◆ Department of Mechanical and Environmental Informatics

1. Program Outline

Department of Mechanical and Environmental Informatics offers broad range of advanced courses as well as fundamental subjects in the field of mechanical informatics and environmental informatics. The courses are categorized into three groups: fundamental courses, which cover basic topics necessary for understanding physical phenomenon and information processing; advanced courses, which provide the state-of-the-art results and techniques in the field; and pragmatical courses, in which students acquire practical skills of mechanical and environmental informatics. Along with master's and doctoral research activities, students are expected to enhance the abilities of problem identification and resolution.

2. Course Outlines and Faculty

In this program, students are expected to acquire the following abilities on the basis of the outline described above.

1) Basic and cutting-edge expertise on various targeted areas in the field of mechanical and environmental informatics.
2) Technique to computerize and analyze environmental systems.
3) Maneuvering ability to apply the knowledge of mechanical and environmental informatics.
4) Problem setting and solving ability in the field of mechanical and environmental informatics.
5) Communication and presentation skills on the basis of logical thinking.
6) Adaptivity to rapidly progressing information society.

3. Guide to Study in the Department of Mechanical and Environmental Informatics

In this program, you will study on the basis of the following contents, in order to obtain knowledge mentioned above.

A) Basic and cutting-edge expertise

Study necessary basics for understanding of phenomena and processing of information, i.e., modeling, analysis, sensing, monitoring, design, planning, and information basic technology. Also study on cutting-edge knowledge on mechanical and environmental informatics such as production system, biological systems, robotics, architecture, urbanization, and environment).

B) Basic laboratory course

As basic education for obtaining hands-on skills of mechanical and environmental informatics, study on system design, computer programming skill, integrated technique and philosophy to computerize and analyze environmental systems.

C) Problem Based Learning (PBL) hands-on subject

Through PBL hands-on education by the courses of group laboratory, individual practice and internship, apply basics and cutting-edge knowledge of mechanical and environmental informatics to real problems. In addition, obtain communication and presentation skills, which are necessary in the process of problem-finding/-setting/-solving.

D) Master's thesis research and research ability

Through the documentation of research process and the discussion with many professionals including a supervisor, obtain the basic research ability. At the same time, firmly obtain problem-setting and -solving ability through master's thesis research.

E) Culture and international communication

Strengthen humanity and obtain adaptivity to different fields, through cultural and language subjects in addition to information ethics and project management.

4. Graduation Requirements

Department of Mechanical and Environmental Informatics

【Master's degree】
・36 credits or more from the graduate school courses.
・Research Courses (研究科目群)
　(1) 4 credits from the Seminar Courses. (講究科目)
　(2) 8 credits from the Graduate Research Courses. (研究関連科目)

・Courses by Departments (専門科目群)
    (1) 14 credits or more from the Departmental Courses. (専攻専門科目)Students who would like to take either Mechanical and Environmental Informatics International Off-Campus Project A or B, he/she must consult his/her supervisor in advance. There might be some restrictions to take these subjects, depending on his/her nationality and/or residential status.
    (2) 2 credits or more from the Courses in Other Departments. (他専門科目)
・2 credits or more from the Liberal Arts and General Education(G). (大学院教養・共通科目群)
・Complete master's thesis and pass the final examination.

【Doctoral degree】
For a Doctoral degree a doctoral candidate must satisfy the following requirements:
    (1) Seminar Course in each term and Research Process must be taken.
    (2) Activities outside school such as presentation at international conferences and journal publication.
    (3) Complete a thesis for the degree and pass the final examination.
The candidate who satisfies the above requirements and passes the final examination is awarded the doctoral degree. The minimum period of study is three years in total, which include both the master's and doctoral program for the both degrees. Note that the above requirements are minimal and some additional requirements may be conditioned depending on the special course. All students are strongly advised to consult with their own supervisors about the study plan.

4. Tables of Courses

Some of courses can be delivered in English by requests from the students. These courses are counted as the credits of the above degree requirements for master's and doctoral degrees. Likewise, lectures given in Japanese are counted as the credits of the requirements, too. If there are any questions or anything that is not clear about the curriculum, please consult academic advisor(s) and lecturer(s) for details in advance since more detailed information may be described in the Japanese version of the course guide.

