Syllabus

International Doctoral Degree Program

（2015-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, D2, D3
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering					

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

その他
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			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering					

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
その他
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	Mechanical Engineering			**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, kyoumu iinkai fukuiintyou				
Numbering					

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.

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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.

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Self Preparation and Review

Related subjects

Inquire this of your supervisor.

Inquire this of your supervisor.

Notes for textbook

Inquire this of your supervisor.

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.

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.

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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.

Inquire this of your supervisor.

Reference URL

Office hours

Inquire this of your supervisor.

Inquire this of your supervisor.

Relations to attainment objectives of learning and education

Key words

(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	Mechanical Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	森 謙一郎, 柴田 隆行, 安部 洋平 MORI Ken-Ichiro, SHIBATA Takayuki, ABE Yohei				
Numbering					

Objectives of class

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)

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)

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)

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)

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: discretizaton 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)

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/nanomarching technologies

(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: discretizaton 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)
9th week: Introduction of MEMS/NEMS
10th week: Photolithography
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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/nanomarching technologies

Self Preparation and Review

Students are required to prepare and review each lesson.
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)
Strength of material, Solid mechanics, Numerical methods (K. Mori and Y. Abe)
Micromachining engineering (T. Shibata)

Notes for textbook

Handout

Handout

Notes for reference

(T.Shibata) 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.
(T.Shibata) 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)
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)

Evaluation of achievement

Reports of every week : 100% (K. Mori and Y. Abe)
Written report : 100% (T. Shibata)
Reports of every week : 100% (K. Mori and Y. Abe)
Written report : 100% (T. Shibata)

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
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

Reference URL

http://plast.me.tut.ac.jp/index.eng.html (K. Mori and Y. Abe)
http://mems.me.tut.ac.jp/ (T. Shibata)
http://plast.me.tut.ac.jp/index.eng.html (K. Mori and Y. Abe)
http://mems.me.tut.ac.jp/ (T. Shibata)

Office hours

Monday (K. Mori and Y. Abe)
Anytime during regular working hours. Contact me by email before coming if possible. (T. Shibata)
Monday (K. Mori and Y. Abe)
Anytime during regular working hours. Contact me by email before coming if possible. (T. Shibata)

Relations to attainment objectives of learning and education

Key words

K. Mori and Y. Abe: forming processes, solid mechanics, finite element method // T.Shibata: micro/nanomachining, MEMS/NEMS
K. Mori and Y. Abe: forming processes, solid mechanics, finite element method // T.Shibata: 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	Mechanical Engineering			**Beggining grade**	D1, D2, D3
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					

Objectives of class

A presentation is given of the advanced knowledge on the deformation and fracture in engineering materials, including the details of the elastic and plastic fracture mechanics as well as general deformation and fracture behaviors of metallic materials, toughening of materials, techniques around fractography and non-destructive testing.
The successful student will learn deep understanding on how micro-structural design can influence the mechanical properties of materials as well as the use of fracture mechanics to quantitatively estimate failure criteria for both elastic and plastically deforming structures.
A presentation is given of the advanced knowledge on the deformation and fracture in engineering materials, including the details of the elastic and plastic fracture mechanics as well as general deformation and fracture behaviors of metallic materials, toughening of materials, techniques around fractography and non-destructive testing.
The successful student will learn deep understanding on how micro-structural design can influence the mechanical properties of materials as well as the use of fracture mechanics to quantitatively estimate failure criteria for both elastic and plastically deforming structures.

Contents of class

01st day : KOBAYASHI
Introduction (trend of deformation and fracture research in materials)
02nd day : KOBAYASHI
Linear-elastic fracture mechanics (fundamental of fracture mechanics, stress intensity factor and stress field-plastic zone)
03rd day : KOBAYASHI
Elastic plastic fracture mechanics (J-integration, stress field, fracture criterion by JIC)
04th day : KOBAYASHI
Advanced imaging of fracture (fundamental of X-ray imaging in synchrotron radiation facility)
05th day : KOBAYASHI
Advanced imaging of fracture (X-ray tomography)

06th day : MIURA
Microstructure of materials (recovery, recrystallization, phase transformation)
07th day : MIURA
Microstructure of materials (deformed microstructure)
08th day : MIURA
Microstructure analysis of materials
09th day : MIURA
Severe plastic deformation for strengthening
10th day : MIURA
Applications of microstructural control for industrial materials

11th day : TODAKA
Fundamental and advanced methods for investigating mechanical property
12th day : TODAKA
Fractography of materials
13th day : TODAKA
Applications of quantum beam for material engineering
14th day : TODAKA
Corrosion of materials (Introduction)
15th day : TODAKA

Corrosion of materials (Hydrogen embrittlement)

16th day:
Preparation of report
01st day : KOBAYASHI
Introduction (trend of deformation and fracture research in materials)
02nd day : KOBAYASHI
Linear-elastic fracture mechanics (fundamental of fracture mechanics, stress intensity factor and stress field-plastic zone)
03rd day : KOBAYASHI
Elastic plastic fracture mechanics (J-integration, stress field, fracture criterion by JIC)
04th day : KOBAYASHI
Advanced imaging of fracture (fundamental of X-ray imaging in synchrotron radiation facility)
05th day : KOBAYASHI
Advanced imaging of fracture (X-ray tomography)

06th day : MIURA
Microstructure of materials (recovery, recrystallization, phase transformation)
07th day : MIURA
Microstructure of materials (deformed microstructure)
08th day : MIURA
Microstructure analysis of materials
09th day : MIURA
Severe plastic deformation for strengthening
10th day : MIURA
Applications of microstructural control for industrial materials

11th day : TODAKA
Fundamental and advanced methods for investigating mechanical property
12th day : TODAKA
Fractography of materials
13th day : TODAKA
Applications of quantum beam for material engineering
14th day : TODAKA
Corrosion of materials (Introduction)
15th day : TODAKA
Corrosion of materials (Hydrogen embrittlement)

16th day:
Preparation of report

Self Preparation and Review

Related subjects
Students should have finished a course in mechanics of materials before receiving this class. General knowledge and skills in differential and integral calculus are also needed.
Students should have finished a course in mechanics of materials before receiving this class. General knowledge and skills in differential and integral calculus are also needed.

