Syllabus

International Doctoral Degree Program

（2019-Spring Term）

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

Subject name[English]	Advanced Seminar on Mechanical Engineering 1[Advanced Seminar on Mechanical Engineering 1]				
Schedule number	D51010010	**Subject area**	Advanced Mechanical Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	4
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Mechanical Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering	MEC_DOC71015				

Objectives of class

The seminar aims to enhance the ability of each student to plan and accomplish research in the field of mechanical engineering through reviewing, reading, and discussing technical papers related to his/her doctor thesis research topic.

Contents of class

Each student reads English technical papers related to his/her doctor thesis, introduces the contents of the papers and discusses them with other students and his/her supervisor.

Self Preparation and Review

Related subjects

Inquire this of your supervisor.

Notes for textbook

Inquire this of your supervisor.

Notes for reference

Goals to be achieved

To acquire the ability of each student to discuss his/her doctor thesis research topic and topics related to his/her research field with his/her supervisor and specialists in his/her field.
To acquire the ability to write English technical papers.

Evaluation of achievement

The achivement is evaluated based on the results of paper introduction, understanding of papers, answers to questions, and on the contribution to discussion.

Examination

試験期間中には何も行わない
None during exam period

Details of examination

Other information

Inquire this of your supervisor.

Reference URL

Office hours

Inquire this of your supervisor.

Relations to attainment objectives of learning and education

(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner
Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniques for problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner.

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**	D2
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering	MEC_DOC71015				

Objectives of class

The seminar aims to enhance the ability of each student to plan and accomplish his/her research in the field of mechanical engineering through reviewing, reading, and discussing technical papers related to his/her doctor thesis research topic.

Contents of class

Each student reads English technical papers related to his/her doctor thesis, introduces the contents of the papers and discusses them with other students and his/her supervisor.

Self Preparation and Review

Related subjects

Inquire this of your supervisor.

Notes for textbook

Inquire this of your supervisor.

Notes for reference

Goals to be achieved

To acquire the ability of each student to discuss his/her doctor thesis research topic and topics related to his/her research field with his/her supervisor and specialists in his/her field.
To acquire the ability to write English technical papers.

Evaluation of achievement

The achivement is evaluated based on the results of paper introduction, understanding of papers, answers to questions, and on the contribution to discussion.

Examination

試験期間中には何も行わない
None during exam period

Details of examination

Other information

Inquire this of your supervisor.

Reference URL

Office hours

Inquire this of your supervisor.

Relations to attainment objectives of learning and education

(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner
Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniques for problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner.

Key words

(D51010021)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	D51010021	**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**	D2
Charge teacher name[Roman alphabet mark]	S1系教務委員 1kei kyomu Iin-S				
Numbering	MEC_DOC71015				

Objectives of class
保証科目のため入力不要
保証科目のため入力不要

Contents of class

Self Preparation and Review

Related subjects

Notes for textbook

Notes for reference

Goals to be achieved

Evaluation of achievement

Examination
その他
Other

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
機械工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner
Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniquesfor problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner

Key words

(D51030010)Advanced Mechanical Systems[Advanced Mechanical Systems]

Subject name[English]	Advanced Mechanical Systems[Advanced Mechanical Systems]				
Schedule number	D51030010	**Subject area**	Advanced Mechanical Engineering	**Required or elective**	Elective
Time of starting a course	Spring 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
Charge teacher name[Roman alphabet mark]	河村 庄造, 足立 忠晴, 竹市 嘉紀 KAWAMURA Shozo, ADACHI Tadaharu, TAKEICHI Yoshinori				
Numbering	MEC_DOC73025				

Objectives of class

The class aims to give advanced knowledge on solid mechanics, vibration engineering or tribology.

Contents of class

Prof. S. Kawamura
From 1st to 5th weeks
Vibration engineering of machines and structures is lectured with current topics. Each student is assigned some examinations, and/or reviewing current papers related to the vibration engineering, and must present them. Practical modeling and simulation of structural vibration are understood through discussion based on the presentations.
Topics: Vibration engineering, Modeling and simulation of dynamic phenomena and so on.

Prof. T. Adachi
From 6th to 10th weeks
Mechanics of solids and structures including materials science is lectured with current topics. Each student is assigned some examinations, and/or reviewing current papers related to the mechanics, and must present them. Practical mechanics and design of engineering materials and mechanical structures are understood through discussion based on the presentations.
Topics: Mechanics of solids and structures, Mechanical properties of materials, Design of mechanical components and so on.

Associate Prof. Y. Takeichi
From 11th to 15th weeks
Fundamentals of tribology including materials science are lectured with current topics. Each student is assigned some examinations, and/or reviewing current papers related to the tribology, and must present them. Practical lubrication engineering and design of sliding mechanical components are understood through discussion based on the presentations.
Topics: Tribology, Lubrication engineering, Surface properties, Wear of materials, Tribological coatings and so on.

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

Fundamental knowledge on solid mechanics, vibration engineering or tribology.

Notes for textbook

Handouts will be prepared

Notes for reference

N/A

Goals to be achieved

get advanced knowledge on solid mechanics, vibration engineering or tribology.

Evaluation of achievement

A comprehensive report(70%) and discussion(30%)
S: Achieved all goals and obtained total points of reports, 90 or higher (out of 100 points).
A: Achieved 80% of goals and obtained total points of reports, 80 or higher (out of 100 points).
B: Achieved 70% of goals and obtained total points of reports, 70 or higher (out of 100 points).
C: Achieved 60% of goals and obtained total points of reports, 60 or higher (out of 100 points).

Examination

その他
Other

Details of examination

N/A

Other information

Tadaharu Adachi: Room D-305, E-mail: adachi@me.tut.ac.jp
Shozo Kawamura: Room D-404, E-Mail: kawamura@me.tut.ac.jp
Yoshinori Takeichi: Room D-304, E-Mail: takeichi@tut.jp

Reference URL

N/A

Office hours

Ask us by E-Mail

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
機械工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner
Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniquesfor problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner

Key words

solid mechanics, vibration engineering, tribology

(D51030030)Advanced Manufacturing Processes[Advanced Manufacturing Processes]

Subject name[English]	Advanced Manufacturing Processes[Advanced Manufacturing Processes]				
Schedule number	D51030030	**Subject area**	Advanced Mechanical Engineering	**Required or elective**	Elective
Time of starting a course	Spring 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
Charge teacher name[Roman alphabet mark]	福本 昌宏, 伊﨑 昌伸, 横山 誠二, 安井 利明 FUKUMOTO Masahiro, IZAKI Masanobu, YOKOYAMA Seiji, YASUI Toshiaki				
Numbering	MEC_DOC74025				

Objectives of class

1. 材料の生産と加工
　本授業は固体物理学、化学熱力学および輸送現象論を含む。コーティングされた材料の機能向上および太陽電池などの創製するため、材料のコーティングプロセスおよびコーティングされた材料の特性について学ぶ。さらに、鋼の製造および高温環境下で鋼を使用するための物理化学を学ぶ。
2. 接合プロセス
　最先端の接合プロセス、および表面改質プロセスの原理および実用技術を学ぶ。本授業は、力学、固体物理学、化学熱力学および移動現象論を網羅している。

1. Production and manufacturing of materials
This subject incorporates the solid state physics, chemical thermodynamics, and transport phenomena.
Students will learn coating process and properties of coated materials to improve performance of materials and to prepare solar cells, and so on. In addition, students will learn physical chemistry to produce steels and to use steels at high temperature.
2. Joining process
Students will learn principle and practical technology of advanced joining process and surface modification process. This subject incorporates the mechanics, solid state physics, chemical thermodynamics, and transport phenomena.

Contents of class

第 1 週:材料の製造と加工1－水溶液の化学熱力学(伊崎)
第 2 週:材料の製造と加工2ー無機薄膜固体の固体物理学(電子論)(伊崎)
第 3 週:材料の製造と加工3ー無機薄膜固体の固体物理学(結晶学)(伊崎)
第 4 週:材料の製造と加工4ー無機薄膜固体の溶液プロセスによる製造と応用(結晶学)(伊崎)
第 5 週:材料の製造と加工5ー蒸発の原理と応用(横山)
第 6 週:材料の製造と加工6ー高温度における冶金反応(横山)
第 7 週:材料の製造と加工7ー鉄鋼製錬プロセス(横山)
第 8 週:材料の製造と加工8ー資源とリサイクル(横山)
第 9 週:接合加工プロセス1－序論(福本)
第 10 週:接合加工プロセス2－粒子分散複合材料の製造プロセスとその原理(福本)
第 11 週:接合加工プロセス3－構造材料の接合プロセス(福本)
第 12 週:接合加工プロセス4－粒子積層膜創製法開発の最前線(福本)
第 13 週:接合加工プロセス5－表面処理プロセス(PVD、CVD)序論(安井)
第 14 週:接合加工プロセス6－PVD、CVD の基本原理(安井)
第 15 週:接合加工プロセス7－PVD、CVD の新展開(安井)
第 16 週:レポート

1st week: Production and manufacturing of materials1 - Chemical thermodynamics for aqueous solution.(Izaki)
2nd week: Production and manufacturing of materials 2 - Solid state physics of inorganic thin solid film (electron theory).(Izaki)
3rd week: Production and manufacturing of materials 3 - Solid state physics of inorganic thin solid film (crystal).(Izaki)
4th week: Production and manufacturing of materials 4 - Preparation and application of inorganic thin solid film with the process of soft solution.(Izaki)

5th week: Production and manufacturing of materials 5 – Fundamentals and application of evaporation .(Yokoyama)
6th week: Production and manufacturing of materials 6 – Metallurgical reaction at high temperature.(Yokoyama)
7th week: Production and manufacturing of materials 7 – Iron and steel-making process.(Yokoyama)
8th week: Production and manufacturing of materials 8 – Resource and recycling.(Yokoyama)
9th week: Joining process 1 – Introduction. (Fukumoto)
10th week: Joining process 2 – Processing and its principle of particle distributed composite. (Fukumoto)
11th week: Joining process 3 – Bulk joining process. (Fukumoto)
12th week: Joining process 4 – Frontier and new development in particle deposition. (Fukumoto)
13th week: Joining process 5 – Introduction of surface process, PVD and CVD. (Yasui)
14th week: Joining process 6 – Fundamental principles of PVD and CVD. (Yasui)
15th week: Joining process 7 – New development of PVD and CVD. (Yasui)
16th week: Writing reports

Self Preparation and Review
授業後の復習、授業前の予習が重要。
Review after every class, and read the text before next class.

Related subjects
接合加工プロセス、表面加工学、材料科学、材料物理化学
Joining process, surface process engineering, materials science, Physical chemistry of materials.

Notes for textbook
資料を配布する。
Text will be distributed.

