



ENGINEERING PRODUCT DEVELOPMENT

PILLAR OVERVIEW

The curriculum of the Engineering Product Development (EPD) pillar prepares students for leadership in the conception, design, implementation and operation of innovative technology-intensive products, with emphasis on products whose development cuts across traditional disciplinary boundaries. The product sectors currently addressed are electronics, energy, machinery, and transportation. The pillar features commitment to educational and research excellence, multidisciplinary interaction, and a focus on product development that includes close engagement with industry.

All SUTD students are required to take foundational subjects in humanities and the sciences as part of their curriculum. They go through a rigorous curriculum that is focused on design and on a modern pedagogical approach where students learn how to solve complex problems in interdisciplinary teams.

In Term 4, EPD pillar students will go through common foundation classes in both Mechanical and Electrical subjects. From Term 5 onwards, aside from the common core subjects which all EPD students have to take, HASS electives and Technical Application Electives will be offered. In Terms 7 and 8, the Capstone is a culminating project that allows students to use the skills they have learned in EPD in a real world industry or research project. The capstone projects often focus on interdisciplinary applications, solved by a team of students chosen appropriately from different pillars.

EPD pillar graduates will be prepared for a wide variety of engineering, design

and management careers across multiple industries. The skills learned by EPD pillar graduates would provide graduates with a deep understanding of the technical fundamentals and with skills and capabilities for leading the development of new products, systems, processes or methodologies, in both the private and public sector, including:

- Aerospace and Automotive Industries
- Automated Systems
- Biomedical and Healthcare
- Consumer Electronics and Digital Media
- Consumer Home
- Engineering and Product Development
- Manufacturing
- Robotic Systems
- Academia

The following chart illustrates the EPD curriculum structure. The diagram depicts the typical sequence of subjects in the EPD curriculum. Each major row indicates a calendar year with columns representing the Jan-Apr, May-Aug, and Sep-Dec terms ordered from left to right.

Programme Structure



● - Freshmore Subject ● - Core Subject ● - HASS Subject ● - Elective Subject ● - Capstone



EPD PILLAR CORE SUBJECTS

- Probability and Statistics
- Circuits and Electronics
- Structures and Materials
- Systems and Control
- Engineering Design and Project Engineering

TECHNICAL APPLICATION (TECH) ELECTIVES

All engineering pillars also have a set of elective subjects associated with different applications streams, which permit greater focus and depth in applying their knowledge and offer students an important context to promote inter-pillar interactions and synergies. Students will be able to take technical electives in one of the four focused areas: Global Issues, Transportation, Manufacturing Systems and Enterprise Systems.

TRACKS

The following eight tracks, including the General/Custom track, will assist faculty in guiding students to realise their dreams and aspirations in focus areas.

MECHANICAL ENGINEERING

Mechanical Engineering (ME) is the application of physical principles in the analysis, design, construction and operation of mechanical systems. The objective of the ME track is to prepare students with solid knowledge of mechanical concepts, thermal fluid system, materials science, principles of design and control, and the application of these understandings to creative solutions for modern mechanical systems. The skillset developed through the study will enable students to design and analyse aerospace system, automotive vehicles, biomedical instruments, energy conversion systems, fluidic and thermal systems, industrial machinery, manufacturing equipment, robotics and more. The ME track at EPD pillar will also expose the students to the frontier of modern research in ME, including clean energy, advanced materials, micro/nano-technology and biomechanics. Students who graduate from ME track are very versatile and have career options in a broad spectrum of industries, including aerospace, automation and control, automobile, biomedical instrumentation, computer-aided design (CAD) / computer-aided manufacturing (CAM), manufacturing plant, mechanical design and consulting, oil and gas technology, pharmaceutical manufacturing, robotics, semiconductor manufacturing, thermal and power engineering and others.

Track Subjects:

- Fluid Mechanics

Electives:

- Dynamics
- Thermal Systems for Power and Environment
- Machine Element Design
- Materials Science
- Entrepreneurship
- Fluid Flow and Machinery
- Design and Fabrication of Microelectromechanical Systems
- Structural Mechanics
- Advanced Feedback and Control
- Topics in Bioengineering
- Micro Nano Projects Laboratory
- Introduction to Robotics
- Mechanical Projects Laboratory

ELECTRICAL ENGINEERING

Electrical Engineering (EE) covers the study, application and product design of electrical, digital, as well as electromagnetism in the field of analog and digital electronics, power engineering, communication systems, control systems, signal processing and wireless technology. There are wide ranges of career opportunities for EE graduates from consumer electronic design and manufacturing to high-end research and development. The curriculum is organised to equip the graduate with in-depth fundamental and hands-on skills in EE through these subjects. There are wide ranges of career opportunities for EE graduates from consumer electronic design, power and energy management systems engineering, manufacturing, electrical and electronics engineering to high-end research and development, and more.

