◆ Education Program of Advanced Information Technology Leaders

Degree: Master's degree and Doctoral degree (2 years and 3 years)

Participation Departments:
Department of Computer Science
Department of Mechanical and Environmental Informatics
Department of Mathematical and Computing Sciences

1. Program Outline

Japan is a world leader in both research and practical application in many areas of information science & technology including embedded software, multi-media processing, human interface, robot informatics, large-scale computational technology and environmental information technology such as consumer electronics, computer games and industrial intelligent robotics. The aim of this program is to offer enrollment in master's and doctoral programs to overseas students qualified in information science & engineering subjects, and to educate them to engineering, research and teaching leaders who will actively contribute to the research and development system to cope with the globalization of these Japanese information technologies. This program includes practice oriented courses in these areas. Students will be trained using Japan's most advanced computing environments, and will also be able to participate in industrial internships.

2. Guide to Study

*** Education program focused on Japan's cutting edge information technology**

This program focuses on the six disciplines of Japan's most cutting-edge academic and industrial research fields in information sciences; i.e., embedded software, multi-media processing, human interface, robot informatics, regional planning, and computing and mathematics. The aim of this program is to foster engineering, research, and teaching leaders who will actively contribute to information sciences.

*** Confers master's and doctoral degrees**

In this program, we seek master's and doctoral students. In transition from the master's program to the doctoral program, the students' ability to conduct research needs to be ensured through master's theses and/or other academic activities.

*** Practice-oriented program**

It is essential to acquire practical skills for the development of software in the above six disciplines. In the lectures we spare significant amount of time on computer exercises. Furthermore, we facilitate the students acquiring high practical skills through the courses of "Projects", "Seminars" and "Special Experiments" by doing practical projects with other Japanese students in an interactive way. In these projects, students are allowed to use the Tokyo Tech's state-of-the-art facilities such as TSUBAME Supercomputer. Furthermore, for practical training purposes we also provide opportunities for the students to participate in industrial internships so that they can experience projects of software development in the software industry and robot development at HRI.

*** Six disciplines in the program**

We categorize the courses of this program into the six disciplines, i.e., embedded software, multi-media processing, human interface, robot informatics, regional planning and computing and mathematics, so that one can focus on one of the six disciplines to go through both basic and advanced topics in the specified

discipline by the student. The six disciplines and their course names are listed below. Even though students are encouraged to focus on one of the disciplines, it is possible to take courses from two or more disciplines according to the students' areas of interest. For example, if a student is interested in humanoid technology, then he/she can take courses from both disciplines of human interface and robot informatics. Students can also take courses other than the courses listed below in consultation with their academic advisers.

1. **Multi-media processing discipline**
   Advanced Coding Theory, Advanced Data Engineering, Pattern Information Processing, Computer Graphics, Speech Information Processing,
2. **Human interface discipline**
   Advanced Data Engineering, Human Computer Interaction, Machine Learning, Advanced Data Analysis, Pattern Information Processing, Computer Graphics, Speech Information Processing, Complex Networks, Introduction to Neural Engineering,
3. **Embedded software discipline**
   Advanced Coding Theory, Distributed Algorithms, Advanced Data Engineering, Concurrent System Theory, Advanced Data Analysis, Pattern Information Processing, Software Design Methodology, Linear Systems and Control, Mathematical Processing of Measurement Information, Advance Operating Systems,
4. **Robot informatics discipline**
   Machine Learning, Pattern Information Processing, Speech Information Processing, Logic and Software, Advanced Operating Systems, Mechanical and Environmental Informatics Project I, Mechanical and Environmental Informatics Project II, Linear Systems and Control, Advanced Course of Inverse Problems, Control Theory for Robot Intelligence, Nonlinear and Adaptive Control, Introduction to Neural Engineering, Introduction to Biomedical Instrumentation, Advanced course of Digital Human Modeling, Advanced course in nonlinear dynamics,
5. **Regional Planning discipline**
   Mechanical and Environmental Informatics Project I, Mechanical and Environmental Informatics Project II, Theory and Applications of Urban Spatial Data, Analysis of Vibration and Elastic Wave, Intellectual Infrastructure Systems, Air Quality Engineering, Regional Information Analysis, Advanced Course on Coastal Environments, Econometric Analysis,
6. **Computing and mathematical science discipline**
   Advanced Coding Theory, Distributed Algorithms, Concurrent System Theory, Machine Learning, Advanced Data Analysis, Logic and Software, Topics in Mathematical Optimization, Fundamentals of Mathematical and Computing Sciences: Mathematics, Fundamentals of Mathematical and Computing Sciences: Applied Mathematical Sciences, Fundamentals of Mathematical and Computing Sciences: Computer Science, Special Lecture on Mathematical and Information Sciences I--IV, Forum on Global Informatics I-II

*** The official language of this program is English.**

*** Follow-up system after graduation**

We provide assistance for the students in the case where one seeks job opportunities related to the above six areas in Japanese companies by using the existing job placement system for Japanese students at Tokyo Tech.