Research Courses (研究科目群)

Course Number	Remarks* (See footnotes)	Course	Department Offering Course**	Credit	Chair	Semester S: Spring A:Autumn	Opening Year a: Annually e: Even o: Odd
77701	R, MP	Seminar in Mechanical and Environmental Informatics I	MEI	0-1-0	Academic Adviser	S	a
77702	R, MP	Seminar in Mechanical and Environmental Informatics II	MEI	0-1-0	Academic Adviser	A	a
77703	R, MP	Seminar in Mechanical and Environmental Informatics III	MEI	0-1-0	Academic Adviser	S	a
77704	R, MP	Seminar in Mechanical and Environmental Informatics IV	MEI	0-1-0	Academic Adviser	A	a
77801	R, DP	Seminar in Mechanical and Environmental Informatics V	MEI	0-2-0	Academic Adviser	S	a
77802	R, DP	Seminar in Mechanical and Environmental Informatics VI	MEI	0-2-0	Academic Adviser	A	a
77803	R, DP	Seminar in Mechanical and Environmental Informatics VII	MEI	0-2-0	Academic Adviser	S	a
77804	R, DP	Seminar in Mechanical and Environmental Informatics VIII	MEI	0-2-0	Academic Adviser	A	a
77805	R, DP	Seminar in Mechanical and Environmental Informatics IX	MEI	0-2-0	Academic Adviser	S	a
77806	R, DP	Seminar in Mechanical and Environmental Informatics X	MEI	0-2-0	Academic Adviser	A	a
77713	R, MP	Mechanical and Environmental Informatics Research Process I	MEI	0-1-1	Academic Adviser	S	a
77714	R, MP	Mechanical and Environmental Informatics Research Process II	MEI	0-1-1	Academic Adviser	A	a
77715	R, MP	Mechanical and Environmental Informatics Research Process III	MEI	0-1-1	Academic Adviser	S	a
77716	R, MP	Mechanical and Environmental Informatics Research Process IV	MEI	0-1-1	Academic Adviser	A	a
77717	R, DP	Mechanical and Environmental Informatics Research Process V	MEI	0-1-1	Academic Adviser	S	a
77718	R, DP	Mechanical and Environmental Informatics Research Process VI	MEI	0-1-1	Academic Adviser	A	a
77719	R, DP	Mechanical and Environmental Informatics Research Process VII	MEI	0-1-1	Academic Adviser	S	a
77720	R, DP	Mechanical and Environmental Informatics Research Process VIII	MEI	0-1-1	Academic Adviser	A	a
77721	R, DP	Mechanical and Environmental Informatics Research Process IX	MEI	0-1-1	Academic Adviser	S	a
77722	R, DP	Mechanical and Environmental Informatics Research Process X	MEI	0-1-1	Academic Adviser	A	a

*R: Required, MP: Master's Program, DP: Doctoral Program

**MEI: Dept. Mechanical and Environmental Informatics

Courses by Departments (専門科目群)