Track Subjects:

- Electromagnetic and Applications

Electives:

- Microelectronic Circuits and Devices
- Entrepreneurship
- Design and Fabrication of Microelectromechanical Systems
- Discrete Time Signal Processing
- Introduction to Nanoelectronics
- Micro Nano Project Laboratory
- Wireless Communication
- Introduction to Robotics
- Introduction to Power Systems
- Digital Integrated Circuits Design



ROBOTICS

Designing robots requires multi-disciplinary knowledge and expert skills in fabrication, mechanical, electronics, and electrical engineering, art, and user studies. With the emergence of service robotics industries and recent boom in the traditional industrial robotics market, this track aims to provide the students with knowledge of the robotics fundamentals, skills in the modelling, design and development of robotic platforms, an insight into their theoretical essentials and the expertise to apply these methods to real world problems. The skillset developed through the study will enable students to design and realise novel robotic mechanisms, sensing and control strategies for mobile robots and build human interactive robotic systems. The Robotics track at EPD pillar will also expose the students to the frontier of modern research, including bio-inspired designs, nano-robots, wearable systems and next generation industrial robotics. A series of tailor made projects are seeded into the track providing opportunity for the students to demonstrate skills related to simulation, design and implementation of industry specific robotic platforms and research problems. The students specialising in this track typically follow careers in robotics, automation, research agencies, manufacturing, aerospace, maritime, oil and gas industry, consumer electronics, biomedical, and defence research.

Track Subjects:

- Electromagnetic and Applications
- Introduction to Robotics

Electives:

- Digital Systems Laboratory
- Dynamics
- Machine Element Design
- Entrepreneurship
- Discrete Time Signal Processing
- Advanced Feedback and Control

MATERIALS SCIENCE

Materials Science and Engineering is a broad field which embraces ceramics, metallurgy, polymer science and solid state physics. It reaches down into the microscopic world of atoms and bridges the condensed state of matter to the macroscopic world of material function. The objective of the Materials Science and Engineering track is to equip students with a strong foundation in the design, synthesis, processing, characterisation and application of materials to solve engineering problems and meet societal needs. Students in the Materials Science and Engineering track will develop skills to manipulate how atoms or molecules are arranged in materials so as to change the way materials behave. In this way, they will be able to create materials with unique electrical, magnetic, mechanical, optical, or thermal properties. Students in the Materials Science and Engineering track at EPD pillar will be exposed to frontiers of advanced materials research for aerospace, clean and renewable energy, environmental protection, microsystems, micro/nanoelectronics and water treatment. Upon successful completion, students in the Materials Science and Engineering track will find career opportunities in many industries including aerospace, biomedical technology, clean and renewable energy, consumer products, materials research, medical device development, microelectronics manufacturing, pharmaceutical manufacturing, water treatment and many others.

Track Subjects:

- Electromagnetic and Applications
- Fluid Mechanics

Electives:

- Dynamics
- Microelectronic Circuits and Devices
- Materials Science
- Entrepreneurship
- Design and Fabrication of Microelectromechanical Systems
- Introduction to Nanoelectronics
- Micro Nano Projects Laboratory
- Mechanical Projects Laboratory

BIOMEDICAL ENGINEERING

Biomedical Engineering is a discipline that applies the design concepts and principles of engineering to medicine. The objective of the biomedical engineering track is to prepare students with problem solving skills of engineering and appreciable knowledge connecting engineering and medicine fields to advance medical treatment and diagnosis. This subject will equip the students with the skillsets in design and analysis of surgical tools, surgical robots, lifesaving equipment, biomedical instruments for treatment and diagnosis, physiological parameter monitors using sensors, biomechanics (cardiovascular, musculoskeletal), biomedical imaging, medical devices, cell and tissue engineering and more, with various medical applications. The Biomedical Engineering track at EPD pillar will also give students research opportunities in biomaterials, drug delivery, biomechanics (hard and soft tissue), mechanobiology, sports engineering, cellular and tissue engineering, neuroscience and engineering, computational biomedical engineering, new DNA sequencing methods (generic engineering). Students graduating from biomedical engineering track are multi-disciplinary (spanning engineering and medicine) and have career opportunities in medical regulatory authorities, medical devices and bioinstrumentation, imaging and diagnostic services (eg. X-Ray, MRI, infusion pumps), medical robotics, implant design and fabrication, animal trials, hospital management and consultancy.

