assignment

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** Printed synopses of lecture are distributed.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216888>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Oohama (C302, +81-88-656-9446, oohama@is.tokushima-u.ac.jp)

⇒ Kitayama .

⇒ Tokushige (C303, +81-88-656-9447, tokusige@is.tokushima-u.ac.jp) (Office Hour: 月曜日, 火曜日 (16:00-18:00))

## Integrated Information System Design

2 units (selection)

Minoru Fukumi · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Takashi Shimamoto · PROFESSOR / INTELLIGENT NETWORKS AND COMPUTER SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The aim of this lecture is to master the modern design technologies of very large scale integrated circuits.

**Outline)** Very large scale integrated circuit (V-LSI) design and production method. Using CAD technology, VLSI logic design, testing and fabrication are explained. Design of high-speed algorithm and parallel distributed processing system. Neural network and genetic algorithm for integrated circuit design.

**Style)** Lecture and exercise

**Requirement)** It is necessary to get the unit of the mos integrated circuits in master course.

**Notice)** In order to get the unit of this lecture, the graduate course students should have learned the-state-of-the-art of the modern hardware technology, especially C-MOS integrated circuits.

**Goal)** This lecture is designed to provide engineers and scientists with an introduction to the field of VLSI neurocomputing.

**Schedule)** 1. Embedded software architecture 2. Real-time schedule method 3. System description language 4. Application specific integrated circuits 5. Power consumption and speed of very large scale integrated circuits 6. Shared memory and communication method 7. Cache memory and main memory 8. System modeling and documentation 9. Partitioning and performance 10. data flow graph and finite state machine 11. Behavior description language and Spec C 12. Control data-flow graph and function synthesis 13. Neural computing board diagram using EEPROM-style programmable synapses 14. Layout pattern example 15. Gate-sizing wiring and timing driven 16. Boundary scan and delay estimation

**Evaluation Criteria)** Unit evaluation contains test and design of VLSI

**Textbook)** Hardware Annealing in Analog VLSI Neurocomputing, Kluwer Academic Publishers

**Reference)** Electronics Circuits, written by Norio Akamatsu

**Webpage)** <http://titan.is.tokushima-u.ac.jp/~fukumi>

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216699>

**Student)** Able to be taken by student of other department and faculty

**Contact)**

⇒ Fukumi (D210, +81-88-656-7510, fukumi@is.tokushima-u.ac.jp) (Office Hour: 原則として, 水曜日 15時 ~ 18時, ただし年度により異なる場合があるので講義の際に指定する。)

**Note)** Lecturer will show the schedule of this lecture and design technologies.

## Parallel and Distributed Processing Systems

2 units (selection)

Takao Shimomura · PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kenji Ikeda · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Masahiko Sano · ASSOCIATE PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** This class introduces the knowledge and design skills necessary for developing parallel and distributed processing systems, and parallel and distributed algorithms.

**Outline)** Architectures of parallel and distributed processing systems, fault tolerance of distributed control systems and the development techniques of distributed systems for Web applications.(Portfolio style).

**Style)** Lecture in combination with Portfolio

**Keyword)** WWW, fault tolerance, parallel and distributed processing architecture

**Fundamental Lecture)** “Web Programming”(1.0, ⇒p.84)

**Goal)** 1. To understand the architecture of parallel and distributed processing systems, decentralized adaptive control systems and their fault tolerance, and the design of distributed WWW systems.

**Schedule)** 1. Parallel and distributed processing architectures 2. Memory and communication architectures 3. Parallel and distributed operating systems 4. Client server model 5. Cluster computing 6. linear space and normed space 7. small gain theorem and its applications 8. decentralized systems composed of interconnected subsystems 9. stability of decentralized control systems 10. fault tolerance of decentralized control systems 11. Servlets and JavaServer Pages 12. Web application servers 13. Web application systems 14. Web programming frameworks 15. Web programming design patterns 16. Assignment

**Evaluation Criteria)** Assignment count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216884>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Shimomura (C402, +81-88-656-7503, shimomura@is.tokushima-u.ac.jp) (Office Hour: Wed 15:00~ 18:00)

## Applied Knowledge Systems

2 units (selection)

Jun-ichi Aoe · PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kenji Kita · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Masami Shishibori · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Masao Fuketa · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kazuhiro Morita · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** The course introduces the basic principle and theory of knowledge-based systems, including natural language processing systems, voice language processing systems, information retrieval systems.

**Outline)** Knowledge systems to natural language processing, voice language processing, information retrieval and document database. Artificial natural language processing systems, such as automatic building systems of intelligent dictionaries, text understanding and summarization systems, dialog systems, natural language interface systems, text classification systems, natural language analysis systems and knowledge-based machine translation systems.

**Style)** Portfolio

**Keyword)** knowledge-based system, natural language processing system, speech and language processing system, information retrieval system, machine translation system

**Fundamental Lecture)** “Language Modeling”(1.0, ⇒p.83), “Natural Language Understanding”(1.0, ⇒p.84)

**Relational Lecture)** “Multimedia Systems and Applications”(0.5, ⇒p.165)

**Goal)** To learn various methods for constructing knowledge-based intelligent information systems.

**Schedule)** 1. Natural language processing systems 1: design and retrieval methods of dictionaries 2. Natural language processing systems 2: design and implementation of parsers 3. Natural language processing systems 3: design and implementation of language understanding systems 4. Machine translation systems 1: rule-based and example-based approaches 5. Machine translation systems 2: super-function 6. Machine translation systems 3: integrated methods 7. Speech and language processing systems 1: design of language models 8. Speech and language processing systems 2: design of acoustic models 9. Speech and language processing systems 3: design of search algorithms 10. Information retrieval systems 1: document retrieval based on vector space models 11. Information retrieval systems 2: retrieval methods based on inverted index files 12. Information retrieval systems 3: design and implementation of intelligent document retrieval systems 13. Intelligent multimedia contents processing systems 1 14. Intelligent multimedia contents processing systems 2 15. Recent topics 16. Assignment



**Evaluation Criteria)** Assignment count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216574>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Aoe (Dr604, +81-88-656-7486, aoe@is.tokushima-u.ac.jp) (Office Hour: Tuesday 12:50 - 14:20)

⇒ Kita (Dr503, +81-88-656-7496, kita@is.tokushima-u.ac.jp) (Office Hour: Tuesday 12:50 - 14:20)

## Intelligent Information Systems

2 units (selection)

Hiroaki Ogata · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Hiroyuki Mitsuhashi · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kazuhide Kanemishi · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Teruaki Ito · ASSOCIATE PROFESSOR / MECHANICAL SCIENCE, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

**Target)** Learning the design methods of intelligent information systems such as educational software and interactive systems.

**Outline)** Intelligent systems and their mechanics. Intelligent CAI. Intelligent interface. Micro-worlds in intelligent CAI. Learner-teacher modelling. Knowledge acquisition models. Empirical and analytical machine learning, e. g., ID3, similarity-, explanation-, and case-based learning. Genetics-based machine learning, e. g., genetic evolution and co-evolution of production systems, finite state machines, recurrent neural networks, and strategic knowledge. Concepts of collaborative interface systems based on intelligent interactions, and their implementation for design support systems.

**Style)** Lecture and exercise

**Keyword)** *intelligent interface, intelligent educational systems, intelligent agents, CSCW, CSCL, interactive interface*

**Fundamental Lecture)** “Human Factors”(1.0, ⇒p.159)

**Relational Lecture)** “Applied Knowledge Systems”(0.5, ⇒p.164), “Autonomous Adaptive Systems Engineering”(0.5, ⇒p.163)

**Goal)** Acquisition of the design methods of educational systems and interactive systems

**Schedule)** 1. Overview of Intelligent CAI, History and theories of CAI 2. Intelligent CAI 3. ITS 4. Learner model, Tutoring model, Theories of CAI 5. Web Based Learning Environment 6. Adaptive Hypermedia, Personalization 7. Game-based Learning 8. CSCL(Theories) 9. CSCL(Systems) 10. Knowledge Management, SNS and Education Support System 11. Mobile Learning Environment(Theories) 12. Mobile Learning Environment(Systems) 13. Ubiquitous Learning Environment(Theories) 14. Ubiquitous Learning Environment(Systems) 15. Summary of Educational Technologies 16. examination

**Evaluation Criteria)** We will grade based on reports and interactive presentation among students.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216764>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Ogata (C507, +81-88-656-7498, ogata@is.tokushima-u.ac.jp) (Office Hour: 月曜日 ~ 金曜日:午後 5 時 ~ 6 時)

⇒ Ito (M316, +81-88-656-2150, ito@me.tokushima-u.ac.jp)

**Note)** ◇ 授業を受ける際には、2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。◇ 授業計画 1~ 15 は、各講義のレポートおよび最終試験により達成度評価を行なう。

## Multimedia Systems and Applications

2 units (selection)

Tetsushi Ueta · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** Multimedia has become an indispensable part of modern computer technology. This course covers the theories, models, and systems of basic and advanced methods for designing and implementing multimedia systems. Latest multimedia Web technologies and some advanced topics will also be discussed.

