

Syllabus

**International Doctoral Degree
Program
(2017-Fall Term)**

(D51010010)Advanced Seminar on Mechanical Engineering 1[Advanced Seminar on Mechanical Engineering 1]

Subject name[English]	Advanced Seminar on Mechanical Engineering 1[Advanced Seminar on Mechanical Engineering 1]				
Schedule number	D51010010	Subject area	Advanced Mechanical Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	4
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered	Mechanical Engineering			Beggining grade	D1
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering	MEC_DOC71015				
Objectives of class	The seminar aims to enhance the ability of each student to plan and accomplish research in the field of mechanical engineering through reviewing, reading, and discussing technical papers related to his/her doctor thesis research topic.				
Contents of class	Each student reads English technical papers related to his/her doctor thesis, introduces the contents of the papers and discusses them with other students and his/her supervisor.				
Self Preparation and Review					
Related subjects	Inquire this of your supervisor.				
Notes for textbook	Inquire this of your supervisor.				
Notes for reference					
Goals to be achieved	To acquire the ability of each student to discuss his/her doctor thesis research topic and topics related to his/her research field with his/her supervisor and specialists in his/her field. To acquire the ability to write English technical papers.				
Evaluation of achievement	The achivement is evaluated based on the results of paper introduction, understanding of papers, answers to questions, and on the contribution to discussion.				
Examination	試験期間中には何も行わない None during exam period				
Details of examination					
Other information	Inquire this of your supervisor.				
Reference URL					
Office hours	Inquire this of your supervisor.				
Relations to attainment objectives of learning and education					
Key words					

(D51010020)Advanced Seminar on Mechanical Engineering 2[Advanced Seminar on Mechanical Engineering 2]

Subject name[English]	Advanced Seminar on Mechanical Engineering 2[Advanced Seminar on Mechanical Engineering 2]				
Schedule number	D51010020	Subject area	Advanced Mechanical Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered	Mechanical Engineering			Begging grade	D2
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering	MEC_DOC71015				
Objectives of class	The seminar aims to enhance the ability of each student to plan and accomplish his/her research in the field of mechanical engineering through reviewing, reading, and discussing technical papers related to his/her doctor thesis research topic.				
Contents of class	Each student reads English technical papers related to his/her doctor thesis, introduces the contents of the papers and discusses them with other students and his/her supervisor.				
Self Preparation and Review					
Related subjects	Inquire this of your supervisor.				
Notes for textbook	Inquire this of your supervisor.				
Notes for reference					
Goals to be achieved	To acquire the ability of each student to discuss his/her doctor thesis research topic and topics related to his/her research field with his/her supervisor and specialists in his/her field. To acquire the ability to write English technical papers.				
Evaluation of achievement	The achivement is evaluated based on the results of paper introduction, understanding of papers, answers to questions, and on the contribution to discussion.				
Examination	試験期間中には何も行わない None during exam period				
Details of examination					
Other information	Inquire this of your supervisor.				
Reference URL					
Office hours	Inquire this of your supervisor.				
Relations to attainment objectives of learning and education					
Key words					

(D51010050)Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]

Subject name[English]	Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]				
Schedule number	D51010050	Subject area	Advanced Mechanical Engineering	Required or elective	Required
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered				Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S1系教務委員, 教務委員会副委員長 1kei kyomu Iin-S, kyouumu iinkai fukuuiintyou				
Numbering	MEC_DOC71015				
Objectives of class					
<p>New technologies are often developed from the combination of different disciplines. It is clear that successful interdisciplinary efforts require mastery of specific competencies. This course will develop a student's scientific and technical knowledge in which researchers from different disciplines. If such competencies are explicated, it might be possible to enhance researchers' abilities to develop the next generation in interdisciplinary scholarship.</p> <p>The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.</p>					
Contents of class					
<p>In this seminar, doctoral course student of 2nd year will make a presentation to other D2 students of different research fields, in order to obtain the research ability to integrate varieties of research fields. See the schedule.</p> <p>1) Presentations</p> <p>In this class, each student will make a presentation to other students of different research fields. So the student who do the presentation will prepare the outline for approximately 2 pages (A4) , and make a power-point. *Supervisor will come and check his student's presentation, if available.</p> <p>2) Title and abstract of presentation</p> <p>Not only D2 students, but also other students are welcome to attend the presentation. So please submit the title and abstract (200 words) 3 weeks before your presentation to Academic Affairs Division. We will post it on the bulletin board inside the campus.</p> <p>3) Report you will submit</p> <p>You will be requested to submit a report after each presentation to your supervisor. As an initial training to create a new research project, students will work to make brief summary of a topic from other student's research filed with the goal of creating research project. And students will complete a research proposal that will be integrated from other scientific field and their own research filed.</p> <p>4) Schedule of your presentation</p> <p>Please check the schedule given before the semester begins.</p> <p>5) Absence from the class</p> <p>Basically, you have to attend every class. If you need to take absence due to the sickness or conference, please discuss with your supervisor what you should do instead.</p>					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Notes for reference					
Goals to be achieved					
The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into					

complex problems and issues and also appreciate the unique advantages of integrative research and learning.

Evaluation of achievement

Your supervisor will check your report, and submit your academic score to the member of Academic Affairs Committee at the end of semester.

Examination

試験期間中には何も行わない

None during exam period

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(D51010070)Ethics for Researchers[Ethics for Researchers]

Subject name[English]	Ethics for Researchers[Ethics for Researchers]				
Schedule number	D51010070	Subject area	Advanced Mechanical Engineering	Required or elective	Required
Time of starting a course	Fall1 term	Day of the week,period	Wed.1~1	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, 原 邦彦, 上野 未貴 kyoumu iinkai fukuuintyou, HARA Kunihiko, UENO Miki				
Numbering	COM_DOC71015				
Objectives of class					
Assist graduate students as they undertake research activities and promote an understanding of the inherent ethical problems; lead students to think independently and exercise normative consciousness of research ethics through ethics education in research in accordance with goals of scientific education and research and characteristics of individual research specialties.					
Contents of class					
<ul style="list-style-type: none"> * 1st week: Introduction, 1st module("Research Misconduct") in e-learning * 2nd - 6th week: 2nd - 7th modules in e-learning - 2nd week: "Ethical Issues in the Management of Data in Engineering Research" - 3rd week: "Responsible Authorship" - 4th week: "Ethical Issues in the Peer Review and Publication of Engineering Research" & "Collaborative Research in Engineering Fields" - 5th week: "Whistleblowing and the Obligation to Protect the Public" - 6th week: "Managing Public Research Funds" * ~7th week: Discussion with supervisor * 8th week: make a final report 					
Self Preparation and Review					
Students will need to refer to their textbook to prepare for and review each lesson.					
Related subjects					
Philosophy of Science and Technology, Ethics for Engineers					
Notes for textbook					
Notes for reference					
<p>For the Sound Development of Science ?The Attitude of a Conscientious Scientist Japan Society for the Promotion of Science Editing Committee , MARUZEN PUBLISHING 2015 ISBN978-4-621-08938-5 (PDF: https://www.jsps.go.jp/j-kousei/data/rinri.pdf)</p>					
Goals to be achieved					
To prevent misconduct and promote fair research activities, this course provides knowledge and techniques regarding research ethics in accordance with characteristics of each graduate student's research specialties.					
Evaluation of achievement					
[Evaluation method] Final exam(100%)					
[Evaluation basis]					
Those who take and pass the short test after each unit of e-learning contents will be evaluated with following basis.					
A: Achieved all goals and obtained 80 points or higher (out of 100) as total score of exams					
B: Achieved most goals and obtained 65 points or higher (out of 100) as total score of exams					
C: Achieved more than half of specified goals and obtained 55 points or higher (out of 100) as total score of exams					
Examination					
レポートで実施 By Report					
Details of examination					
By report					
Other information					

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

Research Ethics, Conflict of Interest, Legal Compliance, Research Misconduct, Confidentiality Obligation, Security Export Control Policy, Copyright, Professionalism

(D51030020)Advanced Production Processes[Advanced Production Processes]

Subject name[English]	Advanced Production Processes[Advanced Production Processes]				
Schedule number	D51030020	Subject area	Advanced Mechanical Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Mon.2~2	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	森 謙一郎, 柴田 隆行, 安部 洋平, 永井 萌土 MORI Ken-Ichiro, SHIBATA Takayuki, ABE Yohei, NAGAI Moeto				
Numbering	MEC_DOC73025				
Objectives of class					
<p>With the recent development of computers, numerical methods tend to be used in the field of manufacturing processes. The finite element method is mainly explained in this lecture. The finite element method is widely applied to engineering problems such as solid mechanics, fluid mechanics, etc. (K. Mori and Y. Abe)</p> <p>In addition, the objectives of this course is to introduce fundamentals of conventional micromachining technologies and the state-of-art nanomachining technologies, and their application in the development of "Micro/Nano Electro Mechanical System (MEMS/NEMS)". (T. Shibata and M. Nagai)</p>					
Contents of class					
(K. Mori and Y. Abe)					
1st week: Numerical Methods: finite difference method, finite element method and boundary element method					
2nd week: Finite difference method for heat conduction: discretization of differential equation governing heat conduction, calculation of temperature distribution					
3rd week: Basic equations in solid mechanics: three-dimensional stress and strain, equilibrium equations, constitutive equations in elasticity and plasticity, yield criteria, incompressibility condition, etc.					
4th week: Finite element method for elastic deformation: triangular elements, distributions of displacement and strain					
5th week: Equilibrium equations of nodal forces, stiffness matrix,					
6th week: Treatment of boundary conditions					
7th week: Plasticity, elastic-plastic finite element method					
8th week: Finite element method for plastic deformation					
(T. Shibata and M. Nagai)					
9th week: Introduction of MEMS/NEMS					
10th week: Photolithography					
11th week: Wet etching and dry etching					
12th week: Physical vapor deposition (PVD) and chemical vapor deposition (CVD)					
13th week: Plating, electroforming, and bonding process					
14th week: Surface micromachining and bulk micromachining					
15th week: Microactuators and scaling law					
16th week: State-of-the-art in micro/nanomachining technologies					
Self Preparation and Review					
Students are required to prepare and review each lesson.					
Related subjects					
Strength of material, Solid mechanics, Numerical methods (K. Mori and Y. Abe)					
Micromachining Engineering (T. Shibata and M. Nagai)					
Notes for textbook					
Handout					
Notes for reference					
(T. Shibata and M. Nagai)					
Useful information on MEMS technologies can be obtained from the following website; http://www.memsnet.org/mems/					
Reference: (1) M.J. Madou, "Fundamentals of Microfabrication, 2nd ed.", CRC Press, 2002. (2) S. Franssila, "Introduction to Microfabrication", John Wiley & Sons, 2004. (3) M. Gad-El-Hak, "The MEMS Handbook, 2nd ed.", CRC Pr I Llc, 2006.					
Goals to be achieved					
To understand the finite element method (K. Mori and Y. Abe)					
To gain an understanding of the principles of micro/nanomachining technologies and to apply knowledge of the technologies to the design and manufacturing of a micro/nanodevice (T. Shibata and M. Nagai)					
Evaluation of achievement					

Reports of every week : 100% (K. Mori and Y. Abe)

Written report : 100% (T. Shibata and M. Nagai)

Examination

レポートで実施

By Report

Details of examination

Other information

Ken-ichiro Mori: room D-606, extension number: 6707, e-mail: mori@me.tut.ac.jp

Yohei Abe: room D-604, extension number: 6705, e-mail: abe@me.tut.ac.jp

Takayuki Shibata: room D-605, extension number: 6693, e-mail: shibata@me.tut.ac.jp

Moeto Nagai: room D-607, extension number: 6701, e-mail: nagai@me.tut.ac.jp

Reference URL

<http://plast.me.tut.ac.jp/index.eng.html> (K. Mori and Y. Abe)

<http://mems.me.tut.ac.jp/> (T. Shibata and M. Nagai)

Office hours

Monday (K. Mori and Y. Abe)

Anytime during regular working hours. Contact me by email before coming if possible. (T. Shibata and M. Nagai)

Relations to attainment objectives of learning and education

Key words

K. Mori and Y. Abe: forming processes, solid mechanics, finite element method // T. Shibata and M. Nagai: micro/nanomachining, MEMS/NEMS

(D51030040)Advanced Materials Science[Advanced Materials Science]

Subject name[English]	Advanced Materials Science[Advanced Materials Science]				
Schedule number	D51030040	Subject area	Advanced Mechanical Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Fri.2~2	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Begging grade	D1
Charge teacher name[Roman alphabet mark]	三浦 博己, 戸高 義一, 小林 正和 MIURA Hiromi, TODAKA Yoshikazu, KOBAYASHI Masakazu				
Numbering	MEC_DOC74025				
Objectives of class					
Learn knowledge and application about strength・fracture and problems・solutions of materials' microstructures on the base of material science necessary for safe and reliable usages of materials. Learn methods for experiments and the evaluation on the base academic understanding. Learn mechanisms of manifestation of functions and properties in relation with processing for the manifestation, because controls of properties and optimization of structural・functional materials are now carried out.					
Contents of class					
1st: Introduction (deformation, fracture and micro structural control of materials and the recent related topics) (MIURA)					
2nd: Microstructural control and improvement of mechanical property (MIURA)					
3rd: Dynamic recrystallization and micro structural control I (MIURA)					
4th: Dynamic recrystallization and micro structural control II (MIURA)					
5th: Static recrystallization and micro structural control (MIURA)					
6th: Evaluation and analysis of material Microstructure 1(Synchrotron radiation)(KOBAYASHI)					
7th: Evaluation and analysis of material Microstructure 2(Imaging, tomography)(KOBAYASHI)					
8th: Evaluation and analysis of material Microstructure 3(Image processing, modeling)(KOBAYASHI)					
9th: Evaluation and analysis of material Microstructure 4(Orientation analysis)(KOBAYASHI)					
10th: Evaluation and analysis of material Microstructure 5(Texture analysis)(KOBAYASHI)					
11th: Microstructure of materials 1 (Structure, Lattice defect) (TODAKA)					
12th: Microstructure of materials 2 (Phase diagram, Solidification, Diffusion) (TODAKA)					
13th: Microstructure of materials 3 (Deformed structure, Recovery, Recrystallization, Phase transformation) (TODAKA)					
14th: Strength of Materials 1 (Strengthening mechanism, Heat treatment・Deformation process) (TODAKA)					
15th: Strength of Materials 2 (Plastic deformation and microstructure) (TODAKA)					
16th: Term-end report					
Self Preparation and Review					
Self Preparation and Review are essential.					
Related subjects					
B3 機械の材料と加工 (Materials and Processing in Mechanical Engineering), 材料物理化学					
B4 材料信頼性工学, 構造材料学 (Structural Materials), 材料解析					
M1 材料保証学, 材料機能制御工学特論 (Advanced Materials Function Control Engineering)					
Notes for textbook					
The text for lecture is distributed.					
Reference1	Book title	Recrystallization and related annealing phenomena		ISBN	978-0-08-044164-1
	Author	F.J.Humphreys and M.Hatherly	Publisher	Elsevier	Publish year 2004
Reference2	Book title	Materials Science and Engineering: An Introduction, 8th Edition		ISBN	978-0470419977
	Author	William D. Callister, David G. Rethwisch	Publisher	John Wiley and Sons	Publish year 2009
Reference3	Book title	材料の科学と工学 <1> - <4>		ISBN	978-4563067120
	Author	W.D. キャリスター (著), William D., Jr. Callister (原著), 入戸野 修 (翻訳)	Publisher	培風館	Publish year 2002