3. Graduation Requirements

[Degree Requirements]

Students must take enough coursework, based on rules of Tokyo Tech to get their degrees. The rules are as follows.

Master's Degree

(a) Total credits (Lectures from the departments other than listed below can be included)
Department of Mathematical and Computing Sciences: 30 credits or more
Department of Computer Science: 30 credits or more
Department of Mechanical and Environmental Informatics: 36 credits or more

(b) Research Courses
Department of Mathematical and Computing Sciences: 4 credits for seminars and 8 credits or more for Advanced Exercises and Experiments
Department of Computer Science: 4 credits for seminars and 4 credits for Special Experiments
Department of Mechanical and Environmental Informatics: 4 credits for seminars and 8 credits or more for Mechanical and Environmental Informatics Research Process

(c) Courses by Departments (Lectures of the department that the student belongs to and lectures of the other two departments in the 8 subject areas shown below)
Department of Mathematical and Computing Sciences: 10 credits or more. The students must take subjects of 3 subject areas or more out of the 8 areas.
Department of Computer Science: 16 credits or more. The students must take subjects of 3 subject areas or more out of the 8 areas.
Department of Mechanical and Environmental Informatics: 16 credits or more including 5 credits for Mechanical and Environmental Informatics Project I&II. The students must take subjects of 3 subject areas or more out of the 8 areas.

(d) Project Based Learning Subjects:
Department of Mathematical and Computing Sciences: 2 credits. The students must take "System Development International Project".
Department of Computer Science: 2 credits. The students must take either "System Development International Project" or "Human Centered Informatics Exercise".
Department of Mechanical and Environmental Informatics: No requirement (Project Based Learning Subjects are included in Special Subject in (c)).

(e) Liberal Arts and General Education: 2 credits or more

Doctoral degree

(The following rules are applied to the students of this international graduate program only.)

(a) Seminar Courses: 12 credits or more
(b) The students that are from other universities must take the lectures of their departments at 8 credits or more. Note that, the lectures in the 8 subject areas shown below are included regardless to the department that the students belong to.
(c) The students must take "Forum on Global Informatics I", "Forum on Global Informatics II", "Doctoral Career Design II-S-E", and "Doctoral Career Design II-F-E."

[Subject Area]

1. **Computer System**
Advanced Coding Theory, Distributed Algorithms, Advanced Data Engineering

2. **Software**
   Concurrent System Theory, Logic and Software, Software Design Methodology, Advanced Operating Systems
3. **Artificial Intelligence**
   Machine Learning, Complex Networks
4. **Cognitive Engineering**
   Human Computer Interaction, Advanced Data Analysis, Pattern Information Processing, Computer Graphics, Speech Information Processing, Introduction to Neural Engineering
5. **System Control**
   Mechanical and Environmental Informatics Project I, Mechanical and Environmental Informatics Project II, Linear Systems and Control, Control Theory for Robot Intelligence, Nonlinear and Adaptive Control, Advanced course in nonlinear dynamics
6. **Measuring/Monitoring/Modeling**
   Advanced Course of Inverse Problems, Mathematical Processing of Measurement Information, Introduction to Biomedical Instrumentation, Advanced course of Digital Human Modeling, Analysis of Vibration and Elastic Wave, Intellectual Infrastructure Systems
7. **Socio-Environmental Informatics**
   Theory and Applications of Urban Spatial Data, Air Quality Engineering, Regional Information Analysis, Advanced Course on Coastal Environments, Econometric Analysis
8. **Mathematical and Computing Sciences**
   Topics in Mathematical Optimization, Fundamentals of Mathematical and Computing Sciences: Mathematics, Fundamentals of Mathematical and Computing Sciences: Applied Mathematical Sciences, Fundamentals of Mathematical and Computing Sciences: Computer Science, Special Lecture on Mathematical and Information Sciences I-IV, Forum on Global Informatics I-II

Some of the other subjects in the three participation departments can be delivered with English by request from the students. These lectures might be counted as the credits of the above requirements (b) of master's and of doctoral course. Please consult your academic adviser(s) and lecturer(s) for the details in advance.

If there are any questions or anything that is not clear about the curriculum, please see the web pages of the departments,
http://www.cs.titech.ac.jp/cs-home-e.html, http://www.mei.titech.ac.jp/index-e.html, or
http://www.is.titech.ac.jp/is-wiki/?About%20us, and consult your adviser(s).