**Outline)** The course introduces the theories, models, and systems of basic and advanced methods for next generation digital contents processing, including (1) intelligent processing for texts, speech, images, and movies, (2) intelligent media integration, and (3) intelligent human-computer interfaces.

**Style)** Portfolio

**Keyword)** *multimedia, digital contents, human-computer interface, media integration*

**Fundamental Lecture)** “Language Modeling”(1.0, ⇒p.83), “Applied Image Processing”(1.0, ⇒p.84)

**Relational Lecture)** “Applied Knowledge Systems”(0.5, ⇒p.164)

**Goal)** To learn advanced methods in design and implementation of next generation digital contents processing systems.

**Schedule)** 1. Multimedia contents fundamentals 2. Image, video, and audio compression 3. Intelligent document processing (1) 4. Intelligent document processing (2) 5. Intelligent image and video processing (1) 6. Intelligent image and video processing (2) 7. Intelligent speech processing (1) 8. Intelligent speech processing (2) 9. Multimedia storage systems and databases (1) 10. Multimedia storage systems and databases (2) 11. Multimedia information retrieval (1) 12. Multimedia information retrieval (2) 13. Multimedia Web Technologies (1) 14. Multimedia Web Technologies (2) 15. Recent topics 16. Assignment

**Evaluation Criteria)** Assignment count 100%.

**Textbook)** To be introduced in the class.

**Reference)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216703>

**Contact)**

⇒ Ueta (AIT 507, +81-88-656-7501, tetsushi@ait.tokushima-u.ac.jp) (Office Hour: Wednesday, afternoon)

## Advanced Affective Computing

2 units (selection)

Fuji Ren · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Motoyuki Suzuki · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand novel theories and algorithms of affective computing research fields, such as emotion information processing and emotion recognition.

**Outline)** First, concepts of affective computing and emotion are introduced, and basic theories and algorithms using emotion recognition and other affective computing research fields are lectured. After that, we study a detail of emotion recognition methods from various media, which is text, speech, and facial expression. Finally, emotion creating methods and expressing methods for robots are lectured.

**Keyword)** *affective information, emotion recognition, emotion calculation, language understanding, emotion creating, emotion expressing*

**Fundamental Lecture)** “Artificial Intelligence 1”(1.0), “自然言語処理”(1.0)

**Relational Lecture)** “Advanced Machine Translation”(0.5, ⇒p.85)

**Goal)** Understanding novel theories and algorithms of affective computing research fields, such as emotion information processing and emotion recognition.

**Schedule)** 1. Introduction of affective computing 2. Affective computing and emotion 3. Modeling method of emotion 4. Measuring method of emotion 5. Emotion in linguistic expression 6. Emotional corpus 7. Emotion recognition from text 8. Emotion in sound 9. Emotion recognition from speech 10. Emotion in still image and movie 11. Emotion recognition from facial expression 12. Emotion recognition from multi-modal 13. Emotion creating method for robot 14. Applications of affective computing 15. Affective communication between human and robot 16. Conclusion

**Evaluation Criteria)** Evaluation is carried out by report.

**Textbook)** なし

**Reference)** なし

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216601>

**Student)** Doctoral Course Students of Graduate School of Advanced Technology and Science

**Contact)**

⇒ Ren (C204, +81-88-656-9684, ren@is.tokushima-u.ac.jp) (Office Hour: 16:00-15:00 Tuesday, 16:00-17:00 Thursday)

⇒ Suzuki (C202, +81-88-656-9689, suzuki.m@is.tokushima-u.ac.jp)

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## Advanced Exercise on Intelligent Science

2 units (compulsory)  
All teachers

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**Target)** To conduct research leading to the awarding of doctoral degrees.

**Outline)** To conduct research in the Natural Language Understanding, Document Processing, Multimedia Information Retrieval, Image Processing, Movie Image Processing, Voice Recognition, Autonomous Agents Design, Internet Security, Intelligent Software, etc (seminars, portfolios etc).

**Style)** Lecture in combination with Portfolio

**Keyword)** *information science, software engineering*

**Notice)** Course plan differs depending on the laboratory you choose.

**Goal)** To present the results of your research related conferences, departmental research meetings, etc.

**Schedule)** 1. After the student selects the subjects, research can be carried out at the laboratory. However, the course contents are as shown below. 2. コーパスからスーパー関数の自動抽出及び機械翻訳への応用 3. 話者認識における長・短期間の音声変動に関する研究 4. カットシーン間の距離分布に基づくCM映像検出手法に関する研究 5. 進化的RBFネットワークによる三次元物体認識 6. リカレントニューラルネットワークの構造と重みの同時最適化のための進化計算手法に関する研究 7. メモリ展開されたコードを使う未知ウイルス解析支援システム 8. ウイルスの感染挙動と感染環境の状態を把握するための仮想ウイルス感染ネットワークに関する研究 9. PZTカメラを用いた教材コンテンツ作成のための講演者追跡システムの開発 10. 自由文からの感性情報解析技術に関する研究 11. 固有商品の好評不評情報抽出に関する研究 12. Web上での学習活動を再現・共有可能にするWBLシステム 13. ペン入力インタフェースにおけるジェスチャー評価実験 14. 自然言語処理技術を用いた中学理科教授学習システム 15. 協見運転防止のための近赤外線カメラを用いた顔の向き検出 16. 単音節認識のための基本周期を用いた母音認識

**Textbook)** None

**Reference)** Using papers for each research field.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216759>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Committee Member of School Affair

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## Advanced Research on Intelligent Science

2 units (compulsory)  
Teachers in other colleges or departments

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**Target)** To obtain broad information on recent engineering

**Outline)** To research a theme in a technology, which is different from the main technology in your field.

**Style)** Portfolio, Lecture in combination with Portfolio, Lecture and exercise

**Keyword)** *engineering, technology, different field*

**Requirement)** N/A

**Notice)** N/A

**Goal)** To learn a recent technology, which is different from the main technology in your field.

**Schedule)** Choose a theme on technology or engineering, which is different from that in your field.

**Evaluation Criteria)** Evaluated with portfolio or examination.

**Textbook)** Ask to teachers.

**Reference)** Prints

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216760>

**Student)** Able to be taken by only specified class(es)

## Systems Innovation Engineering — Optical Systems Engineering

### SYLLABUS OF SUBJECTS

• *Integrated Subjects*

<b>Human Factors</b> ...Yoshida .....	167
<b>Life Science</b> ...Takagi · Tsuji .....	167
<b>Social Science</b> ...yokohata .....	167
<b>Science and Technology Studies</b> ...Tanaka .....	168
<b>Management Theory of New Business</b> ...Vice chairperson of School Affairs Committee , Faculty of Engineering · First-line men with experience of practical business .....	168
<b>Introduction to Intellectual Property</b> ...Fujii · Yano · Iida · Yamauchi · 京和 .....	168
<b>Advanced Lecture in Theory of Business Models</b> ...Yamanaka · Yoshida · Tamaari · 非常勤講師 .....	169
<b>Long-term Internship (D)</b> ...Yamanaka .....	169
<b>Management of Technology</b> ...Yamanaka · Morimoto · Part-time Lecturer .....	169
<b>International Advanced Technology and Science 1</b> ...Murakami .....	170
<b>International Advanced Technology and Science 2</b> ...Murakami .....	170
<b>Presentation Method (D)</b> ...Graduate School of Advanced Technology and Science .....	170
<b>Internship (D)</b> .....	170
<b>Venture Business (D)</b> .....	171

• *Specialized Subjects*

<b>Radio Frequency Solid State Physics</b> ...Nakamura .....	171
<b>Engineering of Correlated Electron Matter</b> ...Kishimoto · Kawasaki .....	171
<b>Nonlinear Optical Devices</b> ...Haraguchi .....	171
<b>Applied Statistical Physics</b> ...Goto · Mori .....	171
<b>Organic Photo-functional Materials</b> ...Tanaka · Tezuka .....	172
<b>Advanced Optical Information Systems</b> ...Suyama · Yamamoto .....	172
<b>Medical Information Systems</b> ...Niki · Kawata .....	172
<b>Photonic Semiconductor Device Physics</b> ...Sakai · Naoi · Nishino .....	173
<b>Optical and Functional Inorganic Materials</b> ...Tominaga .....	173
<b>Medical and Biological Engineering</b> ...Akutagawa .....	173
<b>Visual pattern processing</b> ...Terada · Karungaru .....	173
<b>Applied Knowledge Systems</b> ...Aoe · Kita · Shishibori · Fuketa · Morita .....	174
<b>Advanced Lecture on Quantum Nanostructure Semiconductors</b> ...Isu · Kitada .....	174

• *Specialized Exercise and Experiments*

<b>Advanced Exercise on Optical System Engineering</b> ...All teachers .....	174
<b>Advanced Research on Optical System Engineering</b> ...Teachers in other colleges or departments .....	174

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### Human Factors

2 units (selection)

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES

**Target)** The objective of this class is to provide students with sufficiently thorough appreciation of the many facets of the human factors discipline so that they may make use of it to their own doctoral works.