Notes for reference

参考書 4

書名「マテリアル工学シリーズ 2 材料組織学」, 著者名:高木節雄, 津崎兼彰, 出版社:朝倉書店, ISBN:978-4254236927, 出版年:2000

参考書 5

書名「マテリアル工学シリーズ 3 材料強度学」, 著者名:加藤雅治, 熊井真次, 尾中晋, 出版社:朝倉書店, ISBN:978-4254236934, 出版年:1999

Goals to be achieved

1. Understand mechanisms of deformation, fracture and microstructural control of materials and the related recent topics
2. Understand meanings of microstructural control and improvement of mechanical property
3. Understand mechanisms of dynamic recrystallization and microstructural control for actual applications
4. Understand mechanisms of static recrystallization and microstructural control for actual applications
5. Understand and explain imaging technique by using synchrotron radiation
6. Understand and explain representation of crystallographic orientation
7. Understand and explain relationship between microstructure and properties
8. Propose heat treatment and deformation process for control of microstructure and properties

Evaluation of achievement

Evaluation of results : intermediate reports(50%)and term-end final report(50%)

Criterion: evaluate results for the students presented at all the lectures essentially as below.

A: achieve all objectives and total marks of reports and exam. over 80.

B: achieve 7 objectives and total marks of reports and exam. over 65.

C: achieve 5 objectives and total marks of reports and exam. over 55.

Examination

その他

Other

Details of examination**Other information****Reference URL**

<Miura> <http://str.me.tut.ac.jp>

<Kobayashi> <http://str.me.tut.ac.jp>

<Todaka> <http://martens.me.tut.ac.jp/>

Office hours

<Miura> Please send e-mail in advance for appointment.

<Kobayashi> Please send e-mail in advance for appointment.

<Todaka> Please send e-mail in advance for appointment.

Relations to attainment objectives of learning and education**Key words**

Properties, crystal structure, microstructure, thermo process, mechanical process

(D51030080)Advanced Environmental Engineering[Advanced Environmental Engineering]

Subject name[English]	Advanced Environmental Engineering[Advanced Environmental Engineering]				
Schedule number	D51030080	Subject area	Advanced Mechanical Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Thu.1~1	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	柳田 秀記, 飯田 明由, 関下 信正, 横山 博史 YANADA Hideki, IIDA Akiyoshi, SEKISHITA Nobumasa, YOKOYAMA Hiroshi				
Numbering	MEC_DOC76025				
Objectives of class					
エネルギーと環境問題に関して、特に熱流体工学の視点から検討できる高度な素養を身につけることを目標として、将来、環境問題に取り組むための理論と最近の技術動向について学ぶ。					
The class aims to acquire advanced knowledge necessary for tackling energy and environmental problems in future from the standpoint of thermal and fluid engineering.					
Contents of class					
後期1					
第1回から第7回 自然エネルギー変換科学研究室(飯田・関下)					
大気乱流や大気汚染, ビル風, ヒートアイランド, 風力発電などについて, 受講者が最近の英語論文の内容を紹介し, 他の受講者や担当教員との間で討論を行う。この過程を通して, 大気汚染や都市の熱流体問題や再生可能エネルギーについての基礎理論と最近の技術動向について学ぶ					
8回目:まとめとレポート					
後期2					
第8回~15回 省エネルギー研究室(柳田・横山)					
力学現象を利用する流体の浄化技術, 攪拌技術, 低騒音化技術等および流体现象の数値解析技術について, 受講者が最近の英語論文の内容を紹介し, 他の受講者や担当教員との間で討論を行う。この過程を通して, 浄化技術や低騒音化についての基礎理論と最近の技術動向について学ぶ。					
第16回 まとめとレポート					
1st to 7th weeks:(Prof.Iida and Prof.Sekishita)					
Each student is requested to read English papers that treat atmospheric turbulence, air pollution, building wind and heat island, to introduce the contents of the papers, and to discuss them with the other students and the lecturer. Fundamental theories and recent trend of heat and mass transfer problems and urban air pollution are acquired through this process.					
8th week: Report and summary					
9th to 15th weeks:(Prof.Yanada and Prof.Yokoyama)					
Each student is requested to read a few English papers that treat fluid filtration technologies utilizing mechanical phenomena, to introduce the contents of the papers, and to discuss them with the other students and the lecturer. Fundamental theories and recent trend of fluid filtration technologies are acquired through this process.					
16th week: Report and summary					
Self Preparation and Review					
検索した論文の紹介に必要な理論などを各自でよく調べて授業に臨むこと。					
Study the fundamental theories necessary for understanding the techical papers and carefully prepare for the introduction of the papers.					
Related subjects					
流体力学, 計測工学, 統計力学					
Hydrodynamics, Instrumentation engineering, Statistical mechanics					
Notes for textbook					
英語論文を使用					
English technical papers are used.					
Notes for reference					

Goals to be achieved

再生エネルギーに関する基本事項について理解する。

風力発電の基礎について理解する。

大気拡散, 大気汚染について, 基礎理論と技術動向を理解する。

力学現象を利用する流体の浄化技術について, 基礎理論と技術動向を理解する。

空力騒音, 数値解析について, 基礎理論と技術動向を理解する。

To understand the fundamentals of renewable energy and theory of wind turbine.

To understand fundamental theories and technical trends of Atmospheric Diffusion and Air Pollution.

To understand methods and theories of fluid filtration utilizing mechanical phenomena.

To understand methods and theories of aeroacoustics and numerical simulation.

Evaluation of achievement

評価法: 課題レポートにより評価する(各レポートを 100 点満点で評価し, 平均点を評価点とする)

Report 100%

Examination

レポートで実施

By Report

Details of examination**Other information****Reference URL**

飯田研究室 <http://aero.me.tut.ac.jp>

Prof.Iida: <http://aero.me.tut.ac.jp>

Office hours

e-mail で時間を相談する。

Inquire this of the lecturers by e-mail.

Relations to attainment objectives of learning and education**Key words**

エネルギー, 環境, 風力発電, 風車, 大気乱流, 大気拡散, 流体浄化, 空力騒音, 数値解析

Energy, Environment, Wind power generation, Windmill, Atmospheric turbulence, Atmospheric diffusion, Liquid filtration,

Aerodynamic noise, Numerical simulation

(D51030090)Advanced Systems and Instrumentation Engineering[Advanced Systems and Instrumentation Engineering]

Subject name[English]	Advanced Systems and Instrumentation Engineering[Advanced Systems and Instrumentation Engineering]				
Schedule number	D51030090	Subject area	Advanced Mechanical Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Tue.2~2	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	章 忠, 内山 直樹, 阪口 龍彦 SHO Tadashi, UCHIYAMA Naoki, SAKAGUCHI Tatsuhiko				
Numbering	MEC_DOC75025				
Objectives of class					
1)Learns some important methods in signal processing. 2)Understand some methods in image based recognition. 3)Provides analytical methods for nonlinear systems and their application to real systems.					
Contents of class					
1th week: Basic theory of the wavelet transforms 2th week: Theory of complex discrete wavelet transform 3th week: Design methods of complex discrete wavelet transform 4th week: Theory of complex wavelet packet transform 5th week: Design methods of complex wavelet packet transform Lecturer: Sho					
6th week: Linear programming problems 7th week: Linear programming algorithms 8th week: Integer programming problems 9th week: Integer programming algorithms 10th week: Combinatorial optimization problems Lecturer: Sakaguchi(The above subjects may be changed according to students' requests and backgrounds)					
11th week: Fundamental properties of nonlinear systems 12th week: Analysis of nonlinear systems I 13th week: Analysis of nonlinear systems II 14th week: Application of nonlinear analysis to real systems I 15th week: Application of nonlinear analysis to real systems II Lecturer: Uchiyama(The above subjects may be changed according to students' requests and backgrounds)					
Self Preparation and Review					
Required to prepare for and review each lecture contents based on handouts provided.					
Related subjects					
1. Advanced signal measurements engineering 2. Advanced image measurements engineering 3. Advanced systems engineering					
Notes for textbook					
Handouts will be provided.					
Rader & Gold:chap.5 in Theory and application of digital signal processing (Printice-Hall)					
Reference1	Book title	Frontiers in Computing Technologies for Manufacturing Applications		ISBN	978-1-84628-954-

					5
	Author	Yoshiaki Shimizu, Zhong Zhang, Rafael Batres	Publisher	Springer	Publish year 2007
Reference2	Book title	Nonlinear Control of Engineering Systems: A Lyapunov-Based Approach		ISBN	0-8176-4265-X
	Author	W. E. Dixon et al.	Publisher	Birkhauser	Publish year 2003
Reference3	Book title	Nonlinear Systems, 3rd Ed.		ISBN	0-13-067389-7
	Author	H. K. Khalil	Publisher	Prentice Hall	Publish year 2002
Notes for reference					
Goals to be achieved					
<p>1) Learn the advanced signal processing methods and knowledge</p> <p>2) Understand the theory of wavelet transform.</p> <p>4) Learn mathematical methods in image processing and pattern recognition.</p> <p>5) Apply the methods to pattern classification.</p> <p>6) Expected to understand analysis of nonlinear systems.</p> <p>7) Be able to apply the analytical methods to real nonlinear systems</p>					
Evaluation of achievement					
<p>The final grade will be determined by report assignments of three lecturers (Each ratio is 100/3 %).</p> <p>Basically, students are expected to attend all courses.</p> <p>The credit of this course is given if the score of the above reports is 55% or over.</p> <p>Grade levels are C (55% – less than 65%), B (65 – less than 80%) and A (80% or over).</p>					
Examination					
<p>試験期間中には何も行わない None during exam period</p>					
Details of examination					
Other information					
Reference URL					
Office hours					
<p>Sho (Accept at any time)</p> <p>Miyake(Accept at any time)</p> <p>Uchiyama(Contact by e-mail first.)</p>					
Relations to attainment objectives of learning and education					
Key words					
Signal processing, Pattern recognition, Nonlinear systems, Systems engineering					

(D52010020)Seminar on Electrical and Electronic Information Engineering 2[Seminar on Electrical and Electronic Information Engineering 2]

Subject name[English]	Seminar on Electrical and Electronic Information Engineering 2[Seminar on Electrical and Electronic Information Engineering 2]				
Schedule number	D52010020	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	4
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered	Electrical and Electronic Information Engineering			Beggining grade	D1
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering	ELC_DOC71015				
Objectives of class					
The seminar aims to provide a broad understanding of theoretical and experimental approaches related to the electrical and electronic engineering for the research work of his/her master thesis.					
Contents of class					
The class provides both of fundamental knowledge on the research work of master thesis and the most advanced results in the related field by reading research papers and monographs. Contents of the class depend on the supervisor. To be announced by individual supervisors.					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Textbook or material will be made available from the supervisor. To be announced by individual supervisors.					
Notes for reference					
Goals to be achieved					
To acquire fundamental knowledge on individual research fields. To acquire the ability of finding a problem, the ability of solving the problem and the presentation skill.					
Evaluation of achievement					
Coursework, presentation and/or report.					
Examination					
試験期間中には何も行わない None during exam period					
Details of examination					
Other information					
Reference URL					
Office hours					
Relations to attainment objectives of learning and education					
Key words					



(D52010030)Seminar on Electrical and Electronic Information Engineering 3[Seminar on Electrical and Electronic Information Engineering 3]

Subject name[English]	Seminar on Electrical and Electronic Information Engineering 3[Seminar on Electrical and Electronic Information Engineering 3]				
Schedule number	D52010030	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered	Electrical and Electronic Information Engineering			Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering	ELC_DOC71015				
Objectives of class					
The seminar aims to provide a broad understanding of theoretical and experimental appooches related to the electrical and electronic information engineering for the research work of his/her master thesis.					
Contents of class					
The class provides both of fundamental knowledge on the research work of master thesis and the most advanced results in the related field by reading research papers and monographs. Contents of the class depend on the supervisor. To be announced by individual supervisors.					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Textbook or material will be made available from the supervisor. To be announced by individual supervisors.					
Notes for reference					
Goals to be achieved					
To acquire fundamental knowledge on individual research fields. To acquire the ability of finding a problem, the ability of solving the problem and the presentation skill.					
Evaluation of achievement					
Coursework, presentation and/or report.					
Examination					
試験期間中には何も行わない None during exam period					
Details of examination					
Other information					
Reference URL					
Office hours					
Relations to attainment objectives of learning and education					
Key words					



(D52010050)Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]

