

# Biomedical Engineering

## OVERVIEW



The healthcare industry needs Biomedical Engineers as much as doctors and nurses. You can make your mark in this growing sector by working with your peers to develop the next generation of medical devices and medicinal drugs.

With Singapore on its way to becoming a global centre for medical research and advanced patient care, numerous international biomedical companies have already set up base here. So, if you have a passion to help improve the quality of lives for patients worldwide, then not only is this course perfect for you but it is also your stepping stone to excellent job opportunities and advancement prospects.

### Your Journey

## Year 1

You will receive a firm foundation in fundamental engineering concepts, through lab work, study trips to companies, and hands-on learning opportunities, preparing you for specialisation in the medical and life sciences fields.

## Year 2

Here, you will deepen your engineering skills, pick up fundamental knowledge of the life sciences, and learn how engineering is used to further the development of technology in the medical and life sciences fields.

## Year 3

You can specialise by choosing an elective in Audiometry & Hearing Devices, Clinical Laboratory Equipment, or Medical Biochemistry. Together with the Major Project and internship, you will be ready for an exciting and lucrative career upon graduation.

## ENTRY REQUIREMENTS

### Minimum Entry Requirements

To be eligible for consideration for admission, applicants must obtain 26 points or better for the net ELR2B2 aggregate score (i.e. English Language, 2 relevant subjects and best 2 other subjects, including CCA Bonus Points) and meet the minimum entry requirements of this course. CCA cannot be used to meet the minimum entry requirements.

English Language (EL1)*	Grades 1-7
Mathematics (E or A)	Grades 1-6
Any one of the listed subjects^	Grades 1-6
Any two other subjects, excluding CCA	

**Note:** Applicants should not be suffering from partial or complete colour vision deficiency, uncontrolled epilepsy, profound hearing loss or severe vision impairment.

\* SPM / UEC holders must have a minimum of grade 6 for the Bahasa Inggeris (English Language) subject.

^ List of acceptable subjects: Biology, Biotechnology, Chemistry, Combined Science, Computing/Computer Studies, Design & Technology, Electronics/Fundamentals of Electronics, Physics/Engineering Science, Science (Chemistry, Biology), Science (Physics, Biology), Science (Physics, Chemistry)/Physical Science.

See also the minimum entry requirements for:

- ITE Certificate Holders
- International Students

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## COURSE STRUCTURE

### TP Fundamentals Subjects

Subject code	Subject	Level	Credit Units
ECS1005	<p>Communication &amp; Information Literacy</p> <p>In this subject, you will learn how to conduct research for relevant information and validate information sources. You will also learn to recognise and avoid plagiarism, and follow standard citation and referencing guidelines when presenting information. In the course of learning, you will be required to plan, prepare and present information appropriately in written and oral form. You will also be taught to consider the Message, Audience, Purpose and Strategy (MAPS) when writing and delivering oral presentations.</p>	1	2
ECS1006	<p>Workplace Communication</p> <p>In this subject, you will be taught how to conduct effective meetings while applying team communication strategies and the skills for documenting meeting notes. You will be required to write clear emails, using the appropriate format, language, tone and style for an audience. You will also be taught to communicate appropriately in and for an organisation when using various platforms. In all aspects, the principles of applying Message, Audience, Purpose and Strategy (MAPS) will be covered.</p>	1	2
ECS1007	<p>Persuasive Communication</p> <p>In this subject, you will be taught how to use persuasive language in written documents. You will be required to use information to your advantage to verbally communicate and convince an audience about your idea, product or service. Skills such as persuasive vocabulary, language features, graphical illustrations, tone and style would also be covered. The Message, Audience, Purpose and Strategy (MAPS) will also be applied when engaging in verbal and written communication.</p>	1	2
GCC1001	<p>Current Issues &amp; Critical Thinking</p> <p>This subject presents you with a panoramic view of current local and global issues, which may have long term implications for Singapore. You will learn to apply critical thinking tools to examine current issues, support your views with relevant research and up-to-date data, articulate an informed opinion and mature as civic-minded individuals.</p>	1	2