**Outline)** This class offers a broad and comprehensive overview of the human factors/ergonomics discipline with four areas of emphasis, (1) historical review of human factors research, (2) human physical, perceptual and cognitive capabilities and limitations, (3) application of human factors research data in design, especially in the interface design of computer-based systems, and (4) discussion about the relationship between the designed system (technology) and people.

**Schedule)** **1.** What is Human Factors **2.** Historical Overview of Human Factors **3.** Multi-Disciplinary Aspect of Human Factors **4.** Health and Safty Issue of Human Factors **5.** Human Psychological Capability **6.** Task Analysis **7.** Human Error **8.** Universal Design **9.** Cognitive Artifact **10.** Visibility and Affordance **11.** Human-Computer Interaction **12.** Human Information Processing **13.** Knowledge and Mental Model **14.** Usability Paradigms and Principles **15.** Evaluation and Testing **16.** Making system that makes us smart

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216806>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yoshida (+81-88-656-7897, yos@ias.tokushima-u.ac.jp)

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### Life Science

2 units (selection)

Hiroshi Takagi · PART-TIME LECTURER / FUKUI PREFECTURAL UNIVERSITY

Akihiko Tsuji · PROFESSOR / BIOLOGICAL REACTIONS, BIOLOGICAL SCIENCE AND TECHNOLOGY, EARTH AND LIFE ENVIRONMENTAL ENGINEERING

**Target)** Understanding of significance of protein in biotechnology

**Outline)** Basics of structure, function and application of protein are introduced

**Style)** Lecture

**Keyword)** *protein, enzyme, biotechnology*

**Goal)**

1. Understanding of multiple functions of proteins
2. Understanding of principle of protein engineering and its application

**Schedule)** **1.** Introduction of life science **2.** History of life science **3.** Structure and function of DNA and RNA **4.** mRNA is a template of protein **5.** Duplication of DNA **6.** Regulation of protein expression **7.** Human Genetics **8.** Genetic disease **9.** DNA diagnosis **10.** Structure and function of protein **11.** Principle of gene technology (1) **12.** Principle of gene technology (2) **13.** Protein engineering **14.** Future of life science (1) **15.** Future of life science (2) **16.** Preparation of report

**Evaluation Criteria)** Evaluation by report

**Textbook)** To be introduced in the class

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216740>

**Contact)**

⇒ Tsuji (G710, +81-88-656-7526, tsuji@bio.tokushima-u.ac.jp) (Office Hour: Monday 16:20-17:50)

**Note)** When you take this class, it is necessary to do preparation for 2h and review for 2h every 2h class for your understanding and taking credit.

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### Social Science

2 units (selection)

yasuyoshi yokohata · PART-TIME LECTURER / SHIROKUNI UNIVERSITY

**Target)** The mutual relationship of economic activities, the structure and function of economic society, and the concept and technique of mathematical programming modelling are lectured.

**Outline)** Not only the mutual relationship of economic activities is explained from domestic and international points of view, but also the technique of case studies by application of mathematical programming models is taught using the various kinds of materials and examples.

**Keyword)** *economic activities, structure and function, mathematical programming model*

**Goal)** To understand the mutual relationship of economic activities, empirically explain them using the mathematical programming model and evaluate the model.

**Schedule)** 1. Guidance and purpose of this subject 2. Examples of economic activities 1 3. Examples of economic activities 2 4. Examples of economic activities 3 5. Change in structure of economic society 1 6. Change in structure of economic society 2 7. Function of economic society 1 8. Function of economic society 2 9. Mutual relationship of economic activities 1 10. Mutual relationship of economic activities 2 11. Concept of mathematical programming model 12. Technique of model construction 13. Modelling of economic activities 1 14. Modelling of economic activities 2 15. Evaluation of modelling

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216691>

**Student)** Able to be taken by only specified class(es)

**Contact)**  
⇒ Kondo (ECO602, +81-88-656-7339, kondo@eco.tokushima-u.ac.jp)

## Science and Technology Studies

(selection)

Ichiro Tanaka · PART-TIME LECTURER / 非常勤講師

**Target)** Students are expected to learn the minimum essentials of science and technology studies and their functions in contemporary society.

**Outline)** 科学技術論は、科学技術に関する研究活動と成果について、社会科学や人文の多様な領域の知識を用いて行う研究である。科学技術の社会的重要性が明らかになった1930年代に新たな学問分野として登場し、とくに1970年代以降、国の政策、企業経営、市民生活など多くの分野に影響を与えている。この講義の前半では、技術革新が社会に影響を及ぼした事例と、逆に社会の変化が技術革新を促した事例を取り上げ、技術と社会との相互影響関係について考察する。後半では、産業革命以降の欧米と日本の産業構造の特徴を、それぞれの近代化過程の違いから考察する。

**Style)** Lecture

**Goal)**

1. 科学・技術の進歩と社会の変化との相互影響関係の理解
2. 学生たち自身の研究の社会的意味の理解

**Schedule)** 1. 序論 2. 農業技術の革新とヨーロッパ社会 3. 荘園制と三圃式農法—農業技術の革新とヨーロッパ社会 2 4. 馬力の発見—農業技術の革新とヨーロッパ社会 3 5. 機械時計の進歩と中世社会の崩壊 6. 神聖な時間と世俗的な時間—機械時計の進歩と中世社会の崩壊 2 7. 機械時計と資本主義社会の成立—機械時計の進歩と中世社会の崩壊 3 8. 動力機関の発展と工業化社会 9. 産業革命と蒸気機関—動力機関の発展と工業化社会 2 10. 工業化社会の成立 11. 日本における伝統産業から近代産業への発展 12. 地場産業と中小企業 13. 高度成長期の製造業 14. 失われた10年と産業の空洞化 15. 科学技術と社会の未来

**Textbook)** 資料を配付します。

**Reference)** 講義中に紹介します。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216582>

**Student)** 大学院博士後期課程学生

**Contact)**

- ⇒ Tanaka . (Office Hour: tanaka@kenroku.kanazawa-u.ac.jp)  
⇒ 工学部学務係 (Office Hour: 月曜から金曜:8時30分~17時15分)

## Management Theory of New Business

2 units (selection)

Vice chairperson of School Affairs Committee, Faculty of Engineering / FACULTY OF ENGINEERING

First-line men with experience of practical business · PART-TIME LECTURER

**Target)** New business is the word which means the business to make the most of technical knowledge, technology, the new idea and which is developed creatively, and that main bearer is the enterprise called a venture. There is a purpose of this class in providing the knowledge which is necessary, and know-how and a spirit so that a taking lecture student may establish a venture business.

**Outline)** 活力ある日本社会の再生が求められている。こうした要請を受け、政府は平成14~16年度にかけて「大学発ベンチャー3年1000社計画」を実施し、その目標はほぼ達成されたが、今後も継続的に起業家教育を推進していくことの重要性には変わりはない。この授業は、こうした認識にもとづいて、徳島県及び財団法人とくしま産業振興機構が支援して開設された『とくしま経営塾「平成長久館」起業力養成講座』である。

**Requirement)** The person whom the one with the classroom is constructed by the class start time in the person who doesn't learn the unit of "Introduction to new business" in the college, and a group are organized, and it is limited to the person with the intention to make a business plan, and taking lecture is recognized.

**Notice)** Being late and a whisper in class should be prohibited strictly. Be careful over and again because it should dispose of exit and future taking lecture may not be recognized when it is wicked.

**Goal)** Learning of the necessary knowledge to establish venture business, and the ability which can make a business plan.