Subject name[English]	Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]				
Schedule number	D52010050	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Required
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered				Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S2系教務委員, 教務委員会副委員長 2kei kyomu Iin-S, kyouumu iinkai fukuuintyou				
Numbering	ELC_DOC71015				
Objectives of class					
In this lecture, each student is requested to present its own doctoral research intelligibly for the doctoral students from other departments. By studying various topics in other areas, each student is supposed to acquire the ability to organize various knowledge of different areas to promote its own research and development.					
Contents of class					
Lecture 1: The vice-chair of the committee of educational affairs give the guidance and instructions for the applicants to enforce this lecture. The students arrange the schedule of the lectures by themselves.					
Lecture 2 -- 16:					
10 lectures out of 15: Two or three students present their research themes along with the problems and solutions in their activities. Each students prepares a resume of two A4 pages, presents the contents in 20 minutes using presentation software (e.g. powerpoint), and then discusses with doctoral students from other departments (20 minutes).					
5 lectures out of 15: Five professors (one for each department) give the lectures on their research topics. The students discuss the interdisciplinary research based on the professor's talk.					
When a student presents their research, its supervisor is requested to attend to the class. Thus, the presentation schedule is examined in the committee of educational affairs.					
The student presentations are open to faculty members and students. Each student is requested to submit the title and the abstract of the talk by three weeks before the scheduled date, which are publicized in our campus.					
Self Preparation and Review					
Related subjects					
Specialized and general subjects in each course.					
Notes for textbook					
Notes for reference					
Goals to be achieved					
To acquire the ability to present the research for the doctoral students from other departments.					
To acquire the ability to organize various knowledge of different areas to promote its own research and development.					
Evaluation of achievement					
The evaluation is given by the supervisor, totally considering the reports submitted by the student. Each student selects one or more presentations from the other's presentations, and writes a report of 1 page (A4) on the relationship to its own theme with the possible feedback to the own theme.					
Examination					
試験期間中には何も行わない None during exam period					
Details of examination					

Other information
Reference URL
Office hours
Relations to attainment objectives of learning and education
Key words

(D52010070)Ethics for Researchers[Ethics for Researchers]

Subject name[English]	Ethics for Researchers[Ethics for Researchers]				
Schedule number	D52010070	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Required
Time of starting a course	Fall1 term	Day of the week,period	Wed.1~1	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, 原 邦彦, 上野 未貴 kyoumu iinkai fukuiintyou, HARA Kunihiro, UENO Miki				
Numbering	COM_DOC71015				
Objectives of class					
Assist graduate students as they undertake research activities and promote an understanding of the inherent ethical problems; lead students to think independently and exercise normative consciousness of research ethics through ethics education in research in accordance with goals of scientific education and research and characteristics of individual research specialties.					
Contents of class					
<ul style="list-style-type: none"> * 1st week: Introduction, 1st module("Research Misconduct") in e-learning * 2nd - 6th week: 2nd - 7th modules in e-learning <ul style="list-style-type: none"> - 2nd week: "Ethical Issues in the Management of Data in Engineering Research" - 3rd week: "Responsible Authorship" - 4th week: "Ethical Issues in the Peer Review and Publication of Engineering Research" & "Collaborative Research in Engineering Fields" - 5th week: "Whistleblowing and the Obligation to Protect the Public" - 6th week: "Managing Public Research Funds" * ~7th week: Discussion with supervisor * 8th week: make a final report 					
Self Preparation and Review					
Students will need to refer to their textbook to prepare for and review each lesson.					
Related subjects					
Philosophy of Science and Technology, Ethics for Engineers					
Notes for textbook					
Notes for reference					
For the Sound Development of Science ?The Attitude of a Conscientious Scientist Japan Society for the Promotion of Science Editing Committee , MARUZEN PUBLISHING 2015 ISBN978-4-621-08938-5 (PDF: https://www.jsps.go.jp/j-kousei/data/rinri.pdf)					
Goals to be achieved					
To prevent misconduct and promote fair research activities, this course provides knowledge and techniques regarding research ethics in accordance with characteristics of each graduate student's research specialties.					
Evaluation of achievement					
[Evaluation method] Final exam(100%)					
[Evaluation basis]					
Those who take and pass the short test after each unit of e-learning contents will be evaluated with following basis.					
A: Achieved all goals and obtained 80 points or higher (out of 100) as total score of exams					
B: Achieved most goals and obtained 65 points or higher (out of 100) as total score of exams					
C: Achieved more than half of specified goals and obtained 55 points or higher (out of 100) as total score of exams					
Examination					
レポートで実施					
By Report					
Details of examination					
By report					

Other information
Reference URL
Office hours
Relations to attainment objectives of learning and education
Key words Research Ethics, Conflict of Interest, Legal Compliance, Research Misconduct, Confidentiality Obligation, Security Export Control Policy, Copyright, Professionalism

(D52030020)Advanced Electronic Materials 2[Advanced Electronic Materials 2]

Subject name[English]	Advanced Electronic Materials 2[Advanced Electronic Materials 2]				
Schedule number	D52030020	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Thu.3~3	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	松田 厚範, 石山 武 MATSUDA Atsunori, ISHIYAMA Takeshi				
Numbering	ELC_DOC74025				
Objectives of class					
Objectives of this subject are to understand the advanced aspects on functional materials, photonics, electroductics, spin electronics, and also to have overall knowledge on the latest technologies on these physical phenomena.					
Contents of class					
"Advanced Electronic Materials 2" is composed of four advanced topics of functional materials, photonics, electroductics, and spin electronics, which will be delivered for three times for each by four professors whose expertise lie on the individual categories.					
The category of "Functional materials" is made to learn preparation, characterization and applications of functional materials for electrochemical devices. The contents are Functional materials for ionis including all-solid-state-Li-ion battery and advanced intermediate-temperature fuel cell.					
The category of "electroductics" is electrochemical reaction on electrode. The contents are 1) fundamentals of thermodynamics in aqueous solution, 2) fundamental of electrical double layer 3) fundamental of adsorption, 4) fundamentals of electrochemical reaction, and 5) applications of chemical sensor.					
The category of "photonics" is devoted to the understanding of interactions between photon (light wave) and materials based on the quantum theory and also to industrial applications of photonic devices. 1) Optoelectronic devices, 2) optical processes in semiconductors and exciton, 3) nanomaterial.					
The category of "spin electronics" covers a wide area from fundamentals to applications of magnetic materials and magnetics. 1) Origin of magnetics, 2) Soft and hard magnetic materials, 3) Major applications of magnetics and magnetic materials, 4) Interaction phenomena among spins and various physical quantities, 5) Micro-magnetic devices and systems, 6) Spintronics and spin photonics					
Self Preparation and Review					
Students must perform their preparation and review of this subject based on the course materials with following the instruction of the teachers.					
Related subjects					
Physics for Electronics, Analysis of Inorganic Materials, Advanced Materials for Electronics, Functional Materials for Optical Applications.					
Notes for textbook					
None					
Reference1	Book title	Fuel Cells		ISBN	978-1-4614-5784-8
	Author	Klaus-Dieter Kreuer	Publisher	Springer	Publish year 2013
Reference2	Book title	Solid State Ionics for Batteries		ISBN	978-4-431-24974-0
	Author	Tsutomu Minami et al	Publisher	Springer	Publish year 2005
Notes for reference					

None
<p>Goals to be achieved</p> <p>(1) To understand fundamental aspects on functional materials, photonics, electroductics and spin electronics. (2) To get the knowledge on the latest technologies on these physical phenomena.</p>
<p>Evaluation of achievement</p> <p>The final evaluation will be the sum of four categories (25%); functional materials, photonics, electroductics, spin electronics.</p>
<p>Examination</p> <p>レポートで実施 By Report</p>
<p>Details of examination</p> <p>Taking examination and submission of report will be explained and required by the teachers during their classes.</p>
<p>Other information</p> <p>Functional materials; Atsunori Matuda : matsuda@ee.tut.ac.jp Electroductics; Toshiaki Hattori : thattori@ee.tut.ac.jp Photonics; Takeshi Ishiyama: ishiyama@ee.tut.ac.jp Spin electronics; Hiroyuki Takagi : takagi@ee.tut.ac.jp</p>
<p>Reference URL</p> <p>http://www.ee.tut.ac.jp/material</p>
<p>Office hours</p> <p>one hour after every classes</p>
<p>Relations to attainment objectives of learning and education</p>
<p>Key words</p> <p>functional materials, photonics, spin electronics, ionics, micro-optics, electroductics</p>

(D52030030)Advanced Electrical Systems 1[Advanced Electrical Systems 1]

Subject name[English]	Advanced Electrical Systems 1[Advanced Electrical Systems 1]				
Schedule number	D52030030	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Mon.2~2	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	滝川 浩史, 櫻井 庸司, 穂積 直裕 TAKIKAWA Hirofumi, SAKURAI Yoji, HOZUMI Naohiro				
Numbering	ELC_DOC73025				
Objectives of class					
<p>This lecture is implemented as an introduction to electrical energy systems and intended for students and other engineering disciplines. It is being useful as reference and self-study guide for the professional dealing with this important area. There are following three sub courses to choose from.</p> <p>This lecture is implemented as an introduction to electrical energy systems and intended for students and other engineering disciplines. It is being useful as reference and self-study guide for the professional dealing with this important area. There are following three sub courses to choose from.</p>					
Contents of class					
<p>Sub Course 1</p> <ol style="list-style-type: none"> 1. Generation and control of various plasmas 2. Characteristics and diagnostics of plasma 3. Applications of functional plasma and trends <p>Sub Course 2</p> <ol style="list-style-type: none"> 1. Li-ion and Post Li-ion Batteries 2. Materials for Advanced Batteries 3. Modern Aspects of Electrochemical Energy Conversion Devices <p>Sub Course 3</p> <ol style="list-style-type: none"> 1. Ultrasonic techniques for medical use 2. Diagnosing techniques for industrial use 3. Assessment for high voltage insulation system <p>Sub Course 1</p> <ol style="list-style-type: none"> 1. Generation and control of various plasmas 2. Characteristics and diagnostics of plasma 3. Applications of functional plasma and trends <p>Sub Course 2</p> <ol style="list-style-type: none"> 1. Li-ion and Post Li-ion Batteries 2. Materials for Advanced Batteries 3. Modern Aspects of Electrochemical Energy Conversion Devices <p>Sub Course 3</p> <ol style="list-style-type: none"> 1. Ultrasonic techniques for medical use 2. Diagnosing techniques for industrial use 3. Assessment for high voltage insulation system 					
Self Preparation and Review					
Related subjects					
<p>Basic electrical power engineering course is prerequisite.</p> <p>Basic electrical power engineering course is prerequisite.</p>					
Notes for textbook					
<p>Materials will be prepared by the lecturer.</p> <p>(Reference)</p> <p>(1) E. Kuffel, W. Zaengel and J. Kuffel: High Voltage Engineering (Newnes), (2) D. Linden: Handbook of Batteries (McGraw-Hill), (3) J. Larminie and A. Dicks: Fuel Cell Systems Explained (Wiley)</p> <p>Materials will be prepared by the lecturer.</p>					

(Reference)

(1) E. Kuffel, W. Zaengel and J. Kuffel: High Voltage Engineering (Newnes), (2) D. Linden: Handbook of Batteries (McGraw-Hill),
(3) J. Larminie and A. Dicks: Fuel Cell Systems Explained (Wiley)

Notes for reference

Goals to be achieved

Evaluation of achievement

Marks are based on reports(100%)

Marks are based on reports(100%)

Examination

レポートで実施

By Report

Details of examination

Other information

Office, Tel and E-mail:

Sakurai: C-305, 0532-44-6722, sakurai@ee.tut.ac.jp

Takikawa: C-311, 0532-44-6727, takikawa@ee.tut.ac.jp

Hozumi: F2-304, F2-301, 0532-44-6934, hozumi@icceed.tut.ac.jp

Office, Tel and E-mail:

Sakurai: C-305, 0532-44-6722, sakurai@ee.tut.ac.jp

Takikawa: C-311, 0532-44-6727, takikawa@ee.tut.ac.jp

Hozumi: F2-304, F2-301, 0532-44-6934, hozumi@icceed.tut.ac.jp

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(D52030060)Advanced Microelectronics 2[Advanced Microelectronics 2]

Subject name[English]	Advanced Microelectronics 2[Advanced Microelectronics 2]				
Schedule number	D52030060	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Tue.2~2	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	若原 昭浩, 岡田 浩, 河野 剛士 WAKAHARA Akihiro, OKADA Hiroshi, KAWANO Takeshi				
Numbering	ELC_DOC74025				
Objectives of class					
先端的な半導体デバイスのための理論、デバイス構造、設計や作製プロセスを理解することを目標とする。 To understand semiconductor physics, structure, design, and processing of advanced semiconductor devices.					
Contents of class					
この科目は前半と後半の2つの部分から構成される。前半では pn 接合や MOS 構造における多数および少数キャリアの振る舞いについて扱う。注入された少数キャリアのダイナミクスについても触れる。後半では学生が以下から1つのトピックスを選択する。					
<ol style="list-style-type: none"> 1. ナノ構造デバイスの作製および評価技術(岡田) 2. バンドエンジニアリングと量子効果デバイス(若原) 3. 先端 MEMS/NEMS 技術(河野) 					
講義に加えて学生が主体的に取り組むケーススタディも実施する。学生は与えられた課題についての調査研究や、要求を満足するデバイスを設計するなどの課題に取り組み、プレゼンテーションを行う。 This subject consists of two parts. The first half begins by introducing majority- and minority-carrier behavior in fundamental pn-junction and MOS structures. Injected minority carrier dynamics in semiconductors is also included. On the latter half, student choose one from following three topics.					
<ol style="list-style-type: none"> 1. Fabrication and characterization technology for Nanosturcture devices (Prof. Okada) 2. Band engineering and quantum effect devices (Prof. Wakahara) 3. MEMS/NEMS technology(Prof. Kawano) 					
Adding to lectures by professors, in this subject, a case study is also conducted. Namely, students are required to give a presentation on researches on the given topics, and on design of devices that satisfies required specifications.					
Self Preparation and Review					
Related subjects					
Master's course: Semiconductor physics 2					
Master's course: Semiconductor physics 2					
Notes for textbook					
S.M.Sze, Physics of Semiconductor Devices (Wiley)					
関連する参考文献やデータ、資料などは講義で配布する。 S.M.Sze, Physics of Semiconductor Devices (Wiley)					
Related references, data, printed matters will be given in the class.					
Notes for reference					
Goals to be achieved					

1. 半導体における基本的な物理現象を深く理解し、基本的な半導体デバイスの動作原理を修士課程学生に説明できること
2. 与えられた要求仕様を満足する半導体デバイスの基本部分を設計することができること
3. 与えられたトピックスを調査し、講義できること

You will be able to:

1. Deeply understand fundamental phenomena in semiconductors, and explain operation principle of basic semiconductor devices to master course students.
2. Design a essential part of semiconductor devcie that satisfies the given specification.
3. Investigate on given topics, and give a lecture on this.

