FY2021 Master's program summary

1) Basic Biomedical Engineering

Students must select at least **4 credits** from Category A.
Students must select at least **2 credits** from Category B.

Lectures of Applied Medical Engineering

Lecture	Language	Requirement	Category	Credit
Introduction to Biomedical Engineering	J	SR	A	2
Introduction to Coaching Communication in Biomedical Engineering	J	SR	A	2
Biomechanics	JE2	SR	A	2
Biomaterials	JE1	SR	A	1
Medical Micro/Nano Technology	J	SR	A	2
Bioelectromagnetics	J	SR	A	2
Biomedical Ultrasonics	JE1	SR	A	2
Measurement and Control for Biomedical Engineering	JE1	SR	A	2
Medical Information Metrology	J	SR	A	2
Bio-Medical Interface Fabrication	JE1	SR	A	2
Technology Related to Diagnostic Medical Imaging	J	SR	A	2
Quantum Medical Imaging	J	SR	A	2
Artificial Organs and Regenerative Medicine	J	S		2
Pathogenesis and Treatment of Diseases and Disorders 1: Biomedical Engineering for Rehabilitation, Sports, Neurousurgery and Dentisity	J	S		2
Pathogenesis and Treatment of Diseases and Disorders 2: Biomedical Engineering for Therapeutic Treatment & Rehabilitation	J	S		2
Particle Therapy Engineering	J	S		2
Socio-Biomedical Engineering	E	S		2
Medical and Welfare Engineering	J	S		2
Medical Device Innovation Strategy	J	S		2
Regulatory Science for Medical Device	J	S		2
Business Ecosystem for Medical Device	J	S		2

FY2021 Master's program summary

Lecture	Language	Requirement	Category	Credit
Laboratory Training in Mechanical and Electrical Engineering for Biomedical Applications	JE1	SR	B	2
Laboratory Training for Physiology	JE1	SR	B	2
Laboratory Training for Biotechnology	J	SR	B	2
Medical Device Development Practice	J	SR	B	2
Special Lecture on Biomedical Engineering A	J	S		1~2
Domestic Internship Training A	J	S		1~2
International Internship Training A	E	S		1~2
Medical Device Innovation International Internship A	E	S		1~2
Problem-Based-Learning Seminar	J	R		4
Master Course Seminar on Biomedical Engineering	J	R		6
Related lectures	Students can select lectures recognized as related by the Faculty Committee.			

Language:
J = Lectures offered in Japanese
E = Lectures offered in English
All materials such as lecture slides, report assignments and exam questions are provided in English.
JE1 = Lectures offered in Semi-English
Lectures will be given in Japanese in principle, but questions will be accepted in English. All materials and exam questions will be provided in English.
JE2 = Lectures offered in English and Japanese every other year.

Requirement:
R = Required
SR = Selective required
S = Selective

FY2021 Master's program summary

2) Applied Biomedical Engineering

Students must select at least **20 credits** from the lectures listed below, including **10 credits** from required subjects and at least **6 credits** from elective required subjects.
A: Students must select at least **4 credits** from the following lectures.
B: Students must select at least **2 credits** from the following lectures.

Lectures of Applied Medical Engineering

Lecture	Language	Requirement	Category	Credit
Introduction to Biomedical Engineering	J	SR	A	2
Introduction to Coaching Communication in Biomedical Engineering	J	SR	A	2
Biomechanics	JE2	SR	A	2
Biomaterials	JE1	SR	A	2
Medical Micro/Nano Technology	J	S		2
Bioelectromagnetics	J	S		2
Biomedical Ultrasonics	JE1	S		2
Measurement and Control for Biomedical Engineering	JE1	S		2
Medical Information Metrology	J	S		2
Bio-Medical Interface Fabrication	JE1	S		2
Technology Related to Diagnostic Medical Imaging	J	SR	A	2
Quantum Medical Imaging	J	SR	A	2
Artificial Organs and Regenerative Medicine	J	SR	A	2
Pathogenesis and Treatment of Diseases and Disorders 1: Biomedical Engineering for Rehabilitation, Sports, Neurousurgery and Dentisity	J	SR	A	2
Pathogenesis and Treatment of Diseases and Disorders 2: Biomedical Engineering for Therapeutic Treatment & Rehabilitation	J	SR	A	2
Particle Therapy Engineering	J	SR	A	2
Socio-Biomedical Engineering	E	S		2
Medical and Welfare Engineering	J	S		2
Medical Device Innovation Strategy	J	S		2
Regulatory Science for Medical Device	J	S		2
Business Ecosystem for Medical Device	J	S		2