**Schedule)** 1. Guidance 2. What is the new business? 3. Keynote lecture 4. Theory of a stand-alone version venture success 5. The law knowledge which is necessary for entrepreneur 6. Fund-raising and capital policy 7. Indirect finance 8. Direct finance 9. The basis of the company management 10. The elementary knowledge of the business accounting 11. The point of the business plan preparation 12. Management strategy and marketing 13. Product development and intellectual property 14. Business plan preparation practice 15. Examination 16. Business plan announcement meeting

**Evaluation Criteria)** It is evaluated by the presentation (40%) of the written examination (60%) and the business plan. And, the presentation of the written examination and the business plan is decided to be recognized only for the taking lecture student who attended it for 2/3 and more of the classes that it is opened.

**Textbook)** The summary is distributed every time.

**Reference)** Several are introduced in the school hours.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216804>

**Student)** he person who hasn't learned the unit of the new business outline that it is opened with this learning in all the students enrolled in the graduate school yet is made the target. The number of completion people may be restricted in the method such as a lottery in case of a taking lecture applicant many. As for the details, an applicant for taking lecture is to follow those directions because the notice which showed attention in taking lecture is done.

**Contact)**

⇒ Vice chairperson of School Affairs Committee, Faculty of Engineering

**Note)** The man of business that it is active in the forefront every time, and an adviser are invited as an instructor, and working knowledge is provided for theory plus practice in this class from the specialist's position. This class is the thing which is useful enough even if it is taken to the person who aims at a general enterprise and a laboratory, the employment to the self-governing body and so on.

## Introduction to Intellectual Property

2 units (selection)

Akio Fujii · VISITING PROFESSOR, Mikio Yano · PART-TIME LECTURER, Akio Iida · PART-TIME LECTURER

Yasunobu Yamauchi · PART-TIME LECTURER, · PART-TIME LECTURER

**Target)** Understanding the basic systems and importance of protection and practical use of intellectual property based on some examples.

**Outline)** It is necessary for a working staff in a company, a university, etc., in a future. It is introduced the importance to protect and practical use of intellectual property at governments, industrial circles, universities and institutes in Japan using potential on scientific techniques. This lecture is treated the basic systems of protection and practical use of intellectual property particularly based on strategy and invasion of patent in an organization such as company, university, etc.

**Style)** Lecture

**Keyword)** *intellectual property, patent law, protect and use of intellectual property*

**Relational Lecture)** “Introduction to Intellectual Property”(0.5)

**Requirement)** No requirement

**Notice)** It is necessary to be present at Four days concentrated lecture.

**Goal)**

1. Understanding concept of intellectual property right.
2. Understand the Patent Act, the Trademark Act, the Design Act and the Copyright Act.
3. Understanding on basic practical use of intellectual property.

**Schedule)** 1. 知的所有権とは (藤井) 2. 知的所有権制度の概要 (特許・商標等) (藤井) 3. 知的所有権制度の概要 (意匠・著作権制度等) (藤井) 4. 特許発明と特許権侵害 (藤井) 5. 特許発明と特許権侵害 (事例) (藤井) 6. 知的所有権の管理とその活用 (企業・大学・研究所) (藤井) 7. 今後の研究開発と知的所有権のあり方 (藤井) 8. レポート課題・書式・提出方法の説明等 (藤井) 9. 特許明細書の読み方・特許は明細書を中心に動く (山内) 10. 技術者が知っておくべき実務知識・特許法上の留意事項 (山内) 11. 技術開発の現場における知的財産 (京和) 12. 研究と特許権侵害 (矢野) 13. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 14. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 15. 知的財産の利用と活用 (種苗法による育成者権含む) (飯田) 16. レポート課題・書式・提出方法の説明等 (教務委員長)

**Evaluation Criteria)** Passing mark is over 60% on the examinations and the reports for each reaching level, respectively.

**Textbook)** To be used textbooks made by lecturers.

**Reference)** Nobuhiro Nakayama: Titeki Shoyuken, Nikkan Kohgyo Shinbunsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216755>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ School Affairs (Office Hour: 月曜から金曜:8時30分~17時15分)

## Advanced Lecture in Theory of Business Models

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Atsuya Yoshida · PROFESSOR / INSTITUTE OF SOCIO-ARTS AND SCIENCES, Tomoko Tamaari · ASSISTANT PROFESSOR / CENTER FOR COMMUNITY REVITALIZATION  
非常勤講師

**Target)** 持続可能な地域再生のためのビジネスモデルの構築を実践的に習得する。

**Outline)** ・持続可能な地域づくり・環境保全のためのビジネス資源の活用とビジネスモデル構築を実践的に習得する。これらの習得により、地域で直面する課題解決に対応する能力、望ましいあり方・方向性を探る能力を養う。・ビジネスモデルは、地域再生モデル、環境保全モデル、協働・連携モデル、ICT活用モデルから構成する。本授業は、ICT活用型「葉っぱビジネス」「いろどり」や2020年にゴミをゼロにするゼロウェイスト活動等で日本及び世界から注目されている上勝町と連携し実施する。

**Requirement)** 履修者は原則として、上勝に宿泊する(宿泊費、交通費は実費) ※宿泊と交流会の申込については、連絡先に記載している「宿泊・交流会に関する問合せ」先、地域創生センター玉有に問合せください。

**Notice)** 集中講義方式で実施する。日程等の詳細が決定したら、掲示およびHPにて公表するので、注意すること。 <参考>平成22年度ビジネスモデル特論 > 「上勝学舎」「常三島キャンパス」での集中講義方式で実施する。eラーニング(サイバー教室)も併用する。○集中講義-1(地域再生ビジネスモデル) 上勝学舎地域再生講座を受講 \* 11月27日(土)~11月28日(日) 上勝学舎(第1回~第12回) 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ごう奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス

**Goal)** 本授業では、現在求められている地域再生の観点から、ビジネス力の他に、戦略力、自然力、人間力、協働連携力、ICT力を重視する。すべてを育成することを目標とはしないが、各個人が有する力を自ら把握し、協働する場を提供することで、総合力としての育成を目指す。

**Schedule)** 1. ガイダンス:吉田敦也(徳島大学教授) 2. 地域再生と行政-真・善・美の追求:-笠松和市(上勝町長) 3. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 4. 地域再生資源としての棚田と活用:谷崎勝祥(檜原の棚田村会長), 坂本真理子((有)環境とまちづくり) 5. 遊休農地等を活用した集落居住促進ビジネス展開:佐藤幸好(徳島県建築士会・会長) 6. ヘクター当たり1000万円稼ごう奇跡、千葉県大山千枚田:石田三示(衆議院議員, 大山千枚田保存会・前事務局長) 7. 地域再生につながる棚田オーナー制とワーキングホリデー:澤田俊明(徳島大学客員教授) 8. 市民による棚田酒づくり, 90アールの遊休農地を復田:おでんでん・事務局長(要交渉), 田代優秋(徳島大学学術研究員) 9. 儲かる仕掛けのつくり方:横石知二(㈱いろどり代表取締役社長) 10. 重要文化的景観「檜原の棚田」の景観価値:平井松午(徳島大学教授) 11. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス創出ワークショップ:山中英生(徳島大学教授) 12. -学びは効果をもたらしたか?!-地域再生・中山間ビジネス

創出ワークショップ:山中英生(徳島大学教授) 13. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 14. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教) 15. ICT演習:吉田敦也(徳島大学教授), 玉有朋子(徳島大学助教)

**Evaluation Criteria)** 授業中の発言(20%), グループワーク・期末レポート(合計80%)で評価する。

**Textbook)** 適宜配付する。尚、教材費として3,000円徴収する。

**Reference)** Several are introduced in class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216842>

**Student)** 徳島大学大学院先端技術科学教育部マスターコース、及び、ドクターコースの学生

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: 年度ごとに建設工学科の掲示板を参照のこと。)

**Note)** ◇ 宿泊・交流会に関する問合せ:地域創生センター玉有(088-656-7684, kamikatsu-school@cr.tokushima-u.ac.jp) ◇ <http://www.cr.tokushima-u.ac.jp/kamikatsu/article/0018658.html> → 上勝学舎ホームページ

## Long-term Internship (D)

4 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

**Target)** This program is provided long-term internship in the actual industrial companies and so on, doing a joint study between companies and university on practical problems proposed by the company and practical experience of management of technologies. Through the long-term internship, the program will allow students to become an engineer with a core role in researches and companies

**Outline)** Credits are acknowledged to students who experienced the internship in companies or government offices of 270 hours during three months or more and presentation to executive officer of the company. Their fulfillment is evaluated by activity reports during internship and appraisal and interviewed report from a mentor.

**Goal)** Grasping abilities for practical engineers by studying activities in company and so on.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by mentors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216766>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Iritani (Office Hour: (創成学習開発センター, 088-656-7619, iritani@ee.tokushima-u.ac.jp))

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

**Note)** Students who resister the coop-education program for "Pai-shape" engineers with sense for management of technology, are able to have a grant-in-aid for travel and so on. Ask committee members of long-term internship in your course or coordinators of this program.