Notes for textbook

Reference1	**Book title**	Strength and toughness of materials			**ISBN**	4-431-20038-X
	Author	T. Kobayashi	**Publisher**	Springer-Verlag	**Publish year**	2004
Reference2	**Book title**	Fracture Mechanics: Fundamentals and Applications, 3rd Edition.			**ISBN**	978-0-849-31656-2
	Author	T. L. Anderson	**Publisher**	CRC Press	**Publish year**	2005
Reference3	**Book title**	Elements of Modern X-ray Physics			**ISBN**	978-0-470-97394-3
	Author	Jeans Als-Nielsen, Des McMorrow	**Publisher**	John Wiley & Sons,Ltd	**Publish year**	2011

Notes for reference
参考書 4 書名「X-Ray Tomography in Material Science」著者名：Jose Baruchel,

Jean-Yves Buffiere, Eric Mairem Paul Merle, Gilles Peix
出版社：HERMES Science Publications ISBN：2-7462-0115-1 出版年：2000
参考書 5 書名「Recrystallization and Related Annealing Phenomena, Second Edition」
著者名：F.J. Humphreys, M. Hatherly 出版社：Pergamon ISBN：978-0-080-44164-1 出版年：2004
参考書 4 書名「X-Ray Tomography in Material Science」著者名：Jose Baruchel,
Jean-Yves Buffiere, Eric Mairem Paul Merle, Gilles Peix
出版社：HERMES Science Publications ISBN：2-7462-0115-1 出版年：2000
参考書 5 書名「Recrystallization and Related Annealing Phenomena, Second Edition」
著者名：F.J. Humphreys, M. Hatherly 出版社：Pergamon ISBN：978-0-080-44164-1 出版年：2004

Goals to be achieved

1. Understanding on microstructure in materials
2. Understanding on fracture mechanics in brittle materials like a ceramics
3. Understanding on fracture mechanics in ductile materials like a metal
4. Understanding on concepts of energy release rate, stress intensity factor and J-integration
5. Understanding on relation between microstructure and mechanical property in materials
6. Understanding on advanced X-ray imaging technique for observation of fracture
7. Understanding on methods for investigating mechanical property
8. Understanding on relation between corrosion and mechanical property in materials

1. Understanding on microstructure in materials
2. Understanding on fracture mechanics in brittle materials like a ceramics
3. Understanding on fracture mechanics in ductile materials like a metal
4. Understanding on concepts of energy release rate, stress intensity factor and J-integration
5. Understanding on relation between microstructure and mechanical property in materials
6. Understanding on advanced X-ray imaging technique for observation of fracture
7. Understanding on methods for investigating mechanical property
8. Understanding on relation between corrosion and mechanical property in materials

Evaluation of achievement

Report(s), possibly presented by each student within the class

Report(s), possibly presented by each student within the class

Examination

レポートで実施

By Report

Details of examination

Other information

Miura: D-508, ext.6697, miura@me.tut.ac.jp
Kobayashi: D-504, ext.6706, m-kobayashi@me.tut.ac.jp
Todaka: D-603, ext.6704, todaka@me.tut.ac.jp

Miura: D-508, ext.6697, miura@me.tut.ac.jp
Kobayashi: D-504, ext.6706, m-kobayashi@me.tut.ac.jp
Todaka: D-603, ext.6704, todaka@me.tut.ac.jp

Reference URL

http://str.me.tut.ac.jp/
http://martens.me.tut.ac.jp/

http://str.me.tut.ac.jp/
http://martens.me.tut.ac.jp/

Office hours

Please contact via E-mail.

Please contact via E-mail.

Relations to attainment objectives of learning and education

Key words

Fracture, Strength, Toughness, Damage, Mechanical Test, Microstructure, Lattice Defect

Fracture, Strength, Toughness, Damage, Mechanical Test, Microstructure, Lattice Defect

(D51030060)Advanced Production and Instrumentation Systems[Advanced Production and Instrumentation Systems]

Subject name[English]	Advanced Production and Instrumentation Systems[Advanced Production and Instrumentation Systems]				
Schedule number	D51030060	**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	Mechanical Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	章　忠, 内山　直樹, 三宅　哲夫 SHO Tadashi, UCHIYAMA Naoki, MIYAKE Tetsuo				
Numbering					

Objectives of class

1) To learn techniques of shape recognition and instrumentation in image based measurement are described from the practical point of view.
2) To learn new signal processing algorithms and abnormal detection technology.
1) To learn techniques of shape recognition and instrumentation in image based measurement are described from the practical point of view.
2) To learn new signal processing algorithms and abnormal detection technology.

Contents of class

Week: 1-7: New signal processing algorithms
1. New time-frequency analysis theory
2. New wavelet analysis theory
3. Advanced signal processing and abnormal detection system

Week 8-15: Mathematical tools for image recognition
1. Linear algebra
2. Linear and non-linear Least squares
3. Singular value decomposition
4. Reconstruction of points, planes and curved surfaces
5: Pattern recognition

Week 16: Examination
Week: 1-7: New signal processing algorithms
1. New time-frequency analysis theory
2. New wavelet analysis theory
3. Advanced signal processing and abnormal detection system

Week 8-15: Mathematical tools for image recognition
1. Linear algebra
2. Linear and non-linear Least squares
3. Singular value decomposition
4. Reconstruction of points, planes and curved surfaces
5: Pattern recognition

Week 16: Examination

Self Preparation and Review

Related subjects

Optimization for Industrial Engineering Applications

Advanced Signal and Image Processing
Optimization for Industrial Engineering Applications

Advanced Signal and Image Processing

Notes for textbook

Reference1	**Book title**	Frontiers in Computing Technologies for Manufacturing Applications			**ISBN**	1846289548 (1-84628-954-8)
	Author	Shimizu, Y., Zhang, Z., Batres, R.	**Publisher**	Springer	**Publish year**	2007

Notes for reference

Goals to be achieved

Upon completion of this course the student will be able to:
1)Develop a data model.
2)Develop a signal processing and abnormal detection system.
3)Understand data fitting and relation of some statistical theories.
Upon completion of this course the student will be able to:
1)Develop a data model.
2)Develop a signal processing and abnormal detection system.
3)Understand data fitting and relation of some statistical theories.

Evaluation of achievement

Report (100%)
Report (100%)

Examination

レポートで実施
By Report

Details of examination

Other information

Zhong Zhang
Office: D-610
Extension No: 6711
E-mail: zhang@me.tut.ac.jp

Tetsuo Miyake
Office: D-609
Extension No: 6710
E-mail: miyake@me.tut.ac.jp

Zhong Zhang
Office: D-610
Extension No: 6711
E-mail: zhang@me.tut.ac.jp

Tetsuo Miyake
Office: D-609
Extension No: 6710
E-mail: miyake@me.tut.ac.jp

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

business process modeling, information modeling, signal processing, image processing, abnormal detection
business process modeling, information modeling, signal processing, image processing, abnormal detection

(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	Mechanical Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	飯田 明由, 関下 信正, 柳田 秀記 IIDA Akiyoshi, SEKISHITA Nobumasa, YANADA Hideki				
Numbering					

Objectives of class

The class aims to acquire advanced knowledge necessary for tackling energy and environmental problems in future from the standpoint of thermal and fluid engineering.

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

The class is given by Prof.Iida (first five weeks), Prof.Sekishita (second five weeks), and Prof.Yanada (last five weeks).

1st to 5th weeks:
In the first five lectures, students will learn about the technology of wind turbines and renewable energy.