Reference1	**Book title**	Principles of Extractive Metallurgy			**ISBN**	0470115394
	Author	Rosenqvist	**Publisher**	Tapir Academic Press	**Publish year**	2006
Reference2	**Book title**	Growth and Transport in Nanostructured Materials: The Fundamentals of PVD, CVD and ALD			**ISBN**	3319246704
	Author	Angel Yanguas-Gil	**Publisher**	Springer	**Publish year**	2015
Reference3	**Book title**	Solid State Physics			**ISBN**	0123850304
	Author	Giuseppe Grosso, Giuseppe Pastori Parravicini	**Publisher**	Academic Press	**Publish year**	2013

Notes for reference
N/A

Goals to be achieved
1)結晶構造と電子状態を理解していること。
2)蒸気圧、活量、pH、電位を理解していること。
3)反応の平衡と速度論を理解していること。
4)都市鉱山、リサイクルを理解していること。
5)金属とセラミックスの接合に関する原理と力学を理解していること。
6)薄膜および厚膜の製造プロセスの原理、力学、特性を理解していること。
7)複合材料の機械特性を理解していること。
8)真空技術者や平均自由行程の概念を理解していること。
9)プラズマの発生とその応用を理解していること。
1) To understand crystal structure and electron state.
2) To understand evaporation pressure, activity, pH, electron potential.
3) To comprehend equilibrium and kinetics of reaction.
4) To comprehend urban mine and recycling.
5) To understand principles and mechanics on joining of metals and ceramics.
6) To understand principles, mechanics and characteristics of preparation process of thin and thick coating.
7) To understand mechanical properties of composites.goo
8) To understand vacuum technology and concept of mean free path.
9) To understand plasma generation and its application.

Evaluation of achievement
S:達成目標をすべて達成しており，かつレポートの合計点(100 点満点)が 90 点以上
A:達成目標を○%達成しており，かつレポートの合計点(100 点満点)が 80 点以上
B:達成目標を○%達成しており，かつレポートの合計点(100 点満点)が 70 点以上
C:達成目標を○%達成しており，かつレポートの合計点(100 点満点)が 60 点以上

※ただし，過年度生が履修した場合には，従来（A～C）の評価基準が適用される。
Each instructor will give students assignments. Average score is used for evaluation.

[Evaluation basis] Students who attend all classes will be evaluated as follows:
S: Achieved all goals and obtained total points of reports, 90 or higher (out of 100 points).
A: Achieved all goals and obtained total points of reports, 80 or higher (out of 100 points).
B: Achieved 80 % of goals and obtained total points of reports, 70 or higher (out of 100 points).
C: Achieved 60 % of goals and obtained total points of reports, 60 or higher (out of 100 points).
(The cconventional evaluation standard of (A – C) is applied for a past fiscal year student.)

Examination

レポートで実施
By Report

Details of examination

N/A

Other information

伊﨑昌伸（部屋 D-505,内線 6694,e-mail:m-izaki@me.tut.ac.jp）
横山誠二（部屋 D-507,内線 6696,e-mail:yokoyama@me.tut.ac.jp）
福本昌宏（部屋 D-503,内線 6692,e-mail:fukumoto@tut.jp）
安井利明（部屋 D-601,内線 6703,e-mail:yasui@tut.jp）
Masanobu Izaki (D-505,ext.6694, e-mail:m-izaki@me.tut.ac.jp)
Seiji Yokoyama (D-507, ext.6696, e-mail:yokoyama@me.tut.ac.jp)
Masahiro Fukumoto (D-503, ext.6692, e-mail:fukumoto@tut.jp)
Toshiaki Yasui (D-601, ext.6703,e-mail:yasui@tut.jp)

Reference URL

N/A

Office hours

いつでも可。ただし、事前にメールで連絡すること。
Any time, but inform us your visit by e-mail before your visit.

Relations to attainment objectives of learning and education

材料と加工法の技術開発する広範囲な実践力と能力を養う。

（A）幅広い人間性と考え方
人間社会を地球的な視点から多面的にとらえるグローバルな感性を持ち，人間と自然との共生，公共の福祉について俯瞰的にとらえる能力を身につけている。
（B）技術者・研究者としての正しい倫理観と社会性
高度上級技術者・研究者としての専門的・倫理的責任を有し，社会における技術的課題を発見・設定・解決・評価する能力を身につけている
（C）高度な知識を統合的・発展的に活用できる実践力・創造力
機械工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。
（E）最新の技術や社会環境の変化に対する探究心と持続的学習力
社会，環境，技術等の変化の本質を探求し，生涯にわたって自発的に計画し学習する能力を身につけている。
A broad range of expertise and the ability to carry out technological development in materials and manufacturing.

(A) Personality and outlook with a broad perspective
Have an international mindset to see human society from various angles with a global perspective; and the ability to comprehensively grasp the symbiosis between humans and nature aswell as public welfare
(B) Sound ethics and social awareness as highly advanced-level engineers and researchers
Be conscious of specialized and ethical responsibilities as highly advanced-level engineers and researchers; and have the ability to discover, set,solve and evaluate technical issues in society
(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner
Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniquesfor problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner
(E) Inquisitive outlook and skills for continuous learning in response to state-of-the-art technology and changes in the social environment
Have the skills to investigate the nature of change in society, environment and technology, andvoluntarily make plans and learn throughout one's life

Key words

薄膜、コーティング、蒸発、活量、スプレイ加工、移動現象論、熱力学

thin solid film, coating, evaporation, activity, spray forming, transport phenomena, thermodynamics

(D51030050)Engineering of Intelligent Robotics[Engineering of Intelligent Robotics]

Subject name[English]	Engineering of Intelligent Robotics[Engineering of Intelligent Robotics]				
Schedule number	D51030050	**Subject area**	Advanced Mechanical Engineering	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Thu.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Mechanical Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	佐藤 海二, 三好 孝典, 佐野 滋則 SATO Kaiji, MIYOSHI Takanori, SANO Shigenori				
Numbering	MEC_DOC75025				

Objectives of class

Students will acquire the basic knowledge of mechanisms, actuators, measurement and control methods which are fundamental and useful for intelligent robots by taking this course

Contents of class

The following contents are provided;
1st week: Modeling for control system
2nd week: System identification
3rd week: Validation
4th week:Observer and State Estimation
5th week: Report 1
6th week: Planer Kinematics of robot
7th week: Differential Motion of robot
8th week: Statics of robot
9th week: Dynamics of robot
10th week: Report 2
11th week: Precision Motion Mechanisms – Basic mechanical characteristics
12th week: Precision Motion Mechanisms – Representative actuators
13th week: Precision Motion Mechanisms – Precision positioning system (1)
14th week: Precision Motion Mechanisms – Precision positioning system (2)
15th week: Report 3

Self Preparation and Review

Read the handouts before and after the lecture.

Related subjects

Fundamentals of linear algebra, differential equation, mechanics, measurement and control theory, and robotics.

Notes for textbook

Handouts will be prepared.

Reference1	**Book title**	Introduction to Autonomous Mobile Robots (Intelligent Robotics and Autonomous Agents series)			**ISBN**	
	Author	Roland Siegwart and Illah R. Nourbakhsh	**Publisher**	MIT Press	**Publish year**	2004

Notes for reference

N/A

Goals to be achieved

(1) Understand characteristics of components and their effective use in precision motion mechanisms
(2) Understand the kinematics and dynamics of robot
(3) Understand the basic of system identification

Evaluation of achievement

Report (100 %)

A：Score of the report is 80 or higher.
B：Score of the report is 65 or higher.
C：Score of the report is 55 or higher.

Examination

レポートで実施

By Report

Details of examination

N/A

Other information

Shigenori Sano, D−407, 6677, sano@me.tut.ac.jp
Takanori Miyoshi, D−509, 6698, miyoshi@me.tut.ac.jp
Kaiji Sato, D−408, 6678, sato@me.tut.ac.jp

Reference URL

Basic knowledge on robotics and control are required.

Office hours

Contact the professors by e−mail first.

Relations to attainment objectives of learning and education

（C）高度な知識を統合的・発展的に活用できる実践力・創造力
機械工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner
Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniquesfor problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner

Key words

Robot, Control, Sensor, Actuator, Mechanism, Mechanical system

(D51030070)Advanced Energy Engineering[Advanced Energy Engineering]

Subject name[English]	Advanced Energy Engineering[Advanced Energy Engineering]				
Schedule number	D51030070	**Subject area**	Advanced Mechanical Engineering	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Fri.4～4	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Mechanical Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	鈴木 孝司, 中村 祐二 SUZUKI Takashi, NAKAMURA Yuji				
Numbering	MEC_DOC76025				

Objectives of class

The aim of the present lecture is to understand the basic equation governed by the reactive thermo-fluid system (known as "complex" physics), and how to simplify to predict the phenomena.

Contents of class

*Introduction : (2 weeks)
Classification of reactive thermo-fluid system
Analytical concept for multi-phase fluid system
Introduction of basic equation
Ways to a simplification
*Fundamental theory for Non-reacting, multi-phase flow system (4 week)
Physics on surface boundary
Instability analysis
Optical method for visualization
Dynamic behavior of droplets (break up, merging etc)
*Chemical reaction -reactive system without transport effect- (2 weeks)
Overview of fundamental idea of chemical reaction
equilibrium state
reaction rate expression, reaction model (simplified)
*Ignition theory -chemical system with simplified transport effect- (1 weeks)
Frank-Kamenetskii' s theory
*Premixed flame theory -chemical system with transport effect (1); chemical-controlled- (2 weeks)
Rankine-Hugoniot equation
Premixed flame structure (asymptotic analysis)
*Diffusion flame theory -chemical system with transport effect (2); transport-controlled- (2 weeks)
Mixture fraction analysis
Burke-Schumann flame theory
*Combustion modeling : (2 weeks)
Prediction of regression rate of solid propellant
Fire modeling
*Final Exam (1 week)

Self Preparation and Review

Students MUST be pre-studied the related area, especially for applied mathematics, fluid dynamics and thermodynamics (advance level is strongly preferred).

Related subjects

Applied mathematics, fluid dynamics, thermodynamics for advanced level.
Basic combustion (preferred)

Notes for textbook

Instructors will provide the materials, if necessary.

Reference1	**Book title**	The Molecular Theory of Gases and Liquids			**ISBN**	
	Author	J.O. Hirschfelder, C.F. Curtiss, R.B. Bird	**Publisher**	John Wiley and Sons	**Publish year**	1954
Reference2	**Book title**	Combustion Physics			**ISBN**	
	Author	C.K. Law	**Publisher**	Cambridge	**Publish year**	2006

				University Press		
Reference3	**Book title**	Combustion Theory			**ISBN**	
	Author	F.A. Williams	**Publisher**	Addison-Wesley	**Publish year**	1985

Notes for reference

[additional references]

- Fundamentals of Fire Phenomena／J.G. Quintiere：John Wiley and Sons, 2009
- Fundamental Aspects of Combustion／A. Linan & F.A. Williams：Oxford Univ. Press, 1993
- Combustion Analysis (in Japanese)／T. Niioka：Tohoku Univ. Press, 2003
- any textbook for applied math book dealing with asymptotic analysis (purturbation theory) is good to have in your hand

Goals to be achieved

The goal is to understand the combustion theory; learn one of effective ways to simplify the complex (multi-scale, multi-physics) problem.

Evaluation of achievement

50%: assignments (several assignments are requested during the term), 50%: final exam (or final report).