FY2021 Master's program summary

Lecture	Language	Requirement	Category	Credit
Laboratory Training in Mechanical and Electrical Engineering for Biomedical Applications	JE1	S	B	2
Laboratory Training for Physiology	JE1	S	B	2
Laboratory Training for Biotechnology	J	S	B	2
Medical Device Development Practice	J	S		2
Special Lecture on Biomedical Engineering A	J	S		1~2
Domestic Internship Training A	J	S		1~2
International Internship Training A	E	S		1~2
Medical Device Innovation International Internship A	E	S		1~2
Problem-Based-Learning Seminar	J	R		4
Master Course Seminar on Biomedical Engineering	J	R		6
Related lectures	Students can select lectures recognized as related by the Faculty Committee.			

Language:
J = Lectures offered in Japanese
E = Lectures offered in English
All materials such as lecture slides, report assignments and exam questions are provided in English.
JE1 = Lectures offered in Semi-English
Lectures will be given in Japanese in principle, but questions will be accepted in English. All materials and exam questions will be provided in English.
JE2 = Lectures offered in English and Japanese every other year.

Requirement:
R = Required
SR = Selective required
S = Selective

FY2021 Master's program summary

3) Medical Device Innovation

Students must select at least **20 credits** from the lectures listed below, including 1**8 credits** from required subjects.

Lectures of Applied Medical Engineering

Lecture	Language	Requirement	Category	Credit
Introduction to Biomedical Engineering	J	S		2
Introduction to Coaching Communication in Biomedical Engineering	J	S		2
Biomechanics	JE2	S		2
Biomaterials	JE1	S		2
Medical Micro/Nano Technology	J	S		2
Bioelectromagnetics	J	S		2
Biomedical Ultrasonics	JE1	S		2
Measurement and Control for Biomedical Engineering	JE1	S		2
Medical Information Metrology	J	S		2
Bio-Medical Interface Fabrication	JE1	S		2
Technology Related to Diagnostic Medical Imaging	J	S		2
Quantum Medical Imaging	J	S		2
Artificial Organs and Regenerative Medicine	J	S		2
Pathogenesis and Treatment of Diseases and Disorders 1: Biomedical Engineering for Rehabilitation, Sports, Neurousurgery and Dentisity	J	S		2
Pathogenesis and Treatment of Diseases and Disorders 2: Biomedical Engineering for Therapeutic Treatment & Rehabilitation	J	S		2
Particle Therapy Engineering	J	S		2
Socio-Biomedical Engineering	E	S		2
Medical and Welfare Engineering	J	S		2
Medical Device Innovation Strategy	J	R		2
Regulatory Science for Medical Device	J	R		2
Business Ecosystem for Medical Device	J	R		2

FY2021 Master's program summary

Lecture	Language	Requirement	Category	Credit
Laboratory Training in Mechanical and Electrical Engineering for Biomedical Applications	JE1	S		2
Laboratory Training for Physiology	JE1	S		2
Laboratory Training for Biotechnology	J	S		2
Medical Device Development Practice	J	R		2
Special Lecture on Biomedical Engineering A	J	S		1~2
Domestic Internship Training A	J	S		1~2
International Internship Training A	E	S		1~2
Medical Device Innovation International Internship A	E	S		1~2
Problem-Based-Learning Seminar	J	R		4
Master Course Seminar on Biomedical Engineering	J	R		6
Related lectures	Students can select lectures recognized as related by the Faculty Committee.			

Language:
J = Lectures offered in Japanese
E = Lectures offered in English
All materials such as lecture slides, report assignments and exam questions are provided in English.
JE1 = Lectures offered in Semi-English
Lectures will be given in Japanese in principle, but questions will be accepted in English. All materials and exam questions will be provided in English.
JE2 = Lectures offered in English and Japanese every other year.