4. Table of Course Subjects

1. Dept. of Computer Science

Courses by Departments

Class	Credits	Lecturer	Semester	Note
Advanced Coding Theory	2-0-0	Haruhiko Kaneko	Spring	Odd
Distributed Algorithms	2-0-0	Takehiro Tokuda	Autumn	
Advanced Data Engineering	2-0-0	Haruo Yokota	Autumn	
Concurrent System Theory	2-0-0	Naoki Yonezaki	Spring	
Human Computer Interaction	2-0-0	Hideki Koike	Spring	
Machine Learning	2-0-0	Tsuyoshi Murata	Autumn	Even
Advanced Data Analysis	2-0-0	Masashi Sugiyama	Spring	Odd
Pattern Information Processing	2-0-0	Masashi Sugiyama	Spring	Even
Computer Graphics	2-0-0	Not yet determined	Spring	Not offered in 2014
Speech Information Processing	2-0-0	Koichi Shinoda	Spring	
Logic and Software	2-0-0	Shinya Nisizaki	Spring	Odd
Software Design Methodology	2-0-0	Motoshi Saeki	Autumn	Even
Complex Networks	2-0-0	Tsuyoshi Murata	Autumn	Odd
Advanced Operating Systems	2-0-0	Takuo Watanabe	Autumn	
System Development International Project	0-2-0	Katsuhiko Gondow, Chikako Morimoto	Spring	
Human Centered Informatics Exercise	0-2-0	Koichi Shinoda, Haruhiko Kaneko	Autumn	

Research Courses

Class	Credits	Lecturer	Semester	Note
Special Experiments I on Computer Science	0-0-2	Academic Advisor	Spring	Master's, 1st year
Special Experiments II on Computer Science	0-0-2	Academic Advisor	Autumn	Master's, 1st year
Seminar I on Computer Science	0-1-0	Academic Advisor	Spring	Master's, 1st year
Seminar II on Computer Science	0-1-0	Academic Advisor	Autumn	Master's, 1st year
Seminar III on Computer Science	0-1-0	Academic Advisor	Spring	Master's, 2nd year
Seminar IV on Computer Science	0-1-0	Academic Advisor	Autumn	Master's, 2nd year
Seminar V on Computer Science	2-0-0	Academic Advisor	Spring	Doctoral, 1st year
Seminar VI on Computer Science	2-0-0	Academic Advisor	Autumn	Doctoral, 1st year
Seminar VII on Computer Science	2-0-0	Academic Advisor	Spring	Doctoral, 2nd year
Seminar VIII on Computer Science	2-0-0	Academic Advisor	Autumn	Doctoral, 2nd year
Seminar IX on Computer Science	2-0-0	Academic Advisor	Spring	Doctoral, 3rd year
Seminar X on Computer Science	2-0-0	Academic Advisor	Autumn	Doctoral, 3rd year

2. Dept. of Mechanical and Environmental Informatics

Courses by Departments

Class	Credits	Lecturer	Semester	Note
Mechanical and Environmental Informatics Project I	0-1-2	Yusuke Miyazaki et al.	Autumn	
Mechanical and Environmental Informatics Project II	0-1-1	Faculty Members	Spring	
Linear Systems and Control	1-0-0	Tomohisa Hayakawa	Autumn	
Advanced Course of Inverse Problems	1-0-0	Kenji Amaya	Autumn	

Mathematical Processing of Measurement Information	2-0-0	Seiichiro Hara	Autumn	Even
Control Theory for Robot Intelligence	2-0-0	Jun-ichi Imura	Spring	
Nonlinear and Adaptive Control	1-0-0	Tomohisa Hayakawa	Autumn	
Introduction to Neural Engineering	2-0-0	Tohru Yagi	Autumn	Even
Introduction to Biomedical Instrumentation	2-0-0	Tohru Yagi	Spring	Odd
Advanced Course in Nonlinear Dynamics	2-0-0	Hiroya Nakao	Spring	Even
Advanced Course of Digital Human	2-0-0	Yusuke Miyazaki	Autumn	Even
Theory and Applications of Urban Spatial	2-0-0	Toshihiro Osaragi	Autumn	Odd
Analysis of Vibration and Elastic Wave	2-0-0	Souichi Hirose	Spring	
Intellectual Infrastructure Systems	2-0-0	Takamasa Mikami	Spring	Odd
Air Quality Engineering	2-0-0	Shuji Fujii, Naoki	Spring	Even
Advanced Course on Coastal Environments	2-0-0	Kazuo Nadaoka	Autumn	Even

Research Courses

Class	Credits	Lecturer	Semester	Note
Seminar I in Mechanical and Environmental Informatics	0-1-0	Academic Advisor	Spring	Master's, 1st year
Seminar II in Mechanical and Environmental Informatics	0-1-0	Academic Advisor	Autumn	Master's, 1st year
Seminar III in Mechanical and Environmental Informatics	0-1-0	Academic Advisor	Spring	Master's, 2nd year
Seminar IV in Mechanical and Environmental Informatics	0-1-0	Academic Advisor	Autumn	Master's, 2nd year
Seminar V in Mechanical and Environmental Informatics	0-1-1	Academic Advisor	Spring	Doctoral, 1st year
Seminar VI in Mechanical and Environmental Informatics	0-1-1	Academic Advisor	Autumn	Doctoral, 1st year
Seminar VII in Mechanical and Environmental Informatics	0-1-1	Academic Advisor	Spring	Doctoral, 2nd year
Seminar VIII in Mechanical and Environmental Informatics	0-1-1	Academic Advisor	Autumn	Doctoral, 2nd year
Seminar IX in Mechanical and Environmental Informatics	0-1-1	Academic Advisor	Spring	Doctoral, 3rd year
Seminar X in Mechanical and Environmental Informatics	0-1-1	Academic Advisor	Autumn	Doctoral, 3rd year
Mechanical and Environmental Informatics Research Process I	0-1-1	Each Prof.	Spring	Master's, 1st year
Mechanical and Environmental Informatics Research Process II	0-1-1	Each Prof.	Autumn	Master's, 1st year
Mechanical and Environmental Informatics Research Process III	0-1-1	Each Prof.	Spring	Master's, 2nd year
Mechanical and Environmental Informatics Research Process IV	0-1-1	Each Prof.	Autumn	Master's, 2nd year
Mechanical and Environmental Informatics Research Process V	0-1-1	Each Prof.	Spring	Doctoral
Mechanical and Environmental Informatics Research Process VI	0-1-1	Each Prof.	Autumn	Doctoral

