FY2024 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 Course for Biomedical Measurements and Diagnostics	E	S	2
Advanced Course for Materials and Energy	E	S	2
Advanced Course for Biological Systems	E	S	2
Advanced Course for Biomedical Engineering for Health and Welfare	JE1	S	2
Advanced Course for Medical Device Innovation	E	S	2
Advanced Course for Medical Diagnosis and Treatment	E	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
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.

Requirement:
R = Required
S = Selective

Lecture Summary

Advanced Course for Biomedical Measurements and Diagnostics
WBI-BME701E

Tatsuo Yoshinobu, Makoto Kanzaki, Hiroshi Watabe, Noriyasu Homma, Kenichi Funamoto, Ayumi Hirano

In this lecture, students will acquire broad and deep expertise in the fundamental principles of measurement technologies to obtain biological information and diagnostic methods based on the measured physical and chemical quantities. The lecture also encourages students to think about current problems in biomedical measurements and diagnostics from both engineering and medical perspectives and cultivate the ability to find and set up problems.

Advanced Course for Materials and Energy
WBI-BME702E

Shin Yabukami, Kazutaka Murayama, Takayuki Narushima, Masaya Yamamoto, Hidemi Kato, Kenta Yamanaka

An omnibus-style lecture on the latest trends in research in the field of materials and energy in medical engineering. Materials science such as biomaterials, metal materials, composite materials, electromagnetic materials, and polymer materials, which form the basis of medical engineering, will be explained. Learn about the use of nuclear, mechanical, thermal, optical, electromagnetic, and other energies in medical engineering.

Advanced Course for Biological Systems
WBI-BME703E

Tetsu Tanaka, Takuji Ishikawa, Takaaki Abe, Matsuhiko Nishizawa, Mitsuhiro Hayashibe, Norihiro Sugita, Akio Ishiguro

In this lecture, students will gain an overview of biological systems from an engineering perspective, learn about the latest research and development trends in the field, and develop problem-solving skills.

Advanced Course for Biomedical Engineering for Health and Welfare
WBI-BME704B

Takashi Watanabe, Mami Tanaka, Takeshi Yamaguchi, Takeshi Okuyama, Koji Ikeda

Students will learn about medical equipment and nursing care equipment used by patients, disabled persons, and their families in hospitals, facilities, and homes, including their purposes, types, usage from a medical perspective, and their development methods, and their development methods and productization processes from an engineering perspective.

Advanced Course for Medical Device Innovation
WBI-BME705E
Yoshifumi Saijo, Yuji Matsuura, Yoichi Haga, Mototaka Arakawa, Masayoshi Mizutani, Masatoshi Saito, Makoto Ohta, Kazushi Ishiyama

To develop each student's research leading to innovative medical devices by omnibus lectures given by professors of Division of Medical Device innovation.

1. Bio-medical engineering for the super aging society
2. Fundamental of powder jet processing
3. MEMS for medical devices 1
4. MEMS for medical devices 2
5. High resolution ultrasound/photoacoustic imaging
6. Blood flow measurement with ultrasound
7. Development and application of the artificial placenta 1
8. Development and application of the artificial placenta 2
9. Biophotonics 1
10. Biophotonics 2

Advanced Course for Medical Diagnosis and Treatment
WBI-BME706E
Yukio Katori, Kuniyasu Niizuma, Tetuya Kodama, Noriko Himori, Hiroyasu Kanetaka, Shin Yoshizawa, Tomoyuki Yambe

The three leading causes of death in Japan, namely cancer, heart disease, and cerebrovascular disease, will be explained, and their prevention and treatment strategies will be taught. The course is designed to cultivate the insight to identify basic research issues from the clinical viewpoint.

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-BME793E
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.