Requirement:
R = Required
SR = Selective required
S = Selective

FY2021 Master's program summary

Lecture Summary

Introduction to Biomedical Engineering
WBI-BME601J

All faculties

This lecture will provide an overview of "Biomedical Engineering" from the perspective of its actual application and completion in the field of medicine and diagnosis. In particular, the lecture will cover the basics of (1) clinical engineering, (2) medical devices, (3) medical imaging, (4) molecular, cellular and tissue engineering, and (5) biomaterials, which are currently playing an important role in medical engineering. The lecture provides an overview of the current and future needs in medical research and treatment, with a focus on gastrointestinal diseases. Focusing on the development and application of physical methods for introducing molecules into cells, furthermore, students will learn about cells, the basic unit of life, and their functions, as well as the dynamics and imaging of molecules inside cells, chip technology, diagnosis and treatment.

Introduction to Coaching Communication in Biomedical Engineering
WBI-BME602J

Shinichi Izumi (Takashi Kano, Akihiro Tachiiri, Hidero Niioka)

The ability to communicate is not only a skill that companies and organizations should have in the human resources they seek, but it is also an essential skill in research activities. Coaching is used in various fields such as sports, business, education, and medical care as a form of communication that promotes the proactive behavior of others and helps them achieve their goals. The purpose of this course is to provide students with coaching skills that will be useful in their graduate school research activities and post-graduate careers.

Biomechanics
WBI-BME603B

Makoto Ohta, Kenji Kikuchi

This course provides a detailed description of the mechanical mechanisms and functions of living organisms from the standpoint of continuum mechanics. Especially, fluid mechanics of blood flow and airflow, muscles, blood vessels, and cells as soft materials, and statics and dynamics of the skeletal system as hard materials will be discussed to establish the mechanical understanding necessary for future research. Then, measurement and visualization methods of mechanical information in living organisms will be explained, and students will learn the principles of measurement of biological information and its applications.

Note: This course is offered in Japanese and English every other year, and will be

offered in Japanese in R03.

Biomaterials
WBI-BME604B
Takayuki Narushima, Nobuyuki Morimoto, Kyosuke Ueda

In the super-aging society, expectations for biomaterials are high and various functions are required. This course covers the design, physical, mechanical, chemical, and biological properties of metallic, ceramic, and polymeric biomaterials used for artificial organs and therapy, their biological reactions with hard and soft tissues, as well as their evaluation methods. The purpose of this course is to provide an understanding of the fundamental characteristics of biomaterials.

Medical Micro/Nano Technology
WBI-BME605J
Yoichi Haga

This lecture focuses on the fundamentals and applications of microfabrication technologies that are useful for realizing small but highly functional and multifunctional medical and health care devices, especially MEMS (microelectromechanical systems) technology, which is developed from semiconductor microfabrication technology to create a batch of small mechanical elements. In addition to explaining specific elemental technologies and basic principles, specific applications to minimally invasive medical devices, implantable devices, and healthcare devices, as well as future directions will be discussed. In addition, specific methods for clinical evaluation and development of medical devices for actual clinical use will be discussed.

Bioelectromagnetics
WBI-BME606J
Undecided

The electrical and magnetic properties of biological tissues are described, and the engineering handling methods are explained. This is followed by an overview of the effects of electromagnetic fields and waves on living organisms and an introduction to the concept of regulation. Finally, topics such as MRI, electromagnetic stimulation, biomagnetic measurement, MEG, hyperthermia and other medical applications of electromagnetic fields and electromagnetic waves are introduced. Throughout the course, the goal is to acquire the basic knowledge necessary for research in borderline areas that span engineering and medicine.

Biomedical Ultrasonics
WBI-BME607B
Mototaka Arakawa

The basic concepts of elastic waves will be taught while understanding their generation, propagation, interaction with light, and their applications, especially in medical and biological applications. In this lecture, the basics and applications of linear and nonlinear propagation of longitudinal waves are first explained, then electroacoustic conversion by piezoelectric effect is explained. In addition, imaging applications, biological effects and therapeutic applications, interaction between ultrasonic waves and microbubbles, interaction between ultrasonic waves and light waves by acousto-optic effects, and operation of elastic wave application devices will be explained.

Measurement and Control for Biomedical Engineering
WBI-BME608J

Takashi Watanabe, Norihiro Sugita

This lecture covers the fundamentals and applications of measurement and control for biological systems. First, students will learn the basics of measurement of bio-electric signals and human movements. Next, students will learn the basics of PID control, neural network control, and fuzzy control, as well as application examples for motor control using functional electrical stimulation. In addition, students will learn about the identification of biological systems, and learn about the measurement and control of biological signals through exercises using Matlab.

