College of Engineering Systems

■ Bachelor of Engineering

Program Educational Objectives

Human resources who can support and lead safe, secure, comfortable, affluent, and sustainable human life from an engineering perspective, i.e.

1. basic skills that can be applied to a wide range of fields
2. the ability to carry out work with a broad perspective
3. basic human skills as a member of society and a professional

We aim to train engineers and researchers who have acquired the skills and the ability.

Graduate Profile	We cultivate professionals equipped with the capabilities listed above, capable of excelling across diverse industrial fields, including artificial intelligence, communications, electrical and electronic engineering, control and systems engineering, robotics, mechanical engineering, architecture, civil engineering, aerospace, risk management, materials science, and energy.
Career Paths after Graduation / Completion	Approximately 15% of graduates enter the workforce, while about 85% pursue further studies in the Master's Program at the Graduate School of Science and Technology, Degree Programs in Systems and Information Engineering, University of Tsukuba, seeking to acquire more advanced and broader specialized knowledge and cultivate their application skills. After completing the Master's program, many students enter the workforce and contribute to the industry. However, a significant number also choose to continue their studies by advancing to the Doctoral program to pursue more advanced and creative research activities. Beyond graduate school, graduates find employment across diverse industries, including automotive manufacturing, construction, heavy industry, transportation, machinery manufacturing, information equipment manufacturing, software companies, trading companies, steel manufacturing, electric power, food service, consulting, and IT.

Diploma Policy

The Bachelor's degree in Engineering is conferred upon those who have acquired the knowledge and skills (i.e., General Competence) based on the educational objectives of the University of Tsukuba's Bachelor's Program, as well as the knowledge and skills (i.e., Specialized Competence) based on the educational objectives of the School of Science and Engineering and the College of Engineering Systems.

Knowledge and Skills (Specialized Competences)	1. Foundational skills applicable across diverse fields	– Possesses logical and mathematical thinking and analytical skills – Understands physical natural phenomena – Has acquired the ability to use computers to acquire and process information
	2. Broad-minded work execution capabilities	– Understands the relationship between science and technology, society, the global community, and the entire planet – Can plan new technologies and design, and operate concrete systems – Can devise concrete solutions to problems and advance work systematically
	3. Basic competences as a member of society and a professional	– Possesses communication skills enabling international engagement – Has acquired presentation skills to clearly articulate well-reasoned ideas to third parties – Possesses the social awareness, sense of responsibility, and ethical standards expected of an engineer
Guidelines for Assessing Learning Outcomes	At the presentation of the graduation research compiled in the final year, the supervising faculty member and participating faculty members will evaluate the following competences: - Foundational skills applicable across diverse fields, and broad-minded work execution capabilities will be assessed based on the content of the graduation thesis. - Basic competences as a member of society and a professional will be assessed based on the presentation of the graduation thesis. Students can track their progress at any time by entering earned credits into the achievement evaluation sheet (see diagram below), which is organized by competence category.	

Curriculum Policy

To acquire the fundamental abilities and logical thinking skills necessary to address various problems in the field of engineering, and to ensure that learning outcomes meet the objectives for the Bachelor's degree in Engineering, the curriculum is organized and implemented based on the following principles.

Curriculum Design Framework	**Corresponding Course Categories/Subject Groups** – For foundational skills applicable across diverse fields, students complete specialized foundational courses in mathematics, physics, computer science, etc., and develop the ability to analyze engineering problems by applying this knowledge. – For broad-minded work execution capabilities, students complete specialized courses in their major field. They develop the ability to plan technologies and design/operate systems while understanding the relationship between science and technology and society, the global community, and the entire planet. Furthermore, through experimental and graduation research guidance, they acquire the ability to devise solutions to problems and execute them systematically. – For basic competences as a member of society and a professional, students will acquire communication and presentation skills by completing courses in foreign languages, experiments, and graduation research. Furthermore, by completing ethics courses for engineers and specialized practical subjects, students will develop the social awareness, sense of responsibility, and ethical standards expected of engineers. **Sequential Learning Policy** – During the first and second years, a curriculum system that allows students to study various specialized fields in an interdisciplinary manner cultivates the foundational abilities necessary for either major within the College of Engineering Systems. It also teaches the concept of “Engineering Systems,” which encompasses the engineering field in an interdisciplinary way. – Starting in the fall semester of the second year, students specialize in one of two main fields, selecting specialized courses in various disciplines to acquire deep expertise. – During the second and third years, students cultivate the integrated, creative, and problem-solving abilities necessary for designing various systems through foundational, specialized, and applied experiments within their major, along with related specialized courses. Furthermore, since all experiments are conducted in small groups, this also fosters teamwork skills. – In the fourth year, students are assigned to one of the desired laboratories within the college, unrestricted by their primary major field. They complete their graduation research by applying the foundational skills and broad specialized knowledge they have acquired. This cultivates engineers capable of constructing engineering systems that benefit people's lives. Additionally, students with outstanding academic performance through their second year may undertake a special graduation research project in their third year, enabling early graduation.