[Evaluation basis]

Students who attend all classes will be evaluated as follows:

S: Achieved all goals and obtained total points of exam and reports, 90 or higher (out of 100 points).

A: Achieved 80 % goals and obtained total points of exam and reports, 80 or higher (out of 100 points).

B: Achieved 70 % of goals and obtained total points of exam and reports, 70 or higher (out of 100 points).

C: Achieved 60 % of goals and obtained total points of exam and reports, 60 or higher (out of 100 points).

Examination

レポートで実施

By Report

Details of examination

Final exam will be replaced by final report.

Detail will be announced in the class.

Other information

M/A

Reference URL

Office hours

Anytime when instructor is available: send mail to instructor to book your time for personal meeting

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力

機械工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，

課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and progressive manner

Have advanced knowledge about mechanical engineering and related fields, and have ability to create and practice original techniquesfor problem solving by acquiring the research and development methodology that combines such knowledge in an extensive and organic manner

Key words

Reactive thermo-fluid analysis, Multi-scale and multi-physics problem

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

Subject name[English]	Seminar on Electrical and Electronic Information Engineering 2[Seminar on Electrical and Electronic Information Engineering 2]				
Schedule number	D52010020	**Subject area**	Advanced Electrical and Electronic Information Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	4
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Electrical and Electronic Information Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering	ELC_DOC71015				

Objectives of class

The seminar aims to provide a broad understanding of theoretical and experimental 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.
Grades: S: 90-100, A:80-89, B:70-79, C:60-69

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

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about electrical and electronic information engineering as well as related fields; have the practical and creative skills to utilize such knowledge for problem solving in an integrated manner

(D) Communication skills for global success
Have the communication skills to effectively express one's own ideas and results while working on issues faced by a globally changing society in cooperation with other team members
(E) Inquisitive mind and continuous learning skill for changes in the state-of-the-art technology and in the social environment
Have the skills to voluntarily make plans and learn throughout one's life in response to changes in society, environment and technology

Key words

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

Subject name[English]	Seminar on Electrical and Electronic Information Engineering 3[Seminar on Electrical and Electronic Information Engineering 3]				
Schedule number	D52010030	**Subject area**	Advanced Electrical and Electronic Information Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	2～
Department Offered	Electrical and Electronic Information Engineering			**Beggining grade**	D2
Charge teacher name[Roman alphabet mark]	S2系教務委員 2kei kyomu Iin-S				
Numbering	ELC_DOC71015				

Objectives of class

The seminar aims to provide a broad understanding of theoretical and experimental 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.
Grades: S: 90-100, A:80-89, B:70-79, C:60-69

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

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about electrical and electronic information engineering as well as related fields; have the practical and creative skills to utilize such knowledge for problem solving in an integrated manner

(D) Communication skills for global success
Have the communication skills to effectively express one's own ideas and results while working on issues faced by a globally changing society in cooperation with other team members
(E) Inquisitive mind and continuous learning skill for changes in the state-of-the-art technology and in the social environment
Have the skills to voluntarily make plans and learn throughout one's life in response to changes in society, environment and technology

Key words

(D52030040)Advanced Electrical Systems 2[Advanced Electrical Systems 2]

Subject name[English]	Advanced Electrical Systems 2[Advanced Electrical Systems 2]				
Schedule number	D52030040	**Subject area**	Advanced Electrical and Electronic Information Engineering	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Wed.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Electrical and Electronic Information Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	未定, 稲田 亮史, 村上 義信 To be assigned, INADA Ryoji, MURAKAMI Yoshinobu				
Numbering	ELC_DOC73025				

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 subcourses 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 subcourses to choose from.

Contents of class

Subcourse 1
1. Introduction of carbon nanomaterials and their relationship to electrical engineering
2. Mechanical property of carbon nanomaterials
3. Electrical property of carbon nanomaterials
4. Application of carbon nanomaterials to energy devices
5. Application of carbon nanomaterials to power electronics

Subcourse 2 (R. Inada)
1. Introduction of Electrochemical Energy Conversion Devices
2. Fundamentals of Electrochemical Energy Conversion Devices
3. Lithium-Ion Secondary Batteries (1)
4. Lithium-Ion Secondary Batteries (2)
5. Recent Trend in Electrochemical Energy Conversion Devices

Subcourse 3 (Yo. Murakami)
1. Introduction of Electric Energy Systems (1 week)
2. High Voltage Engineering and Electrical Insulation (2 weeks)
3. Fundamental Properties of Dielectrics and Electrical Insulating Materials(2 weeks)

Subcourse 1
1. Introduction of carbon nanomaterials and their relationship to electrical engineering
2. Mechanical property of carbon nanomaterials
3. Electrical property of carbon nanomaterials
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Subcourse 2 (R. Inada)
1. Introduction of Electrochemical Energy Conversion Devices
2. Fundamentals of Electrochemical Energy Conversion Devices
3. Lithium-Ion Secondary Batteries (1)
4. Lithium-Ion Secondary Batteries (2)
5. Recent Trend in Electrochemical Energy Conversion Devices

Subcourse 3 (Yo. Murakami)
1. Introduction of Electric Energy Systems (1 week)
2. High Voltage Engineering and Electrical Insulation (2 weeks)
3. Fundamental Properties of Dielectrics and Electrical Insulating Materials(2 weeks)

Self Preparation and Review

Materials to be used in the lecture will be distributed from the lecturer before starting each subcourse. The lecturers will give a lecture on the premise that all the students have prepared this material before the lecture begins. It may not be possible to attend a lecture if you do not prepare materials.
Materials to be used in the lecture will be distributed from the lecturer before starting each subcourse. The lecturers will give a lecture on the premise that all the students have prepared this material before the lecture begins. It may not be possible to attend a lecture if you do not prepare materials.

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.
Materials will be prepared by the lecturer.

Reference1	**Book title**	Fuel Cell Systems Explained			**ISBN**	
	Author	J. Larminie and A. Dicks	**Publisher**	Wiley	**Publish year**	
Reference2	**Book title**	Lithium Ion Batteries: Science and Technologies			**ISBN**	
	Author	M. Yoshio, R.J. Brodd and A. Kozawa	**Publisher**	Springer-Verlag	**Publish year**	
Reference3	**Book title**	High Voltage Engineering			**ISBN**	
	Author	E. Kuffel, W. Zaengel and J. Kuffel	**Publisher**	Newnes	**Publish year**	

Notes for reference

N/A

Goals to be achieved

Evaluation of achievement

In final exams we will ask questions on the contents of all subcourses. We evaluate the results only based on the final exam scores. The result is evaluated in the following five stages.
S: If the score of the final exam is 90 points or more
A: If the score of the final exam is 80 points or more
B: If the score of the final exam is 70 points or more
C: If the score of the final exam is 60 points or more
D: If the score of the final exam is less than 60 points
In final exams we will ask questions on the contents of all subcourses. We evaluate the results only based on the final exam scores. The result is evaluated in the following five stages.
S: If the score of the final exam is 90 points or more
A: If the score of the final exam is 80 points or more
B: If the score of the final exam is 70 points or more
C: If the score of the final exam is 60 points or more
D: If the score of the final exam is less than 60 points

Examination

定期試験を実施（対面）
Examination(Face to Face)

Details of examination

In order to obtain good results in final exams, we will also conduct a small test at any time while each subcourse is offered. Therefore, it is desirable to prepare lecture materials beforehand and attend all the lectures.
In order to obtain good results in final exams, we will also conduct a small test at any time while each subcourse is offered. Therefore, it is desirable to prepare lecture materials beforehand and attend all the lectures.

Other information

N/A

Reference URL

N/A

Office hours

We do not have an office hour, so contact first by e-mail.

We do not have an office hour, so contact first by e-mail.

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
電気・電子情報工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，課題解決のための独創的な技術を創造し，実践できる
能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about electrical and electronic information engineering as well as related fields; have the practical and creative skills toutilize such knowledge for problem solving in an integrated manner

Key words

(D52030050)Advanced Microelectronics 1[Advanced Microelectronics 1]

Subject name[English]	Advanced Microelectronics 1[Advanced Microelectronics 1]				
Schedule number	D52030050	**Subject area**	Advanced Electrical and Electronic Information Engineering	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Wed.1～1	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Electrical and Electronic Information Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	澤田　和明, 石川　靖彦, 関口　寛人, 髙橋　一浩 SAWADA Kazuaki, ISHIKAWA Yasuhiko, SEKIGUCHI Hiroto, TAKAHASHI Kazuhiro				
Numbering	ELC_DOC74025				

Objectives of class

From the viewpoint of deep understanding of advanced microelectronics, physics of semiconductors including material design and an example of latest device will be lectured.

From the viewpoint of deep understanding of advanced microelectronics, physics of semiconductors including material design and an example of latest device will be lectured.

Contents of class

a) Physics and Properties of Semiconductors
  Crystal growth and device processing
  Energy band engineering
    Alloy semiconductor
    Strain effect
    Superlattice
  Carrier transport phenomena
    Tummeling effect
b)Metal-Semiconductor Contacts
  Schottky barrier
  Current transport processes
  Ohmic contact

c) Integrated circuits
  device processing
  MEMS/NEMS
  Latest MOS FETs
  Current topics in IC/MEMS

a) Physics and Properties of Semiconductors
  Crystal growth and device processing
  Energy band engineering
    Alloy semiconductor
    Strain effect
    Superlattice
  Carrier transport phenomena
    Tummeling effect
b)Metal-Semiconductor Contacts
  Schottky barrier
  Current transport processes
  Ohmic contact

c) Integrated circuits
  device processing
  MEMS/NEMS
  Latest MOS FETs
  Current topics in IC/MEMS

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

The basic knowledge on the quantum mechanics, thermodynamics, and electronics are desirable.

Semiconductor Physics, Master course
The basic knowledge on the quantum mechanics, thermodynamics, and electronics are desirable.

Semiconductor Physics, Master course

Notes for textbook

Physics of Semiconducotr Devices
S.M.Sze, Willy
Physics of Semiconducotr Devices
S.M.Sze, Willy

Notes for reference

N/A

Goals to be achieved

(1) To understand fundamental aspects on microelectronics, and physics of semiconductors including material design.
(2) To get the knowledge on the latest technologies on microelectronics.
(1) To understand fundamental aspects on microelectronics, and physics of semiconductors including material design.
(2) To get the knowledge on the latest technologies on microelectronics.

Evaluation of achievement

Reports (100%)
Reports (100%)

Examination

レポートで実施
By Report

Details of examination

N/A

Other information

K. Sawada (C-605)
sawada@ee.tut.ac.jp
ext. 6739
Y. Ishikawa (C-607)
ishikawa@ee.tut.ac.jp
ext. 6741
H. Sekiguchi (C-610)
sekiguchi@ee.tut.ac.jp
ext. 6744
K. Takahashi (C-606)
takahashi@ee.tut.ac.jp
ext. 6740
K. Sawada (C-605)
sawada@ee.tut.ac.jp
ext. 6739
Y. Ishikawa (C-607)
ishikawa@ee.tut.ac.jp
ext. 6741
H. Sekiguchi (C-610)
sekiguchi@ee.tut.ac.jp
ext. 6744
K. Takahashi (C-606)
takahashi@ee.tut.ac.jp
ext. 6740

Reference URL

http://www.tut.ac.jp/english/introduction/02EE.pdf
(department)

http://www.int.ee.tut.ac.jp/
(devision)

http://www.tut.ac.jp/english/research/research_highlights.html
(research activities)
http://www.tut.ac.jp/english/introduction/02EE.pdf

(department)

http://www.int.ee.tut.ac.jp/
(devision)

http://www.tut.ac.jp/english/research/research_highlights.html
(research activities)

Office hours

book an apopintment by e-mail, phone, etc.
book an apopintment by e-mail, phone, etc.