Medical Information Measurement
WBI-BME609J

Hiroshi Kanai

The purpose of this course is to provide a systematic understanding of the fundamentals of spectral analysis methods, including their physical meanings, for the effective use of wave information in medical information measurement. For this purpose, the basics of maximum likelihood estimation, least squares, eigenvalue expansion, singular value decomposition, pattern recognition, z-transform, discrete Fourier transform, spectrum estimation using autoregressive model, estimation of transfer function and coherence function, delay time estimation, and time-frequency analysis are described.

Bio-Medical Interface Fabrication
WBI-BME610B

Tsunemoto Kuriyagawa, Masayoshi Mizutani

This lecture focuses on ultra-precision machining to achieve function creation processing aimed at creating functional interfaces. In this lecture, we will discuss ultra-precision machining technology that approaches the limit of dimensional accuracy including surface roughness, peripheral technologies such as Machine Tools, and function creation as an example of its

application, which is a machining with "precision" that cannot be achieved by conventional technologies.

Technology Related to Diagnostic Medical Imaging
WBI-BME611J
Classes cancelled/undecided

In this course, students will learn the basic concepts of medical imaging and its specific applications in the field of medicine, which has become an indispensable technology for prompt, accurate and effective treatment in modern medicine. This is followed by an overview of the future development of medical engineering, which is the basis for advancing research and development, based on basic and clinical research. In particular, students will gain a deep understanding of the basics of three-dimensional diagnostic imaging (CT, MRI) and three-dimensional analysis of various images using computers.

Quantum Medical Imaging
WBI-BME612J
Koji Watabe, Toshiki Terakawa

The principles and image reconstruction methods of diagnostic imaging devices such as X-ray CT, MRI, ultrasound, and PET, as well as the structure of clinical medical databases (methods for creating clinical medical images, image processing methods for extracting meaningful information from image data, data storage, retrieval, and data storage) will be discussed.

Artificial Organs and Regenerative Medicine
WBI-BME614J
Tomoyuki Yambe

This course provides an understanding of the structure and function of normal tissues at the level of individual cells that make up organs, which are important for artificial organs and regenerative medicine, and an understanding of the functional multifaceted nature of organs through animal experiments and perioperative ICU management. In addition, the current status of artificial organs and regenerative medicine will be explained using the digestive organs as an example, and various methods such as stem cell application, transplantation, and gene transfer will be understood.

Pathogenesis and Treatment of Diseases and Disorders 1: Biomedical Engineering for Rehabilitation, Sports, Neurousurgery and Dentisity
WBI-BME615J
Shinji Kamakura, Shiniti Izumi, Ryoichi Nagatomi, Kuniyasu Niizuma (Hirofumi Taki)

This course explains how abnormalities in the structure and function of the human

body occur and teaches about their prevention and treatment. In Pathophysiology and Therapeutics 1, a wide range of pathologies are covered from the perspectives of sports medicine, rehabilitation medicine, neurosurgery, and dentistry.

Pathogenesis and Treatment of Diseases and Disorders 2: Biomedical Engineering for Therapeutic Treatment & Rehabilitation
WBI-BME616J
Takaaki Abe, Tetsuaki Kawase, Tomoyuki Yambe, Makoto Kanzaki

In Clinical Pathophysiology and Therapeutics 2, students will be taught how abnormalities in the structure and function of the human body occur, especially in digestive, circulatory, endocrine, renal, and sensory organ diseases, and how to prevent and treat them. This course is designed to help students understand how the knowledge of life and human body mechanisms acquired in the first semester is related to the prevention and treatment of diseases, and to cultivate the insight to identify issues in basic research from a clinical perspective.

Particle Therapy Engineering
WBI-BME617J
Koji Watabe, Toshiki Terakawa

In this lecture, we will discuss particle beam therapy and its treatment system, which is the most advanced treatment technology that can kill malignant tumors without damaging normal tissues, whereas conventional radiation therapy has damaged normal tissues. Particle irradiation and dose, effects of particle irradiation on cells, medical accelerators, particle beam transport engineering, irradiation systems, dosimetry systems, etc. will be discussed.

Socio-Biomedical Engineering
WBI-BME618E
Ryoichi Nagatomi

Now that it has become clear that lifestyle modification is effective in preventing many chronic diseases, the need for medicine outside the hospital has increased dramatically. In this course, we will explain what health means from a medical standpoint, and learn how to assess health conditions and lifestyle habits necessary for preventive medicine, and how to utilize biological information. Note: This course is offered in English.