Teaching and Learning Methods

This college covers an exceptionally broad range of engineering fields and consists of two main majors: the Intelligent Engineering Systems Major and the Engineering Mechanics and Energy Major (see diagram right). While there are some differences in the content studied within each major, courses from the other major are easily accessible. Furthermore, no barriers are placed between majors during the final-year laboratory assignment process. While maintaining a certain degree of specialization within each major, the curriculum emphasizes interdisciplinary approaches as much as possible. This enables students to acquire fundamental knowledge across broad fields and develop critical thinking and judgment skills grounded in a wide perspective. To ensure the educational standards demanded by society, this college actively employs non-tenured lecturers from industry for multiple practical courses and offers specialized English courses taught by foreign faculty. Furthermore, we provide sufficient laboratories and equipment for the experiments and practical exercises conducted in each academic year, along with large-scale programming labs capable of accommodating numerous students simultaneously. Through these educational methods, students acquire the expressive and communication skills required of engineers, as well as the fundamental human competences expected of professionals in society.

Structure of Majors

Intelligent Engineering Systems
Informatics
Artificial Intelligence
Risk Engineering
Electrical and Electronic Engineering
Communication Engineering
Control Engineering
Mechanical Engineering
Systems Engineering
Cybernics
Robotic Engineering

Engineering Mechanics and Energy
Architectonics
Mechanical Engineering
Civil Engineering
Materials Engineering
Aerospace Engineering
Informatics
Risk Engineering
Energy Science
Electrical and Electronic Engineering
Nuclear Engineering

Curriculum structure

Intelligent Engineering Systems
Artificial Intelligence, Communications, Electrical and Electronic Engineering, Control and Systems Engineering, Robot Engineering

Engineering Mechanics and Energy
Architecture Engineering, Civil Engineering, Aerospace Engineering, Risk Engineering, Materials Engineering, Energy Science

4th year

Graduation Project and Thesis

Ethics for Engineers

3rd year

Pattern Recognition, Information Theory, Numerical Analysis, Devices and Elements for Mechatronics, Image Processing, Info-Telecommunication Systems II, Principles of Research and Development, Machine Learning A・B, Intelligent Information Processing, System Dynamics, Advanced Programming

Reliability Engineering
Measurement Engineering

Combustion Engineering, Steel Structure, Gas Dynamics, Disaster Preventive Engineering, Introduction to Environmental Engineering, Electric Power Engineering, Architectural Equipments, Geotechnical Engineering, Remote Sensing, Machinery Engineering of Energy Conversion, Reinforced Concrete Structure, System Dynamics, Hydrogen Energy Engineering

Laboratory of Intelligent Interactive Systems

Advanced Laboratory of Mechanics Engineering and Energy/Applied Laboratory of Engineering Mechanics and Energy

Artificial Intelligence, Communication Engineering, System Optimization, Robotics, Info-Telecommunication Systems I, Human Computer Interface, Digital Signal Processing, Data Structure and Algorithm, Technical English Exercise

Electronic Circuits
Topics on Engineering Systems
Feedback Control

Heat Transfer, Architectural Environmental Engineering, Planning and Design, Mechanics of Composite Materials, Architectural Design and Planning , Soil Mechanics, Aquatic Environment, Power Electronics, Engineering Fluid Dynamics, Concrete Engineering, Technical English Exercise, Introduction to Energy Studies

2nd year

Discrete Mathematics, Introduction to Programming C・D, Control of Linear Systems, Logic Circuits, Materials Engineering for Mechatronics, Technical English B, Computer and Network, Biosystem

Electric Circuit
Machine Design
Applied Mathematics B

Advanced Thermodnamics, Materials Engineering, Physical Chemistry, Fluid Mechanics, Electro magnetics Engineering, Numerical Computation, Electromagnetic Materials, Applied Thermodynamics, Theory of Vibration, Structural Mechanics, Technical English B

Basic Laboratory of Engineering Systems

1st year

Mathematics Subjects
Complex Analysis
Ordinary Differential Equations
Advanced Analysis
Advanced Linear Algebra
Calculus 1・2・3
Linear Algebra 1・2・3
Mathematics Literacy 1・2