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
電気・電子情報工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，課題解決のための独創的な技術を創造し，実践できる
能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about electrical and electronic information engineering as well as related fields; have the practical and creative skills toutilize such knowledge for problem solving in an integrated manner

Key words

(D52030070)Advanced Information and Communication Systems 1[Advanced Information and Communication Systems 1]

Subject name[English]	Advanced Information and Communication Systems 1[Advanced Information and Communication Systems 1]				
Schedule number	D52030070	**Subject area**	Advanced Electrical and Electronic Information Engineering	**Required or elective**	Elective
Time of starting a course	Spring 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
Charge teacher name[Roman alphabet mark]	大平 孝, 上原 秀幸, 竹内 啓悟 OHIRA Takashi, UEHARA Hideyuki, TAKEUCHI Keigo				
Numbering	ELC_DOC75025				

Objectives of class

Students select one course from the following three courses:
A first course is intended for learning how to design microwave circuits needed for advanced wireless communication systems and wireless power transmission systems. The distributed constant element theory is addressed to characterize linear circuits at high frequencies. Based on this technique, students challenge synthesis of a variety of microwave signal and power processing functions.
A second course is intended for learning mainly medium access control, multi-hop communications and other topics related to wireless networks. Students are required to give solutions of the problems which cause performance degradation.
The last course is intended for learning point-to-point communication systems, multiuser communication systems, and multiple-input multiple-output (MIMO) systems in the physical layer of wireless communications. Students challenge a unified understanding of existing advanced schemes in wireless communications.

Contents of class

Course 1 provided by Prof. Ohira:
1. Transmission lines
2. Scattering matrix
3. Mizuhashi Smith chart

Course 2 provided by Prof. Uehara:
1. Medium access control protocols
2. Multi-hop communications
3. Ad hoc and sensor networks

Course 3 provided by Prof. Takeuchi:
1. Point-to-point communication systems
2. Multiuser communication systems
3. MIMO systems

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the black board.

Related subjects

The students who register for this lecture must have studied the Information and Communication Technology 1 and 2 (Ohira, Uehara, & Takeuchi) in master course program, or its equivalent. All courses taken at other universities must be approved by the professors before registering for this course.

Prerequisite of Course 1:
Deep understanding on electromagnetic field theory, linear passive and reciprocal circuit theory, and sophisticated experience on complex and matrix mathematics.

Prerequisite of Course 2:
Sufficient knowledge about the following; wireless digital modulation and demodulation, radio propagation characteristic, signal processing, probability, random variables and stochastic process.

Prerequisite of Course 3:
Deep understanding on modulation/demodulation, signal processing, probability theory, and information theory is prerequisite. In

particular, sufficient knowledge about probability theory is required.

Notes for textbook

Course 1: Lecture on the blackboard without resorting to textbooks.

Course 2: Instruct in 1st class.

Course 3: Same as Course 2.

Notes for reference

N/A

Goals to be achieved

Course 1:
- Understand the distributed constant elements and concept of scattering matrix.
- Derive frequency responses on linear RF circuits exploiting Mizuhashi Smith chart.
- Characterize various kinds of high frequency functional circuits and compose them based upon given specifications.

Course 2:
- Understand the mechanism of medium access control and multi-hop communications
- Understand the characteristics of ad hoc and sensor networks
- Present a solution or a new application for the above

Course 3:
- Understand the concept of detection, diversity, and channel uncertainty in point-to-point communication systems.
- Understand resource allocation and interference management in multiuser communication systems.
- Understand statistical channel models and basic multiuser detection schemes in MIMO systems.

Evaluation of achievement

Course 1: Marks are based on the final test.

Course 2: Marks are based on reports and presentations.

Course 3: Marks are based on reports and tests.

Examination

定期試験を実施（対面）
Examination(Face to Face)

Details of examination

N/A

Other information

For e-mail address information, visit http://www.comm.ee.tut.ac.jp/

Reference URL

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

Office hours

Appoint a time slot via email

Relations to attainment objectives of learning and education

（C）高度な知識を統合的・発展的に活用できる実践力・創造力
電気・電子情報工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，課題解決のための独創的な技術を創造し，実践できる
能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about electrical and electronic information engineering as well as related fields; have the practical and creative skills toutilize such knowledge for problem solving in an integrated manner

Key words

microwave, circuit, electromagnetic field, Smith chart, scattering matrix, distributed constant element, wireless networks, medium access control, multi-hop, wireless communications, modulation/demodulation, MIMO

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

Subject name[English]	Seminar on Computer Science and Engineering 1[Seminar on Computer Science and Engineering 1]				
Schedule number	D53010010	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	4
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	S3系教務委員 3kei kyomu Iin-S				
Numbering	CMP_DOC71015				

Objectives of class

各研究室が指定する情報学に関する最先端の技術情報(特に英語による最先端の技術情報)を発見する能力、ならびに、その技術情報を理解、説明、質疑・応答できる能力を養う。

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

教員が指定する最先端の技術情報(特に英語による最先端の技術情報)について理解したところを説明する。

教員は技術情報の内容の発見、理解、説明、質疑・応答する方法について直接指導を行う。

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

教員が指定する内容に関し、予習・復習を行う。

Consult with your advisor.

Related subjects

指導教員に問い合わせること。

Consult with your advisor.

Notes for textbook

指導教員に問い合わせること。

Consult with your advisor.

Notes for reference

Goals to be achieved

(1)最先端の専門分野の英文が理解でき、わかりやすく説明できる。

(2)技術的な情報を扱う英文が解釈でき、作文できる。

(3)論文の標準的な構成ができる。

(4)発表というスタイルでの情報提供ができる。

(5)情報の不足を質問という形式で指摘できる。

(1) To understand English literature on state-of-the-art areas of expertise, and to explain clearly.

(2) To interpret technical information written in English, and to write such information in English.

(3) To make a standard construction of a technical paper.

(4) To provide information by oral presentation.

(5) To point out the lack of information by questions.

Evaluation of achievement

技術情報の発見に向けた自主性、技術情報の理解度、説明の方法、質問への回答、議論への参加の様子等から総合的に指導教員が判定する。

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

Examination

試験期間中には何も行わない

None during exam period

Details of examination

課題レポートやプレゼンテーションに基づいて評価する。

Your supervisor will evaluate your presentation and your reports.

Other information

Reference URL

Office hours

指導教員に問い合わせること。

Consult with your advisor.

Relations to attainment objectives of learning and education

Key words

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

Subject name[English]	Seminar on Computer Science and Engineering 2[Seminar on Computer Science and Engineering 2]				
Schedule number	D53010020	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	2～
Department Offered	Computer Science and Engineering			**Beggining grade**	D2
Charge teacher name[Roman alphabet mark]	S3系教務委員 3kei kyomu Iin-S				
Numbering	CMP_DOC71015				

Objectives of class

各研究室が指定する情報学に関する最先端の技術情報(特に英語による最先端の技術情報)を発見する能力、ならびに、その技術情報を理解、説明、質疑・応答できる能力を養う。

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

教員が指定する最先端の技術情報(特に英語による最先端の技術情報)について理解したところを説明する。

教員は技術情報の内容の発見、理解、説明、質疑・応答する方法について直接指導を行う。

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

教員が指定する内容に関し、予習・復習を行う。

Consult with your advisor.

Related subjects

指導教員に問い合わせること。

Consult with your advisor.

Notes for textbook

指導教員に問い合わせること。

Consult with your advisor.

Notes for reference

Goals to be achieved

(1)最先端の専門分野の英文が理解でき、わかりやすく説明できる。

(2)技術的な情報を扱う英文が解釈でき、作文できる。

(3)論文の標準的な構成ができる。

(4)発表というスタイルでの情報提供ができる。

(5)情報の不足を質問という形式で指摘できる。

(1) To understand English literature on state-of-the-art areas of expertise, and to explain clearly.

(2) To interpret technical information written in English, and to write such information in English.

(3) To make a standard construction of a technical paper.

(4) To provide information by oral presentation.

(5) To point out the lack of information by questions.

Evaluation of achievement

技術情報の発見に向けた自主性、技術情報の理解度、説明の方法、質問への回答、議論への参加の様子等から総合的に指導教員が判定する。

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

Examination

試験期間中には何も行わない

None during exam period

Details of examination

課題レポートやプレゼンテーションに基づいて評価する。

Your supervisor will evaluate your presentation and your reports.

Other information

Reference URL

Office hours

指導教員に問い合わせること。

Consult with your advisor.

Relations to attainment objectives of learning and education

Key words

(D53030150)Web Data Engineering, Advanced 1[Web Data Engineering, Advanced 1]

Subject name[English]	Web Data Engineering, Advanced 1[Web Data Engineering, Advanced 1]				
Schedule number	D53030150	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Elective
Time of starting a course	Spring1 term	**Day of the week,period**	Mon.1～1	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	青野 雅樹 AONO Masaki				
Numbering	CMP_DOC72425				

Objectives of class

インターネット、すなわち Web 上には、大量のデータが日々作成・蓄積・更新されている。この中から有用なデータを検索し、抽出する Web アプリケーション技術や、複数の Web アプリケーション間でデータをやりとりする技術も重要になってきている。特に、このようなビッグデータをどう表現するかも、アプリケーションをカスケードする場合、必須である。
本講義では、Web 上やデータファイルにあるテキストだけでなく、画像、動画、3D モデルなど様々なメディアに対するデータ表現技術、特徴量抽出技術、次元削減を含むインデクシング、テキストマイニング、データマイニング、自然言語処理、情報検索技術、回帰・分類・クラスタリングに代表される統計的機械学習、リンク解析に代表される Web マイニング技術、ならびに深層学習技術に焦点を当て、最新のデータサイエンス技術を講述する。

Day by day, a massive amount of data has been generated, accumulated, and updated on the Internet, where data include texts, images, sounds, movies, 2D/3D shapes, numeric values, and their composites. Extracting important pieces of information is crucial in many Closed/Open Web applications. The objectives of this lecture is to demonstrate the state-of-the art technologies in data science ranging from data representation, data mining, text mining, natural language processing, information retrieval, information extraction, machine learning (including both unsupervised and supervised learning with/without deep learning frameworks), based on fundamental data science technologies.