EIN1001	<p><b>Innovation &amp; Entrepreneurship</b></p> <p>The Innovation &amp; Entrepreneurship subject is designed for learners from all disciplines to embrace innovation in either their specialised fields or beyond. You will first learn the Design Thinking framework, where you will develop problem statements and ideate solutions. Next, you will discover the tools for prototyping and innovation, such as 3D printing and laser cutting, at TP's Makerspace+ facility. Finally, you will acquire commercial awareness through the LEAN Startup framework of idea crystallisation, prototype building, customer testing and validation, refinement of business model canvas, and crowdfunding or crowdsourcing avenues.</p>	1	2
LEA1011	<p><b>Leadership: Essential Attributes &amp; Practice 1</b></p> <p>LEAP 1, 2 and 3 are three fundamental subjects that seek to cultivate in you, the attitude, skills and knowledge for the development of your leadership competencies. This character-based leadership programme enables you to develop your life-skills through establishing personal core values, which will become the foundation for your leadership credibility and influence.</p>	1	1
LEA1012	<p><b>Leadership: Essential Attributes &amp; Practice 2</b></p> <p>LEAP 1, 2 and 3 are three fundamental subjects that seek to cultivate in you, the attitude, skills and knowledge for the development of your leadership competencies. This character-based leadership programme enables you to develop your life-skills through establishing personal core values, which will become the foundation for your leadership credibility and influence.</p>	1	1
LEA1013	<p><b>Leadership: Essential Attributes &amp; Practice 3</b></p> <p>LEAP 1, 2 and 3 are three fundamental subjects that seek to cultivate in you, the attitude, skills and knowledge for the development of your leadership competencies. This character-based leadership programme enables you to develop your life-skills through establishing personal core values, which will become the foundation for your leadership credibility and influence.</p>	1	1
LSW1002	<p><b>Sports &amp; Wellness</b></p> <p>This subject will help you develop both the physical and technical skills in your chosen sports or fitness activities. Through a structured curriculum that facilitates group participation, practice sessions and mini competitions, you will learn to build lifelong skills such as resilience, leadership, communication and teamwork. Physical activity sessions will be supplemented by health-related topics to provide you with a holistic approach to healthy living.</p>	1	2
MCR1001	<p><b>Career Readiness 1</b></p> <p>This Career Readiness programme comprises three core subjects – Personal Management, Career Preparation and Career Management. It seeks to help you understand your career interests, values, personality and skills for career success. It also equips you with the necessary skills for seeking and securing jobs, and to develop professional work ethics.</p>	1	1

MCR1002	<p>Career Readiness 2</p> <p>This Career Readiness programme comprises three core subjects – Personal Management, Career Preparation and Career Management. It seeks to help you understand your career interests, values, personality and skills for career success. It also equips you with the necessary skills for seeking and securing jobs, and to develop professional work ethics.</p>	1	1
MCR1003	<p>Career Readiness 3</p> <p>This Career Readiness programme comprises three core subjects – Personal Management, Career Preparation and Career Management. It seeks to help you understand your career interests, values, personality and skills for career success. It also equips you with the necessary skills for seeking and securing jobs, and to develop professional work ethics.</p>	1	1
EGS1002	<p>Global Studies</p> <p>This subject provides essential skills and knowledge to prepare you for an overseas experience. You will examine the elements of culture and learn the key principles of cross-cultural communication. In addition, you will gain an appreciation and awareness of the political, economic, technological and social landscape to function effectively in a global environment.</p>	1	3
EGS1003	<p>Managing Diversity at Work*</p> <p>This subject explores the concepts of identity, diversity and inclusion at the workplace. It examines the relationship between identity and diversity, the benefits and challenges of diversity and the strategies that promote inclusion and inspire collaboration in a diverse workplace. Examples of the elements of diversity covered in this subject include nationality, generation, ethnicity and gender.</p>	1	3
EGS1004	<p>Global Citizenship &amp; Community Development*</p> <p>Students will examine the meaning and responsibilities of being a Global Citizen, in order to contribute towards a more equitable and sustainable world. In addition, students will learn how sustainable solutions can support community development, and, execute and critique a community action plan that addresses the needs of a specific community/cause.</p>	1	3
EGS1005	<p>Expressions of Culture*</p> <p>This subject provides a platform for an understanding of culture and heritage through modes of expression. Students will be introduced to global and local cultures via everyday objects, places and human behaviour seen through time and space. Students will explore issues and challenges in culture and heritage sustainability in community, national and global contexts.</p>	1	3
TGL1001	<p>Guided Learning</p> <p>The subject introduces students to the concepts and process of self-directed learning in a chosen area of inquiry. The process focusses on four stages: planning, performing, monitoring and reflecting. Students get to plan their individual learning project, refine and execute the learning plan, as well as monitor and reflect on their learning progress and project. The learning will be captured and showcased through a curated portfolio. The self-directed learning project will broaden and/or deepen a student's knowledge and skills.</p>	1	3