Medical and Welfare Engineering
WBI-BME619J
Mami Tanaka

This paper discusses the technologies required in the field of medical and welfare

engineering from an engineering perspective, and discusses the creation of new sensors and actuators, information processing technologies, systemization, and their development as the basis for the development of medical and welfare engineering.

Medical Device Innovation Strategy
WBI-BME621J
Yoshifumi Saijo

In order to learn the basics for understanding and developing medical devices, students will learn the definition and current status of medical devices, as well as the mechanism and usage of individual medical devices such as CT, MRI, ultrasound, and endoscopes. Students will also learn about the current status of medical device development in companies.

Regulatory Science for Medical Device
WBI-BME622J
Makoto Ohta, Koji Ikeda

In order to implement advanced technology in society, it is necessary to harmonize it with people and society. This course examines regulatory science, which is the basis of this concept, from the perspective of medical device development, to understand the concept.

Business Ecosystem for Medical Device
WBI-BME623J
Ryoichi Nagatomi, Michi Fukushima, Tsuyoshi Kato

In order for a new medical device to be commercialized and used in the medical field, it is necessary to go through research and development and clinical trials, and at the same time, it is necessary to commercialize the procurement of materials, manufacturing, sales and after-sales care, and to establish it as a business. In some cases, a single company will commercialize the product, while in other cases, multiple companies will cooperate. Cooperation with the research and development system is also essential. This series of processes is called the business ecosystem for medical devices. This process varies depending on the healthcare system based on the healthcare policy of the country where the product will be commercialized. The purpose of this course is to provide students with an overview of their position and role when they are involved in the commercialization of medical devices in the future.

Laboratory Training in Mechanical and Electrical Engineering for Biomedical Applications
WBI-BME671J
Tetsu Tanaka, Mami Tanaka, Yoichi Haga, Takuji Ishikawa, Hiroshi Kanai, Yuji

Matsuura, Tatsuo Yoshinobu, Takashi Watanabe, Ayumi Hirano, Makoto Yoshizawa

Students acquire knowledge and skills in mechanical and electrical engineering necessary for research and development of devices in medical engineering through practical training.

Laboratory Training for Physiology

WBI-BME672J

Shinichi Isumi, Tetsuaki Kawase, Ryoichi Nagatomi, Shinji Kamakura, Tomoyuki Yambe, Kuniyasu Niizuma

Students will learn experimental techniques related to human physiology with the aim of understanding the mechanisms of how life phenomena occur. They will also learn how medical devices are used to diagnose abnormalities in physiological functions and biological structures, as well as learn about the needs of the clinical field of medicine and nursing care.

Laboratory Training for Biotechnology

WBI-BME673J

Tetsuya Kodama, Takaaki Abe, Hiroyasu Kanetaka, Kazutaka Murayama, Makoto Kanzaki, Keiko Numayama

The purpose of this course is to systematically learn the molecular biological analysis methods essential for medical engineering research. This course consists of gene sequencing, vector design, gene cloning, gene transfer, fluorescence observation, and protein analysis.

Medical Device Development Practice

WBI-BME674J

Yoshifumi Saijo, Shinichi Izumi, Tetsuaki Kawase, Takaaki Abe, Shinji Kamakura, Kuniyasu Niizuma

After exploring and quantitatively evaluating clinical issues by observing clinical sites and interviewing medical professionals, students will create ideas for medical devices to solve these issues and fabricate prototypes.

Special Lecture on Biomedical Engineering A

WBI-BME691J

All faculties

This is a special lecture on the latest academic research in the field of medical engineering, or on the creation and development of studies related to the field of medical engineering.

Domestic Internship Training A

FY2021 Master’s program summary

[WBI-BME692J

All faculties

Conduct research and development activities outside the university for one week to one month during the Master's or Doctoral course. Through this training, students will learn how to put their daily university research into practice in the field of research and development.

International Internship Training A

WBI-BME693E

All faculties

Short- to medium-term visits to overseas research facilities, including partner universities, to build an international cooperative system and gain basic experience to understand the global development of medical engineering.

Medical Device Innovation International Internship A

WBI-BME696E

All faculties

Short- to medium-term visits to overseas research facilities to understand the latest international information related to medical devices and to gain basic experience in building international cooperative systems.

Problem-Based-Learning Seminar

WBI-BME694J

All faculties

PBL (Problem-Based Learning) education by multiple instructors from different fields, which fosters the ability to set problems as a medical engineering engineer through the systematization and synthesis of high-level specialized knowledge.