Lecture 01: Explain basic problems of environmental and renewable energy.
Lecture 02:Study about fundamental and problems of wind turbines
Lecture 03:To understand the limitation of wind turbine, we will discuss about Betz' law.
Lecture 04:Learn about Actuator Theory to design wind turbines.
Lecture 05: Introduce the recent technology of wind turbines.

6th to 10th weeks:
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.

11th to 15th weeks:
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.

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and recent trend of fluid filtration technologies are acquired through this process.

Self Preparation and Review

Please read handouts before the lecture.
Please read your notes again for review of lecture.
Please read handouts before the lecture.
Please read your notes again for review of lecture.

Related subjects

Hydrodynamics
Hydrodynamics

Notes for textbook

Prof.Iida: Printed materials are given.
Prof.Sekishita: English technical papers are used.
Prof.Yanada：English technical papers are used.
Prof.Iida: Printed materials are given.
Prof.Sekishita: English technical papers are used.
Prof.Yanada：English technical papers are used.

Notes for reference

Goals to be achieved

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 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.

Evaluation of achievement

Report 100%
Report 100%

Examination

レポートで実施
By Report

Details of examination

Other information

Prof.Iida:
office:D-410, extension:6680, e-mail：iida@me.tut.ac.jp
Prof.Sekishita：
office:D2-303, extension:6687, e-mail:seki@me.tut.ac.jp
Prof.Yanada:
office:D-309, extension：6668, e-mail：yanada@me.tut.ac.jp
Prof.Iida:
office:D-410, extension:6680, e-mail：iida@me.tut.ac.jp
Prof.Sekishita：
office:D2-303, extension:6687, e-mail:seki@me.tut.ac.jp
Prof.Yanada:
office:D-309, extension：6668, e-mail：yanada@me.tut.ac.jp

Reference URL

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

Office hours

Prof.Iida: 13:00～15:00 on Monday
Prof.Sekishita and Prof.Yanada: Inquire this of the lecturer by e-mail.
Prof.Iida: 13:00～15:00 on Monday
Prof.Sekishita and Prof.Yanada: Inquire this of the lecturer by e-mail.

Relations to attainment objectives of learning and education

Key words
Fluid dynamics
Fluid dynamics

(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, D2, D3
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering					

Objectives of class

The seminar aims to provide a broad understanding of theoretical and experimental approoches 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

その他
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**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering					

Objectives of class

The seminar aims to provide a broad understanding of theoretical and experimental approoches 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

その他
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	Electrical and Electronic Information Engineering			**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, kyoumu iinkai fukuiintyou				
Numbering					

Objectives of class

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.

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.

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.

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.

Contents of class

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.

1) Presentations

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.

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.

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.

1) Presentations

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.

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

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.
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

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(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.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Electrical and Electronic Information Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	松田　厚範, 服部　敏明, 石山　武, 高木　宏幸 MATSUDA Atsunori, HATTORI Toshiaki, ISHIYAMA Takeshi, TAKAGI Hiroyuki				
Numbering					

Objectives of class

Objectives of this subject are to understand the fundamental aspects on functional materials, photonics, electrodics, spin electronics, and also to have overall knowledge on the latest technologies on these physical phenomena.

Objectives of this subject are to understand the fundamental aspects on functional materials, photonics, electrodics, 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 topics of functional materials, photonics, electrodics, 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 "electrodics" 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

"Advanced Electronic Materials 2" is composed of four topics of functional materials, photonics, electrodics, 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 "electrodics" 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.

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,

Physics for Electronics, Analysis of Inorganic Materials, Advanced Materials for Electronics, Functional Materials for Optical Applications,

Textbook1	**Book title**	Physical Chemistry			**ISBN**	0198700725
	Author	Atkins	**Publisher**	Oxford University Press	**Publish year**	2006
Textbook2	**Book title**	Inorganic Chemistry			**ISBN**	0199264635
	Author	Shriver	**Publisher**	Oxford University Press	**Publish year**	2006

Notes for textbook

None

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

Goals to be achieved

(1) To understand fundamental aspects on functional materials, photonics, electrodics and spin electronics.
(2) To get the knowledge on the latest technologies on these physical phenomena.
(1) To understand fundamental aspects on functional materials, photonics, electrodics and spin electronics.
(2) To get the knowledge on the latest technologies on these physical phenomena.

Evaluation of achievement

The final evaluation will be the sum of four categories (25%); functional materials, photonics, electrodics, spin electronics.

The final evaluation will be the sum of four categories (25%); functional materials, photonics, electrodics, spin electronics.

Examination

試験期間中には何も行わない

None during exam period

Details of examination

Taking examination and submission of report will be explained and required by the teachers during their classes.

Taking examination and submission of report will be explained and required by the teachers during their classes.

Other information

Functional materials; Atsunori Matuda : matsuda@ee.tut.ac.jp
Electrodics; Toshiaki Hattori : thattori@ee.tut.ac.jp
Photonics; Takeshi Ishiyama: ishiyama@ee.tut.ac.jp
Spin electronics: Hiroyuki Takagi : takagi@ee.tut.ac.jp
Functional materials; Atsunori Matuda : matsuda@ee.tut.ac.jp
Electrodics; Toshiaki Hattori : thattori@ee.tut.ac.jp
Photonics; Takeshi Ishiyama: ishiyama@ee.tut.ac.jp
Spin electronics: Hiroyuki Takagi : takagi@ee.tut.ac.jp

Reference URL

http://www.ee.tut.ac.jp/material
http://www.ee.tut.ac.jp/material

Office hours

one hour after every classes
one hour after every classes

Relations to attainment objectives of learning and education

Key words

functional materials, photonics, spin electronics, ionics, micro-optics, electrodics
functional materials, photonics, spin electronics, ionics, micro-optics, electrodics

(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	Electrical and Electronic Information Engineering			**Beggining grade**	D1, D2, D3
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					

Objectives of class

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.

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.

Contents of class

Sub Course 1
1. Generation and control of various plasmas
2. Characteristics and diagnostics of plasma
3. Applications of functional plasma and trends

Sub Course 2
1. Li-ion and Post Li-ion Batteries
2. Materials for Advanced Batteries
3. Modern Aspects of Electrochemical Energy Conversion Devices

Sub Course 3
1. Ultrasonic techniques for medical use
2. Diagnosing techniques for industrial use
3. Assessment for high voltage insulation system

Sub Course 1
1. Generation and control of various plasmas
2. Characteristics and diagnostics of plasma
3. Applications of functional plasma and trends

Sub Course 2
1. Li-ion and Post Li-ion Batteries
2. Materials for Advanced Batteries
3. Modern Aspects of Electrochemical Energy Conversion Devices

Sub Course 3
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

Basic electrical power engineering course is prerequisite.

Basic electrical power engineering course is prerequisite.

Notes for textbook

Materials will be prepared by the lecturer.

(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)

Materials will be prepared by the lecturer.