Evaluation of achievement

ケーススタディや研究調査の完成度で評価する。

Achievenemt of lectures of the case study, and writing research reports.

Examination

その他

Other

Details of examination

評価方法については講義の中で指示する。

Qualification will be directed in the class.

Other information

選択に際しては下記の教員にコンタクトすること。

若原昭浩 : C-608 wakahara[at]ee.tut.ac.jp

岡田浩 : C-303B okada[at]ee.tut.ac.jp

河野剛士 : C-603 kawano[at]ee.tut.ac.jp

Before choosing a sub-course, contact to following professors

Akihiro Wakahara : C-608 wakahara[at]ee.tut.ac.jp

Hiroshi Okada : C-303B okada[at]ee.tut.ac.jp

Takeshi Kawano : C-603 kawano[at]ee.tut.ac.jp

Reference URL

<http://www.int.ee.tut.ac.jp>

<http://www.eiiris.tut.ac.jp>

<http://www.int.ee.tut.ac.jp>

<http://www.eiiris.tut.ac.jp>

Office hours

Relations to attainment objectives of learning and education

Key words

Solid-state electronics, semiconductor physics, laser diode, low-dimensional quantum devices

Solid-state electronics, semiconductor physics, laser diode, low-dimensional quantum devices

(D52030080)Advanced Information and Communication Systems 2[Advanced Information and Communication Systems 2]

Subject name[English]	Advanced Information and Communication Systems 2[Advanced Information and Communication Systems 2]				
Schedule number	D52030080	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	市川 周一, 田村 昌也 ICHIKAWA Shuichi, TAMURA Masaya				
Numbering	ELC_DOC75025				
Objectives of class					
This lecture introduces some advanced topics on (1) computer system engineering and (2) analog filters. The details are given below.					
Contents of class					
The topics of item (1) include the following items:					
1. Parallel and High-performance computing,					
2. Parallel and High-performance computer architecture,					
3. Custom computing circuit, special-purpose computing system.					
The topics of item (2) include the following items:					
1. Analog filter consisting of passive components					
2. Design of microwave filter used in wireless communications					
3. Fusion of microwave filter and one's expertise					
Self Preparation and Review					
Related subjects					
The students who register for this lecture must have studied the Advanced Electronic Information System 1 and 2 (Ichikawa, Tamura) in master course program, or its equivalent.					
All courses taken at other universities must be approved by the lecturers before registering for this course.					
Notes for textbook					
Course materials and references are shown by lecturers.					
Notes for reference					
Goals to be achieved					
The students are required to obtain the advanced knowledge on the above-mentioned items for their research activities in doctoral program.					
Evaluation of achievement					
There will be assignments for the topics shown above; course grades will be the average of these assignments.					
Attendance to all lectures is compulsory; the absence without permission will result in a substantial penalty.					
Examination					
レポートで実施 By Report					
Details of examination					
Other information					
Ichikawa, Room C-404, ichikawa@tut.jp Tamura, Room C-405, tamura@ee.tut.ac.jp					
Reference URL					
Ichikawa http://meta.ccs.ee.tut.ac.jp/~ichikawa/index-e.html Tamura http://www.comm.ee.tut.ac.jp/em/index_en.html					
Office hours					

Please make an appointment via e-mail.

Relations to attainment objectives of learning and education

Key words

(1) computer system, high performance computing (2) analog filter, microwave

(D52030090)Methodology of R & D[Methodology of R & D]

Subject name[English]	Methodology of R & D[Methodology of R & D]				
Schedule number	D52030090	Subject area	Advanced Electrical and Electronic Information Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Tue.3~3	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering	ELC_DOC78025				
Objectives of class The class aims to provide a basic understanding of R&D methodology related to the electrical and electronic information engineering for the research work of his/her doctor thesis.					
Contents of class The class provides some fundamental tips to conduct R&D work effectively. Contents of the class depend on the supervisor. To be announced by individual supervisors.					
Self Preparation and Review					
Related subjects					
Notes for textbook Reference and material will be available from the supervisor.					
Notes for reference					
Goals to be achieved To acquire the ability of identifying and formulating research problem, planning and implementing specific research tasks, troubleshooting and communicating outcomes.					
Evaluation of achievement Coursework and presentation are evaluated generally.					
Examination 試験期間中には何も行わない None during exam period					
Details of examination					
Other information					
Reference URL					
Office hours					
Relations to attainment objectives of learning and education					
Key words					

(D53010010)Seminar on Computer Science and Engineering 1[Seminar on Computer Science and Engineering 1]

Subject name[English]	Seminar on Computer Science and Engineering 1[Seminar on Computer Science and Engineering 1]				
Schedule number	D53010010	Subject area	Advanced Computer Science and Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	4
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered	Computer Science and Engineering			Beggining grade	D1
Charge teacher name[Roman alphabet mark]	S3系教務委員, S3系教務委員—23kei kyomu Iin-S, 3kei kyomu Iin-S2				
Numbering	CMP_DOC71015				
Objectives of class					
<p>各研究室が指定する情報学に関する最先端の技術情報(特に英語による最先端の技術情報)を発見する能力、ならびに、その技術情報を理解、説明、質疑・応答できる能力を養う。</p> <p>The course is intended for students to study basic materials in depth, related to his/her research subjects in computer science and engineering.</p> <p>It is also aimed for students to acquire various skills, required in general research work, such as those for oral presentation, and technical discussion and writing.</p>					
Contents of class					
<p>教員が指定する最先端の技術情報(特に英語による最先端の技術情報)について理解したところを説明する。</p> <p>教員は技術情報の内容の発見、理解、説明、質疑・応答する方法について直接指導を行う。</p> <p>While specific contents depend on the research areas students are involved in, it is usually the case for students to read relevant textbooks/research papers and report on them, as well as to present and discuss on the research work of their own.</p>					
Self Preparation and Review					
<p>教員が指定する内容に関し、予習・復習を行う。</p> <p>Consult with your advisor.</p>					
Related subjects					
<p>指導教員に問い合わせること。</p> <p>Consult with your advisor.</p>					
Notes for textbook					
<p>指導教員に問い合わせること。</p> <p>Consult with your advisor.</p>					
Notes for reference					
Goals to be achieved					
<p>(1)最先端の専門分野の英文が理解でき、わかりやすく説明できる。</p> <p>(2)技術的な情報を扱う英文が解釈でき、作文できる。</p> <p>(3)論文の標準的な構成ができる。</p> <p>(4)発表というスタイルでの情報提供ができる。</p> <p>(5)情報の不足を質問という形式で指摘できる。</p> <p>(1) To understand English literature on state-of-the-art areas of expertise, and to explain clearly.</p> <p>(2) To interpret technical information written in English, and to write such information in English.</p> <p>(3) To make a standard construction of a technical paper.</p> <p>(4) To provide information by oral presentation.</p> <p>(5) To point out the lack of information by questions.</p>					
Evaluation of achievement					
<p>技術情報の発見に向けた自主性、技術情報の理解度、説明の方法、質問への回答、議論への参加の様子等から総合的に指導教員が判定する。</p> <p>Will be evaluated by taking into account various factors overall, such as technical explanation, question answering, discussion involvements and so on.</p>					
Examination					
試験期間中には何も行わない					

None during exam period

Details of examination

課題レポートやプレゼンテーションに基づいて評価する。

Your supervisor will evaluate your presentation and your reports.

Other information

Reference URL

Office hours

指導教員に問い合わせること。

Consult with your advisor.

Relations to attainment objectives of learning and education

Key words

(D53010020)Seminar on Computer Science and Engineering 2[Seminar on Computer Science and Engineering 2]

Subject name[English]	Seminar on Computer Science and Engineering 2[Seminar on Computer Science and Engineering 2]				
Schedule number	D53010020	Subject area	Advanced Computer Science and Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered	Computer Science and Engineering			Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S3系教務委員, S3系教務委員—23kei kyomu Iin-S, 3kei kyomu Iin-S2				
Numbering	CMP_DOC71015				
Objectives of class					
<p>各研究室が指定する情報学に関する最先端の技術情報(特に英語による最先端の技術情報)を発見する能力、ならびに、その技術情報を理解、説明、質疑・応答できる能力を養う。</p> <p>The course is intended for students to study basic materials in depth, related to his/her research subjects in computer science and engineering.</p> <p>It is also aimed for students to acquire various skills, required in general research work, such as those for oral presentation, and technical discussion and writing.</p>					
Contents of class					
<p>教員が指定する最先端の技術情報(特に英語による最先端の技術情報)について理解したところを説明する。</p> <p>教員は技術情報の内容の発見、理解、説明、質疑・応答する方法について直接指導を行う。</p> <p>While specific contents depend on the research areas students are involved in, it is usually the case for students to read relevant textbooks/research papers and report on them, as well as to present and discuss on the research work of their own.</p>					
Self Preparation and Review					
<p>教員が指定する内容に関し、予習・復習を行う。</p> <p>Consult with your advisor.</p>					
Related subjects					
<p>指導教員に問い合わせること。</p> <p>Consult with your advisor.</p>					
Notes for textbook					
<p>指導教員に問い合わせること。</p> <p>Consult with your advisor.</p>					
Notes for reference					
Goals to be achieved					
<p>(1)最先端の専門分野の英文が理解でき、わかりやすく説明できる。</p> <p>(2)技術的な情報を扱う英文が解釈でき、作文できる。</p> <p>(3)論文の標準的な構成ができる。</p> <p>(4)発表というスタイルでの情報提供ができる。</p> <p>(5)情報の不足を質問という形式で指摘できる。</p> <p>(1) To understand English literature on state-of-the-art areas of expertise, and to explain clearly.</p> <p>(2) To interpret technical information written in English, and to write such information in English.</p> <p>(3) To make a standard construction of a technical paper.</p> <p>(4) To provide information by oral presentation.</p> <p>(5) To point out the lack of information by questions.</p>					
Evaluation of achievement					
<p>技術情報の発見に向けた自主性、技術情報の理解度、説明の方法、質問への回答、議論への参加の様子等から総合的に指導教員が判定する。</p> <p>Will be evaluated by taking into account various factors overall, such as technical explanation, question answering, discussion involvements and so on.</p>					
Examination					
試験期間中には何も行わない					

None during exam period

Details of examination

課題レポートやプレゼンテーションに基づいて評価する。

Your supervisor will evaluate your presentation and your reports.

Other information

Reference URL

Office hours

指導教員に問い合わせること。

Consult with your advisor.

Relations to attainment objectives of learning and education

Key words

(D53010050)Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]

Subject name[English]	Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]				
Schedule number	D53010050	Subject area	Advanced Computer Science and Engineering	Required or elective	Required
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered				Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S3系教務委員, 教務委員会副委員長, S3系教務委員 - 23kei kyomu Iin-S, kyoumu iinkai fukuiintyou, 3kei kyomu Iin-S2				
Numbering	CMP_DOC71014				
Objectives of class					
<p>New technologies are often developed from the combination of different disciplines. It is clear that successful interdisciplinary efforts require mastery of specific competencies. This course will develop a student's scientific and technical knowledge in which researchers from different disciplines. If such competencies are explicated, it might be possible to enhance researchers' abilities to develop the next generation in interdisciplinary scholarship.</p> <p>The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.</p> <p>New technologies are often developed from the combination of different disciplines. It is clear that successful interdisciplinary efforts require mastery of specific competencies. This course will develop a student's scientific and technical knowledge in which researchers from different disciplines. If such competencies are explicated, it might be possible to enhance researchers' abilities to develop the next generation in interdisciplinary scholarship.</p> <p>The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.</p>					
Contents of class					
<p>In this seminar, doctoral course student of 2nd year will make a presentation to other D2 students of different research fields, in order to obtain the research ability to integrate varieties of research fields. See the schedule.</p> <p>1) Presentations</p> <p>In this class, each student will make a presentation to other students of different research fields. So the student who do the presentation will prepare the outline for approximately 2 pages (A4) , and make a power-point. *Supervisor will come and check his student's presentation, if available.</p> <p>2) Title and abstract of presentation</p> <p>Not only D2 students, but also other students are welcome to attend the presentation. So please submit the title and abstract (200 words) 3 weeks before your presentation to Academic Affairs Division. We will post it on the bulletin board inside the campus.</p> <p>3) Report you will submit</p> <p>You will be requested to submit a report after each presentation to your supervisor. As an initial training to create a new research project, students will work to make brief summary of a topic from other student's research filed with the goal of creating research project. And students will complete a research proposal that will be integrated from other scientific field and their own research filed.</p> <p>4) Schedule of your presentation</p> <p>Please check the schedule given before the semester begins.</p> <p>5) Absence from the class</p> <p>Basically, you have to attend every class. If you need to take absence due to the sickness or conference, please discuss with your supervisor what you should do instead.</p> <p>In this seminar, doctoral course student of 2nd year will make a presentation to other D2 students of different research fields, in order to obtain the research ability to integrate varieties of research fields. See the schedule.</p> <p>1) Presentations</p> <p>In this class, each student will make a presentation to other students of different research fields.</p>					

So the student who do the presentation will prepare the outline for approximately 2 pages (A4) , and make a power-point.
*Supervisor will come and check his student's presentation, if available.

2) Title and abstract of presentation

Not only D2 students, but also other students are welcome to attend the presentation.

