School of Engineering

DIPLOMA IN BIOMEDICAL ENGINEERING

Fascinated by how engineering and biology can benefit society? Or are you interested in helping medical professionals do their work better? If you have a passion to improve the lives of others, then the Diploma in Biomedical Engineering (BME) is perfect for you. This forward-thinking field is responsible for the design of sophisticated medical equipment such as diagnostic and therapeutic machines, as well as lifesaving devices like the artificial heart and dialysis machine.

The first diploma of its kind in Singapore, BME is jointly delivered by Ngee Ann Polytechnic's School of Engineering and School of Life Sciences & Chemical Technology. Besides teaching you how to develop medical equipment, BME also gives you a firm grounding in research that could lead to the discovery of faster and more accurate tools for medical conditions.

In your first year, you will acquire a strong foundation in engineering in topics covering electrical, electronic and mechanical engineering. Then in your second year, you will study cell and molecular biology alongside medical instrumentation and clinical engineering. You will also be equipped with electronic design and prototyping skills.

In your final year, you will focus on areas such as healthcare informatics as well as various types of medical equipment. You will also learn to design and develop technical projects. What's more, you will have the opportunity to go on a six-month local or overseas internship with a university, hospital, multinational corporation (MNC) or research institute.

YEAR 1 COURSE MODULES

LEVEL 1.1

Electrical Engineering Fundamentals
This module provides a foundation in electricity covering basic concepts of electrical circuits and the methods used to analyse them. The module emphasises the understanding of the basic electrical circuit laws (Ohm's Law, Kirchhoff's Voltage and Current Laws) and network theorems, and their application to electrical network analysis. Topics covered include fundamentals of electricity, network theorems, capacitance, electromagnetic induction and inductance.

Engineering Mathematics 1
This module is designed to provide students with the fundamental skills in mathematics required to solve basic engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in each topic is on simple applications and problem solving. Topics include algebra, trigonometry, logarithms, plane analytic geometry, matrices and complex numbers. Throughout the module, there is appropriate use of a Computer Algebra System.

Integrated Real-world Project 1
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and further enhanced through relevant contextualisation. Students will work in teams and undertake the project development underpinned by the design thinking approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects. Data analytics will be introduced using case-based approach and applied in the integrated real-world project.

Career & Professional Preparation 1 will be incorporated to give students a foundational introduction to their three-year diploma course curriculum and how it prepares them for industry. It will help them to embark on their course with the end in mind, through guided reflection of their personal characteristics, and producing an overall game plan for their future education and career goals.

Mechanical Engineering Fundamentals
This module introduces students to the study of external forces in two dimensions and their effect on particles and rigid bodies that are at rest. Students learn the skills to analyse the forces acting on the bodies by drawing free-body diagrams and applying the conditions of equilibrium. Topics include forces and resultants, moments and couples, equilibrium and the concepts of plane friction. This module also aims to equip students with the skills to analyse problems of rigid bodies in motion. Only linear motion in two dimensions will be covered. Topics include kinematics and kinetics of linear motion

Programming
This practice-oriented module equips students with basic knowledge and skills in computer programming using a suitable high-level language. The main topics include basic computer programming concepts and fundamental programming constructs such as sequences, selection and repetition.

LEVEL 1.2

AC Circuits
This module provides students with basic knowledge of the fundamental principles in electric circuit analysis. The module extends DC network theorems to AC circuits which involve impedances such as capacitance and inductance. The module also includes analysis of simple AC series, parallel and series-parallel combination circuits, concept of AC power and understanding of power factor and its effect on electrical energy usage.

Analogue Electronics
The aim of this module is to lay the foundations in analogue electronics. At the end of this module, students will acquire content knowledge and understanding on the basic concepts of analogue electronics and some applications. Key topics covered in this module include operating characteristics, working principles and applications of discrete electronic devices such as various types of diodes, MOSFETs and BJTs. Practical circuits will be used to enhance and strengthen the learners' knowledge so that they will acquire the relevant competencies to move on to more specialised modules.