Physics Subjects
Introduction to Materials Engineering
Introduction to Fluid Mechanics
Introduction to Thermodynamics
Advanced Mechanics
Advanced Electromagnetics
Mechanics 1・2・3
Electromagnetics 1・2・3

System Programming
Introduction to Programming A・B
Introduction to Engineering Systems

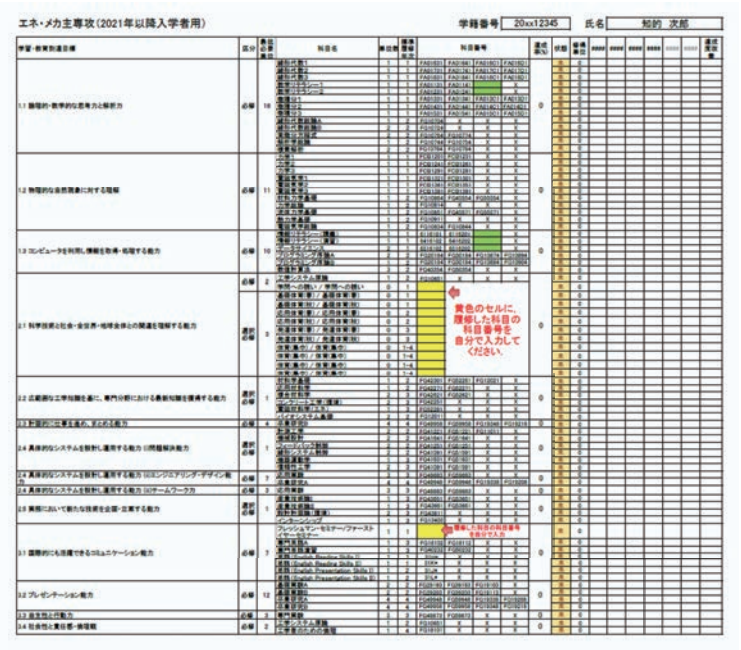
Foundation Subjects for Major

Probability Theory and Statistics
Introduction to Material Science for Engineers
Applied Mathematics A
Technical English A

Contents Engineering System
Space Technology
Tsukuba Robot Contest
Contents Media Engineering
Introduction to Engineer of Large Scale Projects

Information Literacy (Lectures・Exercises)
Data Science
Invitation to Engineering Systems
Invitation to Arts and Science
English, Physical Education (until 3rd year)
Introductory Subjects that are offered by other Schools and Colleges

Common Foundation Subjects, Specific Foundation Subjects



Admission Policy

Desired Student Profile	Students admitted to the College of Engineering Systems are expected to have the following (1) to have the basic academic skills and sense required for engineering. (2) to be full of curiosity and a desire to learn about engineering. (3) to have a clear sense of purpose to apply engineering to benefit society. (4) to acquire excellent thinking, judgment, and expression skills and communication skills.

Student Evaluation and Selection	Individual Achievement Test First Round	Applicants are evaluated on the depth of their understanding of fundamental concepts, principles, and laws in the natural sciences and mathematics, as well as their ability to examine and understand phenomena from a scientific perspective and to process them using mathematical methods.
	Individual Achievement Test Second Round	In addition to the assessment of basic academic ability, applicants are evaluated on their strong interest in engineering systems, their deep understanding of fundamental concepts in the natural sciences and mathematics, and their motivation for academic study.
	Entrance Examination by School Recommendation	Applicants are evaluated on their ability to balance coursework with extracurricular activities such as student government and sports during high school, as well as on their foundational academic ability in mathematics and other subjects required for engineering, their scientific way of thinking and engineering aptitude, and their thinking, judgment, and communication skills.
	Entrance Examination for IB Students	In addition to foundational academic ability in the natural sciences and mathematics, applicants are evaluated on their capacity for independent learning and thinking, communication skills, and strong motivation to actively pursue studies in engineering.
	Entrance Examination for Foreign School Students	TypeI) Applicants are comprehensively evaluated on their interest in and understanding of engineering, Japanese language proficiency, and the foundational academic ability required for successful study after enrollment.
	Transfer examination	Applicants are comprehensively evaluated on their foundational academic ability and motivation to undertake specialized engineering education, strong interest in engineering, logical thinking skills, and communication abilities.