3.Dept. of Mathematical and Computing Sciences

Courses by Departments

Class	Credits	Lecturer	Semester	Note
Topics in Mathematical Optimization	2-0-0	Mituhiro Fukuda	Spring	
Fundamentals of Mathematical and Computing Sciences: Mathematics	2-0-0	Masaaki Umehara, Sadayoshi Kojima, Shinya Nishibata	Spring	
Fundamentals of Mathematical and Computing Sciences: Applied Mathematical Sciences	2-0-0	Naoto Miyoshi, Mituhiro Fukuda, Taiji Suzuki	Spring	
Fundamentals of Mathematical and Computing Sciences: Computer Science	2-0-0	Osamu Watanabe, Toshio Endo, Ken Wakita	Autumn	
Special Lecture on Mathematical and Information Sciences I	2-0-0	Visiting (Assoc.) Professor	Spring	Even
Special Lecture on Mathematical and Information Sciences II	2-0-0	Visiting (Assoc.) Professor	Autumn	Even
Special Lecture on Mathematical and Information Sciences III	2-0-0	Visiting (Assoc.) Professor	Spring	Odd
Special Lecture on Mathematical and Information Sciences IV	2-0-0	Visiting (Assoc.) Professor	Autumn	Odd
Forum on Global Informatics I	0-1-0	Osamu Watanabe, Tsuyoshi Murata, Tohru Yagi	Spring	Doctoral, 1st year
Forum on Global Informatics II	0-1-0	Osamu Watanabe, Tsuyoshi Murata, Tohru Yagi	Autumn	Doctoral, 1st year
Doctoral Career Design II-S-E	0-1-0		Spring	Doctoral, 2nd year
Doctoral Career Design II-F-E	0-1-0		Autumn	Doctoral, 2nd year

Research Courses

Class	Credits	Lecturer	Semester	Note
Advanced Exercises and Experiments in Mathematical Science I	0-1-1	Each Prof.	Spring	Master's, 1st year
Advanced Exercises and Experiments in Mathematical Science II	0-1-1	Each Prof.	Autumn	Master's, 1st year
Advanced Exercises and Experiments in Mathematical Science III	0-1-1	Each Prof.	Spring	Master's, 2nd year
Advanced Exercises and Experiments in Mathematical Science IV	0-1-1	Each Prof.	Autumn	Master's, 2nd year
Advanced Exercises and Experiments in Computing Science I	0-1-1	Each Prof.	Spring	Master's, 1st year
Advanced Exercises and Experiments in Computing Science II	0-1-1	Each Prof.	Autumn	Master's, 1st year
Advanced Exercises and Experiments in Computing Science III	0-1-1	Each Prof.	Spring	Master's, 2nd year

Advanced Exercises and Experiments in Computing Science IV	0-1-1	Each Prof.	Autumn	Master's, 2nd year
Seminar I on Mathematical and Computing Sciences	0-1-0	Academic Advisor	Spring	Master's, 1st year
Seminar II on Mathematical and Computing Sciences	0-1-0	Academic Advisor	Autumn	Master's, 1st year
Seminar III on Mathematical and Computing Sciences	0-1-0	Academic Advisor	Spring	Master's, 2nd year
Seminar IV on Mathematical and Computing Sciences	0-1-0	Academic Advisor	Autumn	Master's, 2nd year
Seminar V on Mathematical and Computing Sciences	0-2-0	Academic Advisor	Spring	Doctoral, 1st year
Seminar VI on Mathematical and Computing Sciences	0-2-0	Academic Advisor	Autumn	Doctoral, 1st year
Seminar VII on Mathematical and Computing Sciences	0-2-0	Academic Advisor	Spring	Doctoral, 2nd year
Seminar VIII on Mathematical and Computing Sciences	0-2-0	Academic Advisor	Autumn	Doctoral, 2nd year
Seminar IX on Mathematical and Computing Sciences	0-2-0	Academic Advisor	Spring	Doctoral, 3rd year
Seminar X on Mathematical and Computing Sciences	0-2-0	Academic Advisor	Autumn	Doctoral, 3rd year