Course Number	Remarks[1] (See footnotes)	Course	Department Offering Course[2]	Credit	Chair	Semester S: Spring A:Autumn	Opening Year a: Annually e: Even o: Odd
77010		Metrology and Information Processing	MEI(MG)	2-0-0	K. Sasajima	S	e
40046		Optimal Control	OD (3mech)	1-0-0	M. Fujita	S	a
40080		Computer Vision	OD (3mech)	2-0-0	M. Okutomi	S	a
77031		Advanced Course of Regional Planning	MEI(EG)	2-0-0	A. Soshiroda	S	a
77065		GPU Computing	MEI(EG)	1-1-0	T. Aoki	S	a
77019	★	Analysis of Vibration and Elastic Wave	MEI(EG)	2-0-0	S. Hirose	S	o: English e: Japanese
77057	★	Econometric Analysis	MEI(EG)	2-0-0	Y.Matsushita	S	a
75102		Advanced Course on Internet Infrastructure	ISE	2-0-0	M. Ota	S	a
76027	★	Speech Information Processing	OD (CS)	2-0-0	Undecided	S	o
77037	★	Mathematical Processing of Measurement Information	MEI(MG)	2-0-0	S. Hara	A	e: English o: Japanese
77004		Advanced Course of Dynamical Systems	MEI(MG)	2-0-0	K. Kimura	A	o
77006	★	Advanced Course of Inverse Problems	MEI(MG)	1-0-0	K. Amaya	A	a
77054	★	Linear Systems and Control	MEI(MG)	1-0-0	T. Hayakawa	A	a
77055	★	Nonlinear and Adaptive Control	MEI(MG)	1-0-0	T. Hayakawa	A	a
40067	★	Advanced Course of Mechanical Vibration	OD (3mech)	2-0-0	H.Takahara et al.	A	a
77066	★	Advanced course in nonlinear dynamics	MEI(MG)	2-0-0	H. Nakao	S	e (from 2014)
68003		Advanced Theories and Practice of Urban Land Use Planning	OD (SE)	2-0-0	N. Nakai et al.	A	a
77016	★	Theory & Applications of Urban Spatial Data	MEI(EG)	2-0-0	T. Osaragi	A	o: English e: Japanese
75015		Computational Complexity Theory	OD (MCS)	2-0-0	O. Watanabe	A	a
75001		Mathematical Models and Computer Science	OD (MCS)	2-0-0	K. Sasajima K. Amaya	A	a
75003		Grid Computing	OD (MCS)	2-0-0	S. Matsuoka	A	a
75103		Advanced Course on Internet Application	ISE	2-0-0	M. Ota	A	a
77056		Robot Audition and Sound Processing	MEI(MG)	2-0-0	K. Nakadai	S	a
77060	★	Introduction to Neural Engineering	MEI(MG)	2-0-0	T. Yagi	A	e
77053	★	Introduction to Biomedical Instrumentation	MEI(MG)	2-0-0	T. Yagi	S	o (Offered in summer 2013)
77059	★	Control Theory for Robot Intelligence	MEI(MG)	2-0-0	J. Imura	S	a
40035		Intelligent and Integrated Manufacturing	OD (3mech)	2-0-0	Y. Saito T. Tanaka	S	a
40112		Kinematic Synthesis of Mechanisms	OD (3mech)	2-0-0	Y. Takeda	S	
77026	★	Air Quality Engineering	MEI(EG)	2-0-0	S. Fujii N. Kagi	S	e: English (from2014) o: Japanese
77020	★	Intellectual Infrastructure Systems	MEI(EG)	2-0-0	T. Mikami	S	o: English e: Japanese
77047	★	Regional Information Analysis	MEI(EG)	2-0-0	Y. Higuchi	S	a
77013		Conservation and Restoration of Ecological Environmental Systems	MEI(EG)	2-0-0	K. Nadaoka	S	o
61014	★	Advanced Mathematical Methodologies for Infrastructure and Transportation Planning	OD (CE)	2-0-0	D. Fukuda	S	o: English e: Japanese
77501		Special Lecture on Mechano-Informatics A	MEI	1-0-0	Undecided	S	a
77502		Special Lecture on Mechano-Informatics B	MEI	1-0-0	Undecided	S	a
77043		Relationship and Management of CAD/CAM Data System	MEI(MG)	2-0-0	K. Sasajima Y. Nagasaka	A	a
40118		Biomechanical systems	OD (3mech)	1-0-0	N. Ino	A	e
70009	★	Regional Atmospheric Environment	OD (IDE)	2-0-0	M. Kanda	A	a
77048	★	Advanced Course on Coastal Environments	MEI(EG)	2-0-0	K. Nadaoka	A	e
77503		Special Lecture on Mechano-Informatics C	MEI	1-0-0	Undecided	A	a
77040		Object-Oriented Design	MEI(MG)	1-1-0	K. Amaya M. Saeki S. Hara T. Yagi	S	a
77058		Java Programming	MEI(MG)	0-1-0	E. Onodera et al.	S	a
77051		Environmental Monitoring and Data Processing 1	MEI	2-0-0	S. Hirose et al.	S	a
77045		Numerical Simulation of Environments 1	MEI(EG)	2-0-0	Undecided	S	a
77663	★,○	Mechanical and Environmental Informatics Project II	MEI	0-1-1	Faculty Members	S	a
77664	○	Mechanical and Environmental Informatics International Off-Campus Project A	MEI	0-1-2	Chair	S	a
76039		Internship on Information Science & Engineering 1A	ISE	0-0-1	Chair	S	a