Contents of class

(1)はじめに(データ表現を含むデータ科学の基礎)
(2)統計と基礎機械学習技術
(3)情報検索(検索、類似性、言語モデル、次元削減、評価)
(4)Web リンク解析とコンテンツマイニングを含む Web マイニング
(5)教師なし学習(クラスタリング)、評価
(6)教師あり学習(回帰、分類)、評価
(7)マルチメディアの特徴抽出、検索、分類、ディープラーニング入門
(8)最終試験
(1) Introduction (Basics of Data Science including Data Representation)
(2) Statistics and Basic Machine Learning Technologies
(3) Information Retrieval (Search, Similarity, Language Model, Dimensional Reduction, Evaluations)
(4) Web Mining including Web Link Analysis and Content Mining
(5) Unsupervised Learning (Clustering), Evaluations
(6) Supervised Learning (Regression, Classification), Evaluations
(7) Multimedia Feature Extraction, Search, Classification, and Introduction to Deep Learning
(8) Final Exam

Self Preparation and Review

基本的なデータマイニング技術(主成分分析・判別分析・回帰分析、クラスタリング)に関しては、各自、予習・復習をしておくこと。特に、授業の補助用 Web ページで、Python (Jupyter notebook) を使った自習教材を準備するので、慣れておくことが好ましい。
It is desirable to self-study as well as to review fundamental data mining techniques such as clustering, classification, and regression. It should be noted that the knowledge on machine learning and multivariate analysis techniques such as principal component analysis is a prerequisite to this class. It is recommended installing Python into your computer, because some of the lecture materials are assumed the knowledge of Python.

Related subjects

特になし
N/A

Notes for textbook

授業の資料は、http://www.kde.cs.tut.ac.jp/~aono/myLecture.html で公開する。

Materials for this class will be availlable at http://www.kde.cs.tut.ac.jp/~aono/myLecture.html.

Reference1	**Book title**	Information Retrieval, Implementing and Evaluating Search Engines			**ISBN**	978-0-262-02651-2
	Author	Stefan Buttcher, Charles L.A. Clarke, Gordon V. Cormack	**Publisher**	MIT Press	**Publish year**	2010
Reference2	**Book title**	Data Mining and Analysis			**ISBN**	978-0-521-76633-3
	Author	Mohammed J. Zaki, Wagner Meira Jr.	**Publisher**	Cambridge University Press	**Publish year**	2014
Reference3	**Book title**	Data Mining Practical Machine Learning Tools and Techniques, Third Edition			**ISBN**	978-0-12-374856-0
	Author	Ian H. Witten, Eibe Frank, and Mark A. Hall	**Publisher**	Morgan Kaufmann	**Publish year**	2011
Reference4	**Book title**	Python Machine Learning			**ISBN**	978-1-78355-513-0
	Author	Sebastian Raschka	**Publisher**	PACKT Publishing	**Publish year**	2016

Notes for reference

参考書 5

書名「Modern Information Retrieval, the concepts and technology behind search, Second Edition」
著者名：Ricardo Baeza-Yates, Bertier Ribeiro-Neto
出版社：Addison Wesley
ISBN：978-0-321-41691-9
出版年：2011

参考書 6

書名「Google's PageRank and Beyond」
著者名：Amy N. Langville, Carl D. Meyer
出版社：Princeton University Press
ISBN：978-0-691-12202-1
出版年：2006

Reference #5

Title:「Modern Information Retrieval, the concepts and technology behind search, Second Edition」
Authors:Ricardo Baeza-Yates, Bertier Ribeiro-Neto
Publisher：Addison Wesley
ISBN：978-0-321-41691-9
Year：2011

Reference #6

Title:「Google's PageRank and Beyond」
Authors：Amy N. Langville, Carl D. Meyer
Publisher：Princeton University Press
ISBN：978-0-691-12202-1
Year：2006

Goals to be achieved

（1）データサイエンス・データマイニング（データ表現、主成分分析に代表される多変量解析）の基礎技術が理解できること
（2）情報検索（自然言語処理、文書検索・メディア検索、類似度、ランキング）の基礎技術が理解できること
（3）機械学習（分類、回帰分析、クラスタリング）ならびに深層学習の基礎技術が理解できること
（4）リンク解析、Web マイニング解析、時系列データ解析等の基礎技術が理解できること

The following items have to be achieved:

1. Able to implement and apply fundamental data science (mining) technologies.
2. Able to understand fundamental technologies of information retrieval such as natural language processing, search performance measures, feature extraction, and ranking methods such as language model

3. Able to understand basics of machine learning (classification, regression, clustering) and deep learning
4. Able to understand basics of Web link analysis, Wen content mining, Time series data mining

Evaluation of achievement

原則として、すべての授業に出席したものにつき、下記のように成績を評価する。

定期試験 80 点、課題 20 点の合計で評価する。

S: 90 点以上、A: 80 点以上, B: 70 点以上, C: 60 点以上
In principle, for those who have attended all the classes, the credit will be given as follows:

Assignment (20%) and Final exam (80%)

S: (>=90), A: (>=80), B: (>=70), C: (>= 60)

Examination

定期試験を実施（対面）
Examination(Face to Face)

Details of examination

特になし
N/A

Other information

C-511、TEL: 6764, Email: aono@tut.jp

Masaki Aono (C-511) aono@tut.jp

Reference URL

http://www.kde.cs.tut.ac.jp/~aono/myLecture.html

http://www.kde.cs.tut.ac.jp/~aono/myLecture.html

Office hours

事前に aono@tut.jp まで電子メールで予約をとること。
It is recommended that prior email appointment is preferable.

Relations to attainment objectives of learning and education

（C）高度な知識を統合的・発展的に活用できる実践力・創造力
情報・知能工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about computer science and engineering as well as related fields; and have the practical and creative skills to utilize suchknowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

Key words

データ・テキストマイニング、情報検索、特徴量抽出、機械学習、深層学習
data and text mining, information retrieval, feature extraction, machine learning, deep learning

(D53030230)Advanced Statistical Natural Language Processing[Advanced Statistical Natural Language Processing]

Subject name[English]	Advanced Statistical Natural Language Processing[Advanced Statistical Natural Language Processing]				
Schedule number	D53030230	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Elective
Time of starting a course	Spring1 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
Charge teacher name[Roman alphabet mark]	秋葉 友良 AKIBA Tomoyoshi				
Numbering	CMP_DOC72525				

Objectives of class

Important topics on statistical natural language processing will be discussed by focusing on statistical machine translation.

Contents of class

Week 1: Introduction
Week 2: Basic of Probability and Statistics
Week 3: Language Models
Week 4: Translation Models
Week 5: Parameter Estimation
Week 6: EM Algorithm
Week 7: Advanced methods in SMT

Self Preparation and Review

Participants are required to construct a machine translation system according to our detailed instruction text.

Related subjects

Information theory, Formal language theory

Notes for textbook

Resumes will be provided, which are based on:
・Kevin Knight
A Statistical MT Tutorial Workbook
・Seiichi Nakagawa et al.
Spoken Language Processing and Natural Language Processing

Reference1	**Book title**	Statistical Machine Translation			**ISBN**	978-0521874151
	Author	Philipp Koehn	**Publisher**	Cambridge University Press	**Publish year**	2010
Reference2	**Book title**	A Statistical MT Tutorial Workbook			**ISBN**	
	Author	Kevin Knight	**Publisher**		**Publish year**	

Notes for reference

N/A

Goals to be achieved

Basics: Understand the basic concepts of natural language processing
Natural Language Processing: Understand the role of language resources, language and translation models, word alignments, and parameter estimation methods,
Applications: Understand statistical machine translation system.

Evaluation of achievement

Marks are based on reports (100%).

Examination

レポートで実施
By Report

Details of examination

N/A

Other information

Tomoyosi Akiba: C-505, 44-6758, akiba@cs.tut.ac.jp

Reference URL

http://www.cl.ics.tut.ac.jp/~akiba/

Office hours

16:25-17:40, Tuesday and Wednesday

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
情報・知能工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about computer science and engineering as well as related fields; and have the practical and creative skills to utilize suchknowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

Key words

spoken language processing, natural language processing, human language technology

(D53030330)Information Security, Advanced[Information Security, Advanced]

Subject name[English]	Information Security, Advanced[Information Security, Advanced]				
Schedule number	D53030330	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Elective
Time of starting a course	Spring2 term	**Day of the week,period**	Wed.4～4	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	鈴木　幸太郎 SUZUKI Koutarou				
Numbering	CMP_DOC72025				

Objectives of class

情報セキュリティとくに暗号理論について基本的な内容を理解すること

To understand basic topics of information security especially cryptology.

Contents of class

1. 情報セキュリティと暗号理論の概要
2. 公開鍵暗号と証明可能安全性
3. RSA 問題に基づく暗号と署名
4. 離散対数問題に基づく暗号と署名
5. 楕円曲線に基づく暗号と署名
6. より進んだ話題

1. overview of information security and cryptology
2. public key cryptography and provable security
3. encryption and signature schemes based on RSA problem
4. encryption and signature schemes based on discrete logarithm problem
5. encryption and signature schemes based on elliptic curve
6. advanced topics

Self Preparation and Review

毎回講義内容を復習するとともに，次週の内容についてテキスト等を参考に予習してくること。

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

特になし

N/A

Notes for textbook

講義でレジュメを配付します。

Papers(resume)will be distributed.

Notes for reference

・現代暗号への招待、黒澤、サイエンス社、暗号理論について読みやすく書かれている。
・公開鍵暗号の数理、森山ほか、共立出版、公開鍵暗号系について詳しく書かれている。
・クラウドを支えるこれからの暗号技術、光成、秀和システム、暗号に必要な数学について詳しく書かれている。
下記に公開版がある。
https://herumi.github.io/ango/
The followings are open textbooks of cryptology.
https://www.cs.umd.edu/~waa/414-F11/IntroToCrypto.pdf
https://crypto.stanford.edu/~dabo/cryptobook/

Goals to be achieved

情報セキュリティとくに暗号理論について基本的な内容を理解すること

To understand basic topics of information security especially cryptology.

Evaluation of achievement

レポートに基づき評価する
評価基準は下記のとおり
5 段階評価
S: 達成目標を 90%達成しており、かつレポートの合計点（100 点満点）が 90 点以上
A: 達成目標を 80%達成しており、かつレポートの合計点（100 点満点）が 80 点以上
B: 達成目標を 70%達成しており、かつレポートの合計点（100 点満点）が 70 点以上

C: 達成目標を 60%達成しており、かつレポートの合計点（100 点満点）が 60 点以上
4 段階評価
A: 達成目標を 80%達成しており、かつレポートの合計点（100 点満点）が 80 点以上
B: 達成目標を 65%達成しており、かつレポートの合計点（100 点満点）が 65 点以上
C: 達成目標を 55%達成しており、かつレポートの合計点（100 点満点）が 55 点以上
Evaluation is based on reports.
Evaluation criteria is as follows.
5-grade evaluation:
S: Achieved at least 90% of goals and obtained total points of reports, 90 or high (out of 100 points)
A: Achieved at least 80% of goals and obtained total points of reports, 80 or high (out of 100 points)
B: Achieved at least 70% of goals and obtained total points of reports, 70 or high (out of 100 points)
C: Achieved at least 60% of goals and obtained total points of reports, 60 or high (out of 100 points)
4-grade evaluation:
A: Achieved at least 80% of goals and obtained total points of reports, 80 or high (out of 100 points)
B: Achieved at least 65% of goals and obtained total points of reports, 65 or high (out of 100 points)
C: Achieved at least 55% of goals and obtained total points of reports, 55 or high (out of 100 points)

Examination
試験期間中には何も行わない
None during exam period

Details of examination
特になし
N/A

Other information
特になし
N/A

Reference URL
特になし
N/A

Office hours
授業終了後
After each class.