4. Courses by Departments common for all the three departments

Class	Credits	Lecturer	Semester	Note
Internship on Information Science & Engineering 1A	0-0-1	Chair of Dept. of Computer Science	Spring	Consult the academic supervisor(s)
Internship on Information Science & Engineering 2A	0-0-2	Chair of Dept. of Computer Science	Spring	Consult the academic supervisor(s)
Internship on Information Science & Engineering 1B	0-0-1	Chair of Dept. of Computer Science	Autumn	Consult the academic supervisor(s)
Internship on Information Science & Engineering 2B	0-0-2	Chair of Dept. of Computer Science	Autumn	Consult the academic supervisor(s)
Forum on Global Informatics I	0-1-0	Osamu Watanabe, Tsuyoshi Murata, Tohru Yagi	Spring	Doctoral, 1st year
Forum on Global Informatics II	0-1-0	Osamu Watanabe, Tsuyoshi Murata, Tohru Yagi	Autumn	Doctoral, 1st year
Doctoral Career Design II-S-E	0-1-0		Spring	Doctoral, 2nd year
Doctoral Career Design II-F-E	0-1-0		Autumn	Doctoral, 2nd year

5. Liberal Arts and General Education

	Remarks
International Communication Interdisciplinary Courses Interdepartmental Courses Arts and Humanities Career Development Courses Courses for Developing Creativity Courses for International Students	Refer to VI. Liberal Arts and General Education

5. Syllabus of Program Subjects

76019

Advanced Coding Theory

Lecturer Haruhiko Kaneko

Spring Semester, Odd year

Credits: 2-0-0

The objective of this course is to introduce an application of coding theory to digital systems, and to give how to design excellent codes to improve computer system reliability.

76015

Distributed Algorithms

Prof. Takehiro Tokuda

Autumn Semester

Credits: 2-0-0

The objective is for students to understand design principles of concurrent/distributed algorithms and their applications to computing environments.

76029

Advanced Data Engineering

Prof. Haruo Yokota

Autumn Semester

Credits: 2-0-0

The data engineering is an active research area for manipulating a large amount of persistent data sophisticatedly, such as processing databases. This class focuses on advanced approaches for the mechanism, algorithm and architecture in data engineering. Topics include transaction models, data warehousing, OLAP, indexing methods, parallel database operations, data replication, failure recovery, storage systems, workflow management system, XML databases.

76006

Concurrent System Theory

Prof. Naoki Yonezaki

Spring Semester

Credits: 2-0-0

In this course, concepts and techniques for formalizing concurrent systems are introduced. Fundamental algebraic and logical approaches are described. We also used the formalism to analyze and verify properties of concurrent systems. Concurrency, Process algebra, trace, Bi-simulation, Co-induction, Observational congruence, CSP, CCS, π-calculus, Process logic, Dynamic logic.

76017

Machine Learning

Assoc. Prof. Tsuyoshi Murata

Autumn Semester, Even year

Credits: 2-0-0

This course introduces machine learning concepts as well as practical advice on applying machine learning tools and techniques in real-world data mining situations.

76033

Advanced Data Analysis

Assoc. Prof. Masashi Sugiyama

Spring Semester, Odd year

Credits: 2-0-0

The objective of this course is to introduce basic ideas and practical methods of discovering useful structure hidden in the data.

76013

Pattern Information Processing

Assoc. Prof. Masashi Sugiyama

Spring Semester, Even year

Credits: 2-0-0

Inferring an underlying input-output dependency from input and output examples is called supervised learning. This course focuses on a statistical approach to supervised learning and introduces its basic concepts as well as state-of-the-art techniques.

76018

Computer Graphics

Spring Semester (not offered in 2014)

Credits: 2-0-0

The objective of this course is to introduce basic ideas and practical methods of Computer Graphic theory and its application.

76027

Speech Information Processing

Prof. Koichi Shinoda

Spring Semester

Credits: 2-0-0

This course aims to discuss various issues related to speech information processing.

76016

Logic and Software

Assoc. Prof. Shinya Nisizaki

Spring Semester, Odd year

Credits: 2-0-0

Proofs in formal logic can be regarded as programs. This course will introduce mathematical logic as a fundamental theory of programs. Several formal systems in logic are explained from the viewpoint of computer science.

76007

Software Design Methodology

Prof. Motoshi Saeki

Autumn Semester, Even year

Credits: 2-0-0

In this course, you learn the techniques on requirements engineering such as goal-oriented requirements analysis and software design, e.g. object-oriented design methods, and practice them through small

development case studies.

76025

Human Computer Interaction

Prof. Hideki Koike

Spring Semester

Credits: 2-0-0

This course aims to discuss man-machine interface design and its evaluation techniques. Topics include multimodal interface, cognitive engineering, ergonomics, and modeling of human information processing.

76053

Complex Networks

Prof. Tsuyoshi Murata

Autumn Semester, Odd year

Credits: 2-0-0

Basic knowledge for analyzing network data is introduced. Topics include metrics of networks, common properties of real networks, algorithms for processing networks, models of networks, visualization of networks, and tools for analyzing networks.