ESI3001	<p>Student Internship Programme</p> <p>The on-the-job training nature of the programme allows you to gain some industrial experience. Through this programme, you will be exposed to the work environment so that you can better appreciate and understand the problems and issues at the work place. The content and scope of learning varies from organisation to organisation. However, it is envisaged that after the programme, you would have, in general, developed your communication and interpersonal skills as well as the right work ethics, and also become more mature, confident and independent, and have a more realistic expectation of what a working environment is like.</p>	3	12
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\* Students must choose to take either one of these three subjects or TGL1001 Guided Learning.

## Core Subjects

Subject code	Subject	Level	Credit Units
EBS1004	<p>Human Anatomy &amp; Physiology</p> <p>This subject provides you with a basic understanding of human anatomy and physiology. Topics covered include the anatomy of the organs and organ systems and their functions.</p>	1	4
EED1001	<p>Electronic Prototyping</p> <p>This subject introduces you to the use of hand tools and standard laboratory equipment for the construction and testing of electronic prototypes. You will also learn to identify basic electronic components for project work and how to use them to build electronic devices.</p>	1	3
EEE1001	<p>Circuit Analysis</p> <p>This subject provides a good foundation in DC and AC network analysis. You will learn the basic principles of electric circuitry and how to apply circuit theorems to analyse DC and AC networks.</p>	1	6
EEE1002	<p>Electronic Devices &amp; Circuits</p> <p>This subject covers the theory and practical knowledge of electronic devices such as diodes, bipolar junction transistors, field effect transistors and their applications. It also focuses on the fundamentals of operational amplifiers and their applications, and the rudiments of circuit troubleshooting and testing.</p>	1	6
EEE1003	<p>Digital Fundamentals 1</p> <p>This subject provides basic knowledge of digital electronics and circuits. Topics include number systems, operations and codes, logic gates, Boolean algebra and logic simplification, combinational logic, functional blocks, latches and flip-flops.</p>	1	5