Relations to attainment objectives of learning and education

（C）高度な知識を統合的・発展的に活用できる実践力・創造力
情報・知能工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about computer science and engineering as well as related fields; and have the practical and creative skills to utilize suchknowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

Key words
情報セキュリティ
information security

(D53030340)Advanced Auditory System and Sound Perception[Advanced Auditory System and Sound Perception]

Subject name[English]	Advanced Auditory System and Sound Perception[Advanced Auditory System and Sound Perception]				
Schedule number	D53030340	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Elective
Time of starting a course	Spring2 term	**Day of the week,period**	Tue.4～4	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	松井 淑恵 MATSUI Toshie				
Numbering	CMP_DOC73025				

Objectives of class

This course provides an introduction to the human auditory system. It also outlines various psychological experiments for understanding our auditory system, and computational models from the data.

Contents of class

Week 1. Physics of sounds and the auditory system
Week 2. Physiology of the auditory system
Week 3. Loudness
Week 4. Pitch
Week 5. Timber, instrumental sounds and vocal sounds
Week 6. Vocalization mechanism and perception of speech sounds
Week 7 (+0.5). Computational models of the auditory system and its application, and other latest topics

Self Preparation and Review

Lecture materials are disclosed to the official website beforehand. Download them by the day of the lecture.

Related subjects

Visual Perception and Cognition, Speech and Natural Language Processing

Notes for textbook

Papers(resume)will be distributed.

Reference1	**Book title**	The Sense of Hearing, 3rd edition.			**ISBN**	978-1138632
	Author	Christopher J. Plack	**Publisher**	Routledge	**Publish year**	2018
Reference2	**Book title**	An Introduction to the Psychology of Hearing, 6th ediotion.			**ISBN**	978-9004252424
	Author	Brian C. J. Moore	**Publisher**	Brill Academic Pub	**Publish year**	2013

Notes for reference

特になし
N/A

Goals to be achieved

1) Understand the relationship between physiological mechanism of the auditory system and its function
2) Learning the perceptual experiment techniques and computational approach to reveal the auditory system

Evaluation of achievement

The evaluation is based primarily on a final report (100 points).
Students who attend all classes will be evaluated as follows:
S: Achieved all goals and obtained point of final report, 90 or higher (out of 100 points).
A: Achieved 90 % of goals and obtained point of final report, 80 or higher (out of 100 points).
B: Achieved 80 % of goals and obtained point of final report, 70 or higher (out of 100 points).
C: Achieved 70 % of goals and obtained point of final report, 60 or higher (out of 100 points).

Examination

レポートで実施
By Report

Details of examination

特になし
N/A

Other information
特になし
N/A

Reference URL
特になし
N/A

Office hours
On a necessary basis. Please contact me by e-mail in advance.

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
情報・知能工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about computer science and engineering as well as related fields; and have the practical and creative skills to utilize suchknowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

Key words
auditory system, sound perception, music, speech, computational model

(D53030350)Advanced Computer Architecture and Systems[Advanced Computer Architecture and Systems]

Subject name[English]	Advanced Computer Architecture and Systems[Advanced Computer Architecture and Systems]				
Schedule number	D53030350	**Subject area**	Advanced Computer Science and Engineering	**Required or elective**	Elective
Time of starting a course	Spring2 term	**Day of the week,period**	Thu.3～3	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Computer Science and Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	佐藤　幸紀 SATO Yukinori				
Numbering	CMP_DOC72125				

Objectives of class

The goal is to obtain the knowledge on the advanced computer architecture seen in the state-of-the-art computing systems.

Contents of class

Self Preparation and Review

Related subjects

Notes for textbook

Materials will be provided, which are based on a text book:
Computer Architecture, Sixth Edition: A Quantitative Approach
John Hennessy
David Patterson

Reference1	**Book title**	Computer architecture : a quantitative approach			**ISBN**	978-0128119051
	Author	John L. Hennessy, David A. Patterson ; with contributions by Krste Asanović ... [et al.]	**Publisher**	Morgan Kaufmann	**Publish year**	2018

Notes for reference

Goals to be achieved

Evaluation of achievement

Examination

レポートで実施
By Report

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
情報・知能工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated manner
Have advanced knowledge about computer science and engineering as well as related fields; and have the practical and creative skills to utilize suchknowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

Key words

(D54010080)Seminar on Applied Chemistry and Life Science 1[Seminar on Applied Chemistry and Life Science 1]

Subject name[English]	Seminar on Applied Chemistry and Life Science 1[Seminar on Applied Chemistry and Life Science 1]				
Schedule number	D54010080	**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	Applied Chemistry and Life Science			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	S4系教務委員 4kei kyomu Iin-S				
Numbering	ENV_DOC75015				

Objectives of class

This course will provide the students with opportunities to study on his/her research subjects on applied chemistry and life science 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 applied chemistry and life science.

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 Applied Chemistry and Life Sciences 2
All other relevant subjects in Applied Chemistry and Life Science

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 applied chemistry and life science
To understand the contents of scientific papers in a given field of applied chemistry and life science
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.
S: 90 or higher (out of 100 points),
A: 80 or higher (out of 100 points),
B: 70 or higher (out of 100 points),
C: 60 or higher (out of 100 points)

Examination

試験期間中には何も行わない
None during exam period

Details of examination

Other information

Supervisor(s)

Reference URL

http://ens.tut.ac.jp/en/

Office hours

Students are encouraged visiting by appointment.

Relations to attainment objectives of learning and education

Key words
Applied chemistry, Life science, Materials science and engineering

(D54030030)Advanced Ecological Engineering[Advanced Ecological Engineering]

Subject name[English]	Advanced Ecological Engineering[Advanced Ecological Engineering]				
Schedule number	D54030030	**Subject area**	Advanced Applied Chemistry and Life Science	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Thu.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Applied Chemistry and Life Science			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	大門　裕之, 東海林　孝幸, 中野　裕美 DAIMON Hiroyuki, TOKAIRIN Takayuki, NAKANO Hiromi				
Numbering	ENV_DOC74225				

Objectives of class

The course provides students with the opportunity to improve their level in the skills(reading, writing, presentation) through reading current research articles.

Contents of class

1. Students have to select at least three articles in the field of one of professors.
Three weeks/professor & one week
2. Students prepare both reports and present slides.
3. The key words will be given at the first class.

Self Preparation and Review

毎回講義内容を復習するとともに，次週の内容についてテキスト等を参考に予習してくること。

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

Knowledge of environmental chemistry, chemical engineering and materials science is desirable.

Notes for textbook

Papers(resume)will be distributed

Notes for reference

N/A

Goals to be achieved

To improve presentation skills(writing of reports and preparing of slides).

Evaluation of achievement

30% Report, 70% Presentation(30-45 min)

S: 90 or higher (out of 100 points)
A: 80 or higher (out of 100 points)
B: 70 or higher (out of 100 points)
C: 60 or higher (out of 100 points)

Examination

試験期間中には何も行わない
None during exam period

Details of examination

N/A

Other information

N/A

Reference URL

N/A

Office hours

Anytime, but reservation is desirable.

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
応用化学・生命工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，

課題解決のための独創的な技術を創造し，実践できる能力を身につけている。
（E）最新の技術や社会環境の変化に対する探究心と持続的学習力
社会，環境，技術等の変化の本質を探求し，生涯にわたって自発的に計画し学習する能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and constructive manner
Have the ability to create imaginative technology to solve problems and put them into practice through learning, by experience,methodologies for research and development on the basis of the integration of extensive knowledge about applied chemistry, life science and their related fields
(E) Inquisitive outlook and skills for continuous learning in response to state-of-the-art technology and changes in the social environment
Have the ability to explore the nature of changes in society, environment and technology and tovoluntarily make plans and learn throughout one's life

Key words
environmental chemistry, chemical engineering, materials science, sustainable engineering

(D54030040)Advanced Biotechnology 1[Advanced Biotechnology 1]

Subject name[English]	Advanced Biotechnology 1[Advanced Biotechnology 1]				
Schedule number	D54030040	**Subject area**	Advanced Applied Chemistry and Life Science	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Fri.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Applied Chemistry and Life Science			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	浴 俊彦, 田中 照通, 中鉢 淳 EKI Toshihiko, TANAKA Terumichi, NAKABACHI Atsushi				
Numbering	ENV_DOC73225				

Objectives of class

This course will provide the students with the opportunity to study on advanced life sciences (e.g., genomics, molecular genetics, microbiology, and biotechnology).

Contents of class

In this course, the students will be expected to read several papers on the current progress in advanced life science (e.g., genomics, molecular genetics, microbiology, and biotechnology) to understand the frontier of these scientific fields. This course will be given by three instructors as described below (Eki, Tanaka, and Nakabachi).

1st~5th week: Genome and gene sciences (Dr. T. Eki)
6th~10th week: Genetic and Protein engineering (Dr. T. Tanaka)
11th~15th week: Animal-microbe symbioses (Dr. A. Nakabachi)

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

The knowledge of basic molecular biology and biochemistry is absolutely essential.

Notes for textbook

Papers and references will be given by each instructor in the course.

Notes for reference

N/A

Goals to be achieved

To understand the current status in advanced life sciences including genomics, molecular genetics, microbiology and biotechnology by summarizing, and making presentations and/or reports.

Evaluation of achievement

Grades for the course will be based on the average of the subject scores (by Eki, Tanaka, and Nakabachi).

[Evaluation basis]
D1 students who attend all classes will be evaluated as follows:
S: Achieved all goals and obtained total points of exam and reports, 90 or higher (out of 100 points).
A: Achieved all goals and obtained total points of exam and reports, 80 or higher (out of 100 points).
B: Achieved 70% of goals and obtained total points of exam and reports, 70 or higher (out of 100 points).
C: Achieved 60% of goals and obtained total points of exam and reports, 60 or higher (out of 100 points).

D2 and D3 students who attend all classes will be evaluated as follows:
A: Achieved all goals and obtained total points of exam and reports, 80 or higher (out of 100 points).
B: Achieved 70% of goals and obtained total points of exam and reports, 65 or higher (out of 100 points).
C: Achieved 60% of goals and obtained total points of exam and reports, 55 or higher (out of 100 points).

Examination

試験期間中には何も行わない
None during exam period

Details of examination

N/A

Other information

Dr. Toshihiko Eki: Room: G-505, Phone: 6907, E-mail: eki@chem.tut.ac.jp
Dr. Terumichi Tanaka: Room: G-506. Phone: 6920, E-mail: terumichi-tanaka@tut.jp

Dr. Atsushi Nakabachi: Room: G-502, Phone: 6901, E-mail: nakabachi@eiiris.tut.ac.jp

Reference URL

N/A

Office hours

Please make an appointment.