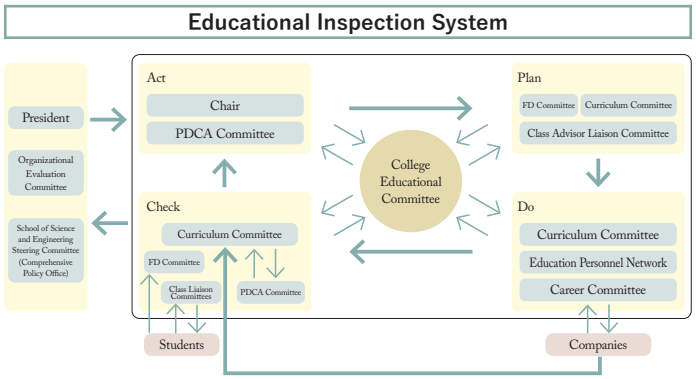
Learning Support Framework

Academic Support	– To enable students to efficiently assess their progress toward acquiring the knowledge and competences required by our college's educational goals and to build learning plans based on this assessment, we have developed a unique achievement evaluation sheet organized by competence. Furthermore, students are required to submit their completed achievement evaluation sheets to the Faculty Review and Improvement Committee at the end of each academic year. This establishes an environment where faculty can also review each student's achievement status. Additionally, for students requiring particular attention, their class teacher conducts interviews to support improvements in their achievement status. – An educational framework is established to develop the foundational writing skills required in the science and technology fields. This is achieved through report guidance provided by TAs (graduate students) and instructors in the required student laboratory courses (2nd year: Basic Laboratory; 3rd year: Specialized Laboratory and Applied Laboratory). Furthermore, through the required courses Specialized English A and B in the second year and Specialized English Seminar in the third year, opportunities are provided to develop practical skills in scientific and technical English, including writing. In the fourth year, through the writing of the graduation thesis, education is provided by the supervising faculty member to further refine the writing skills acquired up to the third year. – Practical opportunities to develop presentation skills are provided within PBL courses such as the Tsukuba Robot Contest and Space Exploration Engineering Project. Furthermore, during the fourth-year graduation research, students learn presentation techniques for logical and clear explanation from their academic advisors and graduate students through progress reports within the laboratory and the graduation research results presentation session held for the entire college. – The “Troubleshooting Consultation Center” is established within the School of Science and Engineering to serve as a consultation point for students struggling with foundational science and engineering subjects or university study methods.
Opportunities for Peer Interaction	– Part of the orientation program is conducted as an off-campus training camp involving upperclassmen. This initiative aims to alleviate new students' anxieties about university activities, including learning in programs like the First-Year Seminar, through interaction with upperclassmen. – In PBL courses such as the Tsukuba Robot Contest and Space Exploration Engineering Project, as well as in student experiments, multiple students work as teams on challenges under the support of upperclassmen and graduate student TAs. Through such collaborative learning, education that enhances motivation to learn is provided. – In the fourth year, regular seminars (including seminar discussions, literature reviews, progress reports, etc.) are held within assigned research laboratories. These provide collaborative spaces where students, including graduate students, engage in discussions and provide feedback to enhance the quality of their graduation research.

Opportunities for Student–Faculty Interaction	– We regularly hold class liaison meetings attended by class representatives and faculty members to provide a forum for exchanging opinions on improving lecture content and the learning environment. – We provide opportunities for students to consult with faculty members about their academic progress and student life under the university's class teacher system. Furthermore, for students requiring special attention due to academic performance or other factors, the college chair and class teacher will reach out to the student and conduct an interview. Students and faculty will then collaborate to resolve any issues. – For the fourth-year graduation research, students complete their research topics through year-long individual guidance from their supervising faculty member, thereby fulfilling the educational objectives of the college.

Approaches to Assuring and Enhancing Educational Quality

– Practice of PDCA cycle and FD activities: We organize curricula to achieve educational goals (Plan) and conduct classes based on syllabi (Do). At the end of each course, a class questionnaire survey is conducted (Check) to examine the effectiveness of the course and to examine the content improvement (Act). We have established a PDCA Committee to implement this educational review system (see diagram below), circulating the PDCA cycle. Furthermore, by incorporating Faculty Development (FD) activities aimed at enhancing teaching methods, we continuously review and improve the entire educational system.
– Improvement of the educational and learning support environments: We have established a system for improvement of the educational and learning support environments (see diagram below). To implement education and support student learning, we maintain the necessary facilities, equipment, and systems while incorporating student feedback. We also undertake the necessary initiatives to maintain, operate, and update these resources.
– Once a year, we compile the results of academic performance evaluations and review educational activities through the Curriculum Committee, the Education Council, and other bodies.



System to Improve the Educational and Learning Support Environments