So please submit the title and abstract (200 words) 3 weeks before your presentation to Academic Affairs Division.

We will post it on the bulletin board inside the campus.

3) Report you will submit

You will be requested to submit a report after each presentation to your supervisor. As an initial training to create a new research project, students will work to make brief summary of a topic from other student's research filed with the goal of creating research project. And students will complete a research proposal that will be integrated from other scientific field and their own research filed.

4) Schedule of your presentation

Please check the schedule given before the semester begins.

5) Absence from the class

Basically, you have to attend every class.

If you need to take absence due to the sickness or conference, please discuss with your supervisor what you should do instead.

Self Preparation and Review

教員が指定する内容に関し、予習・復習を行う。

Consult with your advisor.

Related subjects

指導教員に問い合わせること。

Consult with your advisor.

Notes for textbook

指導教員に問い合わせること。

Consult with your advisor.

Notes for reference

Goals to be achieved

The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.

The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.

Evaluation of achievement

Your supervisor will check your report, and submit your academic score to the member of Academic Affairs Committee at the end of semester.

Your supervisor will check your report, and submit your academic score to the member of Academic Affairs Committee at the end of semester.

Examination

試験期間中には何も行わない

None during exam period

Details of examination

課題レポートやプレゼンテーションに基づいて評価する。

Your supervisor will evaluate your presentation and your reports.

Other information

Reference URL

Office hours

指導教員に問い合わせること。

Your supervisor will evaluate your presentation and your reports.

Relations to attainment objectives of learning and education

Key words

(D53010070)Ethics for Researchers[Ethics for Researchers]

Subject name[English]	Ethics for Researchers[Ethics for Researchers]				
Schedule number	D53010070	Subject area	Advanced Computer Science and Engineering	Required or elective	Required
Time of starting a course	Fall1 term	Day of the week,period	Wed.1~1	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Begging grade	D1
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, 原 邦彦, 上野 未貴 kyoumu iinkai fukuuintyou, HARA Kunihiko, UENO Miki				
Numbering	COM_DOC71014				
Objectives of class					
Assist graduate students as they undertake research activities and promote an understanding of the inherent ethical problems; lead students to think independently and exercise normative consciousness of research ethics through ethics education in research in accordance with goals of scientific education and research and characteristics of individual research specialties.					
Contents of class					
<ul style="list-style-type: none"> * 1st week: Introduction, 1st module("Research Misconduct") in e-learning * 2nd - 6th week: 2nd - 7th modules in e-learning <ul style="list-style-type: none"> - 2nd week: "Ethical Issues in the Management of Data in Engineering Research" - 3rd week: "Responsible Authorship" - 4th week: "Ethical Issues in the Peer Review and Publication of Engineering Research" & "Collaborative Research in Engineering Fields" - 5th week: "Whistleblowing and the Obligation to Protect the Public" - 6th week: "Managing Public Research Funds" * ~7th week: Discussion with supervisor * 8th week: make a final report 					
Self Preparation and Review					
Students will need to refer to their textbook to prepare for and review each lesson.					
Related subjects					
Philosophy of Science and Technology, Ethics for Engineers					
Notes for textbook					
Notes for reference					
For the Sound Development of Science ?The Attitude of a Conscientious Scientist Japan Society for the Promotion of Science Editing Committee , MARUZEN PUBLISHING 2015 ISBN978-4-621-08938-5 (PDF: https://www.jsps.go.jp/j-kousei/data/rinri.pdf)					
Goals to be achieved					
To prevent misconduct and promote fair research activities, this course provides knowledge and techniques regarding research ethics in accordance with characteristics of each graduate student's research specialties.					
Evaluation of achievement					
[Evaluation method] Final exam(100%)					
[Evaluation basis]					
Those who take and pass the short test after each unit of e-learning contents will be evaluated with following basis.					
A: Achieved all goals and obtained 80 points or higher (out of 100) as total score of exams					
B: Achieved most goals and obtained 65 points or higher (out of 100) as total score of exams					
C: Achieved more than half of specified goals and obtained 55 points or higher (out of 100) as total score of exams					
Examination					
レポートで実施 By Report					
Details of examination					
By report					
Other information					

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

Research Ethics, Conflict of Interest, Legal Compliance, Research Misconduct, Confidentiality Obligation, Security Export Control Policy, Copyright, Professionalism

(D53030080)Pattern Information Processing[Pattern Information Processing]

Subject name[English]	Pattern Information Processing[Pattern Information Processing]				
Schedule number	D53030080	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Tue.2~2	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	金澤 靖, 菅谷 保之 KANAZAWA Yasushi, SUGAYA Yasuyuki				
Numbering	CMP_DOC72525				
Objectives of class					
This course involves fundamentals and advanced issues on image processing and computer vision.					
This course involves fundamentals and advanced issues on image processing and computer vision.					
Contents of class					
[Kanazawa]					
1: Introduction					
2: Projective Geometry					
3: Epipolar Geometry					
4: 3-D Reconstruction from Two Views					
5: Affine Projection					
6: Uncalibrated Stereo					
7: Structure from Motion					
8: Experiments					
[Sugaya]					
9: Mathematical Introduction					
10: Limits of Functions					
11: Optimization of Functions					
12: Least Squares					
13: Advance of Least Squares					
14: Non-linear Optimization					
15: Maximum Likelihood					
[Kanazawa]					
1: Introduction					
2: Projective Geometry					
3: Epipolar Geometry					
4: 3-D Reconstruction from Two Views					
5: Affine Projection					
6: Uncalibrated Stereo					
7: Structure from Motion					
8: Experiments					
[Sugaya]					
9: Mathematical Introduction					
10: Limits of Functions					
11: Optimization of Functions					
12: Least Squares					
13: Advance of Least Squares					
14: Non-linear Optimization					
15: Maximum Likelihood					

Self Preparation and Review

The handouts are available via web page beforehand.
 The handouts are available via web page beforehand.

Related subjects

Geometry, Linear Algebra, Statistics.
 Geometry, Linear Algebra, Statistics.

Notes for textbook

Handouts will be prepared.
 Handouts will be prepared.

Reference1	Book title	Multiple View Geometry in Computer Vision			ISBN	
	Author	R.I. Hartley and A. Zisserman	Publisher	Cambridge University Press	Publish year	2000
Reference2	Book title	Computer Vision -- A Modern Approach --			ISBN	
	Author	D.A. Forsyth and J. Ponce	Publisher	Prentice Hall	Publish year	2003
Reference3	Book title	Guide to 3D Vision Computation			ISBN	
	Author	K. Kanatani, Y. Sugaya, and Y. Kanazawa	Publisher	Springer	Publish year	2016

Notes for reference**Goals to be achieved**

Understanding of the fundamentals and advanced issues on image processing and computer vision including:

- camera model,
- epipolar geometry,
- 3-D reconstruction from images,
- optimization

Understanding of the fundamentals and advanced issues on image processing and computer vision including:

- camera model,
- epipolar geometry,
- 3-D reconstruction from images,
- optimization

Evaluation of achievement

Grade will be determined by all submitted reports:

- A: score ≥ 80
- B: score ≥ 65
- C: score ≥ 55

Grade will be determined by all submitted reports:

- A: score ≥ 80
- B: score ≥ 65
- C: score ≥ 55

Examination

レポートで実施

By Report

Details of examination**Other information**

Room F-404, Ext. 6888, Email: kanazawa@cs.tut.ac.jp (Yasushi Kanazawa)
 Room C-507, Ext. 6760, Email: sugaya@iim.cs.tut.ac.jp (Yasuyuki Sugaya)

Room F-404, Ext. 6888, Email: kanazawa@cs.tut.ac.jp (Yasushi Kanazawa)
 Room C-507, Ext. 6760, Email: sugaya@iim.cs.tut.ac.jp (Yasuyuki Sugaya)

Reference URL

<http://www.img.cs.tut.ac.jp/>
<http://www.iim.cs.tut.ac.jp/>
<http://www.img.cs.tut.ac.jp/>
<http://www.iim.cs.tut.ac.jp/>

Office hours

Relations to attainment objectives of learning and education

Key words

image processing, computer vision

image processing, computer vision

(D53030130)Robotics Intelligence 1[Robotics Intelligence 1]

Subject name[English]	Robotics Intelligence 1[Robotics Intelligence 1]				
Schedule number	D53030130	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall1 term	Day of the week,period	Tue.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	三浦 純 MIURA Jun				
Numbering	CMP_DOC73225				
Objectives of class					
Fundamental and advanced issues in intelligent robotics will be discussed. Topics included are probabilistic sensor fusion techniques (e.g., Kalman filter and particle filter) and its application to mobile robot localization and mapping.					
Contents of class					
Week 1: Introduction to scene recognition and sensor fusion. Week 2: Probability basic and Bayes filter. Week 3: Kalman filter and its extensions. Week 4: Nonparametric filters. Week 5: Mobile robot localization. Week 6: Mobile robot mapping. Week 7: SLAM (Simultaneous Localization and Mapping). Week 8: Presentations of students' reports and conclusions.					
Self Preparation and Review					
Related subjects					
Fundamental knowledge of linear algebra and probability theory is useful.					
Notes for textbook					
Handouts will be prepared. The main reference is shown below.					
Reference1	Book title	Probabilistic Robotics		ISBN	978-0262201629
	Author	S. Thrun, W. Burgard, D. Fox	Publisher	The MIT Press	Publish year 2005
Notes for reference					
Goals to be achieved					
Understanding of the fundamentals of sensor fusion strategies and algorithms.					
Evaluation of achievement					
Grade will be determined by the presentation and the report.					
Examination					
レポートで実施 By Report					
Details of examination					
Other information					
Room C-604, Ext. 6773, Email: jun.miura@tut.jp (Jun Miura)					
Reference URL					
http://www.aisl.cs.tut.ac.jp/classes/robotics-and-informatics/					

ID and password will be given at the class.

Office hours

Make an appointment beforehand by email.

Relations to attainment objectives of learning and education

Key words

Robotics

(D53030140)Robotics Intelligence 2[Robotics Intelligence 2]

Subject name[English]	Robotics Intelligence 2[Robotics Intelligence 2]				
Schedule number	D53030140	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall2 term	Day of the week,period	Tue.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	岡田 美智男 OKADA Michio				
Numbering	CMP_DOC73225				
Objectives of class 認知的なロボティクスの歴史的背景, 状況的な認知とロボットの身体性, 社会的相互行為, 社会的なロボットの社会実装などについて学ぶ。 Fundamental and advanced issues on social robotics will be discussed such as historical background of cognitive robotics, embodied cognition, organizing social interaction and applications of social robots.					
Contents of class 講義内容は次の通りとする。 - Historical background of cognitive robotics - Situated cognition and biological-inspired robots - Embodiment and social embeddedness - Organizing social interaction in social robots - Socially assistive robotics - Presentation and discussion - Historical background of cognitive robotics - Situated cognition and biological-inspired robots - Embodiment and social embeddedness - Organizing social interaction in social robots - Socially assistive robotics - Presentation and discussion					
Self Preparation and Review あらかじめ予習のための参考文献を提示します。 References on the class will be prepared.					
Related subjects Fundamentals of cognitive science. Fundamentals of cognitive science.					
Notes for textbook ハンドアウトを用意します。 Handouts will be prepared.					
Reference1	Book title	Understanding Intelligence		ISBN	
	Author	R. Pfeifer, C. Scheier	Publisher	MIT Press	Publish year 2001
Notes for reference					
Goals to be achieved					

社会的なロボットに関する基本的事項を理解することを達成目標とする.

- Historical background of cognitive robotics
- Situated cognition and biological-inspired robots
- Embodiment and social embeddedness
- Organizing social interaction in social robots
- Socially assistive robotics

Understanding of the fundamentals of social robotics including:

- Historical background of cognitive robotics
- Situated cognition and biological-inspired robots
- Embodiment and social embeddedness
- Organizing social interaction in social robots
- Socially assistive robotics

Evaluation of achievement

プレゼンテーションと最終レポートの内容で評価する.

Grade will be determined by the presentations in the class and final report.