EEE1004	<p>Digital Fundamentals 2</p> <p>This subject builds upon the fundamentals of digital electronics acquired in Digital Fundamentals 1. It introduces the digital concepts of the various building blocks in a computer's digital system. You will acquire the theoretical and practical knowledge of registers, counters, memory devices, and conversions between digital and analogue signals and integrated circuit technologies. Digital troubleshooting techniques are also explored in the laboratory work.</p>	1	5
EMA1002	<p>Engineering Mathematics 2</p> <p>This subject introduces the basic concepts of calculus and statistical method to test a hypothesis. Basic concepts in calculus include limits, derivatives and integrals. Applications of the derivative and integrals in engineering will be discussed. Basic statistical method in hypothesis testing includes normal distribution, confidence interval of population mean and procedure to test hypothesis for a claim made about a population mean.</p>	1	4
EMA1003	<p>Engineering Mathematics 1</p> <p>This subject teaches pre-calculus techniques required for an engineering course. It trains you in engineering problem-solving approaches using the appropriate mathematical tools. Topics such as simultaneous equations, matrices, trigonometric, exponential and logarithmic functions, complex numbers and vectors will be covered.</p>	1	4
ESC1003	<p>Chemistry</p> <p>This subject provides the students with an understanding of the fundamentals of chemistry concepts and applications useful in the bioengineering field. Topics covered include the principles, theories and applications of physical, inorganic and organic chemistry, ranging from atomic structure and electron configuration, stoichiometry, the periodic table, chemical bonding, equilibria, electrochemistry, and thermochemistry to topics of organic chemistry covering the hydrocarbons, haloalkanes, the hydroxy, carbonyl and carboxylic acids compounds. Essential practical sessions on chemical experimentation are also covered.</p>	1	4
ESC1004	<p>Engineering Physics</p> <p>This subject covers a spectrum of fundamental physics laws and concepts applicable to the scope of engineering physics. It covers a few core areas including Mechanics, Energy, Thermal Physics, Electromagnetism, Waves &amp; Optics and Materials. This subject provides a foundation for a further in depth study of the various engineering disciplines.</p>	1	3
ESE1006	<p>Computer Programming for Problem Solving</p> <p>This subject covers the process of decomposing a problem into a sequence of smaller abstractions. The abstractions are implemented in software in a structured top-down approach. Software implementation includes the process of designing, writing, testing, and debugging program code.</p>	1	4
ESE1008	<p>Data Visualisation &amp; Analytics</p> <p>This subject covers the data analytics lifecycle, including gathering, cleaning, processing and visualising of data. Exploratory data analysis methods, descriptive and predictive analytics, and the presentation of insights, will also be covered.</p>	1	3

EMA2003	<p>Engineering Mathematics 3</p> <p>This subject introduces Ordinary Differential Equations (ODE). In particular, it focuses on the formulation of engineering problems into first and second order differential equations. Some techniques in solving ODE and the applications of ODE will be discussed, including the use of Laplace Transforms and the calculation of Fourier series.</p>	2	4
EMC3006	<p>Microcontroller Applications</p> <p>This subject provides you with working knowledge on microcontroller architecture, the features and characteristics of the internal peripherals in the microcontroller, such as interrupts, Timer and PWM, in order to design and implement an embedded system that involves hardware and software interfacing. The subject also covers the features of evolving microcontrollers that support Internet of Things (IoT) applications.</p>	2	5
EMD2001	<p>Medical Electronics</p> <p>This subject introduces fundamental instrumentation theories for biomedical applications and design requirements for the measurement of bio-signals. Topics include electrodes and transducers, bio-potential measurements, amplifier basics, as well as differential and instrumentation amplifiers. Filter designs, noise and electromagnetic interference issues are also discussed.</p>	2	4
EMD2002	<p>Medical Devices</p> <p>This subject discusses the fundamentals of medical devices generally used in hospitals, such as the electrocardiograph, electroencephalograph, electromyograph, therapeutic devices, as well as life-saving and support devices. The essential principles of safety and reliability of medical devices are also covered.</p>	2	4
EMF2003	<p>Medical Device Manufacturing Practices</p> <p>This subject provides the fundamental knowledge of, and introduces good manufacturing practices in, the design and manufacturing of medical devices and pharmaceuticals. It covers design control, equipment maintenance, contamination prevention, qualification and validation, non-conformance handling as well as technical documentation.</p>	2	3
EBI3008	<p>Medical Imaging &amp; Informatics</p> <p>This subject will cover Medical Imaging techniques and Health Information Systems with the implementation of IT in the healthcare setting. This covers decision-making in patient care, clinical workflow, network infrastructures, standards and interoperability issues, and patient data privacy and security.</p>	3	4
EMP3002	<p>Major Project</p> <p>The Major Project gives you an opportunity to integrate and apply your knowledge in a practical learning situation. Besides research, design and project management skills, the emphasis will also be on innovation, creativity, teamwork and enterprise.</p>	3	8