Digital Fundamentals
This module introduces the basic concepts of digital systems. It covers the basics of combinational and sequential logic circuits. Flip-flops and their application in counters and registers will also be discussed. This basic knowledge is essential for students to be able to understand, analyse, and design basic digital circuit system.

Engineering Mathematics 2
This module is designed to provide students with the fundamental skills in mathematics required to solve basic engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in each topic is on simple applications and problem solving. Throughout the module, there is appropriate use of a Computer Algebra System. Topics include trigonometry, differentiation and simple integration with applications.

Integrated Real-world Project 2
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and understand the relevance and application of the modules learnt. Students will work in teams and undertake the project development underpinned by the design thinking approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects at the higher levels. This module will also imbue in students a sense of civic consciousness in the context of engineering and society. It serves to create awareness amongst students about the impact of engineering on society in general. In the process it introduces the application of cultural quotient (CQ) skills and mould students' disposition to understand and collaborate across diverse cultures in real world settings.

YEAR 1 COURSE CURRICULUM

Module Name	Credit Units
Level 1.1 (20 hours per week)	
Electrical Engineering Fundamentals	3
Engineering Mathematics 1	4
English Language Express*	NA
Innovation Made Possible^	3
Integrated Real-world Project 1	4
Mechanical Engineering Fundamentals	3
Programming	3
Level 1.2 (21 hours per week)	
AC Circuits	3
Analogue Electronics	3
Communication Essentials^	3
Digital Fundamentals	3
Engineering Mathematics 2	4
Health & Wellness^	1
Integrated Real-world Project 2	4

Notes:

^ For more details on Interdisciplinary Studies (IS) electives, please log on to www.np.edu.sg/is

* This module is only offered to students who are weaker in the English Language.

IS Modules

The School of Interdisciplinary Studies (IS) delivers a broad-based curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge economy. IS offers both prescribed modules and electives to challenge boundaries. Prescribed modules develop students' competencies in core areas such as Communication, Innovation and Enterprise, Culture and Communication, and Personal Mastery and Development, while elective modules provide insights into Arts and Humanities, Business, Design, and Science and Technology.

YEAR 2 COURSE MODULES

LEVEL 2.1

Embedded System
This module aims to equip students with a fundamental in microcontroller and embedded system. Students will acquire the necessary skills and knowledge through a series of practical projects and real-world applications. Students will be able to implement a microcontroller-based system and interfacing with various input/output components as well as sensors.

Integrated Real-world Project 3
This module aims to integrate the knowledge learnt during the semester, deepen the skills in the previous semester and to lay the foundation for future modules by applying them to projects involving medical electronics. Students will work together to deepen the knowledge relating to prototyping sub-circuits using computer-aided design tools and also will be working individually to undertake the project development in various areas of medical electronics such as amplification and detection of electrocardiogram, heart sounds and optical heart rate detection. On completion of the module, students will be able to apply these skills and develop confidence for tackling projects in medical electronics at higher levels.

The Career and Professional Preparation 2 will be incorporated to equip students with skills necessary to seek and secure work. They will also be equipped to communicate their personal brand in a positive way. As students sharpen their communication skills, they will also learn how to market themselves effectively.

Medical Electronics
This module intends to present an understanding of electronic instrumentation and measurements with a focus on physiological signals. Troubleshooting, testing and construction of circuits will be part of the student's key learning and performance task in this module.

Physiological Systems
This module provides the fundamental understanding of the anatomy and physiology of the human body, which is an essential foundation to bridge science and engineering. The cardiovascular, neurological and respiratory systems are emphasised in this module while other systems in the human physiology are covered briefly.

LEVEL 2.2

Cell and Molecular Biology
This module aims to introduce cell and molecular biology concepts. It equips students with an understanding of eukaryotic cell biology, including fundamental chemicals necessary for life, structure and function of cells and organelles, cellular transport mechanisms, cell divisions, deoxyribonucleic acid replication, protein synthesis, genetics, principles of inheritance, cell-to-cell interactions and cell development.

Clinical Engineering
This module introduces the roles and functions of a biomedical engineering department in a healthcare establishment. It covers the regulatory and safety aspects of a hospital or clinical environment. Students will acquire the necessary skills and knowledge to perform electrical safety testing, preventive maintenance and calibration on medical equipment. Basic analytical skills on healthcare data will also be taught.