Examination

レポートで実施

By Report

Details of examination

Other information

Room F-402, Ext. 6886, Email: okada[at]tut.jp (Michio Okada)

Room F-402, Ext. 6886, Email: okada[at]tut.jp (Michio Okada)

Reference URL

<http://www.icd.cs.tut.ac.jp/>

<http://www.icd.cs.tut.ac.jp/en/profile.html>

Office hours

火曜日, 14:30-16:00

Tuesday, 14:30-16:00

Relations to attainment objectives of learning and education

Key words

社会的ロボティクス, 認知ロボティクス, 社会的相互行為

Social Robotics, Cognitive Robotics, Social Interaction

(D53030190)Advanced Complex Systems and Intelligent Informatics 1[Advanced Complex Systems and Intelligent Informatics 1]

Subject name[English]	Advanced Complex Systems and Intelligent Informatics 1[Advanced Complex Systems and Intelligent Informatics 1]				
Schedule number	D53030190	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall1 term	Day of the week,period	Wed.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	村越 一支 MURAKOSHI Kazushi				
Numbering	CMP_DOC73125				
Objectives of class					
This course provides opportunities to learn the followings: * Modeling and analysis on complex systems and learning systems, * System theoretic analysis on complex systems and learning systems, * Computer simulations and implications, and * Implementation of complex systems and learning systems. Recent topics on complex systems and learning systems will be also discussed in the course.					
Contents of class					
A. Introduction on complex dynamical systems B. Dynamical systems C. Complex networks and interactions D. neural networks E. Information Processing by complex systems F. Learning algorithms G. Biological systems and information processing					
Self Preparation and Review					
Related subjects					
You must take the credits of "Complex Systems and Intelligent Informatics" in master course in advance.					
Notes for textbook					
No textbook.					
Notes for reference					
Goals to be achieved					
Evaluation of achievement					
Class performance (50%) and term-end report (50%)					
Examination					
その他 Other					
Details of examination					
Other information					
E-mail: mura[at]tut.jp (replace [at] with @) Room F-507, Ext. 6899					
Reference URL					
Office hours					
After this class					
Relations to attainment objectives of learning and education					

Key words

(D53030200)Advanced Complex Systems and Intelligent Informatics 2[Advanced Complex Systems and Intelligent Informatics 2]

Subject name[English]	Advanced Complex Systems and Intelligent Informatics 2[Advanced Complex Systems and Intelligent Informatics 2]				
Schedule number	D53030200	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall2 term	Day of the week,period	Wed.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	石田 好輝 ISHIDA Yoshiteru				
Numbering	CMP_DOC73125				
Objectives of class					
This course provides opportunities to learn the followings: * Modeling and analysis on complex systems and learning systems, * System theoretic analysis on complex systems and learning systems , * Computer simulations and implications, and * Implementation of complex systems and learning systems. Recent topics on complex systems and learning systems will be also discussed in the course.					
Contents of class					
1. Introduction on complex dynamical systems 2. Dynamical systems 3. Complex networks and interactions 4. Cellular automata and neural networks 5. Information Processing by complex systems 6. Emergence of cooperation in autonomous agents 7. Learning algorithms for agents 8. Evolutionary algorithms for agents 9. Biological systems and information processing					
Self Preparation and Review					
Related subjects					
Notes for textbook					
No textbook. References other than below will be suggested at the first class. Ishida, Y.: Immunity-Based Systems, Springer (2004); Ishida, Y : Self-Repair Networks, Springer (2015); Barabasi, A.L.: Linked, Perseus, (2002); Strogatz, S. H. Sync, Hyperion (2003);					
Notes for reference					
Goals to be achieved					
Evaluation of achievement					
Class performance (50%) and term-end report (50%)					
Examination					
その他 Other					
Details of examination					
Other information					
Room F-504, Ext. 6895					
Reference URL					

Office hours

Wednesday 16:30-17:00

Relations to attainment objectives of learning and education**Key words**

complex systems, cellular automaton, artificial life, immuno intelligence, neural networks, evolutionary game theory

(D53030210)Computer Network Engineering 1[Computer Network Engineering 1]

Subject name[English]	Computer Network Engineering 1[Computer Network Engineering 1]				
Schedule number	D53030210	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall1 term	Day of the week,period	Wed.2~2	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	梅村 恭司 UMEMURA Kyoji				
Numbering	CMP_DOC72325				
Objectives of class					
The objective of this class is mastering both profound and advanced networking technologies behind computer network programs. Precise protocols are lectured to enhance the knowledge of Internet.					
The objective of this class is mastering both profound and advanced networking technologies behind computer network programs.. Precise protocols are lectured to enhance the knowledge of Internet.					
Contents of class					
1. Link Layer 2. Internet Protocol 3. Address Resolution Protocol 4. Internet Control Message Protocol 5. IP routing and Dynamic Routing Protocol 6. Transmission Control Protocol 7. User Datagram Protocol and Multicasting					
1. Link Layer 2. Internet Protocol 3. Address Resolution Protocol 4. Internet Control Message Protocol 5. IP routing and Dynamic Routing Protocol 6. Transmission Control Protocol 7. User Datagram Protocol and Multicasting					
Self Preparation and Review					
Related subjects					
The basic knowledge about the structure of client/server programs is required.					
The basic knowledge about the structure of client/server programs is required.					
Textbook1	Book title	TCP/IP Illustrated Volume. 1, The Protocols,		ISBN	
	Author	W. Richard Stevens	Publisher	Addison-wesley	Publish year
Notes for textbook					
TCP/IP Illustrated Volume. 1, The Protocols, W. Richard Stevens, Addison-wesley					
TCP/IP Illustrated Volume. 1, The Protocols, W. Richard Stevens, Addison-wesley					
Notes for reference					

Goals to be achieved

The goal is to understand precisely the structure of internet protocol with which computer network works.
The goal is to understand precisely the structure of internet protocol with which computer network works.

Evaluation of achievement

Examination will be held in the last class.

Examination will be held in the last class.

Examination

定期試験を実施(対面)
Examination(Face to Face)

Details of examination**Other information**

C-304 umemura@tut.jp

C-304 umemura@tut.jp

Reference URL

<http://www.ss.cs.tut.ac.jp/>
<http://www.ss.cs.tut.ac.jp/>

Office hours

From 10:00AM to 13:00, Tue to Fri
(Appointment are strongly recommended)

From 10:00AM to 13:00, Tue to Fri
(Appointment are strongly recommended)

Relations to attainment objectives of learning and education**Key words**

Computer Network, Distributed Systems
Computer Network, Distributed Systems

(D53030220)Computer Network Engineering 2[Computer Network Engineering 2]

Subject name[English]	Computer Network Engineering 2[Computer Network Engineering 2]				
Schedule number	D53030220	Subject area	Advanced Computer Science and Engineering	Required or elective	Elective
Time of starting a course	Fall2 term	Day of the week,period	Wed.2~2	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	大村 廉 OMURA Ren				
Numbering	CMP_DOC72325				
Objectives of class					
<p>The aim of this class is to understand the concepts, system architecture, and algorithm in distributed computing. The class will cover both of theoretical discussion and practical applications.</p> <p>The contents will focus on advanced topics in distributed systems, namely the knowledge of computer network and basics of distributed systems are required beforehand.</p> <p>The aim of this class is to understand the concepts, system architecture, and algorithm in distributed computing. The class will cover both of theoretical discussion and practical applications.</p> <p>The contents will focus on advanced topics in distributed systems, namely the knowledge of computer network and basics of distributed systems are required beforehand.</p>					
Contents of class					
<p>From the 1st to 2rd week; Synchronization From the 2nd to 3rd week; Consistency From the 4nd to 5rd week; Fault tolerance From the 6th to 7th week; Security The 8th week; Examination or additional topics From the 1st to 2rd week; Synchronization From the 2nd to 3rd week; Consistency From the 4nd to 5rd week; Fault tolerance From the 6th to 7th week; Security The 8th week; Examination or additional topics</p>					
Self Preparation and Review					
<p>It is strongly recommended to read over the reference book, "Distributed Systems: Principles and Paradigms (2nd Edition)" and to search keywords in the book on Internet to find practical examples.</p> <p>It is strongly recommended to read over the reference book, "Distributed Systems: Principles and Paradigms (2nd Edition)" and to search keywords in the book on Internet to find practical examples.</p>					
Related subjects					
<p>Computer Network, Operating Systems, System Programming, (Basics of Distributed Systems) Computer Network, Operating Systems, System Programming, (Basics of Distributed Systems)</p>					
Notes for textbook					
<p>Basically, materials referenced in the class are passed out in the class. Basically, materials referenced in the class are passed out in the class.</p>					
Reference1	Book title	Distributed systems : principles and paradigms		ISBN	978-0132392273
	Author	Andrew S. Tanenbaum, Maarten van Steen	Publisher	Pearson Prentice Hall	Publish year 2007
Notes for reference					
<p>Related materials, such as books, videos, and web pages, are introduced in the class. Related materials, such as books, videos, and web pages, are introduced in the class.</p>					
Goals to be achieved					

The aim of this class is to understand;

- (1) the basic methods and concepts of synchronization in distributed systems;
- (2) the concepts and variations of consistency in distributed systems;
- (3) the basic concepts and methods of fault tolerance in distributed systems;
- (4) the basic concepts of security in distributed systems;
- (5) and some practical examples of distributed systems.

The aim of this class is to understand;

- (1) the basic methods and concepts of synchronization in distributed systems;
- (2) the concepts and variations of consistency in distributed systems;
- (3) the basic concepts and methods of fault tolerance in distributed systems;
- (4) the basic concepts of security in distributed systems;
- (5) and some practical examples of distributed systems.

Evaluation of achievement

The achievement of students are evaluated mainly with a paper test or a report, while the score of quizzes held in the class and attendance ratio are taken into account.

A: 80 and over

B: 65 and over

C: 55 and over

The achievement of students are evaluated mainly with a paper test or a report, while the score of quizzes held in the class and attendance ratio are taken into account.

A: 80 and over

B: 65 and over

C: 55 and over

Examination

その他

Other

Details of examination

A paper examination is carried out in the last class OR a report related to distributed systems is assigned. These are selected according to the number of students.

A paper examination is carried out in the last class OR a report related to distributed systems is assigned. These are selected according to the number of students.

Other information

Teacher's Room: C-509

Internal Phone Number: 6750

E-mail: ren@tut.jp

Teacher's Room: C-509

Internal Phone Number: 6750

E-mail: ren@tut.jp

Reference URL

<http://www.usl.cs.tut.ac.jp>

<http://www.usl.cs.tut.ac.jp>

Office hours

You can ask any questions anytime by e-mail. If you come to the teacher's office, you need to have an appointment.

You can ask any questions anytime by e-mail. If you come to the teacher's office, you need to have an appointment.

Relations to attainment objectives of learning and education

Key words

Distributed System, Computer Network, Operating System

Distributed System, Computer Network, Operating System

(D54010010)Seminar on Environmental & Life Sciences 1[Seminar on Environmental & Life Sciences 1]

Subject name[English]	Seminar on Environmental & Life Sciences 1[Seminar on Environmental & Life Sciences 1]				
Schedule number	D54010010	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	4
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered	Environmental and Life Sciences			Beggining grade	D1
Charge teacher name[Roman alphabet mark]	S4系教務委員 4kei kyomu Iin-S				
Numbering	ELC_DOC71015				
Objectives of class This course will provide the students with opportunities to study on his/her research subjects on advanced environmental and life sciences by reading scientific papers under the guidance of his/her supervisor. The aim of the lesson for the students is to learn the latest knowledge and presentation skills required for his/her research in the seminar as well as to deepen his/her understanding of advanced environmental and life sciences.					
Contents of class The students will be required to read scientific papers written by other language than Japanese, especially English, which are suggested by his/her supervisor, and to report and discuss deeply on his/her research subject in the seminar.					
Self Preparation and Review					
Related subjects Seminar on Environmental & Life Sciences 2 All other relevant subjects in Advanced Environmental and Life Sciences					
Notes for textbook Supervisor will recommend textbooks, papers, and research materials to students.					
Notes for reference					
Goals to be achieved To acquire advanced knowledge on environmental and life sciences To understand the contents of scientific papers in a given field of environmental and life sciences To be able to make oral and poster presentations relevant to papers he/she has read.					
Evaluation of achievement The evaluation is based on the scores of reading textbooks and scientific papers, discussions, reports and presentations of his/her research in the seminar. His/her supervisor evaluates the scores.					
Examination 試験期間中には何も行わない None during exam period					
Details of examination					
Other information Supervisor(s)					
Reference URL http://ens.tut.ac.jp/en/					
Office hours Students are encouraged visiting by appointment.					
Relations to attainment objectives of learning and education					
Key words Environmental science and technology, life science, materials science and engineering, applied chemistry					

(D54010020)Seminar on Environmental & Life Sciences 2[Seminar on Environmental & Life Sciences 2]

Subject name[English]	Seminar on Environmental & Life Sciences 2[Seminar on Environmental & Life Sciences 2]				
Schedule number	D54010020	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered	Environmental and Life Sciences			Begging grade	D2
Charge teacher name[Roman alphabet mark]	S4系教務委員 4kei kyomu Iin-S				
Numbering	ELC_DOC71015				
Objectives of class					
This course will provide the students with opportunities to study on his/her research subjects on advanced environmental and life sciences by reading scientific papers under the guidance of his/her supervisor. The aim of the lesson for the students is to expand the knowledge and presentation skills acquired in Seminar on Environmental and Life Science 1.					
Contents of class					
The students will be required to read scientific papers written by other language than Japanese, especially English, which are suggested by his/her supervisor, and to report and discuss deeply on his/her research subject in the seminar.					
Self Preparation and Review					
Related subjects					
Seminar on Environmental & Life Sciences 1 All other relevant subjects in Advanced Environmental and Life Sciences					
Notes for textbook					
Supervisor will recommend textbooks, papers, and research materials to students.					
Notes for reference					
Goals to be achieved					
To acquire advanced knowledge on environmental and life sciences To understand the contents of scientific papers in a given field of environmental and life sciences To be able to make oral and poster presentations relevant to papers he/she has read.					
Evaluation of achievement					
The evaluation is based on the scores of reading textbooks and scientific papers, discussions, reports and presentations of his/her research in the seminar. His/her supervisor evaluates the scores.					
Examination					
試験期間中には何も行わない None during exam period					
Details of examination					
Other information					
Supervisor(s)					
Reference URL					
http://ens.tut.ac.jp/en/					
Office hours					
Students are encouraged visiting by appointment.					
Relations to attainment objectives of learning and education					
Key words					
Environmental science and technology, life science, materials science and engineering, applied chemistry					

(D54010050)Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]

Subject name[English]	Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]				
Schedule number	D54010050	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Required
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered				Begging grade	D2
Charge teacher name[Roman alphabet mark]	S4系教務委員, 教務委員会副委員長 4kei kyomu Iin-S, kyoumu iinkai fukuiintyou				
Numbering	ENV_DOC71015				
Objectives of class					
<p>New technologies are often developed from the combination of different disciplines. It is clear that successful interdisciplinary efforts require mastery of specific competencies. This course will develop a student's scientific and technical knowledge in which researchers from different disciplines. If such competencies are explicated, it might be possible to enhance researchers' abilities to develop the next generation in interdisciplinary scholarship.</p> <p>The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.</p>					
Contents of class					
<p>In this seminar, doctoral course student of 2nd year will make a presentation to other D2 students of different research fields, in order to obtain the research ability to integrate varieties of research fields. See the schedule.</p> <p>1) Presentations</p> <p>In this class, each student will make a presentation to other students of different research fields. So the student who do the presentation will prepare the outline for approximately 2 pages (A4) , and make a power-point. *Supervisor will come and check his student's presentation, if available.</p> <p>2) Title and abstract of presentation</p> <p>Not only D2 students, but also other students are welcome to attend the presentation. So please submit the title and abstract (200 words) 3 weeks before your presentation to Academic Affairs Division. We will post it on the bulletin board inside the campus.</p> <p>3) Report you will submit</p> <p>You will be requested to submit a report after each presentation to your supervisor. As an initial training to create a new research project, students will work to make brief summary of a topic from other student's research filed with the goal of creating research project. And students will complete a research proposal that will be integrated from other scientific field and their own research filed.</p> <p>4) Schedule of your presentation</p> <p>Please check the schedule given before the semester begins.</p> <p>5) Absence from the class</p> <p>Basically, you have to attend every class. If you need to take absence due to the sickness or conference, please discuss with your supervisor what you should do instead.</p>					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Notes for reference					
Goals to be achieved					

The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.