Master Course Seminar on Biomedical Engineering

WBI-BME695J

All faculties

Experiments and exercises, including research presentations and discussions, will be conducted in each specialized field of medical engineering.

FY2021 Doctoral program summary

Basic Biomedical Engineering and Applied Biomedical Engineering

Students must select at least **16 credits**, including **2 credits** for "Advanced Seminar on Biomedical Engineering" AND **8 credits** for "Doctor Course Seminar on Biomedical Engineering."

Lecture	Language	Requirement	Credit
Advanced Biomedical Measurements and Diagnostics	J	S	2
Advanced Engineering for Medical Diagnosis and Treatment	E	S	2
Advanced Biomechanical Engineering	E	S	2
Regenerative Biomedical Engineering	J	S	2
Advanced Socio-Biomedical Engineering	J	S	2
Advanced Medical Device Innovation	E	S	2
Advanced Biofluids Control System	J	S	2
Artificial Organs	J	S	2
Advanced Biomaterials Science	J	S	2
Advanced Biomedical System Control Engineering	J	S	2
Advanced Biological Information Systems	J	S	2
Special Lecture on Biomedical Engineering B	J	S	1~2
Domestic Internship Training B	J	S	1~2
International Internship Training B	E	S	1~2
Medical Device Innovation International Internship B	E	S	1~2
Advanced Seminar on Biomedical Engineering	J	R	2
Doctor Course Seminar on Biomedical Engineering	J	R	8
Related lectures: Students can select lectures recognized as related by the Faculty Committee.			Up to 4

Language:
J = Lectures offered in Japanese
E = Lectures offered in English

Requirement:
R = Required
S = Selective

FY2021 Doctoral program summary

Lecture Summary

Advanced Biomedical Measurements and Diagnostics
WBI-BME701J

Tatsuo Yoshinobu, Hiroshi Kanai, Koji Watanabe, Kazutaka Murayama, Mototaka Arakawa

In this lecture, students will learn the basic principles of measurement techniques to extract biological information and the broad and deep expertise of diagnostic methods based on the measured physical and chemical quantities. The lecture also encourages students to think about current problems in measurement and diagnostic medical engineering from engineering and medical perspectives and cultivate the ability to find and set up problems.

Advanced Engineering for Medical Diagnosis and Treatment
WBI-BME702E

Shin Yabukami, Tetsuya Kodama, Takayuki Narushima, Masaya Yamamoto, Hiroyasu Kanetaka, Makoto Yoshizawa, Shiro Mori

This lecture aims to develop non-invasive or minimally invasive therapeutic and diagnostic techniques using physical and chemical methods. Lectures on medical materials, medical systems, and cancer research will be given. Lecture materials will be distributed in Japanese and English for self-study before the lecture.

Advanced Biomechanical Engineering
WBI-BME703E

Tsunemoto Kuriyagawa, Yoichi Hag, Tetsu Tnaka, Takuji Ishikawa, Matsuhiko Nishizawa, Makoto Ohta, Makoto Kanzaki

The lecture will focus on engineering modeling and analysis of living organisms from the perspective of mechanical systems. Design and analysis of biological systems will also be the target. The lecture discusses cutting-edge biomechanical systems, including biosensing technologies that mimic biological functions.

Regenerative Biomedical Engineering
WBI-BME704J

Tetsuaki Kawase, Shinji Kamakura, Takaaki Abe, Kuniyasu Niizuma

The purpose of this course is to acquire a broad and wide range of expertise in artificial organs and regenerative medicine for regenerating the functions of living organisms. The lecture’s primary focus is to develop the ability to discover new problems, which will lead directly to the invention of new artificial organs and treatment methods.

Advanced Socio-Biomedical Engineering
WBI-BME705J

Ryoichi Nagatomi, Shinichi Izumi, Mami Tanaka, Takashi Watanabe, Ken Yamaguchi (Koji Ikeda, Hidenori Koyama, Hirofumi Taki, Naofumi Tanaka)

This lecture focuses on medical and nursing care equipment used by patients, disabled people, and their families in hospitals, facilities, and homes. The focus will be on the purpose, types, indications, and usage from the medical perspective, and the development methods and commercialization process from the engineering perspective.