(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	Electrical and Electronic Information Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	若原 昭浩, 岡田 浩, 河野 剛士 WAKAHARA Akihiro, OKADA Hiroshi, KAWANO Takeshi				
Numbering					

Objectives of class

To understand semiconductor physics, structure, design, and processing of advanced semiconductor devices.
To understand semiconductor physics, structure, design, and processing of advanced semiconductor devices.

Contents of class

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.

1. Fabrication and characterization technology for Nanosturecture 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.

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.

1. Fabrication and characterization technology for Nanosturecture 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)

Related references, data, printed matters will be given in the class.
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

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.

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

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

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

Examination

その他
Other

Details of examination

Qualification will be directed in the class.
Qualification will be directed in the class.

Other information

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

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	Electrical and Electronic Information Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	市川 周一, 田村 昌也 ICHIKAWA Shuichi, TAMURA Masaya				
Numbering					

Objectives of class

This lecture introduces some advanced topics on (1) computer system engineering and (2) analog filters. The details are given below.

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

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.

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.

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.
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.
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
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

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.
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
(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	Electrical and Electronic Information Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering					

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.

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

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.

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.

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.

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, D2, D3
Charge teacher name[Roman alphabet mark]	S3系教務委員 3kei kyomu Iin-S				
Numbering					

Objectives of class

The course is intended for students to study basic materials in depth, related to his/her research subjects in computer science and engineering.
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.

Contents of class

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.

Self Preparation and Review

Consult with your advisor.

Related subjects

Consult with your advisor.

Notes for textbook

Consult with your advisor.

Notes for reference

Goals to be achieved

To acquire abilities for technical readings in English, logical thinking/explanation, and clear presentation.

Evaluation of achievement

Will be evaluated by taking into accout various factors overall, such as technical explanation, question answering, discussion involvements and so on.

Examination

その他

None during exam period

Details of examination

Other information

Reference URL

Office hours

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**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	S3系教務委員 3kei kyomu Iin-S				
Numbering					

Objectives of class

The course is intended for students to study basic materials in depth, related to his/her research subjects in computer science and engineering.
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.

Contents of class

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.

Self Preparation and Review

Consult with your advisor.

Related subjects

Consult with your advisor.

Notes for textbook

Consult with your advisor.

Notes for reference

Goals to be achieved

To acquire abilities for technical readings in English, logical thinking/explanation, and clear presentation.

Evaluation of achievement

Will be evaluated by taking into accout various factors overall, such as technical explanation, question answering, discussion involvements and so on.

Examination

その他

None during exam period

Details of examination

Other information

Reference URL

Office hours

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	Computer Science and Engineering			**Beggining grade**	D2
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, S3系教務委員 kyoumu iinkai fukuiintyou, 3kei kyomu Iin-S				
Numbering					

Objectives of class

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.
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.
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.
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.

Contents of class

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.
1) Presentations
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.

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.

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.
1) Presentations
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.

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

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.
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

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(D53030010)Computer System Engineering[Computer System Engineering]

Subject name[English]	Computer System Engineering[Computer System Engineering]				
Schedule number	D53030010	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Elective
Time of starting a course	Fall term	**Day of the week,period**	Tue.1～1	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	小林　良太郎 KOBAYASHI Ryotaro				
Numbering					

Objectives of class

This lecture introduces some advanced topics on computer system engineering. The details are given below.
This lecture introduces some advanced topics on computer system engineering. The details are given below.

Contents of class

The topics of this lecture include the following items:
* Introduction to computer architecture
* Instruction set architecture
* Pipelined architecture
* Memory hierarchy for speedup
* Branch prediction technique
* Multiple instructions issue technique
* Value prediction that predicts the result of each instruction.
* Branch Prediction that predicts the direction and the target PC of each branch instruction.
* High performance Cache that provides the benefit of global replacement while maintaining the constant hit latency of a set-associative cache.
* "Runahead" that was proposed to tolerate long main memory latencies.
* Pre-execution that removes the long latency of miss loads from a program's critical execution by redundantly executing copies of their instruction stream while executing the main program.
* Energy-Effectiveness of Pre-Execution.
* Memory latency and power consumption.
* Physical register and logical register.
* Resource conflict and instruction rename.

The topics of this lecture include the following items:
* Introduction to computer architecture
* Instruction set architecture
* Pipelined architecture
* Memory hierarchy for speedup
* Branch prediction technique
* Multiple instructions issue technique
* Value prediction that predicts the result of each instruction.
* Branch Prediction that predicts the direction and the target PC of each branch instruction.
* High performance Cache that provides the benefit of global replacement while maintaining the constant hit latency of a set-associative cache.
* "Runahead" that was proposed to tolerate long main memory latencies.
* Pre-execution that removes the long latency of miss loads from a program's critical execution by redundantly executing copies of their instruction stream while executing the main program.
* Energy-Effectiveness of Pre-Execution.
* Memory latency and power consumption.
* Physical register and logical register.
* Resource conflict and instruction rename.

Self Preparation and Review

Preparation and review based on the given course materials is helpful for understanding the above-mentioned items.
Preparation and review based on the given course materials is helpful for understanding the above-mentioned items.

Related subjects

Notes for textbook

Course materials and references are prepared by lecturer.
Course materials and references are prepared by lecturer.

Notes for reference

Goals to be achieved

Students are required to obtain the knowledge on the above-mentioned items.
Students are required to obtain the knowledge on the above-mentioned items.

Evaluation of achievement

Attendance to all classes is compulsory. Absence without reasonable excuses (for example, oversleeping and lapse of memory) is unacceptable.

There will be some reports for the topics shown above. The evaluation is performed based on the followings:
A: score of the reports is more than 80 points
B: score of the reports is more than 65 points
C: score of the reports is more than 55 points
Attendance to all classes is compulsory. Absence without reasonable excuses (for example, oversleeping and lapse of memory) is unacceptable.

There will be some reports for the topics shown above. The evaluation is performed based on the followings:
A: score of the reports is more than 80 points
B: score of the reports is more than 65 points
C: score of the reports is more than 55 points

Examination

レポートで実施
By Report

Details of examination

Other information

Ryotaro Kobayashi
Room: C-403
Tel: 6752
email: kobayashi@cs.tut.ac.jp

Ryotaro Kobayashi
Room: C-403
Tel: 6752
email: kobayashi@cs.tut.ac.jp

Reference URL

Office hours

Students are to make an appointment via e-mail if they want to see the lecturer.
Students are to make an appointment via e-mail if they want to see the lecturer.

Relations to attainment objectives of learning and education

Key words

Microarchitecture, computer architecture, speculative execution
Microarchitecture, computer architecture, speculative execution

(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	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	金澤 靖, 菅谷 保之 KANAZAWA Yasushi, SUGAYA Yasuyuki				
Numbering					

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

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

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	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	三浦 純 MIURA Jun				
Numbering					

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 its application to mobile robot localization and mapping.