76010

Advanced Operating Systems

Prof. Takuo Watanabe

Autumn Semester

Credits: 2-0-0

The objective of this course is to introduce the state of the art in operating systems and related technologies. Topics are chosen from Distributed Operating Systems, Realtime Operating Systems, Embedded Systems, System-Level Security Mechanisms, Virtual Execution Environment, System Description Languages, Formal Approaches to System Software, and so on.

76060

System Development International Project

Prof. Katsuhiko Gondow and Lecturer Chikako Morimoto

Spring Semester

Credits: 0-2-0

This class focuses on the social value of the computing system. The aim is to learn business dynamics and the software life cycle by the project-based learning. Through the analysis of a sample system the students learn the followings; 1) requirements process, 2) service management, 3) project management of the system development.

88029

Human centered informatics exercise

Prof. Koichi Shinoda and Lecturer Haruhiko Kaneko

Autumn Semester

Credits: 0-2-0

This course is Project-based learning to acquire knowledge and skills for human centered informatics. Students make a group to carry out a project related to human centered informatics using new technologies and equipment such as human motion capturing systems, biosensors, virtual reality systems.

76711-76712

Special Experiments I, II on Computer Science

Advisor

I : Spring Semester Credits: 0-0-2

II: Autumn Semester Credits: 0-0-2

These courses provide the opportunities of high-level experiments in the field of computer science.

76701-76704

Seminar I, II, III, IV on Computer Science

Advisor

I: Spring Semester Credits: 0-1-0

II: Autumn Semester Credits: 0-1-0

III: Spring Semester Credits: 0-1-0

IV: Autumn Semester Credits: 0-1-0

In these courses, all students read papers and textbooks related to their research fields and discuss each other about them.

76801-76806

Seminar V, VI, VII, VIII, IX, X on Computer Science

Advisor

V: Spring Semester Credits: 2-0-0

VI: Autumn Semester Credits: 2-0-0

VII: Spring Semester Credits: 2-0-0

VIII: Autumn Semester Credits: 2-0-0

IX: Spring Semester Credits: 2-0-0

X: Autumn Semester Credits: 2-0-0

In these courses, all students read papers and textbooks related to their research fields and discuss each other about them.

77602

Mechanical and Environmental Informatics Project I

Assoc. Prof. Yusuke Miyazaki et al.

Autumn Semester

Credits: 0-1-2

In this class, all students are expected to do the followings: 1) through the investigation, analysis and proposal about various projects existing in the real world, 2) development of the ability to integrate and utilize the information and technologies that straggle in various fields, 3) building the ability to make an appropriate decision based on environmental informatics, 4) analysis, design and implementation of a software system using Java language applying object-oriented programming through the problem-based-learning style group work to develop creative power.

77663

Mechanical and Environmental Informatics Project II

All faculty members of the Department of Mechanical and Environmental Informatics

Spring Semester

Credits: 0-1-1

Although this class consists of two courses, students in International Graduate Program must select "software development course". Each student is expected to do analysis, design and implementation of a software system for any topic related to his/her master's thesis individually, using object-oriented programming language.

77713-77716

Mechanical and Environmental Informatics Research Process I, II, III, IV

All faculty members of the Department of Mechanical and Environmental Informatics

I: Spring Semester Credits: 0-1-1

II: Autumn Semester Credits: 0-1-1

III: Spring Semester Credits: 0-1-1

IV: Autumn Semester Credits: 0-1-1

This course provides the opportunities of discussion about the research process, presentation skills and discussion with other research field researchers. The abilities of problem settings and resolution about the research and communication will be improved.

77807-77808

Mechanical and Environmental Informatics Research Process V, VI

Each Prof.

V: Spring Semester Credits: 0-1-1

VI: Autumn Semester Credits: 0-1-1

This course provides the opportunities of discussion about the research process, presentation skills and discussion with other research field researchers. The abilities of problem settings and resolution about the research and communication will be improved.

77701-77704

Seminar in Mechanical and Environmental Informatics I, II, III, IV

Supervisor

I: Spring Semester Credits: 0-1-0

II: Autumn Semester Credits: 0-1-0

III: Spring Semester Credits: 0-1-0

IV: Autumn Semester Credits: 0-1-0

In these courses, all students read papers and textbooks related to their research fields and discuss each other about them.

77705-77710

Seminar in Mechanical and Environmental Informatics V, VI, VII, VIII, IX, X

Supervisor

V: Spring Semester Credits: 0-1-1

VI: Autumn Semester Credits: 0-1-1

VII: Spring Semester Credits: 0-1-1

VIII: Autumn Semester Credits: 0-1-1

IX: Spring Semester Credits: 0-1-1

X: Autumn Semester Credits: 0-1-1

In these courses, all students read papers and textbooks related to their research fields and discuss each other about them.

77054

Linear Systems and Control

Assoc. Prof. Tomohisa Hayakawa

Autumn Semester

Credits: 1-0-0

Introduction to linear systems theory and feedback control. This course provides a foundation of modern control theory and also covers several advanced topics in linear dynamical systems.