Advanced Medical Device Innovation
WBI-BME711E

Yoshifumi Saijo, Tsunemoto Kururikawa, Yoichi Haga, Yuji Matsuura

In this lecture, students will acquire a broad knowledge of the purpose, types, indications, and usage of new medical devices from a medical perspective. At the same time, students will learn development methods, commercialization processes, and the latest information on related engineering technologies from an engineering perspective.

Advanced Biofluids Control System
WBI-BME706J

Makoto Ohta, Kenichi Funamoto

This course provides lectures on complex flow systems in living organisms from both fluid dynamic and biological viewpoints. In addition to acquiring extensive and in-depth expertise in biological flow systems, the main focus of this course is to identify current problems and to develop new problem-solving methods, and to cultivate the ability to find and set up problems in order to elucidate the mechanisms of circulatory diseases and to establish methods for their prevention and treatment.

Artificial Organs
WBI-BME707J

Tomoyuki Yambe

Most of the internal organs in the human body can be replaced by artificial organs in principle. In addition to lectures on artificial organ engineering from a wide range of perspectives, the course fosters the ability to identify a wide range of problems with artificial organs from the perspective of ethics as well as medical engineering. Students will develop perioperative ICU management and resolution skills through animal experiments.

Advanced Biomaterial Science
WBI-BME708J

(Canceled) Takayuki Narushima, Nobuyuki Morimoto

Design of metallic and ceramic biomaterials, manufacturing process, the relationship between microstructure and properties, biofunctionalized surface treatment, polymer nanoparticles for drug delivery, structure and function of proteins and biomacromolecules in water, etc., are lectured by incorporating many of the latest research and development trends.

Advanced Biomedical System Control Engineering
WBI-BME709J
Tsuneyasu Homma, Mitsuhiro Hayashibe

This course analyzes biological systems from the viewpoint of cybernetics, which considers them as systems with information processing, communication, and control functions, and lectures on mathematical modeling, system identification, and state estimation methods for large-scale, complex, nonlinear, nonstationary, and stochastic systems. Based on this knowledge, new problem-solving methods are discussed in terms of system control theory for optimal control of medical systems, such as artificial organs, rehabilitation devices, and health devices, in order to cultivate the problem-finding and problem-setting abilities of doctoral students.

Advanced Biological Information Systems
WBI-BME710J
Akio Ishiguro, Kazushi Ishiyama, Ayumi Hirano

In this lecture, students consider the living organism as an information system with sensing, information transmission, and information processing functions, and clarify the function of the living organism through understanding its individual functions. Students will also learn about observation methods to understand the functions of living organisms. Besides, the lecture aims to improve the problem finding and solving abilities of doctoral students by introducing the current state-of-the-art research and development.

Special Lecture on Biomedical Engineering B
WBI-BME791J
All faculty

This lecture is a special course on the latest academic research in biomedical engineering or on the creation and development of disciplines related to the field of biomedical engineering.

Domestic Internship Training B
WBI-BME792J
All faculties

The purpose of this lecture is to understand the structure and function of organisms

and living bodies at the level of molecules, cells, organs, and the environment of the entire body, and to grasp the current status and trends in the development of medical technology and medical instruments through training activities at other universities, research institutes, medical institutions, and companies with which Tohoku University has a cooperative research and education relationships. Students are required to submit a training report after the training.

International Internship Training B
WBI-BME693E
All faculties
In this course, students are expected to take the initiative in understanding the current status of medical engineering research at Tohoku University, planning future research policies, and disseminating information both domestically and internationally in light of trends in medical engineering research in Japan and abroad. In this course, students will study abroad at universities in the United States, the United Kingdom, and other countries using the study abroad system based on the university exchange agreement of the University of Tokyo, with the aim of understanding the trends and directions of medical engineering research at the university, the country of study, and the world. Students will be required to write an English report after the training.

Medical Device Innovation International Internship B
WBI-BME796E
All faculties
Short-term to medium-term visits to overseas research facilities to acquire practical skills through promotional activities related to the medical devices they have developed. Students will be required to write an English report after the training.

Advanced Seminar on Biomedical Engineering
WBI-BME794J
All faculties
PBL (Problem-Based Learning) education by multiple supervisors from different disciplines, which fosters the ability to set problems as a researcher through the systematization and synthesis of high-level specialized knowledge.

Doctor Course Seminar on Biomedical Engineering
WBI-BME795J
All faculties
Experiments and exercises, including research presentations and discussions, will be conducted in each specialized field of medical engineering.