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
応用化学・生命工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。
(E)最新の技術や社会環境の変化に対する探究心と持続的学習力
社会，環境，技術等の変化の本質を探求し，生涯にわたって自発的に計画し学習する能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and constructive manner
Have the ability to create imaginative technology to solve problems and put them into practice through learning, by experience,methodologies for research and development on the basis of the integration of extensive knowledge about applied chemistry, life science and their related fields
(E) Inquisitive outlook and skills for continuous learning in response to state-of-the-art technology and changes in the social environment
Have the ability to explore the nature of changes in society, environment and technology and tovoluntarily make plans and learn throughout one's life

Key words

(D54030060)Advanced Molecular Function Chemistry 1[Advanced Molecular Function Chemistry 1]

Subject name[English]	Advanced Molecular Function Chemistry 1[Advanced Molecular Function Chemistry 1]				
Schedule number	D54030060	**Subject area**	Advanced Applied Chemistry and Life Science	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Tue.1～1	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Applied Chemistry and Life Science			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	伊津野　真一, 岩佐　精二, 柴富　一孝, 原口　直樹 ITSUNO Shinichi, IWASA Seiji, SHIBATOMI Kazutaka, HARAGUCHI Naoki				
Numbering	ENV_DOC72225				

Objectives of class

This course focuses on state-of-the-art technology of functional polymers and synthesis as for bioactive organic compounds. Synthesis and various applications of the functional polymers and bioactive organic compounds will be discussed.

Contents of class

(1) General aspects of functional polymers (Itsuno, Haraguchi)
(2) Precise molecular design of functional polymers(Itsuno, Haraguchi)
(3) Preparation of highly functionalized polymers(Itsuno, Haraguchi)
(4) Reactive polymer synthesis(Itsuno, Haraguchi)
(5) Optically active polymers(Itsuno, Haraguchi)
(6) Asymmetric synthesis and polymerization(Itsuno, Haraguchi)
(7) Synthesis and structure-function relationship of biobased and biodegradable polymers(Itsuno, Haraguchi)
(8) Bioactive natural products (Iwasa)
(9) Total synthesis of natural products (Iwasa)
(10) Transition metal complexes and 18 electron rule (Iwasa)
(11) Chiral catalysts and their applications (S. Iwasa)
(12) Advanced Lewis acid catalysis. (Shibatomi)
(13) Advanced organocatalysis. (Shibatomi)
(14) Asymmetric synthesis of halogenated compounds and their synthetic applications. (Shibatomi)
(15) Advanced organofluorine chemistry (Shibatomi)

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

D34030060 Advanced Molecular Function Chemistry 1
M44630100 Special Topics in Applied Organic Chemistry
M24630460 応用有機化学特論

Notes for textbook

No textbooks are required.

Notes for reference

N/A

Goals to be achieved

To understand the latest trend of the research on functional polymers.
To understand the latest trend of the research on total synthesis of natural products and their synthetic methods.

Evaluation of achievement

Presentation (50%) and discussion (50%)
Evaluation basis] Students who attend all classes will be evaluated as follows:
S: Achieved all goals and obtained total points of exam and reports, 90 or higher (out of 100 points).
A: Achieved 80 % goals and obtained total points of exam and reports, 80 or higher (out of 100 points).
B: Achieved 70 % of goals and obtained total points of exam and reports, 70 or higher (out of 100 points).
C: Achieved 60 % of goals and obtained total points of exam and reports, 60 or higher (out of 100 points).

Examination

レポートで実施
By Report

Details of examination

N/A

Other information

S. Itsuno: itsuno@ens.tut.ac.jp 6813 (office: B-502)
N. Haraguchi: haraguchi@ens.tut.ac.jp 6812 (office: B-403)
S. Iwasa: office:B-506, tel: 6817, email: iwasa@ens.tut.ac.jp
K. Shibatomi: shiba@ens.tut.ac.jp (room: B-507)

Reference URL

http://www.siorgchem.ens.tut.ac.jp/index.html
http://ens.tut.ac.jp/orgchem/

Office hours

anytime

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
応用化学・生命工学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。
(E)最新の技術や社会環境の変化に対する探究心と持続的学習力
社会，環境，技術等の変化の本質を探求し，生涯にわたって自発的に計画し学習する能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and constructive manner
Have the ability to create imaginative technology to solve problems and put them into practice through learning, by experience,methodologies for research and development on the basis of the integration of extensive knowledge about applied chemistry, life science and their related fields
(E) Inquisitive outlook and skills for continuous learning in response to state-of-the-art technology and changes in the social environment
Have the ability to explore the nature of changes in society, environment and technology and tovoluntarily make plans and learn throughout one's life

Key words

functional polymer, asymmetric catalyst, transition metal, organocatalyst, Lewis acid, fluorine

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

Subject name[English]	Seminar on Architecture and Civil Engineering 1[Seminar on Architecture and Civil Engineering 1]				
Schedule number	D55010010	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	4
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Architecture and Civil Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	S5系教務委員 5kei kyomu Iin-S				
Numbering	ARC_DOC71015				

Objectives of class

All the students are required to attend all the seminars, which is arranged by the laboratory supervisor for the special study subjects related to the current research activity of the laboratory. The scheduled program of the seminars is announced by the supervisor at the guidance of the seminar.

Contents of class

Self Preparation and Review

Related subjects

Notes for textbook

Notes for reference

Goals to be achieved

Evaluation of achievement

Report

Examination

レポートで実施

By Report

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

(C) Practical and creative skills to utilize advanced knowledge in an integrated and developed manner

Have advanced knowledge about architecture and civil engineering as well as related fields; and have the practical and creative skills to utilize such knowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

(D) Communication skills for global success

Have the communication skills to effectively express and transmit one's own ideas and results while working on the issues faced by a globally changing society in cooperation with other team members.

Have sophisticated ability as a leader to contribute for the achievement the goal of team.

(E) Inquisitive outlook and skills for continuous learning in response to state-of-the-art technology and changes in the social environment

Have the skills to investigate the essence of changes in society, environment and technology.
Have the skills to voluntarily make plans and learn throughout one's life.

Key words

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

Subject name[English]	Seminar on Architecture and Civil Engineering 2[Seminar on Architecture and Civil Engineering 2]				
Schedule number	D55010020	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Required
Time of starting a course	Year	**Day of the week,period**	Intensive	**Credit(s)**	1
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	2～
Department Offered	Architecture and Civil Engineering			**Beggining grade**	D2
Charge teacher name[Roman alphabet mark]	S5系教務委員 5kei kyomu Iin-S				
Numbering	ARC_DOC71015				

Objectives of class

All the students are required to attend all the seminars, which is arranged by the laboratory supervisor for the special study subjects related to the current research activity of the laboratory. The scheduled program of the seminars is announced by the supervisor at the guidance of the seminar.

Contents of class

Self Preparation and Review

Related subjects

Notes for textbook

Notes for reference

Goals to be achieved

Evaluation of achievement

Report

Examination

レポートで実施

By Report

Details of examination

Other information

Reference URL

Office hours

Relations to attainment objectives of learning and education

(C) Practical and creative skills to utilize advanced knowledge in an integrated and developed manner

Have advanced knowledge about architecture and civil engineering as well as related fields; and have the practical and creative skills to utilize such knowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

(D) Communication skills for global success

Have the communication skills to effectively express and transmit one's own ideas and results while working on the issues faced by a globally changing society in cooperation with other team members.

Ha(E) Inquisitive outlook and skills for continuous learning in response to state-of-the-art technology and changes in the social environment

Have the skills to investigate the essence of changes in society, environment and technology.

Have the skills to voluntarily make plans and learn throughout one's life.
ve sophisticated ability as a leader to contribute for the achievement the goal of team.

Key words

(D55030030)Advanced Building Environmental Engineering and Building Services[Advanced Building Environmental Engineering and Building Services]

Subject name[English]	Advanced Building Environmental Engineering and Building Services[Advanced Building Environmental Engineering and Building Services]				
Schedule number	D55030030	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Elective
Time of starting a course	Spring 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
Charge teacher name[Roman alphabet mark]	都築　和代, 島﨑　康弘 TSUZUKI Kazuyo, SHIMAZAKI Yasuhiro				
Numbering	ARC_DOC74125				

Objectives of class

The goal of this course is to help professionals update related to the recent research and development on life cycle assessment (LCA) for buildings, environmental symbiotic technologies, climatic building design and urban energy management.

Contents of class

The course consists of the following topics.
1. Buildings and its Impact on the Global Environment
2. Impact Assessment indices for Buildings
3. Life Cycle Inventory for Buildings
4. Overview of CASBEE
5. Environmental Symbiotic Technologies (1)
6. Environmental Symbiotic Technologies (2)
7. Ecological Building Design (1)
8. Ecological Building Design (2)
9. Climatic Building Design (1)
10. Climatic Building Design (2)
11. Sustainable Building Design (1)
12. Sustainable Building Design (2)
13. Energy and Buildings (1)
14. Energy and Buildings (2)
15. Compact city –urban energy management–

Self Preparation and Review

The course materials such book chapter or academic paper related to this course will be appeared or provided at the first class or orientation.

Related subjects

Building science: Indoor Air Quality and Ventilation, Building and Urban Thermal Environment

Notes for textbook

The related handouts will be distributed.

Reference1	**Book title**	Architecture for a Sustainable Future –All about the Holistic Approach in Japan–			**ISBN**	
	Author	Architectural Institute of Japan	**Publisher**	Institute for Building Environment and Energy Conservation	**Publish year**	2002

Notes for reference

N/A

Goals to be achieved

Achievement level of this course is to understand the background of building's impact on the global environment, the practical strategies for sustainable building design, urban energy management and so on.

Evaluation of achievement

Reports related to this subject are reviewed to evaluate the achievement level.

Examination

レポートで実施
By Report

Details of examination
N/A

Other information
Kazuyo Tsuzuki: D-712, Phone: 0532-44-6840, Fax: 0532-44-6831, E-mail: ktsuzuki@ace.tut.ac.jp

Reference URL
N/A

Office hours
Kazuyo Tsuzuki: Thurdsday 13:00-14:30

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
建築・都市システム学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and developed manner
Have advanced knowledge about architecture and civil engineering as well as related fields; and have the practical and creative skillsto utilize such knowledge for problem solving, understanding the methodology of research, creating original technology, and integrating all knowledges organically.

Key words
climatic building design, sustainable building design, building energy management, energy saving

(D55030090)Advanced Transportation Systems and Economics[Advanced Transportation Systems and Economics]

Subject name[English]	Advanced Transportation Systems and Economics[Advanced Transportation Systems and Economics]				
Schedule number	D55030090	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Tue.2～2	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Architecture and Civil Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	渋澤 博幸, 杉木 直 SHIBUSAWA Hiroyuki, SUGIKI Nao				
Numbering	ARC_DOC73325				

Objectives of class

To obtain the advanced knowledge of theories and methods for policies and planning for cities, regions,transportation, and the environment.
To obtain the advanced knowledge of theories and methods for policies and planning for cities, regions,transportation and the environment.