77006

Advanced Course of Inverse Problems

Prof. Kenji Amaya

Autumn Semester

Credits: 1-0-0

This course will provide full details on a variety of inverse problem-solving techniques, including examples and algorithms.

77037

Mathematical Processing of Measurement Information

Assoc. Prof. Seiichiro Hara

Autumn Semester, Even year

Credits: 2-0-0

Recently, because of the improvements of measuring instruments and computers, enormous measurement data can be acquired very easily. However it is not easy to interpret the information contained in such data correctly. In this course, mathematical processing method of extracting and recognizing the information contained in 1D and 2D measured data are explained comprehensively and practically.

77059

Control Theory for Robot Intelligence

Prof. Jun-ichi Imura

Spring Semester

Credits: 2-0-0

Modeling and control methods of hybrid systems, which are dynamical systems composed of continuous variables and discrete (logical) variables, are discussed as one of the mathematical approaches to control for realizing robot intelligence.

77055

Nonlinear and Adaptive Control

Assoc. Prof. Tomohisa Hayakawa

Autumn Semester

Credits: 1-0-0

Theory and application of adaptive control systems. Discussed are methods of on-line parameter identification and adaptive control for nonlinear systems with uncertain parameters. To this end, Lyapunov stability theory and Lyapunov functions for general nonlinear systems is examined in the first half of the course.

77060

Introduction to Neural Engineering

Assoc. Prof. Tohru Yagi
Autumn Semester, Even year
Credits: 2-0-0
Introduction to neural interface, a technology to link the nervous system and a machine. This course provides a foundation of neuroscience and also covers several update topics in neural engineering.

77053

Introduction to Biomedical Instrumentation
Assoc. Prof. Tohru Yagi
Spring Semester, Odd year (Offered in summer 2013)
Credits: 2-0-0
Introduction to biomedical instrumentation, a technology for medicine and health care. This course provides basics of physiology and covers several update topics in biomedical instrumentation.

77066

Advanced Course in Nonlinear Dynamics
Assoc. Prof. Hiroya Nakao
Spring Semester, Even year
Credits: 2-0-0
Nonlinear dynamical systems are used to model various real-world phenomena. In this lecture, starting with basic facts on dynamical systems theory, dynamical processes that lead to self-sustained rhythms, chaotic behavior, and spatiotemporal pattern formation will be explained, with applications in physics, chemistry, and engineering.

77067

Advanced Course of Digital Human Modeling
Assoc. Prof. Yusuke Miyazaki
Autumn Semester, Even year
Credits: 2-0-0
This lecture provides updated topics regarding biomechanical models of human body. The topics include method to measure and model biomechanical characteristics of human body such as the anatomical structure, motion, material properties, tolerance level. Besides, the lecture also covers applications of the digital human models to estimate safety or amenity of products or living environment.

77016

Theory and Applications of Urban Spatial Data
Prof. Toshihiro Osaragi
Autumn Semester, Odd year
Credits: 2-0-0
This course will focus on the theory and applications of spatiotemporal information for statistical-/ mathematical modeling of the sort typically used in urban and metropolitan policy, planning, and environmental analysis. Participants will learn example applications from their area of interest and then develop a simple application in the form of a model that incorporates spatiotemporal data.

77019

Analysis of Vibration and Elastic Wave
Prof. Souichi Hirose

Spring Semester
Credits: 2-0-0
Fundamental theories and analytical methods for vibrations and waves in solids are explained, and various engineering applications in seismic engineering, ultrasonic nondestructive testing and so forth will be presented.

77020

Intellectual Infrastructure Systems
Assoc. Prof. Takamasa Mikami
Spring Semester, Odd year
Credits: 2-0-0
Social infrastructure is becoming smart with the progress of information science and technology. This lecture gives an overview of the state of the art in intellectual infrastructure systems. This course also provides an opportunity to study advanced technologies on lifeline networks and related anti-disaster facilities. Your presentations and discussions will form an important part of this class.

77026

Air Quality Engineering
Prof. Shuji Fujii and Assoc. Prof. Naoki Kagi
Spring Semester, Even year
Credits: 2-0-0
The objective in this course is to understand basics and cleaning techniques for air quality in indoor environment and atmospheric environment and etc. Through reviewing and discussing the previous research papers for air quality, the technologies for measuring, analyzing and cleaning of air were investigated.

77048

Advanced Course on Coastal Environments
Prof. Kazuo Nadaoka
Autumn Semester, Even year
Credits: 2-0-0
Coastal zone is characterized with high primary production and rich biodiversity in its ecosystem, but it is highly vulnerable to various natural disasters and environmental impacts. This course introduces theories on physical and environmental processes in coastal zone with advanced modeling and monitoring technologies. Emphasis is put on significance of integrated watershed and coastal zone system assessment and management.

75049

Topics in Mathematical Optimization
Assoc. Prof. Mituhiro Fukuda
Spring Semester
Credits: 2-0-0
The main focus of this course is on algorithms to solve convex optimization problems which have recently gained some attention in continuous optimization. The course starts with basic theoretical results and then well-known algorithms will be analyzed and discussed.