Evaluation of achievement

Your supervisor will check your report, and submit your academic score to the member of Academic Affairs Committee at the end of semester.

Examination

試験期間中には何も行わない

None during exam period

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(D54010070)Ethics for Researchers[Ethics for Researchers]

Subject name[English]	Ethics for Researchers[Ethics for Researchers]				
Schedule number	D54010070	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Required
Time of starting a course	Fall1 term	Day of the week,period	Wed.1~1	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Begging grade	D1
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, 原 邦彦, 上野 未貴 kyoumu iinkai fukuuintyou, HARA Kunihiko, UENO Miki				
Numbering	COM_DOC71015				
Objectives of class					
Assist graduate students as they undertake research activities and promote an understanding of the inherent ethical problems; lead students to think independently and exercise normative consciousness of research ethics through ethics education in research in accordance with goals of scientific education and research and characteristics of individual research specialties.					
Contents of class					
<ul style="list-style-type: none"> * 1st week: Introduction, 1st module("Research Misconduct") in e-learning * 2nd - 6th week: 2nd - 7th modules in e-learning <ul style="list-style-type: none"> - 2nd week: "Ethical Issues in the Management of Data in Engineering Research" - 3rd week: "Responsible Authorship" - 4th week: "Ethical Issues in the Peer Review and Publication of Engineering Research" & "Collaborative Research in Engineering Fields" - 5th week: "Whistleblowing and the Obligation to Protect the Public" - 6th week: "Managing Public Research Funds" * ~7th week: Discussion with supervisor * 8th week: make a final report 					
Self Preparation and Review					
Students will need to refer to their textbook to prepare for and review each lesson.					
Related subjects					
Philosophy of Science and Technology, Ethics for Engineers					
Notes for textbook					
Notes for reference					
For the Sound Development of Science ?The Attitude of a Conscientious Scientist Japan Society for the Promotion of Science Editing Committee , MARUZEN PUBLISHING 2015 ISBN978-4-621-08938-5 (PDF: https://www.jsps.go.jp/j-kousei/data/rinri.pdf)					
Goals to be achieved					
To prevent misconduct and promote fair research activities, this course provides knowledge and techniques regarding research ethics in accordance with characteristics of each graduate student's research specialties.					
Evaluation of achievement					
[Evaluation method] Final exam(100%)					
[Evaluation basis]					
Those who take and pass the short test after each unit of e-learning contents will be evaluated with following basis.					
A: Achieved all goals and obtained 80 points or higher (out of 100) as total score of exams					
B: Achieved most goals and obtained 65 points or higher (out of 100) as total score of exams					
C: Achieved more than half of specified goals and obtained 55 points or higher (out of 100) as total score of exams					
Examination					
レポートで実施 By Report					
Details of examination					
By report					
Other information					

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

Research Ethics, Conflict of Interest, Legal Compliance, Research Misconduct, Confidentiality Obligation, Security Export Control Policy, Copyright, Professionalism

(D54030020)Advanced Environmental Technology 2[Advanced Environmental Technology 2]

Subject name[English]	Advanced Environmental Technology 2[Advanced Environmental Technology 2]				
Schedule number	D54030020	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Mon.4~4	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	松本 明彦, 小口 達夫, 水嶋 生智 MATSUMOTO Akihiko, OGUCHI Tatsuo, MIZUSHIMA Takanori				
Numbering	ENV_DOC72225				
Objectives of class					
This course aims to fundamental understanding of state-of-art technologies for environmental protection and restoration on the basis of physical and inorganic chemistry					
Contents of class					
The following articles will be commentated in the course.					
1. Physical chemistry and inorganic chemistry for understanding of state-of-art technologies used in environmental protection and/or restoration (1) Physical chemistry and colloid & interface science [A. Matsumoto] (2) Inorganic chemistry and catalysis chemistry [T. Mizushima] (3) Reaction mechanism of combustion in internal-combustion engines [T. Oguchi]					
2. The features of the techniques used in environmental protection and restoration (1) Adsorption and separation technology [A. Matsumoto] (2) Catalysis technology [T. Mizushima] (3) Combustion control of fuels [T. Oguchi]					
3. Practical example of the techniques [All instructors]					
Self Preparation and Review					
Related subjects					
Basic understanding on physical chemistry and inorganic chemitry is essential.					
Notes for textbook					
Reference handouts will be provided in the class.					
Notes for reference					
Goals to be achieved					
Evaluation of achievement					
30 % Homework report and 70 % Final report					
Examination					
レポートで実施 By Report					
Details of examination					
Other information					
Akihiko Matsumoto: room # B-505, E-mail: aki-at-ens.tut.ac.jp (replace "-at-" by "@" when sending e-mail) Takanori Mizushima: room # B-303, E-mail: mizushima-at-ens.tut.ac.jp (replace "-at-" by "@" when sending e-mail) Tatsuo Oguchi: room # G-406, E-mail: oguchi-at-tut.jp(replace "-at-" by "@" when sending e-mail)					
Students who intend to take the class are asked to contact with one of the instructors before registration.					
Reference URL					

Office hours

At any time but booking is required in advance.

Relations to attainment objectives of learning and education**Key words**

(D54030050)Advanced Biotechnology 2[Advanced Biotechnology 2]

Subject name[English]	Advanced Biotechnology 2[Advanced Biotechnology 2]				
Schedule number	D54030050	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Fri.5~5	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	吉田 絵里, 吉田 祥子, 梅影 創, 沼野 利佳 YOSHIDA Eri, YOSHIDA Sachiko, UMEKAGE So, NUMANO Rika				
Numbering	ENV_DOC73225				
Objectives of class					
To acquire knowledge of advanced biotechnology including biology, biochemistry, physiology and engineering.					
Contents of class					
1. Neural physiology and sensing (Yoshida, S)					
1-1 Function and diversity of physiological substances					
1-2 Information transmission between neurons					
1-3 Brain function and neuronal circuits					
1-4 Imaging engineering for neuronal functions					
2.Molecular biology (Numano, R)					
2-1 History of molecular biology					
2-2 Technique of molecular biology					
2-3 Topic of molecular biology1 (Genome)					
2-4 Topic of molecular biology2 (Circadian Rhythms)					
3. RNA engineering (Umekage, S)					
3-1 functional RNA (tentative)					
3-2 antisense RNA, ribozyme, siRNA (tentative)					
3-3 aptamer (tentative)					
3-4 CRISPR-Cas system (tentative)					
4. Bio-related polymer chemistry and engineering (Yoshida, E)					
4-1 Bio-related nanomaterials					
4-2 Design of bio-related polymers with precisely controlled structure					
4-3 Molecular self-assembly					
4-4 Supramolecular chemistry and engineering					
Self Preparation and Review					
Related subjects					
Advanced Polymer Engineering					
Notes for textbook					
Notes for reference					
Goals to be achieved					
To understand cutting-edge biotechnology based on cell biology, physiology, RNA engineering, molecular self-assembly, and bio-related nanonaterilas.					
Evaluation of achievement					
Examinations and term-end reports					
Examination					
授業を実施 Regular Class					
Details of examination					

Other information

Sachiko Yoshida: ex.6802, syoshida@ens.tut.ac.jp, B-406

So Umekage: ex.5832, umekage@ens.tut.ac.jp, G1-201

Rika Numano: ex.6902, numano@ tut. jp, G-407

Eri Yoshida: ex.6814, eyoshida@ens.tut.ac.jp, B-503

Reference URL**Office hours**

Anytime

Relations to attainment objectives of learning and education**Key words**

Nanostructure, Molecular self-assembly, Supramolecules, Neuronal circuit, cell differentiation

(D54030070)Advanced Molecular Function Chemistry 2[Advanced Molecular Function Chemistry 2]

Subject name[English]	Advanced Molecular Function Chemistry 2[Advanced Molecular Function Chemistry 2]				
Schedule number	D54030070	Subject area	Advanced Applied Chemistry and Life Science	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Fri.4~4	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	辻 秀人, 齊戸 美弘, 手老 龍吾 TSUJI Hideto, SAITO Yoshihiro, TERO Ryugo				
Numbering	ENV_DOC72225				
Objectives of class					
<p>Since Enviromental and Life Science are based on various scientific fields related each other, it is important to acquire broader knowledge and understanding of them. In this class, four topics closely relevant to Enviromental and Life Science are open. Objectives of this class is to obtain the in-depth understanding of selected one of these topics.</p>					
Contents of class					
<p>[1] Biobased and biodegradable polymers are developed and studied in terms of various applications including biomedical, pharmaceutical and environmental applications. This course covers the fundamentals and applications of biobased and biodegradable polymers. Submission of a report regarding the current researches on biobased and biodegradable polymers is required. (by H. Tsuji)</p> <p>[2] Miniaturization and automation of the whole separation instruments have been one of the most important projects in separation science, because of the increasing requirements for recent separation systems, such as selective/specific detection with high sensitivities, high throughput processing, as well as an environmentally-friendly feature of the systems. On the basis of the above concept, miniaturized sample preparation and separation techniques will be discussed along with the effective coupling of these techniques. Submission of a comprehensive report regarding these topics is required. (by Y. Saito)</p> <p>[3] Molecular interaction and assembly are key factors for the understanding of the function of biomolecules. This class covers the fundamental and advanced topics of assembly and functions of biomolecules, e.g. proteins, lipids and nucleotides, and related experimental techniques. Submission of a report regarding a chapter of the reference book and a related current research is required. (by R. Tero).</p>					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Related materials will be provided.					
Reference1	Book title	Poly(lactic acid): Synthesis, Structures, Properties, Processing, and Applications		ISBN	0470293667
	Author	Rafael A. Auras, Loong-Tak Lim, Susan E. M. Selke, Hideto Tsuji	Publisher	Wiley	Publish year 2010
Reference2	Book title	Nanoscience: Nanobiotechnology and Nanobiology		ISBN	978-3-540-88633-4
	Author	Patrick Boisseau & Marcel Lahmani	Publisher	Springer	Publish year 2009
Notes for reference					
<p>#2 can be accessed in the university network. http://link.springer.com/book/10.1007%2F978-3-540-88633-4</p>					

(R. Tero)
Goals to be achieved To obtain the in-depth understanding of topic relevant to Enviromental and Life Science.
Evaluation of achievement The evaluation will be made based on the score of the report and presentation.
Examination レポートで実施 By Report
Details of examination
Other information H.Tsuji: room (G-606), e-mail (tsuji@ens.tut.ac.jp), phone: 6922 Y.Saito: room (B-402), e-mail (saito@ens.tut.ac.jp), phone: 6803 R.Tero: room (B-405), e-mail (tero@tut.jp), phone: 6791
Reference URL
Office hours Anytime if available, however, an appointment by e-mail is strongly recommended.
Relations to attainment objectives of learning and education
Key words

(D55010010)Seminar on Architecture and Civil Engineering 1[Seminar on Architecture and Civil Engineering 1]

Subject name[English]	Seminar on Architecture and Civil Engineering 1[Seminar on Architecture and Civil Engineering 1]				
Schedule number	D55010010	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	4
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered	Architecture and Civil Engineering			Beggining grade	D1
Charge teacher name[Roman alphabet mark]	S5系教務委員 5kei kyomu Iin-S				
Numbering	ARC_DOC71015				
Objectives of class	All the students are required to attend all the seminars, which is arranged by the laboratory supervisor for the special study subjects related to the current research activity of the laboratory. The scheduled program of the seminars is announced by the supervisor at the guidance of the seminar.				
Contents of class					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Notes for reference					
Goals to be achieved					
Evaluation of achievement	Report				
Examination	レポートで実施 By Report				
Details of examination					
Other information					
Reference URL					
Office hours					
Relations to attainment objectives of learning and education					
Key words					

(D55010020)Seminar on Architecture and Civil Engineering 2[Seminar on Architecture and Civil Engineering 2]

Subject name[English]	Seminar on Architecture and Civil Engineering 2[Seminar on Architecture and Civil Engineering 2]				
Schedule number	D55010020	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Required
Time of starting a course	Year	Day of the week,period	Intensive	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered	Architecture and Civil Engineering			Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S5系教務委員 5kei kyomu Iin-S				
Numbering	ARC_DOC71015				
Objectives of class	All the students are required to attend all the seminars, which is arranged by the laboratory supervisor for the special study subjects related to the current research activity of the laboratory. The scheduled program of the seminars is announced by the supervisor at the guidance of the seminar.				
Contents of class					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Notes for reference					
Goals to be achieved					
Evaluation of achievement	Report				
Examination	レポートで実施 By Report				
Details of examination					
Other information					
Reference URL					
Office hours					
Relations to attainment objectives of learning and education					
Key words					

(D55010050)Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]

Subject name[English]	Seminar on Interdisciplinary Research[Seminar on Interdisciplinary Research]				
Schedule number	D55010050	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Required
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	2~
Department Offered				Beggining grade	D2
Charge teacher name[Roman alphabet mark]	S5系教務委員, 教務委員会副委員長 5kei kyomu Iin-S, kyoumu iinkai fukuuiintyou				
Numbering	ARC_DOC71015				
Objectives of class					
<p>New technologies are often developed from the combination of different disciplines. It is clear that successful interdisciplinary efforts require mastery of specific competencies. This course will develop a student's scientific and technical knowledge in which researchers from different disciplines. If such competencies are explicated, it might be possible to enhance researchers' abilities to develop the next generation in interdisciplinary scholarship.</p> <p>The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.</p>					
Contents of class					
<p>In this seminar, doctoral course student of 2nd year will make a presentation to other D2 students of different research fields, in order to obtain the research ability to integrate varieties of research fields. See the schedule.</p> <p>1) Presentations</p> <p>In this class, each student will make a presentation to other students of different research fields. So the student who do the presentation will prepare the outline for approximately 2 pages (A4) , and make a power-point. *Supervisor will come and check his student's presentation, if available.</p> <p>2) Title and abstract of presentation</p> <p>Not only D2 students, but also other students are welcome to attend the presentation. So please submit the title and abstract (200 words) 3 weeks before your presentation to Academic Affairs Division. We will post it on the bulletin board inside the campus.</p> <p>3) Report you will submit</p> <p>You will be requested to submit a report after each presentation to your supervisor. As an initial training to create a new research project, students will work to make brief summary of a topic from other student's research filed with the goal of creating research project. And students will complete a research proposal that will be integrated from other scientific field and their own research filed.</p> <p>4) Schedule of your presentation</p> <p>Please check the schedule given before the semester begins.</p> <p>5) Absence from the class</p> <p>Basically, you have to attend every class. If you need to take absence due to the sickness or conference, please discuss with your supervisor what you should do instead.</p>					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Notes for reference					
Goals to be achieved					

The purpose of this class is to recognize how interdisciplinary-based research provides important knowledge and insight into complex problems and issues and also appreciate the unique advantages of integrative research and learning.