Track Subjects:

- Electromagnetic and Applications
- Fluid Mechanics
- Topics in Bioengineering

Electives:

- Digital Systems Laboratory
- Microelectronic Circuits and Devices
- Materials Science
- Entrepreneurship
- Discrete Time Signal Processing
- Design and Fabrication of Microelectromechanical Systems
- Introduction to Nanoelectronics



ALTERNATIVE ENERGIES

The rapid growth in the global energy consumption is putting a strain to the world's energy resources. In addition, there is an urgent need to reduce greenhouse gas emissions to slow down the effects of global warming. Therefore, sustainable alternative energy sources are currently actively sought after to replace fossil fuels. The objective of the Alternative Energies track is to prepare students with strong foundation in the energy conversion processes, thermodynamics, fluid mechanics, electronics, and global issues in energy so that they can apply these knowledge to create novel solutions for alternative energies. The skillset developed will enable the students to design and analyse alternative energy technologies including but not limited to wind and solar systems. The students will also be exposed to micro/nanotechnology and its application to energy conversion and storage. Due to the broad-based training, students graduating from the Alternative Energies track are not only suitable for the energy related industry, but also well positioned for careers in the aerospace, manufacturing, government, consulting, oil and gas, semiconductor and many other industries.

Track Subjects:

- Electromagnetic and Applications
- Fluid Mechanics
- Thermal Systems for Power and Environment
- Power Electronics

Electives:

- Microelectronic Circuits and Devices
- Entrepreneurship
- Fluid Flow and Machinery
- Design and Fabrication of Microelectromechanical Systems
- Introduction to Nanoelectronics
- Introduction to Power Systems
- Micro-Nano Projects Laboratory

COMPUTER ENGINEERING

Computer Engineering is the application of mathematical and scientific principles to the analysis, design, configuration and operation of the computer related systems. The objective of the Computer Engineering track is to prepare students with solid and applicable knowledge of computer architecture, computer science, electronic engineering, programming, network system, database management, information storage and the application of these understandings to creative solutions for computer and network systems. This subject will equip the students with the skillsets in design and analysis of personal computers, electronic circuits, microprocessors, Field Programmable Gate Array (FPGA), computer networks, network servers, embedded systems, operating systems and software with various applications, and more. The Computer Engineering track at EPD pillar will also give students research opportunities in computer software and hardware design, including visual and interactive computing, algorithms and analytics, computational intelligence, compilers, Very Large-Scale Integration (VLSI) design, and distributed computing. Students graduating from Computer Engineering track are very versatile and have career opportunities in software development, computer architecture, electronics design, digital system, data analysis, software quality assurance, telecommunications, transportation, manufacturing, computer-aided design (CAD), hardware and software project management, consultancy, web-based applications development, network systems, and others.

Track Subjects:

- Electromagnetic and Applications

Electives:

- ISTD Elective
- Microelectronic Circuits and Devices
- Entrepreneurship
- Discrete Time Signal Processing
- Digital Integrated Circuits Design
- Wireless Communication

AEROSPACE TECHNOLOGY

Aerospace Technology is the application of scientific knowledge to the analysis, design, manufacture, control, testing, maintenance and operation of devices or systems in the aerospace and aeronautical industries. The objective of this track is to prepare students in the conception, design, implementation and development in either electrical, electronic, mechanical devices or systems, and also acquire an understanding of the major technical challenges and considerations of the transportation industries. Students will gain knowledge, skills and experience in transportation technologies, digital control, signal processing, wireless communication, electronics design, machine design and engineering design. It will also expose students to advance and future concepts in transportation. Graduates from this track will have career options in a broad spectrum of transportation industries which include, but are not limited to the aerospace, ship, railway and automotive sectors.

Track Subjects:

- Electromagnetic and Applications
- Fluid Mechanics

Electives:

- Dynamics
- Materials Science
- Machine Element Design
- Entrepreneurship
- Fluid Flow and Machinery
- Advanced Feedback and Control
- Introduction to Aerospace Engineering
- Wireless Communication

Footnote:

¹Tracks offered in a year are subject to changes



SINGAPORE UNIVERSITY OF
TECHNOLOGY AND DESIGN

Established in collaboration with MIT