## Elective Subjects

Subject code	Subject	Level	Credit Units
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EBS2004	<p>Medical Biochemistry</p> <p>This subject covers biochemical and molecular exchanges that occur within the human body in the context of medicine, usually in terms of drug interactions or cellular responses to diseases. It includes Biochemistry, which investigates the constituents of biological systems, their properties and their significance to biological science, as well as Molecular Genetics, which studies DNA structure, DNA replication, DNA transcription &amp; translation and DNA mutations. Connections will also be made between the two areas of study.</p>	2	4
EBS2005	<p>Clinical Laboratory Equipment</p> <p>This subject focuses on important aspects of clinical laboratory and instruments widely used in clinical laboratories. Topics include centrifuges, automated analysers, separation techniques, bioreactors, mass spectrometry and clinical trials. Essential insights to clinical laboratory practices are also given.</p>	2	4
EBI3004	<p>Audiometry &amp; Hearing Devices</p> <p>This subject focuses on the hearing health sector in biomedicine. It exposes you to the science of hearing assessment and technologies available to remediate hearing loss. You will study the properties of sound, the physiology of hearing and the causes of hearing impairment; and you will be equipped with the skills to screen for hearing impairment. You will also learn about the underlying technologies behind digital hearing aids.</p>	3	4
EED3014	<p>Advanced Skills Practices</p> <p>This subject provides opportunities for you to integrate and apply your knowledge for high level competitions or projects in practical learning situations. The project or skills training can involve substantial work related to either a high level industrial program or an end-user product, as well as advanced training to develop technical abilities to execute specific tasks competitively. It could also involve the development, evaluation of workable designs and implementation of ideas related to an innovative product suitable for manufacturing, or an improvement to existing products or processes. You may be required to work on software, hardware, or a combination of both hardware and software.</p>	3	8

## Special Electives

Students can opt to take Special Electives when offered. These optional subjects, taken in addition to the diploma elective subjects, aim to stretch the students' potential to enable them meet their aspirations.

Subject code	Subject	Level	Credit Units
EED3009	<p>Special Project 1</p> <p>The focus of this subject is on the application of students' existing domain knowledge to develop a deliverable. The subject will introduce new skills and knowledge specific to the project, as and when required.</p>	3	2

EED3010	<p>Special Project 2</p> <p>This subject provides opportunities for students to apply the acquired knowledge and skills, along with their fundamental and in-depth knowledge from different subjects to designing, developing, and implementing a well-engineered project solution.</p>	3	2
EED3011	<p>Higher Engineering Skills 1</p> <p>Higher Engineering Skills 1 and 2 aim to impart some special design and hands-on skills that allow you to acquire knowledge and skills that are not normally incorporated into a diploma programme. These Special Elective subjects will equip you with the skills and knowledge to participate in competitions and enable you to tackle real challenges.</p>	3	2
EED3012	<p>Higher Engineering Skills 2</p> <p>Higher Engineering Skills 1 and 2 aim to impart some special design and hands-on skills that allow you to acquire knowledge and skills that are not normally incorporated into a diploma programme. These Special Elective subjects will equip you with the skills and knowledge to participate in competitions and enable you to tackle real challenges.</p>	3	2
EMA3001	<p>Higher Engineering Mathematics</p> <p>The subject introduces mathematical concepts and techniques used in advanced engineering courses. You will learn topics in calculus such as limits and continuity, infinite series, improper integrals, multiple integrals, higher order differential equations, 2D and 3D analytic geometry, and partial differentiation.</p>	3	4

## Graduation Requirements

Cumulative Grade Point Average	min 1.0
TP Fundamentals Subjects	36 credit units
Diploma Core Subjects	83 credit units
Diploma Elective Subjects	min 7 credit units
<b>Total Credit Units Completed</b>	<b>min 126 credit units</b>