Fundamental and advanced issues in intelligent robotics will be discussed. Topics included are probabilistic sensor fusion techniques (e.g., Kalman 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.

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 are useful.

Fundamental knowledge of linear algebra and probability theory are useful.

Notes for textbook

Handouts will be prepared. The main reference is shown below.

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.

Understanding of the fundamentals of sensor fusion strategies and algorithms.

Evaluation of achievement

Grade will be determined by the report.

Grade will be determined by 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)

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.

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.

Make an appointment beforehand by email.

Relations to attainment objectives of learning and education

Key words

Robotics

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	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	岡田 美智男 OKADA Michio				
Numbering					

Objectives of class

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.

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

- 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

Related subjects

Fundamentals of cognitive science.

Fundamentals of cognitive science.

Notes for textbook

Handouts will be prepared.

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

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

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

Grade will be determined by the presentation and final report.

Grade will be determined by the presentation 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/en/profile.html

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

Office hours

Tuesday, 14:30-16:00

Tuesday, 14:30-16:00

Relations to attainment objectives of learning and education

Key words

Social Robotics, Cognitive Robotics, Social Interaction

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	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	村越 一支 MURAKOSHI Kazushi				
Numbering					

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.

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
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.
You must take the credits of "Complex Systems and Intelligent Informatics" in master course in advance.

Notes for textbook

No textbook.
No textbook.

Notes for reference

Goals to be achieved

Evaluation of achievement

Class performance (50%) and term-end report (50%)
Class performance (50%) and term-end report (50%)

Examination

レポートで実施
By Report

Details of examination

Other information

E-mail: mura[at]tut.jp (replace [at] with @)
Room F-507, Ext. 6899
E-mail: mura[at]tut.jp (replace [at] with @)
Room F-507, Ext. 6899

Reference URL

Office hours

After this class
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	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	石田　好輝 ISHIDA Yoshiteru				
Numbering					

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.

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

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);
Barabasi, A.L.: Linked, Perseus, (2002)
Strogatz, S. H. Sync, Hyperion (2003)

No textbook. References other than below will be suggested at the first class.
Ishida, Y.: Immunity-Based Systems, Springer (2004);
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%)
Class performance (50%) and term-end report (50%)

Examination
レポートで実施
By Report

Details of examination

Other information
Room F-504, Ext. 6895
Room F-504, Ext. 6895

Reference URL

Office hours
Wednesday 16:30-17:00
Wednesday 16:30-17:00

Relations to attainment objectives of learning and education

情報・知能工学専攻
(B)理論的・応用的知識の獲得と発展的活用能力
重要な学術・技術分野の理論・応用知識を自発的に獲得し，発展的に活用できる能力
(C)広範囲の知識を有機的に連携させた研究開発能力
広範囲の知識の連携による研究開発に対する方法論を体得し，研究開発の計画立案と，それを実践できる能力
(D)国内外において活躍できる表現力・コミュニケーション力
論文，口頭及び情報メディアを通じて，自分の論点や考えなどを国の内外において効果的に表現し，コミュニケーションする能力

Key words
complex systems, cellular automaton, artificial life, immuno intelligence, neural networks, evolutionary game theory
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.1～1	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	梅村 恭司 UMEMURA Kyoji				
Numbering					

Objectives of class

The objective of this class is mastering both profound and advanced networking technologies. Precise protocols are lectured to enhance the knowledge of Internet.

The objective of this class is mastering both profound and advanced networking technologies. 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. TCP interactive and bulk data flow

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. TCP interactive and bulk data flow

Self Preparation and Review

Related subjects

The ability to write simple client/server programs are required.

The ability to write simple client/server programs are 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 the way that computer network works precisely.

The goal is to understand the way that computer network works precisely.

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.1～1	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	大村　廉 OMURA Ren				
Numbering					

Objectives of class

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.
The contents will focus on advanced topics in distributed systems, namely the knowledge of computer network and basics of distributed systems are required beforehand.

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.
The contents will focus on advanced topics in distributed systems, namely the knowledge of computer network and basics of distributed systems are required beforehand.

Contents of class

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

Self Preparation and Review

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.
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.

Related subjects

Computer Network, Operating Systems, System Programming, (Basics of Distributed Systems)
Computer Network, Operating Systems, System Programming, (Basics of Distributed Systems)

Textbook1	**Book title**	Distributed Systems: Principles and Paradigms (2nd Edition)			**ISBN**	978-0132392273
	Author	Andrew S. Tanenbaum, and Maarten Van Steen	**Publisher**	Prentice Hall	**Publish year**	2006

Notes for textbook

Basically, materials referenced in the class are passed out in the class.
Basically, materials referenced in the class are passed out in the class.

Notes for reference

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.

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, D2, D3
Charge teacher name[Roman alphabet mark]	S4系教務委員 4kei kyomu Iin-S				
Numbering					

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 lessen 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

その他
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			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	S4系教務委員 4kei kyomu Iin-S				
Numbering					

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 lessen 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

その他
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	Environmental and Life Sciences			**Beggining 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					

Objectives of class

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.
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.
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.
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.

Contents of class

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.
1) Presentations
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.

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.

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.
1) Presentations
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.

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

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.
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

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(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.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Environmental and Life Sciences			**Beggining grade**	D1, D2, D3
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					

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

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]

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.

Basic understanding on physical chemistry and inorganic chemitry is essential.

Notes for textbook

Reference handouts will be provided in the class.

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

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 the instructor before registration.

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 the instructor before registration.

Reference URL

Office hours

Booking required in advance.

Booking 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	Environmental and Life Sciences			**Beggining grade**	D1, D2, D3
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					

Objectives of class

To acquire knowledge of advanced biotechnology including biology, biochemistry, physiology and engineering.
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
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
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.
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
Examinations and term-end reports

Examination
定期試験を実施（対面）
Examination(Face to Face)

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
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
Anytime

Relations to attainment objectives of learning and education

Key words
Nanostructure, Molecular self-assembly, Supramolecules, Neuronal circuit, cell differentiation
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**	Wed.1～1	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Environmental and Life Sciences			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	辻　秀人, 齊戸　美弘, 平田　幸夫, 手老　龍吾 TSUJI Hideto, SAITO Yoshihiro, HIRATA Yukio, TERO Ryugo				
Numbering					

Objectives of class

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.

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.

Contents of class

[1] Chromatography is one of the most widely applied methods for the analysis of mixtures, because of its high resolving power. In this topic, the basic theory of chromatography will be provided along with the effects of various parameters on the separation efficiency. To obtain the in-depth understanding of chromatographic process, the emphasis is also placed on practice as well as reports of the simulation of chromatographic process by using Excel-VBA. (by Y. Hirata)

[2] 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)

[3] 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)

[4] 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).