Contents of class

By using books, reports and papers on cities, regions, infrastructure and the environment, students learn the advanced transportation systems and transportation economics. Discussion between the lecturer and students will be performed in the lecture time.

By using books, reports and papers on cities, regions, infrastructure and the environment, students learn the advanced transportation systems and transportation economics. Discussion between the lecturer and students shall be performed in the lecture time.

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

Transportation systems
Analysis of environmental economics
Policy for industry
Econometrics
Transportation systems
Analysis of environmental economics
Policy for industry
Econometrics

Notes for textbook

Textbooks and scientific papers will be announced at the start of the class.

Textbooks and scientific papers will be announced at the start of the class.

Notes for reference

N/A

Goals to be achieved

1.To understand the necessity and significance of policy and planning for cities, regions,infrastructure and the environment.
2.To understand the concept of policy and planning for the above mentioned fields.
3.To understand methodologies in the above mentioned fields.

1.To understand the necessity and significance of policy and planning for cities, regions, infrastructure and the environment.
2.To understand the concept of policy and planning for the above mentioned fields.

3.To understand methodologies in the above mentioned fields.

Evaluation of achievement

Home work assignments will be required. Final reports or examination will be conducted.

D1
S: Total points obtained from exams and/or reports, etc., 90 or higher (out of 100 points).
A: Total points obtained from exams and/or reports, etc., 80 or higher (out of 100 points).
B: Total points obtained from exams and/or reports, etc., 70 or higher (out of 100 points).
C: Total points obtained from exams and/or reports, etc., 60 or higher (out of 100 points).

D2-3
A: Total points obtained from exams and/or reports, etc., 80 or higher (out of 100 points).
B: Total points obtained from exams and/or reports, etc., 65 or higher (out of 100 points).
C: Total points obtained from exams and/or reports, etc., 55 or higher (out of 100 points).
Home work assignments shall be required. Final reports or examination shall be conducted.

D1
S: Total points obtained from exams and/or reports, etc., 90 or higher (out of 100 points).
A: Total points obtained from exams and/or reports, etc., 80 or higher (out of 100 points).
B: Total points obtained from exams and/or reports, etc., 70 or higher (out of 100 points).
C: Total points obtained from exams and/or reports, etc., 60 or higher (out of 100 points).

D2-3
A: Total points obtained from exams and/or reports, etc., 80 or higher (out of 100 points).
B: Total points obtained from exams and/or reports, etc., 65 or higher (out of 100 points).
C: Total points obtained from exams and/or reports, etc., 55 or higher (out of 100 points).

Examination

レポートで実施
By Report

Details of examination

N/A

Other information

Shibusawa: room(D-709), hiro-shibu@tut.jp, phone: 0532-44-6955
Sugiki: room(D-705), sugiki@ace.tut.ac.jp, phone: 0532-44-6833
Shibusawa: room(D-709), hiro-shibu@tut.jp, phone: 0532-44-6955
Sugiki: room(D-705), sugiki@ace.tut.ac.jp, phone: 0532-44-6833

Reference URL

Shibusawa: http://www.pm.ace.tut.ac.jp
Sugiki: https://sites.google.com/site/trlabotut/home-en
Shibusawa: http://www.pm.ace.tut.ac.jp
Sugiki: https://sites.google.com/site/trlabotut/home-en

Office hours

Hiroyuki Shibusawa: At any time. Please contact Shibusawa by e-mail in advance.
Nao Sugiki: At any time. Please contact Sugiki by e-mail in advance.
Hiroyuki Shibusawa: At any time. Please contact Shibusawa by e-mail in advance.
Nao Sugiki: At any time. Please contact Sugiki by e-mail in advance.

Relations to attainment objectives of learning and education

(C)高度な知識を統合的・発展的に活用できる実践力・創造力
建築・都市システム学およびその関連分野に関する高度な知識を修得し，それらを広範囲に有機的に連携させた研究開発方法論を体得することで，
課題解決のための独創的な技術を創造し，実践できる能力を身につけている。

(C) Practical and creative skills to utilize advanced knowledge in an integrated and developed manner
Have advanced knowledge about architecture and civil engineering as well as related fields; and have the practical and creative skillsto utilize such knowledge for problem solving, understanding the methodology of research, creating original technology, and

integrating all knowledges organically.

Key words
planning process, social & economic evaluation method, forecasting models
planning process, social & economic evaluation method, forecasting models

(D55030110)Advanced Management of Technology[Advanced Management of Technology]

Subject name[English]	Advanced Management of Technology[Advanced Management of Technology]				
Schedule number	D55030110	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Elective
Time of starting a course	Spring term	**Day of the week,period**	Wed.4～4	**Credit(s)**	2
Faculty	Graduate Program for Doctoral Degree			**Subject grade**	1～
Department Offered	Architecture and Civil Engineering			**Beggining grade**	D1
Charge teacher name[Roman alphabet mark]	藤原 孝男 FUJIWARA Takao				
Numbering	ARC_DOC75025				

Objectives of class

The main objective is to understand the function of technological entrepreneurship for commercialization of basic research results from a perspective of financial engineering.
Especially the decision-making model is examined for irreversible investment under uncertainty(Fujiwara).

In this course, students learn the regional and urban economic modeling techniques and the urban and regional policy evaluation methodology(Shibusawa).

Contents of class

Fujiwara
From a view point regarding the technological development as risky but competitive investment, this class has following topics:
1-2:Technological entrepreneurship
3-5:Investment decision
6-8:Basic real options
9-11:Optio valuation methods
12-15:Application and cases

For each week class discussion, self-preview & review are expected.

Shibusawa
1-2:Urban and Regional Policy and Evaluation
3-5:Modeling of the Urban and Regional Economic Systems
6-8:Policies and the Evaluation Methodology
9-11:Evaluation Techniques and Tools
12-13:Case Studies of the urban and regional policy
14-15:Evaluating Case Studies

Self Preparation and Review

Review each lecture and prepare for the next class with reference to the textbook.

Related subjects

Fujiwara
Management Science (English), Operations Management (Japanese), Real Options (Japanese), Game Theory (Japanese), Finance (Japanese), & Entrepreneurship (Japanese),

Shibusawa
Economics, Policy, Simulation

Notes for textbook

Fujiwara
Studying materials will be introduced at first class time.

Shibusawa
Papers will be distributed.

Notes for reference

N/A

Goals to be achieved

1)Able to understand the concept and knowledge of management of technology.
2)Able to understand and use the real options analysis.

3)Able to apply and propose original technological management methods.

Evaluation of achievement

Evaluation method: Scoring is based on reports .
Evaluation criteria:
Ph.D 1st and 2nd year S: 90 or higher, A: 80 or higher, B: 70 or higher, C: 60 or higher (Maximum scoring 100).
The other students A: 80 or higher, B: 65 or higher, C: 55 or higher (Maximum scoring 100).

Shibusawa
Policy evaluation reports must be submitted.
A: 80 Points or higher, B: 65 points or higher, C:55 points or higher, D: Less than 55 points

Examination

レポートで実施
By Report

Details of examination

N/A

Other information

Fujiwara
Office#: B-313, Phone#: 6946, e-mail: fujiwara@las.tut.ac.jp

Shibusawa
Office#: B-409, Phone#: 6963, e-mail: hiro-shibu@tut.jp

Reference URL

N/A

Office hours

Fujiwara
Anytime if available.

Shibusawa
Tuesday 10:00-12:00

Relations to attainment objectives of learning and education

(A)幅広い人間性と考え方
人間社会を地球的な視点から多面的にとらえるグローバルな感性を持ち，人間と自然との共生，公共の福祉について俯瞰的にとらえる能力を身につけている。

(A) Personality and outlook with a broad perspective
Have an international mindset to see human society from various angles with a global perspective; and the ability to consider the symbiosis between humans and nature as well as publicwelfare with a wide view.

Key words

Real Options, Game Theory, & Technological Entreprneurship

(D55030130)Advanced Western Culture[Advanced Western Culture]

Subject name[English]	Advanced Western Culture[Advanced Western Culture]				
Schedule number	D55030130	**Subject area**	Advanced Architecture and Civil Engineering	**Required or elective**	Elective
Time of starting a course	Spring 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
Charge teacher name[Roman alphabet mark]	相京　邦宏 AIKYO Kunihiro				
Numbering	ARC_DOC75025				

Objectives of class

Research on a history of scientific ideas in the ancient world.
Research on a history of scientific ideas in the ancient world.

Contents of class

Lecture on a view of nature and science in the ancient world.
Modern scinece and ancient 'science'. What are similarities or differneces between the two?

Program of lecture

1. Orientation(outline of the lecture)
2. Purpose of the Series
3. Science in Antiquity?
4. Modern Science 1
5. Modern Science 2
6. History and Philosophy
7. Building Histories 1
8. Building Histories 2
9. Building Histories 3
10. Intellectual Paternities 1
11. Intellectual Paternities 2
12. Selective Survival of Texts
13. Resources for History 1
14. Resources for History 2
15. Summery of the lecture

Lecture on a view of nature and science in the ancient world.
Modern scinece and ancient 'science'. What are similarities or differneces between the two?

Program of lecture

1. Orientation(outline of the lecture)
2. Purpose of the Series
3. Science in Antiquity?
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7. Building Histories 1
8. Building Histories 2
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10. Intellectual Paternities 1
11. Intellectual Paternities 2
12. Selective Survival of Texts
13. Resources for History 1
14. Resources for History 2
15. Summery of the lecture

Self Preparation and Review

Preparation & review of text
Preparation & review of text

Related subjects
N/A

Notes for textbook
N/A

Notes for reference
Roger French, Ancient Natural History. Routledge, 1994.
Roger French, Ancient Natural History. Routledge, 1994.

Goals to be achieved
(1)A correct perception of a history of science.
(2)A conprehensive grasp of the origin of scientific ideas in Western Europe.
(3)Understanding of basic terms on a history of scinece.
(4)A correct understanding of a relation between modern science and pre-modern scinece.
(5)A total appreciation of a transition of scientific ideas.
(6)A correct understanding of literature on a history of science.

(1)A correct perception of a history of science.
(2)A conprehensive grasp of the origin of scientific ideas in Western Europe.
(3)Understanding of basic terms on a history of scinece.
(4)A correct understanding of a relation between modern science and pre-modern scinece.
(5)A total appreciation of a transition of scientific ideas.
(6)A correct understanding of literature on a history of science.

Evaluation of achievement
Holding the end-of-term exams.
Holding the end-of-term exams.

Examination
レポートで実施
By Report

Details of examination
N/A

Other information
N/A

Reference URL
N/A

Office hours
pm. 1-4(Wednesday)

pm. 1-4(Wednesday)

Relations to attainment objectives of learning and education

(A)幅広い人間性と考え方
人間社会を地球的な視点から多面的にとらえるグローバルな感性を持ち，人間と自然との共生，公共の福祉について俯瞰的にとらえる能力を身につけている。

(A) Personality and outlook with a broad perspective
Have an international mindset to see human society from various angles with a global perspective; and the ability to consider the symbiosis between humans and nature as well as publicwelfare with a wide view.

Key words
ancient, science, history
ancient, science, history