## Management of Technology

2 units (selection)

Hideo Yamanaka · PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING

Emi Morimoto · ASSISTANT PROFESSOR / PLANNING AND DESIGN SYSTEMS ENGINEERING FOR INFRASTRUCTURES, CIVIL AND ENVIRONMENTAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICS SYSTEMS ENGINEERING  
Part-time Lecturer

**Target)** About the production management of the automobile industry, it is understood variously from the point of view such as "research and development", "production management", "purchasing" and "quality control" "marketing" and "cross-cultural management".

**Outline)** It learns about the production management. This time, "the automobile industry" specially takes up the production management of "Honda Motor Co.,Ltd. (following Honda)" even of that in the case, and the class to appreciate that importance with ranking of technology in management is taken.

**Style)** Lecture

**Keyword)** management, management of technology

**Relational Lecture)** "Management Theory of New Business"(0.5, ⇒p.168), "Long-term Internship (D)"(0.5, ⇒p.169), "Advanced Lecture in Theory of Business Models"(0.5, ⇒p.169)

**Notice)** Face a class when a taking lecture person surely does enough preparation every time. And moreover, be the worst, but one person one time is to do some remarks every time.

**Goal)**

1. The elementary knowledge of management is learned.
2. Ranking of the technology in management and that importance are appreciated.
3. It learns how to solve the various problems which always occur in the spot of the management through the case study and the business game.

**Schedule)** 1. Guidance 2. Lecture "What in Management of Technology?" 3. Case report "Research and development of Honda" 4. Case study "Plan an overseas factory." "A new car development order" 5. Lecture "Production management and purchasing" 6. Lecture "Quality control" 7. Case report "The production management of Honda"; "The supply chain management of Honda" 8. Case study "Plan an overseas factory." 9. Case report "The quality control of Honda" 10. Case study "Don't make material defects flare up again." 11. Lecture "Marketing strategy" 12. Lecture "Cross-cultural management" 13. Case report "Around the products project of Honda - the two-wheeled vehicle" 14. Case report "The path of internationalization of Honda" 15. Case report "The personnel management of Honda" 16. Summary and questions and answers

**Evaluation Criteria)** It is evaluated in the remark (40%) in class and the middle, end of a term report (60% in total).

**Textbook)** It doesn't specially use. The summary and so on is distributed every time.

**Reference)** Several are introduced in class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216615>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Yamanaka (A410, +81-88-656-7350, yamanaka@ce.tokushima-u.ac.jp) (Office Hour: オフィスアワー:年度ごとに学科の掲示板を参照のこと)

⇒ Morimoto (創成学習開発センター, +81-88-656-7619, emi\_morimoto@ce.tokushima-u.ac.jp) (Office Hour: 月～木(10時～16時))

**Note)** This class invites seven Honda alumnni who did work in "research and development", "production management", "purchasing", "quality control", "marketing", "cross-cultural management", and so on as an instructor, and it is the class to do case report. Even if it is seen nationwide, the trial done like this is very rare, and it is a precious class. And, an applicant for taking lecture is to attend it in the guidance to hold it in advance. A schedule is indicated separately.

## International Advanced Technology and Science 1

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

**Target)** This is an intensive course for advanced technology and science in english which is held a summer vacation in the university of Tokushima. In this course, world trends of advanced technology and science can deeply be understood. Then the specialized knowledge can be studied in english.

**Outline)** In this course, an intensive course for advanced technology and science in english should be attended in a summer vacation of the university of Tokushima. In this course, when the specialized knowledge for advanced technology and science in english can deeply be understood, the credit will be authorized. The report and portfolio on the world advanced technology and science written in english should be submitted. The evaluation will be done based on the submitted reports and portfolio.

**Goal)**

1. The advanced technology and science in the world should be studied and then world trends of technology and science would be understood.
2. The specialized contents on advanced technology and science would be understood in english and then the power of expression and presentation in english would be improved.

**Evaluation Criteria)** an enterprising behavior, portfolio and reports

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216650>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90hrs. should be submitted. The students should consult with charge teacher of the course.

## International Advanced Technology and Science 2

2 units (selection)

Ri-ichi Murakami · PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

**Target)** In this course, the students go to the foreign university and then attend to intensive classes on advanced technology and science in english. The students also study advanced technology and science in its country and then learn the practical knowledge so that applications of science and technology are studied.

**Outline)** In this course, the students attend to intensive classes on advanced technology and science in english at the foreign university. The students also study the specialized and practical knowledge for advanced technology and science in english. The credit is authorized based on the reports and portfolio on the advanced technology and science of the foreign which are written in english.

**Goal)**

1. Specialized contents of advanced technology and science would be studied and then understand the trends of technology and industry in the foreign.
2. Specialized contents of advanced technology and science would be understood and then the communication ability would be improved.

**Evaluation Criteria)** Enterprising behavior, reports and portfolio.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216651>

**Student)** It is possible for the students of Master's course and Doctoral course to enroll.

**Contact)**

⇒ Murakami (M318, +81-88-656-7392, murakami@me.tokushima-u.ac.jp)

**Note)** The portfolio for 90 hrs. should be submitted. The detail is consulted by the charge teacher.

## Presentation Method (D)

2 units (selection)

Graduate School of Advanced Technology and Science

**Target)** Poster and oral presentations, and journal publications are common means of appealing the research work in various scientific and technological disciplines. It's undoubtedly important for activating the research work. The lecture is intending for students to learn most efficient way to appeal their findings and discussions in scientific community.

**Outline)** Credits are acknowledged to the students who are supervised to give conference speech by themselves and do actually the lectures.

**Goal)** The lecture is aiming at having knowledge and experience of the presentation in international conferences.

**Evaluation Criteria)** Students' achievement is evaluated by portfolios submitted showing the progress in preparation of international conferences as well as by presentation records.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216873>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

## Internship (D)

2 units (selection)

**Target)** This program is provided to increase knowledge and experience in the actual industrial technology in various fields. Through the practical experience, the program will allow students to become discerning and well-balanced researchers or engineers with deeper understanding of technological societies.

**Outline)** Credits are acknowledged to students who experienced the internship in companies and/or government offices. Their fulfillment is evaluated by activity reports during internship.

**Goal)**

1. Grasping internal systems of a company, management, action and strategy to achieve the company's goal. (2)
2. Understanding human relationship and communicative manner in a working society and a company.

**Evaluation Criteria)** Achievement is evaluated by how you tackled, activity reports, and an evaluation record submitted by supervisors in company and/or government.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216611>

**Student)** Able to be taken by only specified class(es)

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Venture Business (D)

2 units (selection)

**Target)** Aims of the lecture are doing collaborative works with private enterprises and establishing venture businesses through such works.

**Outline)** The lecture is aiming at founding a venture business company as well as establishing collaborative research works with private enterprises. It's worth to apply their accomplishment to an actual society beyond the range of a laboratory work.

**Goal)** Objective of the lecture is to have experience and knowledge of collaborative works with private enterprises and to mature the works to venture businesses.

**Evaluation Criteria)** Credits are acknowledged in case of doing collaborative works with enterprises and/or maturing them to venture businesses. Handouts, reports, and presentation materials, etc. are evaluated to approve credits.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216596>

**Note)** A possible student should submit portfolios which are evidenced for his/her 90 hours' extensive work. Students are advised to ask details about this lecture to their supervisors.

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## Radio Frequency Solid State Physics

2 units (selection)

Koichi Nakamura · ASSOCIATE PROFESSOR / PRODUCTION SYSTEMS ENGINEERING, MECHANICAL ENGINEERING, INTELLIGENT STRUCTURES AND MECHANICAL SYSTEMS ENGINEERING

**Target)** This class introduces basis of NMR and applications to studies on superconductivity, magnetism and ionic diffusion in solid.

**Outline)** The spectrum, spin-lattice relaxation, spin-spin relaxation, chemical shift etc., which are obtained by NMR measurements, are introduced and discussed in connection with various physical properties of solids.

**Keyword)** *nuclear magnetic resonance, magnetism, diffusion*

**Goal)**

1. To understand basis of NMR.
2. To understand relationship between various problems in solid state physics and relaxation phenomena observed using NMR.