Integrated Real-world Project 4
This module aims to facilitate students with practical image and signal processing knowledge relevant to medical and healthcare equipment. Through the module, students will be able to integrate the learning from this and other modules and apply image and signal processing skills in medical or laboratory settings. Through practice and research, students will also learn how to incorporate artificial intelligence to enhance the quality of care delivered in the healthcare industry.

This module will also imbue in students a sense of civic consciousness in the context of engineering and safety. The module will also imbue in students' a safety-oriented mindset and develop students' workplace safety and health (WSH) competencies and raise their safety awareness of self and their surroundings.

Medical Instrumentation
This module introduces students to a broad range of biomedical equipment and prepares them to understand and work with common hospital-based equipment that can be diagnostic, therapeutic or clinical monitoring in nature. Students will be taught the principles, functions, features and limitations of these equipment. This will help them better understand and perform the required maintenance, testing and calibrations of these equipment.

YEAR 2 COURSE CURRICULUM

Module Name	Credit Units
Level 2.1 (18 hours per week)	
Embedded System	5
Integrated Real-world Project 3	4
Medical Electronics	5
Physiological Systems	4
Level 2.2 (20 hours per week)	
Cell and Molecular Biology	4
Clinical Engineering	5
Medical Instrumentation	5
Integrated Real-world Project 4	4
World Issues: A Singapore Perspective^	2

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YEAR 3 COURSE MODULES

LEVEL 3.1

Biomechanics & Biomaterials
This module equips students to apply mechanical engineering principles to perform simple force analysis of the musculoskeletal system. It also provides an appreciation of the kinematics and kinetics of human motion. Rehabilitation engineering, including causation, orthopaedic and prosthetic interventions will be discussed. Students will also be introduced to the concepts of biological materials, biomaterials, implants and tissue engineering. This module complements the students' training in electronics and electrical engineering.

Healthcare Informatics
This module aims to introduce students to the different aspects of Information technology as applied in the healthcare environment such as hospitals. Modern hospital systems have been integrated and connected to provide effective and efficient treatment. The involvement of information technology in healthcare is constantly of increased importance. Students will acquire knowledge on the acquisition, use, and storage of health information, electronic health records, clinical data workflow and processes, network infrastructures, and patient data privacy and security. Students will develop configuration, maintenance and troubleshooting skills for managing health information systems through laboratory sessions and activities.

Integrated Real-world Project 5
This module aims to integrate the knowledge learnt in the semester and apply to project work. Students will work in teams and undertake the project development underpinned by the design thinking approach. On completion of the module, students will be able to develop ergonomic project work related to the wireless connectivity of medical devices in a healthcare environment.

This module will also imbue in students a sense of civic consciousness in the context of engineering and sustainability. It will develop students' competencies in sustainable development, raise their awareness of sustainability in the context of society and the environment, and appreciate the impact engineering solutions may have on the environment.

Internet of Things
This module aims to equip students with a basic fundamental in the Internet of Things (IoT). Students will learn the system architecture of a typical IoT system with a good understanding of functionalities of its building blocks. They will acquire the necessary skills and knowledge through a series of practical exercises. Upon completion of the module, students will be able to implement a simple IoT system prototype with off-the-shelf equipment, platforms or services.

LEVEL 3.2

6-Month Internship (Local/Overseas)
The six-month internship will provide students with the opportunity to apply the knowledge acquired in the classroom to work situations, and demonstrate problem solving, communication and interpersonal skills in a work environment.

The programme enables students to hone their ability to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to develop a professional approach to work based on the relevant code of practice.

YEAR 3 COURSE CURRICULUM

Module Name	Credit Units
Level 3.1 (20 hours per week)	
Biomechanics & Biomaterials	4
Healthcare Informatics	4
Integrated Real-world Project 5	4
Internet of Things	4
Project ID: Connecting the Dots ^	4
Level 3.2 (20 hours per week)	
6-Month Internship (Local/Overseas)	20

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