76040		Internship on Information Science & Engineering 2A	ISE	0-0-2	Chair	S	a
77052		Environmental Monitoring and Data Processing 2	MEI	2-0-0	S. Fujii T. Mikami et al.	A	a
77046		Numerical Simulation of Environments 2	MEI(EG)	2-0-0	S. Kanae et al.	A	a
77602	★,○	Mechanical and Environmental Informatics Project I	MEI	0-1-2	Faculty Members	A	a
77665	○	Mechanical and Environmental Informatics International Off-Campus Project B	MEI	0-1-2	Chair	A	a
76041		Internship on Information Science & Engineering 1B	ISE	0-0-1	Chair	A	a
76042		Internship on Information Science & Engineering 2B	ISE	0-0-2	Chair	A	a
77067	★	Advanced Course of Digital Human Modeling	MEI(MG)	2-0-0	Y. Miyazaki	A	e: English (from2014) o: Japanese
77068		Networking for Information Society	MEI(MG)	2-0-0	T. Murase	A	A

1)

★: International Graduate Program,　　○: At least five credits are required in total

2)

ISE: Graduate School of Information Science and Engineering

MEI: Dept. Mechanical and Environmental Informatics

　MG: Mechano-Informatics Group,　　　EG: Environmental Informatics Group

OD: Other Departments

　3mech: Three Deprtments of Mechanical Engineering

　MCS: Dept. Mathematical and Computing Science,　　　　CS: Dept. Computer Science,

　CE: Dept. Civil Engineering,　　　　SE: Dept. Social Engineering,　　　IDE: Dept. International Development Engineering

Liberal Arts and General Education(G) (大学院教養・共通科目群)

	Remarks
International Communication (G) （大学院国際コミュニケーション科目） Interdisciplinary Courses (G) （大学院総合科目） Interdepartmental Courses (G) （大学院広域科目） Arts and Humanities (G) （大学院文明科目） Career Development Courses (G) （大学院キャリア科目） Courses for Developing Creativity (G) （大学院創造性育成科目） Courses for International Students (G) （大学院留学生科目）	Refer to VI. Liberal Arts and General Education

5. Syllabus of Selected Courses offered in English

77602
Mechanical and Environmental Informatics Project I
All faculty members of the department
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 of the ability to make an accurate 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
Spring Semester
Credits: 0-1-1
Although this class consists of two courses, IPG students 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 thesis individually, using object-oriented language.

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

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 (from 2014)

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. Sohichi Hirose

Spring Semester, Odd year

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 & Assoc. Prof. Naoki Kagi

Spring Semester, Even year (English from 2014)

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.

77047

Regional Information Analysis

Prof. Yoichiro Higuchi

Spring Semester

Credits: 2-0-0

The gravity model has long been utilized as an efficient tool for identifying various determinants of interregional migration, industrial input-output table, inter-regional communication via telephone and internet, international trade, and so called spatial interactions. In this lecture, we study firstly linear algebra and matrix differentiation for econometric analyses, and secondly, the development process to overcome various technical problems in estimation of the gravity model. Students are requested to have already taken an introductory course of econometrics.

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.

77057

Econometric Analysis

Assoc. Prof. Yukitoshi Matsushita

Spring Semester

Credits: 2-0-0

Econometric Analysis introduces the first-year master students to multiple regression methods for analyzing cross-section and panel data (microeconometrics). The objective of the course is for the students to learn how to conduct and how to critique empirical studies in economics and related fields. Accordingly, the emphasis of the course is on empirical applications. In order to learn how to analyze data, the students will be assigned homework every week in which they are required to analyze data from the real world using econometrics software (Stata).