**Schedule)** 1. Introduction to nuclear magnetic resonance (NMR) 2. Zeeman interaction 3. Larmor precession 4. Magnetization 5. Motion of magnetization under magnetic field 6. Bloch equations 7. Dipole interaction 8. Magnetic interactions of nuclei with electrons 9. Internal magnetic field in ferro and antiferro magnets 10. Spin-lattice relaxation and motional narrowing of resonance lines 11. Diffusion in solid and spin-lattice relaxation 12. Relaxation model for diffusion 13. NMR studies on lithium ionic conductors 14. NMR studies on protonic conductors 15. Application of NMR

**Evaluation Criteria)** Assignments count 100%.

**Textbook)** なし

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216790>

**Contact)**

⇒ Nakamura (A216, koichi@pm.tokushima-u.ac.jp)

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## Engineering of Correlated Electron Matter

2 units (selection)

Yutaka Kishimoto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Yu Kawasaki · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** In many solid-state materials, new phenomena evolve due to strong electron interactions. In this Lecture, review will be given on some advanced topics and their applications, including high temperature superconductivity, metal-insulator transition and strongly correlated electronics.

**Outline)** New types of superconducting and magnetic phenomena emerge in correlated electron matters. The term "correlated electron" represents the state of matter where many electrons are strongly interacting with each other. After an introductory talk on magnetism and superconductivity, review will be given on some advanced topics, including high temperature superconductivity, metal-insulator transition and colossalmagneto resistance. Potential application of correlated electron matters to technology is also presented focusing on spintronics or strongly correlated electronics.

**Style)** Lecture

**Keyword)** *strongly correlated electron systems, Mott insulator, colossalmagneto resistance, high temperature superconductor*

**Goal)** To understand basic concepts of correlated electron matter and its application

**Schedule)** 1. Introduction to correlated electron matters 2. Perspectives of magnetism and superconductivity in correlated electron matters 3. Electronic states of atoms and ions 4. Magnetic ions in crystal electric field 5. Introduction to superconductivity 6. How to probe rich properties in correlated electron matters 7. Mott insulator and metal-insulator transition 8. Spin, charge and orbital in transition metal oxides 9. Colossalmagneto resistance in transition metal oxides 10. Application of transition metal oxides with correlated electrons 11. High temperature superconductivity 12. Heavy-fermion superconductivity 13. Electronic states of organic conductors 14. Application of superconductors with correlated electrons 15. Towards strongly correlated electronics

**Evaluation Criteria)** Reports on several subjects in lecture

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216622>

**Contact)**

⇒ Kishimoto (A202, +81-88-656-7548, yutaka@pm.tokushima-u.ac.jp) (Office Hour: 金曜日 16:00-17:30)  
⇒ Kawasaki (A217, +81-88-656-9878, yu@pm.tokushima-u.ac.jp)

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## Nonlinear Optical Devices

2 units (selection)

Masanobu Haraguchi · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the principle, typical structure, advantages and disadvantages of current nonlinear optical devices. To develop ability to design new devices and solve various problems for applications.

**Outline)** Physics of second-order and third-order nonlinear optical phenomena. Principles of electro-optics. Optical nonlinearities in fibers. Photorefractive materials. Nonlinear optical media. Anisotropic nonlinear optical media. Dispersive nonlinear optic media. Coupled-wave theory. Electro-optic and acousto-optic devices. Second-order and third-order nonlinear optic devices. Photonic switches. All-optical switches. Bistable optical devices. Optical connections.

**Style)** Portfolio

**Keyword)** *nonlinear optics, harmonic generation, nonlinear optical device, optical switch*

**Relational Lecture)** "Optical and Functional Inorganic Materials"(0.5, ⇒p.152)

**Requirement)** Student should have fundamental knowledge of electromagnetic theory, waveoptics, optical properties of materials and lasers.

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. Possible to explain principles, structure and characteristics of optoelectric devices.
2. Possible to explain principles, structure and characteristics of the second-order nonlinear optical devices.
3. Possible to explain principles, structure and characteristics of the third-order nonlinear optical devices.

**Schedule)** 1. Introduction & interview 2. nonlinear optical phenomena 3. Electrooptic effect and its applications 4. Magneto optic effect and its applications 5. Acousto optic effect and its applications 6. principle of second-order nonlinear effects 7. Second-order nonlinear optical materials 8. Second-order nonlinear optical devices 9. principle of third-order nonlinear effects 10. third-order nonlinear optical materials 11. Third-order nonlinear devices 12. Experiment for nonlinear optical phenomena 13. Current application of nonlinear devices 14. Photonic crystal 15. Integrated optical devices

**Evaluation Criteria)** Activity:20%, reports:40% and oral examinations:40%

**Textbook)** After interview, we will decide suitable text books.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216850>

**Contact)**

⇒ Haraguchi (Opt.209, +81-88-656-9411, haraguti@opt.tokushima-u.ac.jp) (Office Hour: 16:05-18:00)

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## Applied Statistical Physics

2 units (selection)

Nobuo Goto · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Atsushi Mori · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Learn to apply the statistical physics

**Outline)** Concerning the mechanisms and phenomena in materials processing, lectures are given in method for analyzing the results on the basis of the statistical physics.

**Style)** Lecture

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

**Goal)**

1. points of view in statistical physics
2. applying statistical physics to the practical problem

**Schedule)** 1. Thermodynamics of non-equilibrium and non-uniform systems I 2. Thermodynamics of non-equilibrium and non-uniform systems II 3. Thermodynamics of non-equilibrium and non-uniform systems III 4. Advanced statistical mechanics I 5. Advanced statistical mechanics II 6. Advanced statistical mechanics III 7. Exercise I 8. Examination I 9. Advanced statistical mechanics IV 10. Advanced statistical mechanics V 11. Advanced statistical mechanics VI 12. Transport phenomena I 13. Transport phenomena II 14. Transport phenomena III 15. Exercise II 16. Examination II

**Evaluation Criteria)** 60点以上を合格とする。

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216577>

**Contact)**

⇒ Mori (Opt.407, +81-88-656-9417, mori@opt.tokushima-u.ac.jp) (Office Hour: オフィスアワーは、学科の掲示板等をご覧ください。)

## Organic Photo-functional Materials

2 units (selection)

Hitoshi Tanaka · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoshihiko Tezuka · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** The objective of this course is to develop basic and practical knowledge of chemistry that is required to design, synthesize, and construct organic materials with desired functionality.

**Outline)** Physical and chemical properties of molecules and molecular assemblies. Molecular design for functional materials based on the molecular structure. Synthetic method for constructing desired molecular structures. Molecular design, and characteristics of organic photo-functional materials (Tanaka). Physical and chemical properties of conjugated  $\pi$ -electron system and its application for opto-electronic devices (Tezuka).

**Style)** Portfolio

**Relational Lecture)** "Optical and Functional Inorganic Materials"(0.5, ⇒p.152)

**Notice)** You have to prepare for next lesson and review that day's lesson for 2 hrs respectively against 2 hr lesson to understand the lesson and acquire the credits.

**Goal)**

1. to enable a student to understand functionality of organic materials in terms of their molecular structures.
2. to enable a student to construct practical routes for synthesizing desired molecules.

**Schedule)** 1. Introduction to organic materials 2. Atomic groups expressing photo-functionality (1) 3. Atomic groups expressing photo-functionality (2) 4. Generation of photo-functionality by molecular assembly 5. Chemical modification (1): incorporation of functional atomic groups 6. Chemical modification (2): incorporation of functional atomic groups 7. Chemical modification (3): polymerization and polymer reaction 8. Spectroscopic analysis of molecular structure 9. Introduction to  $\pi$ -electron conjugated molecules 10. Synthesis of  $\pi$ -electron conjugated molecules 11. Properties of  $\pi$ -electron conjugated molecules (1) 12. Properties of  $\pi$ -electron conjugated molecules (2) 13. Applications to organic conducting materials 14. Applications to organic electroluminescence devices 15. Applications to organic solar cells

**Evaluation Criteria)** Term papers and oral examination.

**Textbook)** Text books will be decided after interview.

**Reference)** – to be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216899>

**Contact)**

⇒ Tanaka (Opt.211, +81-88-656-9420, tanaka@opt.tokushima-u.ac.jp)  
 ⇒ Tezuka (Opt.307, +81-88-656-9423, ytezuka@opt.tokushima-u.ac.jp)

## Advanced Optical Information Systems

2 units (selection)

Shiro Suyama · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Hirotsugu Yamamoto · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand an architecture, design, and device in optical information systems.

**Outline)** Information processing systems using optoelectronics devices and technologies which include lasers, light emitting diodes, spatial light modulators, nonlinear recording devices and holographic technology: holographic systems, optical computing systems, three-dimensional display systems, optical recording systems, and optical measurement systems. This course is performed with lecture in combination with portfolio.