75051

Fundamentals of Mathematical and Computing Sciences: Mathematics

Prof. Masaaki Umehara, Prof. Sadayoshi Kojima and Prof. Shinya Nishibata

Spring Semester

Credits: 2-0-0

This course introduces several basic concepts of mathematics (algebra, geometry, analysis etc.) and is intended to provide key knowledge necessary for advanced study in Mathematical and Computing Sciences.

75052

Fundamentals of Mathematical and Computing Sciences: Applied Mathematical Sciences

Prof. Naoto Miyoshi, Assoc. Prof. Mituhiro Fukuda and Assoc. Prof. Taiji Suzuki

Spring Semester

Credits; 2-0-0

This course introduces several basic concepts of mathematical optimization, probability and statistics, and is intended to provide key knowledge necessary for advanced study in Mathematical and Computing Sciences

75053

Fundamentals of Mathematical and Computing Sciences: Computer Science

Prof. Osamu Watanabe, Assoc. Prof. Toshio Endo and Assoc. Prof. Ken Wakita

Autumn Semester

Credits: 2-0-0

This course introduces several basic concepts from fields of computer science such as algorithm, computational complexity, programming, computer system, and is intended to provide key knowledge necessary for advanced study in Mathematical and Computing Sciences.

75005, 75006, 75029, 75030

Special Lecture on Mathematical and Information Sciences I, II, III, IV

Visiting (Assoc.) Professor

I: Spring Semester, Even year　Credits: 2-0-0

II: Autumn Semester, Even year　Credits: 2-0-0

III: Spring Semester, Odd year　Credits: 2-0-0

IV: Autumn Semester, Odd year　Credits: 2-0-0

In this course, lectures on various recent topics on mathematical and information sciences are given by visiting professors of Department of Mathematical and Computing Sciences.

75105, 75106

Forum on Global Informatics I, II

Prof. Osamu Watanabe, Assoc. Prof. Tsuyoshi Murata and Assoc. Prof. Toru Yagi

I: Spring Semester　Credits: 0-1-0

II: Autumn Semester　Credits: 0-1-0

This course is for training scientific communication skills for scientific presentation, discussion, organizing tutorial sessions, etc.

75761-75764

Advanced Exercises and Experiments in Mathematical Science I, II, III, IV

Each Prof.
I: Spring Semester Credits: 0-1-1
II: Autumn Semester Credits: 0-1-1
III: Spring Semester Credits: 0-1-1
IV: Autumn Semester Credits: 0-1-1
These courses provide the opportunities of advanced level of exercises and/or experiments in the research field of each student.

75771-75774

Advanced Exercises and Experiments in Computing Science I, II, III, IV
Each Prof.
I: Spring Semester Credits: 0-1-1
II: Autumn Semester Credits: 0-1-1
III: Spring Semester Credits: 0-1-1
IV: Autumn Semester Credits: 0-1-1
These courses provide the opportunities of advanced level of exercises and/or experiments in the research field of each student.

75701-75704

Seminar I, II, III, IV on Mathematical and Computing Sciences
Supervisor
I: Spring Semester Credits: 0-1-0
II: Autumn Semester Credits: 0-1-0
III: Spring Semester Credits: 0-1-0
IV: Autumn Semester Credits: 0-1-0
In these courses, students practice the process of thinking and understanding and skill of presentation and discussion through reading papers and/or textbooks related to their research fields and discussing them each other.

75801-75806

Seminar V, VI, VII, VIII, IX, X on Mathematical and Computing Sciences
Supervisor
V: Spring Semester Credits: 0-2-0
VI: Autumn Semester Credits: 0-2-0
VII: Spring Semester Credits: 0-2-0
VIII: Autumn Semester Credits: 0-2-0
IX: Spring Semester Credits: 0-2-0
X: Autumn Semester Credits: 0-2-0
These courses provide the opportunities of high-level exercises and/or experiments in the research field of each student.

76039-76042

Internship on Information Science & Engineering 1A, 2A, 1B, 2B
A Chair of Department of Computer Science
1A: Spring Semester Credits: 0-0-1
2A: Spring Semester Credits: 0-0-2
1B: Autumn Semester Credits: 0-0-1

2B: Autumn Semester　Credits: 0-0-2

A student goes to an external industry or organization to undergo supervised practical training on the topic related to information science & engineering. There are 4 types of programs 1A, 1B, 2A and 2B according to the period and semester when the internship is undertaken. For example, 1A or 2A should be applied if the student undertakes in the spring semester. The unit of credits depends on the period of the internship, and if it is about 2 weeks, 1A or 1B for 1 credit is applied. In the case of 4 or more weeks, 2A or 2B for 2 credits is applied. When the student applies this subject, she or he must submit to a committee member via an academic adviser the documents including the company or organization that she or he will go and the contents, in advance. Unsuitable contents are rejected to get credits. The schedule including the contents depends on a supervised industry or organization.