[1] Chromatography is one of the most widely applied methods for the analysis of mixtures, because of its high resolving power. In this topic, the basic theory of chromatography will be provided along with the effects of various parameters on the separation efficiency. To obtain the in-depth understanding of chromatographic process, the emphasis is also placed on practice as well as reports of the simulation of chromatographic process by using Excel-VBA. (by Y. Hirata)

[2] 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)

[3] 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)

[4] 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).

Self Preparation and Review

Related subjects

Notes for textbook

Related materials will be provided.

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

#2 can be accessed in the university network.
http://link.springer.com/book/10.1007%2F978-3-540-88633-4
(R. Tero)

#2 can be accessed in the university network.
http://link.springer.com/book/10.1007%2F978-3-540-88633-4
(R. Tero)

Goals to be achieved

To obtain the in-depth understanding of topic relevant to Enviromental and Life Science.

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.

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

Y.Hirata: room (B-402), e-mail (hirata@ens.tut.ac.jp), phone: 6804
H.Tsuji: room (G-606), e-mail (tsuji@ens.tut.ac.jp), phone: 6922
Y.Saito: room (B-404), e-mail (saito@ens.tut.ac.jp), phone: 6803
R.Tero: room (B-405), e-mail (tero@tut.jp), phone: 6791

Y.Hirata: room (B-402), e-mail (hirata@ens.tut.ac.jp), phone: 6804
H.Tsuji: room (G-606), e-mail (tsuji@ens.tut.ac.jp), phone: 6922
Y.Saito: room (B-404), 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.

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, D2, D3
Charge teacher name[Roman alphabet mark]	S5系教務委員 5kei kyomu Iin-S				
Numbering					

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

その他

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**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	S5系教務委員 5kei kyomu Iin-S				
Numbering					

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

その他

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	Architecture and Civil Engineering			**Beggining grade**	D2
Charge teacher name[Roman alphabet mark]	教務委員会副委員長, S5系教務委員 kyoumu iinkai fukuiintyou, 5kei kyomu Iin-S				
Numbering					

Objectives of class

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.
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.
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.
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.

Contents of class

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.
1) Presentations
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.

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.

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.
1) Presentations
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.

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

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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

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.
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

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

Key words

(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	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	中澤 祥二 NAKAZAWA Shoji				
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.

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

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.

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.

Based on reports.

Examination

レポートで実施

By Report

Details of examination

Other information

Reference URL

Nakazawa: http://www.st.ace.tut.ac.jp/~nakazawa/

Matsumoto: http://sel.ace.tut.ac.jp

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

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	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	齊藤　大樹, 松井　智哉 SAITOH Taiki, MATSUI Tomoya				
Numbering					

Objectives of class

The objective of this class is to learn vibration analysis technology in seismic design of the buildings and seismic design method based on vibration analysis.

The objective of this class is to learn vibration analysis technology in seismic design of the buildings and seismic design method based on vibration analysis.

Contents of class

・Vibration of single degree of freedom system
・Numerical integration
・Response spectrum
・Vibration of two degree of freedom system
・Vibration of multi-degree of freedom system
・Elasto-plastic earthquake response analysis
・Vibration of single degree of freedom system
・Numerical integration
・Response spectrum
・Vibration of two degree of freedom system
・Vibration of multi-degree of freedom system
・Elasto-plastic earthquake response analysis

Self Preparation and Review

Related subjects

Notes for textbook

Notes for reference

Goals to be achieved

To understand theories of vibration analysis and seismic performance evaluation of building on based on vibration analysis.

To understand theories of vibration analysis and seismic performance evaluation of building on based on vibration analysis.

Evaluation of achievement

Report

Report

Examination

レポートで実施

By Report

Details of examination

Other information

Processor, Taiki Saito (Room: D-805), E-mail: tsaito@ace.tut.ac.jp

Associate Professor, Tomoya Matsui (Room: D-807), E-mail: matsui@ace.tut.ac.jp

Processor, Taiki Saito (Room: D-805), E-mail: tsaito@ace.tut.ac.jp

Associate Professor, Tomoya Matsui (Room: D-807), E-mail: matsui@ace.tut.ac.jp

Reference URL

Saito:　http://www.rc.ace.tut.ac.jp/saito/index-e.html

Matsui: http://www.rc.ace.tut.ac.jp/matsui/index.html
Saito: http://www.rc.ace.tut.ac.jp/saito/index-e.html
Matsui: http://www.rc.ace.tut.ac.jp/matsui/index.html

Office hours

Please contact by e-mail to make an appointment.
Please contact by e-mail to make an appointment.

Relations to attainment objectives of learning and education

Key words

(D55030040)Advanced Theory in Architectural Design[Advanced Theory in Architectural Design]

Subject name[English]	Advanced Theory in Architectural Design[Advanced Theory in Architectural Design]				
Schedule number	D55030040	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Elective
Time of starting a course	Fall term	**Day of the week,period**	Thu.5～5	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	松島 史朗, 垣野 義典 MATSUSHIMA Shiro, KAKINO Yoshinori				
Numbering					

Objectives of class

Fundamentally, The field focused on the functionality and the relationship between people's activities and spaces.
Herman Hertzberger is one of most famous architects all over the world. His theory is related to spaces and human activities deeply. I would like to show the interesting and international usage of spaces.

Fundamentally, The field focused on the functionality and the relationship between people's activities and spaces.
Herman Hertzberger is one of most famous architects all over the world. His theory is related to spaces and human activities deeply. I would like to show the interesting and international usage of spaces.

Contents of class

1 Guidance
2 Public and Private
3 Territorial claims, Differentiation, Zorning
4 From user to dweller, the 'in-between', public works concept
5 Street, public domain, public accessibility of Private spaces
6 Making spaces, leaving spaces
7 structure and interpretation, form
8 Gridiron, building order, Functionality
9 Flexibility
10 Form and Users, making space, leaving space
11 incentives
12 Inviting form, place and articulation, view
13 view 2, view 3
14 equivalence
15 Summary

1 Guidance
2 Public and Private
3 Territorial claims, Differentiation, Zorning
4 From user to dweller, the 'in-between', public works concept
5 Street, public domain, public accessibility of Private spaces
6 Making spaces, leaving spaces
7 structure and interpretation, form
8 Gridiron, building order, Functionality
9 Flexibility
10 Form and Users, making space, leaving space
11 incentives
12 Inviting form, place and articulation, view
13 view 2, view 3
14 equivalence
15 Summary

Self Preparation and Review

Related subjects

Notes for textbook

Herman Hertzberger: Lessons for Students in Architecture1, 010 Publishers
Herman Hertzberger: Lessons for Students in Architecture2 , 010 Publishers
Herman Hertzberger: Lessons for Students in Architecture1, 010 Publishers
Herman Hertzberger: Lessons for Students in Architecture2 , 010 Publishers

Notes for reference

Goals to be achieved

Master the basic theory for designing planning of public buildings.
Master the basic theory for designing planning of public buildings.