Evaluation of achievement

Your supervisor will check your report, and submit your academic score to the member of Academic Affairs Committee at the end of semester.

Examination

レポートで実施

By Report

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(D55010070)Ethics for Researchers[Ethics for Researchers]

Subject name[English]	Ethics for Researchers[Ethics for Researchers]				
Schedule number	D55010070	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Required
Time of starting a course	Fall1 term	Day of the week,period	Wed.1~1	Credit(s)	1
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, 原 邦彦, 上野 未貴 kyoumu iinkai fukuuintyou, HARA Kunihiko, UENO Miki				
Numbering	COM_DOC71015				
Objectives of class					
Assist graduate students as they undertake research activities and promote an understanding of the inherent ethical problems; lead students to think independently and exercise normative consciousness of research ethics through ethics education in research in accordance with goals of scientific education and research and characteristics of individual research specialties.					
Contents of class					
<ul style="list-style-type: none"> * 1st week: Introduction, 1st module("Research Misconduct") in e-learning * 2nd - 6th week: 2nd - 7th modules in e-learning <ul style="list-style-type: none"> - 2nd week: "Ethical Issues in the Management of Data in Engineering Research" - 3rd week: "Responsible Authorship" - 4th week: "Ethical Issues in the Peer Review and Publication of Engineering Research" & "Collaborative Research in Engineering Fields" - 5th week: "Whistleblowing and the Obligation to Protect the Public" - 6th week: "Managing Public Research Funds" * ~7th week: Discussion with supervisor * 8th week: make a final report 					
Self Preparation and Review					
Students will need to refer to their textbook to prepare for and review each lesson.					
Related subjects					
Philosophy of Science and Technology, Ethics for Engineers					
Notes for textbook					
Notes for reference					
For the Sound Development of Science ?The Attitude of a Conscientious Scientist Japan Society for the Promotion of Science Editing Committee , MARUZEN PUBLISHING 2015 ISBN978-4-621-08938-5 (PDF: https://www.jsps.go.jp/j-kousei/data/rinri.pdf)					
Goals to be achieved					
To prevent misconduct and promote fair research activities, this course provides knowledge and techniques regarding research ethics in accordance with characteristics of each graduate student's research specialties.					
Evaluation of achievement					
[Evaluation method] Final exam(100%)					
[Evaluation basis]					
Those who take and pass the short test after each unit of e-learning contents will be evaluated with following basis.					
A: Achieved all goals and obtained 80 points or higher (out of 100) as total score of exams					
B: Achieved most goals and obtained 65 points or higher (out of 100) as total score of exams					
C: Achieved more than half of specified goals and obtained 55 points or higher (out of 100) as total score of exams					
Examination					
レポートで実施 By Report					
Details of examination					
By report					
Other information					

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

Research Ethics, Conflict of Interest, Legal Compliance, Research Misconduct, Confidentiality Obligation, Security Export Control Policy, Copyright, Professionalism

(D55030010)Advanced Mechanics and Design of Spatial Structure Systems[Advanced Mechanics and Design of Spatial Structure Systems]

Subject name[English]	Advanced Mechanics and Design of Spatial Structure Systems[Advanced Mechanics and Design of Spatial Structure Systems]				
Schedule number	D55030010	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Mon.3~3	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Beggining grade	D1
Charge teacher name[Roman alphabet mark]	中澤 祥二, 松本 幸大 NAKAZAWA Shoji, MATSUMOTO Yukihiko				
Numbering					
Objectives of class					
This lecture is concerned with the advanced theoretical and applied structural mechanics of spatial structures. The primary purpose is to encourage students to gain the advanced concept and to raise their engineering abilities for innovative applications in the future.					
Contents of class					
1. Introduction 2. Analogical understanding of structural instability behavior 3. Effects of imperfections on the structural instability 4. Structural instability modes and large deflection modes 5. Physical experiment and its difficulty on structural instability problems 6. Mathematical analysis and its difficulty on structural instability problems 7. Relationship between experiments and numerical simulations 8. Design procedures for the instability of spatial structures					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Reference1	Book title	The Theory of Plates and Shells		ISBN	0070858209
	Author	S. Timoshenko	Publisher	McGraw-Hill Publishing Company	Publish year 1964
Reference2	Book title	Theory of Elastic Stability		ISBN	0486472078
	Author	S. Timoshenko	Publisher	Dover Publications	Publish year 1961
Reference3	Book title	DYNAMIC ANALYSIS OF EARTHQUAKE RESISTANT STRUCTURES		ISBN	4861631149
	Author	Akenori Shibata	Publisher	東北大学出版会	Publish year 2010
Notes for reference					
Goals to be achieved					
The primary purpose is to encourage students to gain the advanced concept and to raise their engineering abilities for innovative applications in the future.					
Evaluation of achievement					
Based on reports.					
Examination					
その他					

Other
Details of examination
Other information
Reference URL Nakazawa: http://www.st.ace.tut.ac.jp/~nakazawa/ Matsumoto: http://sel.ace.tut.ac.jp
Office hours Nakazawa; Monday, 16:20-17:50 Matsumoto; Friday, 9:30-12:00
Relations to attainment objectives of learning and education
Key words

(D55030020)Advanced Structural Design[Advanced Structural Design]

Subject name[English]	Advanced Structural Design[Advanced Structural Design]				
Schedule number	D55030020	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Tue.4~4	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Begging grade	D1
Charge teacher name[Roman alphabet mark]	齊藤 大樹, 松井 智哉 SAITOH Taiki, MATSUI Tomoya				
Numbering					
Objectives of class					
Learn about a vibration analysis technology in seismic design of building and seismic design method					
Contents of class					
1-2 weeks, Vibration of one degree of freedom system					
3-4 weeks, Elastic seismic response analysis, numerical integration method					
5-6 weeks, Multi-degree-of-freedom system of vibration, Eigen value analysis					
7-8 weeks, Response spectrum					
9 week, Elastic-plastic seismic response analysis					
10 week, Equivalent linearization method					
11 week, Design input ground motion					
12-13 weeks, Basic of the energy method					
14-15 weeks, Basic of the limit strength calculation					
Self Preparation and Review					
Related subjects					
Notes for textbook					
Notes for reference					
Goals to be achieved					
Understand the background and theory of vibration analysis and the design method of the structure based on vibration analysis.					
Evaluation of achievement					
Examination					
レポートで実施 By Report					
Details of examination					
Assessment: Grade is evaluated based on the report in fall semester 1(50%), and the report and exam in fall semester 2(50%).					
Grading: A: exam, 80 or higher (out of 100 points) B: exam, 65 or higher (out of 100 points) C: exam, 55 or higher (out of 100 points)					
Other information					
Reference URL					
Office hours					
Relations to attainment objectives of learning and education					

Key words

(D55030080)Advanced Water Environmental Engineering[Advanced Water Environmental Engineering]

Subject name[English]	Advanced Water Environmental Engineering[Advanced Water Environmental Engineering]				
Schedule number	D55030080	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Thu.1~1	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Begging grade	D1
Charge teacher name[Roman alphabet mark]	井上 隆信, 加藤 茂, 横田 久里子 INOUE Takanobu, KATO Shigeru, YOKOTA Kuriko				
Numbering					
Objectives of class					
Acquiring wide knowledge and information concerning on water environment for thesis work T. Inoue: Studying chemical aspect of river and lake environment S. Kato : Studying physical aspect of coastal, ocean & estuarine environment and disaster K. Yokota: Studying importance of field investigation on water environment in river					
Contents of class					
T. Inoue (1-5) : - Valuation method of river and lake water quality - Restoration of river and lake environment S. Kato (6-10) : - Coastal, ocean & estuarine environment and disaster - Water flow and material transport in coastal zone, ocean & estuary K. Yokota (11-15) : - Experimental and field measurement method for material dynamics investigation - Analysis of material dynamics in water (Attention) - Contact one of instructors in advance. - There are cases where the order of instructors is changed.					
Self Preparation and Review					
Students are required to review the contents of each lecture, and to refer some textbooks and/or materials related to the next lecture as preparation.					
Related subjects					
Notes for textbook					
No specific textbook is used. The resume or related handouts are distributed.					
Notes for reference					
Goals to be achieved					
(1) Understanding river and lake environmental problems and chemical approach to the solution (2) Understanding a situation of coastal, ocean and estuarine environment and disaster, and counter-measurements for related problems (3) Understanding methods of measurement and analysis for material dynamics analysis in water					
Evaluation of achievement					
Evaluation is based primarily on reports given by each instructor (100 points). Each report is evaluated by each instructor. The average of report scores is used as subject evaluation. Grade, A: 80 or higher, B: 65 or higher to lower than 80, C: 55 or higher to lower than 65.					

Examination

その他

Other

Details of examination

Reports and/or oral examination by each instructor

The detail is decided by each instructor.

Other information

T. Inoue : D-811, inoue@ace.tut.ac.jp

S. Kato : D-812, s-kato@ace.tut.ac.jp

K. Yokota: D-810, yokota@ace.tut.ac.jp

Reference URL**Office hours**

T. Inoue: Wednesday 12:30-13:30

S. Kato : At any time (It is desirable to contact Kato about visit time by e-mail in advance.)

K. Yokota: Monday, 13:00-14:00

Relations to attainment objectives of learning and education**Key words**

water quality, water environment, river, lake, coast, ocean, estuary, natural disaster, material dynamics, field measurement, experiment

(D55030100)Advanced Environmental Economics and Planning[Advanced Environmental Economics and Planning]

Subject name[English]	Advanced Environmental Economics and Planning[Advanced Environmental Economics and Planning]				
Schedule number	D55030100	Subject area	Advanced Architecture and Civil Engineering	Required or elective	Elective
Time of starting a course	Fall term	Day of the week,period	Fri.4~4	Credit(s)	2
Faculty	Graduate Program for Doctoral Degree			Subject grade	1~
Department Offered				Begging grade	D1
Charge teacher name[Roman alphabet mark]	宮田 譲 MIYATA Yuzuru				
Numbering					
Objectives of class					
To understand the analysis of regional economic activities.					
To understand the interaction between the natural environment and the regional economy.					
To understand the analysis of regional economic activities.					
To understand the interaction between the natural environment and the regional economy.					
Contents of class					
This class discusses the interaction between the natural environment and the regional economic activities by employing mathematical/numerical models. Details of the lecture are described as follows:					
Topics					
1. The first and second lectures; integrated environmental and economic accounting					
2. The third and fourth lectures; waste and economic accounting matrix					
3. The fifth to seventh lectures; computable general equilibrium analysis of a regional environmental and economic system					
4. The eighth to tenth lectures; an intertemporal model of a regional environmental and economic system					
5. The eleventh and twelfth lectures; environmental tax and the emissions trading					
6. The thirteenth to fifteenth lectures; sustainable growth in the environmental and economic dynamics					
This class discusses the interaction between the natural environment and the regional economic activities by employing mathematical/numerical models. Details of the lecture are described as follows:					
Topics					
1. The first and second lectures; integrated environmental and economic accounting					
2. The third and fourth lectures; waste and economic accounting matrix					
3. The fifth to seventh lectures; computable general equilibrium analysis of a regional environmental and economic system					
4. The eighth to tenth lectures; an intertemporal model of a regional environmental and economic system					
5. The eleventh and twelfth lectures; environmental tax and the emissions trading					
6. The thirteenth to fifteenth lectures; sustainable growth in the environmental and economic dynamics					
Self Preparation and Review					
Related subjects					
microeconomics (undergraduate), macroeconomics(undergraduate), environmental economics (master course)					
microeconomics (undergraduate), macroeconomics(undergraduate), environmental economics (master course)					
Notes for textbook					
Lecture materials are distributed to students as handout. Powerpoint files are available for students as well.					
Lecture materials are distributed to students as handout. Powerpoint files are available for students as well.					
Notes for reference					
Goals to be achieved					
By applying mathematical/numerical models;					
To understand the analysis of national/regional economic activities.					
To understand the interaction between the natural environment and the national/regional economy.					
By applying mathematical/numerical models;					
To understand the analysis of national/regional economic activities.					
To understand the interaction between the natural environment and the national/regional economy.					
Evaluation of achievement					

Students are evaluated by the term report (100%).
Students are evaluated by the term report (100%).

Examination

レポートで実施
By Report

Details of examination

Other information

room # : D806
phone : 0532-44-6955
e-mail address : miyata@ace.tut.ac.jp
room # : D806
phone : 0532-44-6955
e-mail address : miyata@ace.tut.ac.jp

Reference URL

<http://pm.hse.tut.ac.jp/kakenA/>
<http://pm.hse.tut.ac.jp/kakenA/>

Office hours

16:00 to 17:00 on every Tuesday
16:00 to 17:00 on every Tuesday

Relations to attainment objectives of learning and education

Key words

computable general equilibrium model, global environmental problems, national/regional sustainable development
computable general equilibrium model, global environmental problems, national/regional sustainable development