**Keyword)** *information photonics, optical computer, optical information processing, information optics*

**Goal)**

1. To understand the availability of light in optical information system
2. To understand the relation between information photonics and other technology
3. To develop a new architecture of optical information system

**Schedule)** 1. Introduction to optical information system 2. Optics in optical information system (1) 3. Optics in optical information system (2) 4. Light source and detector in optical information system 5. Optical modulator in optical information system (1) 6. Optical modulator in optical information system (2) 7. Analog optical information system (1) 8. Analog optical information system (2) 9. Digital optical information system (1) 10. Digital optical information system (2) 11. Optoelectronic information system (1) 12. Optoelectronic information system (2) 13. Information communication technology and optical information technology 14. Biomedical optical measurement technology and optical information technology 15. Biotechnology and optical information technology 16. Examination

**Evaluation Criteria)** Report 100%

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216836>

**Notice)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

## Medical Information Systems

2 units (selection)

Noboru Niki · PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Yoshiki Kawata · ASSOCIATE PROFESSOR / OPTICAL MATERIALS AND DEVICES, OPTICAL SYSTEMS ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the fundamental concepts of digital environment for medical diagnosis. To learn the design methods of medical information systems.

**Outline)** This course introduces the design and the implementation of digital environment for medical diagnosis based on the various technologies including medical image data acquisition and retrieval, computer aided diagnosis using multimodal medical data sets.

**Style)** Portfolio

**Keyword)** *imaging technology, computed-aided diagnosis systems, digital environment for medical diagnosis*

**Relational Lecture)** "Medical and Biological Engineering"(0.5, ⇒p.173)

**Goal)**

1. To understand medical imaging techniques.
2. To understand various techniques of computer-aided diagnosis.
3. To understand the fundamentals of digital environment for medical diagnosis.

**Schedule)** 1. Introduction 2. Imaging techniques 3. Image processing techniques 4. Pattern recognition techniques 5. Visualization techniques 6. Virtual reality/Mixed reality techniques 7. Design of computer-aided diagnosis systems 8. Implementation of computer-aided diagnosis systems 9. Design and implementation of fundamentals of digital environment for medical diagnosis and therapy 10. Design of medical information systems (1) 11. Design of medical information systems (2) 12. Design of medical information systems (3) 13. Design of medical information systems (4) 14. Design of medical information systems (5) 15. Advanced medical information systems

**Evaluation Criteria)** Report 100%

**Textbook)** Reference books are introduced to each topics.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216556>

**Contact)**



⇒ Niki (Opt.507, +81-88-656-9430, niki@opt.tokushima-u.ac.jp)  
⇒ Kawata (Opt.508, +81-88-656-9431, kawata@opt.tokushima-u.ac.jp)

**Note)** Preparation (2hrs) and Review (2hrs) are required to take this lecture (2hrs).

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### Photonic Semiconductor Device Physics

2 units (selection)

Shiro Sakai · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Yoshiki Naoi · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING  
Katsushi Nishino · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** To understand the device physics and fabrication technique of photonic semiconductor devices..

**Outline)** Interaction of photons and electrons in semiconductors, physics of superlattice semiconductors and their applications as photonic devices. Crystal growth of semiconductors and heteroepitaxy.

**Style)** Lecture

**Keyword)** semiconductor, photonic device

**Relational Lecture)** “Optical and Functional Inorganic Materials”(0.5, ⇒p.152)

**Goal)**

1. To understand device physics of photonic devices in terms of interaction of photons and electrons
2. To understand device physics of quantum effect devices
3. To understand crystal growth and related technologies for fabrication of photonic devices

**Schedule)** 1. Introduction 2. Energy band structure of semiconductors 3. Quantum statistics of electrons in semiconductors 4. Carrier transport in semiconductors 5. Quantum devices and superlattice 6. Light absorption in semiconductors (interaction of electrons and photons) 7. Photocinductivity, photovol and photodiode 8. Physics of light emission of semiconductors 9. Radiative recombination, non-radiative recombination, stimulated emission and spontaneous emission 10. Light emitting diodes and lasers 11. Devices for optical communication 12. Crystal growth of substrates for photonic semiconductor devices 13. MOCVD and MBE 14. Fabrication of Ohmic contact 15. Nano-photonic devices and fabrication technology 16. Examination

**Evaluation Criteria)** Report 50%, Examination 50%. More than 60% is required to pass this class.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216839>

**Contact)**

⇒ Sakai (E棟2階南 A-3, +81-88-656-7446, sakai@ee.tokushima-u.ac.jp)  
⇒ Naoi (E棟2階南 A-4, +81-88-656-7447, naoi@ee.tokushima-u.ac.jp) (Office Hour: 年度ごとに学科の掲示を参照すること.)  
⇒ Nishino (E棟2階南 A-5, +81-88-656-7464, nishino@ee.tokushima-u.ac.jp)

**Note)** 授業を受ける際には、2時間の授業時間毎に2時間の予習と2時間の復習をしたうえで授業を受けることが、授業の理解と単位取得のために必要である。

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### Optical and Functional Inorganic Materials

2 units (selection)

Kikuo Tominaga · ASSOCIATE PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** This course aims to learn the fundamentals of material science of such as single crystals, polycrystals or amorphous films for optical and functional materials. At the same time, the synthesis methods of various films, their evaluation techniques and the propagating optical beam and acoustic waves in crystals are lectured.

**Outline)** Fundamentals of crystal science is lectured at first. Optical and electronic processes in optical and functional materials such as single crystals, polycrystals or amorphous films are followed. Advanced solid state physics of semiconductors, dielectric and ferroelectric materials are included. Synthesis methods of optical and functional crystals and films, evaluation methods of film properties are also contained. Electro-optical and piezo-electrical effects and solid state physics relating with their effects, characterization of crystals, symmetry elements of crystals and material constants, optical properties of crystals, electro-optical effects and nonlinear effects, piezoelectricity, acoustic waves in crystal, interaction of photons and phonons in crystal, synthesis methods of thin films (PVD method; electron beam evaporation, MBE, sputtering, laser ablation), film properties (characterizations of electrical, optical and mechanical properties) are included.

**Style)** Lecture and exercise

**Keyword)** functional material, semiconductor device, crystal optics, thin film technology, deposition techniques of thin films

**Relational Lecture)** “Photonic Semiconductor Device Physics”(0.5), “Nonlinear Optical Devices”(0.5)

**Goal)** Understanding of the solid state physics of piezoelectric materials and functional thin films

**Schedule)** 1. Characterization of crystals 2. Symmetry elements of crystals and material constants 1 3. Symmetry elements of crystals and material constants 2 4. Optical properties of crystals 1 5. Optical properties of crystals 2 6. Electro-optical effects and nonlinear effects 1 7. Electro-optical effects and nonlinear effects 2 8. Piezoelectricity 1 9. Piezoelectricity 2 10. Acoustic waves in crystal 1 11. Acoustic waves in crystal 2 12. Interaction of photons and phonons in crystal 13. Synthesis methods of thin films 1(PVD method; electron beam evaporation, MBE, sputtering, laser ablation) 14. Synthesis methods of thin films 2(PVD method; electron beam evaporation, MBE, sputtering, laser ablation) 15. Film properties (Characterizations of electrical, optical and mechanical properties) 16. Exercise

**Evaluation Criteria)** Reports for each theme and examination

**Textbook)** Tomoya Ogawa: Fundamentals in Crystal Engineering, Shoukabou (in Japanese) and Shunichi Gonda, Applied Handbook of Thin Film Depositions, (NTS) (in Japanese)

**Reference)**

- ◇ 荒川剛他, 無機材料化学, 三共出版
- ◇ 日本学術振興会透明酸化物光・電子材料第166委員会編, 透明導電膜の技術(改訂2版), Ohmsha

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216896>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Tominaga (E棟2階南 A-6, +81-88-656-7439, tominaga@ee.tokushima-u.ac.jp)

**Note)** This lecture will be given in English.

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### Medical and Biological Engineering

2 units (selection)

Masatake Akutagawa · ASSOCIATE PROFESSOR / ELECTRICAL AND ELECTRONIC SYSTEMS, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

**Target)** Various applications of electronic technologies to medical fields are described.

**Outline)** Fundamental approaches to apply engineering such as electronics to medical fields including diagnosis, treatment and alternative function are described in relation to life sciences such as physiology, biomechanics and so forth. Typical systems of medical instruments are introduced. The development of new technologies based on the intelligent functions of living bodies are presented. Functional characteristics of the nervous system and their application to information processing and control are discussed.