Evaluation of achievement

Evaluation of performance : some reports
Evaluation of performance : some reports

Examination

レポートで実施
By Report

Details of examination

Other information

e-mail:y-kakino@ace.tut.ac.jp
Room No. : D-709
e-mail:y-kakino@ace.tut.ac.jp
Room No. : D-709

Reference URL

http://one.world.coocan.jp/
http://one.world.coocan.jp/

Office hours

Relations to attainment objectives of learning and education

Key words

Architectural Planning、space composition、Human life, Culture, Behavior and Activities, function
Architectural Planning、space composition、Human life, Culture, Behavior and Activities, function

(D55030050)Advanced History of Architecture[Advanced History of Architecture]

Subject name[English]	Advanced History of Architecture[Advanced History of Architecture]				
Schedule number	D55030050	**Subject area**	Advanced Architecture and Civil Engineering	**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	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	泉田 英雄 IZUMIDA Hideo				
Numbering					

Objectives of class

A. to understand development of architecture in modern Asia through a series of lectures.
B. to discussing regional development of architecture and engineering between Asian and Europe, suzerain and colony, centre and periphery.
A. to understand development of architecture in modern Asia through a series of lectures.
B. to discussing regional development of architecture and engineering between Asian and Europe, suzerain and colony, centre and periphery.

Contents of class

Course Example;
1) Description and Discussion of Izumida's latest papers on study of architectural history and conservation project.
2) Bibliographical introduction of important existing studies by instructor and students such as;
1. Asia in the Making of Europe(1): Cultural exchange between West and East in middle age and pre-modern age
2. Port City and Architecture(1): Chinese immigration, European Factory, Fortified Factory, Assimilation
3. Colonization(1): Spanish and Dutch town planning, English Settlement, Inland development, Plantation, Engineers, Mapping
4. Exploring of Ancient Civilization and Architecture(2): William Jones and Asia Society, Stanford Raffles in Java, Neo-Indian style, Henry White and Taji Mahal
5. Academy of Architectural History and Ethnology(2): James Fergusson, Harvel, Tensin Okakura, Chuta Ito
6. Development of Technical Education in UK and Japan: William Rankin, Henry Dyer, C.A.McVean, Indian Technical College, Japan's Imperial College, Yozo Yamao,
7. Earthquake Nation: Seismology, John Mile, Noubi Earthquake, J. Conder, Sano Toshikata, etc.
8. Creation of New Style(2): Neo-Saracenic, Neo-Chinese, etc.

Course Example;
1) Description and Discussion of Izumida's latest papers on study of architectural history and conservation project.
2) Bibliographical introduction of important existing studies by instructor and students such as;
1. Asia in the Making of Europe(1): Cultural exchange between West and East in middle age and pre-modern age
2. Port City and Architecture(1): Chinese immigration, European Factory, Fortified Factory, Assimilation
3. Colonization(1): Spanish and Dutch town planning, English Settlement, Inland development, Plantation, Engineers, Mapping
4. Exploring of Ancient Civilization and Architecture(2): William Jones and Asia Society, Stanford Raffles in Java, Neo-Indian style, Henry White and Taji Mahal
5. Academy of Architectural History and Ethnology(2): James Fergusson, Harvel, Tensin Okakura, Chuta Ito
6. Development of Technical Education in UK and Japan: William Rankin, Henry Dyer, C.A.McVean, Indian Technical College, Japan's Imperial College, Yozo Yamao,
7. Earthquake Nation: Seismology, John Mile, Noubi Earthquake, J. Conder, Sano Toshikata, etc.
8. Creation of New Style(2): Neo-Saracenic, Neo-Chinese, etc.

Self Preparation and Review

Related subjects

Architectural and Urban History, Japanese and English language
Architectural and Urban History, Japanese and English language

Notes for textbook

・Gregory, Earthquake Nation: The Cultural Politics of Japanese Seismicity, University of California Press, 2008

・Izumida Hideo, “Urbanization by Immigration and Colonization in Maritime Asia”, Gakugei Shuppan Kai, 2007
（Reference）
・Ohba Osamu, “Pre-Modern and Modern Japanese Townhouse”, Chuo Koron Bijyutsu, 2006
・Nishizawa Yasuhiko, “Japanese Colonial Architecture”, Nagoya Univ. Press, 2008
・Hatsuta Toru, “Modernity in Shopping and Business Area”, Tokyo Univ. Press, 2002
・B. Yeoh, Contesting Space: Power Relations and the Urban Built Environment in Colonial, Singapore, OUP, 2001
・Donald Lach, Asia: The Making of Europe, 4 vols., 1978.
・James Fergusson, Illustrated History of Architecture, 1857.
・Gregory, Earthquake Nation: The Cultural Politics of Japanese Seismicity, University of California Press, 2008
・Izumida Hideo, “Urbanization by Immigration and Colonization in Maritime Asia”, Gakugei Shuppan Kai, 2007
（Reference）
・Ohba Osamu, “Pre-Modern and Modern Japanese Townhouse”, Chuo Koron Bijyutsu, 2006
・Nishizawa Yasuhiko, “Japanese Colonial Architecture”, Nagoya Univ. Press, 2008
・Hatsuta Toru, “Modernity in Shopping and Business Area”, Tokyo Univ. Press, 2002
・B. Yeoh, Contesting Space: Power Relations and the Urban Built Environment in Colonial, Singapore, OUP, 2001
・Donald Lach, Asia: The Making of Europe, 4 vols., 1978.
・James Fergusson, Illustrated History of Architecture, 1857.

Notes for reference

Goals to be achieved

Evaluation of achievement

Performance of discussion and reports
Performance of discussion and reports

Examination

レポートで実施
By Report

Details of examination

Other information

Izumida Hideo, Room D3-804 opens 13:30-15:00 on Wednesday for studentsizumida@tutrp.tut.ac.jp
Izumida Hideo, Room D3-804 opens 13:30-15:00 on Wednesday for studentsizumida@tutrp.tut.ac.jp

Reference URL

https://sites.google.com/site/archisslh/
https://sites.google.com/site/2011resotration/
https://sites.google.com/site/archisslh/
https://sites.google.com/site/2011resotration/

Office hours

Relations to attainment objectives of learning and education

Key words

(D55030060)Sustainable Urban Planning[Sustainable Urban Planning]

Subject name[English]	Sustainable Urban Planning[Sustainable Urban Planning]				
Schedule number	D55030060	**Subject area**	Advanced Architecture and Civil Engineering	**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	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	浅野　純一郎 ASANO Junichiro				
Numbering					

Objectives of class

1) To gain the practical knowledge of Sustainable urban planning.
2) To learn the advanced methods of urban planning which is based on “Sustainable development” conception.
3) To learn the theory and the movement of recent urban planning from EU, US, Japan.

1) To gain the practical knowledge of Sustainable urban planning.
2) To learn the advanced methods of urban planning which is based on “Sustainable development” conception.
3) To learn the theory and the movement of recent urban planning from EU, US, Japan.