**Style)** Lecture in combination with Portfolio

**Goal)** 1 Biological signal measurement 2 Biological signal processing 3 Medical systems

**Schedule)** 1. Introduction of medical engineering 2. Introduction of measurement of biological signal 3. Electrical measurement methods 4. Magnetic measurement methods 5. Ultrasonic measurement methods 6. Other measurement methods 7. Biological signal processing methods 8. Examples of biological signal processing 9. Biological system identification 10. Measurement of brain functions 11. Measurement of other functions 12. Biological monitor 13. Analysis of electrical properties of tissue 14. Examples of medical diagnosis technology 15. Examples of medical treatment technology 16. Medical prosthesis technology

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216558>

**Contact)**

⇒ Akutagawa (工学部電気棟3階北 C-5, +81-88-656-7477, makutaga@ee.tokushima-u.ac.jp) (Office Hour: Thu. 18:00 - 20:00, Fri. 17:00 - 18:00)

**Note)** This lecture will be given in English.

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### Visual pattern processing

2 units (selection)

Kenji Terada · PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING  
Stephen Karungaru-Githinji · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** The basic technologies which replace the visual pattern processing function of man by computer and their applied technologies are made to master.

**Outline)** The advanced processing techniques of visual pattern, i.e., the pre-processing techniques, the feature extraction techniques, the classification techniques of visual pattern, the processing techniques of color image and their application examples are lectured.

**Style)** Lecture in combination with Portfolio

**Keyword)** *pattern recognition, vision, image processing*

**Fundamental Lecture)** “Applied Image Processing”(1.0, ⇒p.84)

**Goal)** Acquisition of knowledge about the processing theories of visual pattern and their various applied technologies, and the processing technologies of color image

**Schedule)** **1.** Concept of pattern recognition **2.** Statistical pattern classification method1 **3.** Statistical pattern classification method 2 **4.** Pattern classification method by the structural analysis technique **5.** Pre-processing method of visual pattern **6.** Feature extraction method of visual pattern 1 **7.** Feature extraction method of visual pattern 2 **8.** Segmentation method of visual pattern 1 **9.** Segmentation method of visual pattern 2 **10.** Pattern classification method by neural network **11.** Pattern classification method by GA **12.** Security image processing **13.** Tracking of moving object **14.** Texture analysis **15.** The feature extraction method of color image and its application **16.** Periodic examination

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216676>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Terada (Dr.802, +81-88-656-7499, [terada@is.tokushima-u.ac.jp](mailto:terada@is.tokushima-u.ac.jp)) (Office Hour: 月, 水曜日 15:00~17:00(年度ごとに学科の掲示を参照すること))

**Note)** ◇ 授業を受ける際には, 2 時間の授業時間毎に 2 時間の予習と 2 時間の復習をしたうえで授業を受けることが, 授業の理解と単位取得のために必要である. ◇ 授業計画 1~15 は, 各講義の最後に行なわれる演習および最終試験により達成度評価を行なう.

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## Applied Knowledge Systems

2 units (selection)

Jun-ichi Aoe · PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kenji Kita · PROFESSOR / APPLIED INFORMATION MEDIA ENGINEERING, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Masami Shishibori · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Masao Fuketa · ASSOCIATE PROFESSOR / INTELLIGENT SYSTEMS, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

Kazuhiro Morita · ASSOCIATE PROFESSOR / INFORMATION SCIENCE, INFORMATION SCIENCE AND INTELLIGENT SYSTEMS, SYSTEMS INNOVATION ENGINEERING

**Target)** The course introduces the basic principle and theory of knowledge-based systems, including natural language processing systems, voice language processing systems, information retrieval systems.

**Outline)** Knowledge systems to natural language processing, voice language processing, information retrieval and document database. Artificial natural language processing systems, such as automatic building systems of intelligent dictionaries, text understanding and summarization systems, dialog systems, natural language interface systems, text classification systems, natural language analysis systems and knowledge-based machine translation systems.

**Style)** Portfolio

**Keyword)** *knowledge-based system, natural language processing system, speech and language processing system, information retrieval system, machine translation system*

**Fundamental Lecture)** “Language Modeling”(1.0, ⇒p.83), “Natural Language Understanding”(1.0, ⇒p.84)

**Relational Lecture)** “Multimedia Systems and Applications”(0.5, ⇒p.165)

**Goal)** To learn various methods for constructing knowledge-based intelligent information systems.

**Schedule)** **1.** Natural language processing systems 1: design and retrieval methods of dictionaries **2.** Natural language processing systems 2: design and implementation of parsers **3.** Natural language processing systems 3: design and implementation of language understanding systems **4.** Machine translation systems 1: rule-based and example-based approaches **5.** Machine translation systems 2: super-function **6.** Machine translation systems 3: integrated methods **7.** Speech and language processing systems 1: design of language models **8.** Speech and language processing systems 2: design of acoustic models **9.** Speech and language processing systems 3: design of search algorithms **10.** Information retrieval systems 1: document retrieval based on vector space models **11.** Information retrieval systems 2: retrieval methods based on inverted index files **12.** Information retrieval systems 3: design and implementation of intelligent

document retrieval systems **13.** Intelligent multimedia contents processing systems 1 **14.** Intelligent multimedia contents processing systems 2 **15.** Recent topics **16.** Assignment

**Evaluation Criteria)** Assignment count 100%.

**Textbook)** To be introduced in the class.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216575>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Aoe (Dr604, +81-88-656-7486, [aoe@is.tokushima-u.ac.jp](mailto:aoe@is.tokushima-u.ac.jp)) (Office Hour: Tuesday 12:50 - 14:20)

⇒ Kita (Dr503, +81-88-656-7496, [kita@is.tokushima-u.ac.jp](mailto:kita@is.tokushima-u.ac.jp)) (Office Hour: Tuesday 12:50 - 14:20)

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## Advanced Lecture on Quantum Nanostructure Semiconductors

2 units (selection)

Toshiro Isu · PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE, Takahiro Kitada · ASSOCIATE PROFESSOR / INSTITUTE OF TECHNOLOGY AND SCIENCE

**Target)** This lecture aims at understanding basic concepts of the quantum effects of semiconductor nanostructures based on materials science and various technologies for device applications.

**Outline)** This lecture introduces characteristics of quantum structures and technologies of the device applications, based on quantum mechanics, semiconductor physics, materials science and photonics. Advanced technologies of fabrication and measurements and recent topics of the research are also introduced.

**Style)** Lecture

**Goal)** To understand materials science and application technologies of nano structure semiconductors

**Schedule)** **1.** Electronic states in semiconductor quantum structures **2.** Electronic properties of quantum structures **3.** Optical properties of quantum structures **4.** Fabrication technologies of semiconductor nanostructures **5.** Evaluation technologies of crystals **6.** Evaluation technologies of nanostructures **7.** Analysis of electronic properties **8.** Analysis of optical properties **9.** Quantum effect devices **10.** Nonlinear optical responses of semiconductors **11.** Responses of optical micro cavity **12.** Research progress in quantum nanostructure semiconductors **13.** Ultrafast optical devices **14.** Quantum information devices **15.** Topics of recent advanced research (1) **16.** Topics of recent advanced research (2)

**Evaluation Criteria)** Assignments

**Textbook)** None

**Reference)** To be introduced in the class

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216907>

**Contact)**

⇒ Isu (A224, +81-88-656-7670, [t.isu@frc.tokushima-u.ac.jp](mailto:t.isu@frc.tokushima-u.ac.jp)) (Office Hour: Tue -Thu 10:00-14:00)

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## Advanced Exercise on Optical System Engineering

2 units (compulsory)

All teachers

**Target)** This subject is especially provided in order to deepen the study, and must be taken under the guidance of a faculty in major field of study.

**Outline)** Exercises related to research theme are performed.

**Style)** Portfolio

**Keyword)** *optical engineering*

**Goal)** To obtain deeper knowledge regarding research theme.

**Schedule)** **1.** Guidance **2.** Exercise **3.** Report

**Evaluation Criteria)** Assignments count 100%.

**Contents)** <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216827>

**Student)** Able to be taken by only specified class(es)

**Contact)**

⇒ Inoue (Opt.310, +81-88-656-9416, [inoue@opt.tokushima-u.ac.jp](mailto:inoue@opt.tokushima-u.ac.jp))

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## Advanced Research on Optical System Engineering

2 units (compulsory)

Teachers in other colleges or departments

**Target**› This subject is essentially provided in order to deepen the research, and must be taken under the guidance of a faculty in other field of study.

**Outline**› Exercises related to research theme are performed.

**Keyword**› *research, optical engineering*

**Goal**› To have wider knowledge regarding research theme.

**Schedule**› 1. Guidance 2. Research 3. Report

**Evaluation Criteria**› Assignments count 100%.

**Textbook**› To be introduced in the class.

**Reference**› To be introduced in the class.

**Contents**› <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216828>

**Student**› Able to be taken by only specified class(es)

**Contact**›

⇒ Inoue (Opt.310, +81-88-656-9416, inoue@opt.tokushima-u.ac.jp)