Contents of class

The major topics that will be addressed in this class are the followings,
1. Overview of the theory about urban planing based on “Sustainability” conception.
2. Overview of policies and methods about “Sustainable urban planning”.
3. Practice by application of “Sustainable urban planning” methods in the fields of land use, community, transportation, and so on.
4. Practice by application of the design methods about “Sustainable urban planning” in the fields of creative housing, living environment, and so on.

The major topics that will be addressed in this class are the followings,
1. Overview of the theory about urban planing based on “Sustainability” conception.
2. Overview of policies and methods about “Sustainable urban planning”.
3. Practice by application of “Sustainable urban planning” methods in the fields of land use, community, transportation, and so on.
4. Practice by application of the design methods about “Sustainable urban planning” in the fields of creative housing, living environment, and so on.

Self Preparation and Review

Related subjects

The following knowledge is desirable,
1) The basic knowledge on urban planning and urban design
2) The knowledge on urban planning system in your country
3) The basic knowledge on GIS and CAD

The following knowledge is desirable,
1) The basic knowledge on urban planning and urban design
2) The knowledge on urban planning system in your country
3) The basic knowledge on GIS and CAD

Notes for textbook

Original textbook and papers are used in this class.
Original textbook and papers are used in this class.

Notes for reference

Goals to be achieved
Evaluation of achievement Evaluation standard will be explained from each professors individually. Evaluation standard will be explained from each professors individually.
Examination レポートで実施 By Report
Details of examination
Other information Junichiro ASANO:(D-708),e-mail:asano@ace.tut.ac.jp Junichiro ASANO:(D-708),e-mail:asano@ace.tut.ac.jp
Reference URL http://urbandesign.web.fc2.com/MOTHER-hp/TEA-hp/top/e-main.html http://urbandesign.web.fc2.com/MOTHER-hp/TEA-hp/top/e-main.html
Office hours
Relations to attainment objectives of learning and education
Key words

(D55030070)Advanced Geologic Hazard Mitigation Planning[Advanced Geologic Hazard Mitigation Planning]

Subject name[English]	Advanced Geologic Hazard Mitigation Planning[Advanced Geologic Hazard Mitigation Planning]				
Schedule number	D55030070	**Subject area**	Advanced Architecture and Civil 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	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	三浦 均也 MIURA Kinya				
Numbering					

Objectives of class

For mitigation planning of natural disaster such as earthquakes, it is necessary to find out the optimum program to control the complex system which is composed of human activity and natural phenomena.The objectives of this lecture are learning of the mitigation planning mentioned above and the understanding the component of the complex system such as soils.

For mitigation planning of natural disaster such as earthquakes, it is necessary to find out the optimum program to control the complex system which is composed of human activity and natural phenomena.The objectives of this lecture are learning of the mitigation planning mentioned above and the understanding the component of the complex system such as soils.

Contents of class

concerning the regional disaster mitigation for the natural disaster such as earthquakes and the component of the complex system such as soils, following matters are explained.

concerning the regional disaster mitigation for the natural disaster such as earthquakes and the component of the complex system such as soils, following matters are explained.

Self Preparation and Review

Related subjects

Geotechnical Analysis

Geotechnical Analysis

Notes for textbook

none

none

Notes for reference

Goals to be achieved

The goal to be achieved is understanding the basic concept of the regional disaster mitigation for earthquakes and the future of the soils which is the component of the complex system.

The goal to be achieved is understanding the basic concept of the regional disaster mitigation for earthquakes and the future of the soils which is the component of the complex system.

Evaluation of achievement

Report and the presentation based on the report

Report and the presentation based on the report

Examination

レポートで実施

By Report

Details of examination

Other information

D-803, 0532-44-6844, k-miura@ace.tut.ac.jp

D-803, 0532-44-6844, k-miura@ace.tut.ac.jp

Reference URL

prepairing

prepairing

Office hours

12:00-14:00 on Tuesday

12:00-14:00 on Tuesday

Relations to attainment objectives of learning and education

Key words

Disaster, Earthquake, Geologic Hazards, Numerical Analysis

Disaster, Earthquake, Geologic Hazards, Numerical Analysis

(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	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
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

Getting 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 chemical and physical aspects of material dynamics in water
Getting 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 chemical and physical aspects of material dynamics in water

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 dynamic in water
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 dynamic in water

Self Preparation and Review

Refer some textbooks related water environment as preparation and review

Refer some textbooks related water environment as preparation and review

Related subjects

N/A
N/A

Notes for textbook

No specific textbook will be used.
The resume or related handouts will be distributed.

No specific textbook will be used.
The resume or related handouts will be distributed.

Notes for reference

Goals to be achieved

T.Inoue: Understanding river and lake environmental problems and chemical approach to the solution
S.Kato : Understanding a situation of coastal, ocean and estuarine environment and disaster, and counter-measurements for related problems
K.Yokota: Understanding methods of measurement and analysis for material dynamics analysis in water
T.Inoue: Understanding river and lake environmental problems and chemical approach to the solution
S.Kato : Understanding a situation of coastal, ocean and estuarine environment and disaster, and counter-measurements for related problems
K.Yokota: Understanding methods of measurement and analysis for material dynamics analysis in water

Evaluation of achievement

Reports(100%)(given by each instructor)
Each report is evaluated by each instructor.
The average of report scores is used as subject evaluation.
Grade: A(100-80), B(79-65), C(64-55)

Reports(100%)(given by each instructor)
Each report is evaluated by each instructor.
The average of report scores is used as subject evaluation.
Grade: A(100-80), B(79-65), C(64-55)

Examination

レポートで実施
By Report

Details of examination

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
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

N/A
N/A

Office hours

T.Inoue: Wednesday 12:30 - 13:30
S.Kato : At any time. (But please contact Kato about visit time by e-mail in advance.)
K.Yokota: Monday, 13:00 - 14:00
T.Inoue: Wednesday 12:30 - 13:30
S.Kato : At any time. (But please 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

N/A

N/A

Key words

(T.Inoue) Water quality, Water environment, River, Lake, (S.Kato) Coast, Ocean, Estuary, Natural disaster, Material transport, (K.Yokota) Material dynamics, Field measurement, Experiment
(T.Inoue) Water quality, Water environment, River, Lake, (S.Kato) Coast, Ocean, Estuary, Natural disaster, Material transport, (K.Yokota) 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**	Tue.5～5	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Architecture and Civil Engineering			**Beggining grade**	D1, D2, D3
Charge teacher name[Roman alphabet mark]	宮田 譲 MIYATA Yuzuru				
Numbering					

Objectives of class

To undestand the analysis of regional economic activities.
To understand the interaction between the natural environment and the regional economy.
To undestand 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 undestand 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 undestand 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 # : B411
phone : 0532-44-6955
e-mail address : miyata@ace.tut.ac.jp
room # : B411
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