DIPLOMA IN AEROSPACE ELECTRONICS (AE)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

The aerospace industry is a significant sector of Singapore's economy, with annual output exceeding $6.3 billion in 2006. With over 100 aerospace companies employing more than 18,000 people to serve both regional and global markets, the aerospace industry is projected to create 18,000 new jobs by 2018.

The **Diploma in Aerospace Electronics (AE)** aims to cater to this growing demand for professionals with aerospace electronics skills. Going beyond mere maintenance and repair, this course gives a strong foundation in basic aircraft-related modules such as the Fundamentals of Aerospace Technology, and specialised modules like Aircraft Navigation & Communication Systems, and Aircraft Electrical & Instrumentation Systems.

First-year students take a number of common core engineering modules as well as specialised aircraft-related modules such as Avionics Systems and Fundamentals of Aerospace Technology. Second-year students have more hands-on exposure via a number of practice-oriented modules to enhance their knowledge and practical skills in electronic engineering.

Third-year students broaden their educational experience through specialised modules and a six-month industrial attachment programme with leading aerospace organisations; such as Singapore Technologies Aerospace, The Republic of Singapore Air Force, Eurocopter, Rockwell Collins and Honeywell; to learn and apply their knowledge in a real-time environment.

AE is aligned with the Singapore Airworthiness Requirements (SAR), as set out by the Civil Aviation Authority of Singapore. Graduates may be exempted from most of the 12 SAR avionics papers. With further training in the aerospace industry, they can become a Licensed Aircraft Maintenance Engineer.

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examinations (or equivalent) results:

Subject	'O' Level Grade
English	1-7**
Mathematics (Elementary/Additional)	1-6
Science (with Physics or Chemistry or Biology component) or Design & Technology	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology and two other subjects.

** Candidates with English as a second language (EL2) must have attained a minimum grade of 6.

Candidates with hearing deficiency or severe vision deficiency including colour appreciation deficiency should not apply for the course.

CAREER PROSPECTS

Career prospects for AE graduates are buoyant. Graduates can work as aircraft maintenance engineers, be involved in R&D activities, provide engineering support, or work in sales and marketing.

ACCREDITATION FOR FURTHER STUDIES

AE graduates can pursue an electrical or electronic engineering degree at local universities or an avionics degree with overseas universities like the Queensland University of Technology, University of Glasgow, University of Bristol and Queen Mary University of London.

COURSE STRUCTURE

FIRST-YEAR MODULES

Level 1.1
- Electrical Technology
- Engineering Mechanics
- Engineering Mathematics 1
- Computer Programming
- Fundamentals of Aerospace Technology
- Creativity & Applied Thinking Skills^
- Sports & Wellness^

Level 1.2
- Analogue Electronics
- Digital Electronics
- Engineering Mathematics 2
- Electrical & Electronic Drawing & CAD
- Avionics Systems
- Individual & the Community^
- Communication Toolkit ^

SECOND-YEAR MODULES

Level 2.1
- Aircraft Maintenance Practices
- Electronic Practical Skills
- Analogue Circuit Design and Applications
- Applications Programming
- Engineering Mathematics 3A
- Any 2 Interdisciplinary Studies (IS) modules^

Level 2.2
- Microcontroller Programming & Interfacing
- Telecommunication Principles
- Fundamentals of Control Systems
- Aircraft Materials
- Innovation & Enterprise in Action^

FINAL-YEAR MODULES

Industrial Attachment Programme (IAP) Path

Level 3.1
- Aircraft Navigation & Communication Systems
- Aircraft Electrical & Instrumentation Systems
- Avionics Project Design
- World Issues: A Singapore Perspective^
- Any 1 Interdisciplinary Studies (IS) module ^

Level 3.2
- Industrial Attachment Programme (IAP)

Non-Industrial Attachment Programme Path

Level 3.1
- Aircraft Navigation & Communication Systems
- Embedded System Design
- Project Design and Development 1
- World Issues: A Singapore Perspective^
- Any 1 Interdisciplinary Studies (IS) module ^

Level 3.2
- Aircraft Electrical & Instrumentation Systems
- Radio Frequency and Microwave Engineering
- Project Design and Development 2

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)
- Any 2 School of Engineering (SoE) elective modules°

^ Denotes Interdisciplinary Studies module. For more details on IS modules, please log on to www.np.edu.sg/is/

° Students take two elective modules to complete their diploma. Electives are chosen and customised from a wide range of clusters under the Engineering and Non-Engineering categories.

COURSE MODULES

LEVEL 1.1

Electrical Technology

This module provides students with the necessary foundation for electrical circuit analysis. Students will learn electrical theorems and techniques for analysing and solving direct and alternating current circuit problems. Hands-on activities in laboratories will equip them with basic electrical measurement skills and reinforce concepts learnt in lectures and tutorials.

Engineering Mechanics

This module pertains to the study of external forces in two dimensions and their effects on particles and rigid bodies at rest. Students will learn to analyse forces acting on rigid bodies by drawing free-body diagrams and applying the conditions of static equilibrium. The module also covers linear and rotational motion of particles and rigid bodies. Topics include forces and resultants, moments and couples, equilibrium, plane friction, kinematics, and kinetics of linear and rotational motions.

Engineering Mathematics 1

This module is designed to equip students, with any level of mathematical ability, with the fundamental skills required to solve engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in this module is on applications and problem solving. Areas covered include algebra, trigonometry, logarithms, matrices and complex numbers.

Computer Programming

This practice-oriented module equips students with the basic knowledge and skills in computer programming using C language. The main topics include basic computing concepts, fundamentals of C, branching, loops, and C functions. On completion of the module, students will be able to explain and write C programs for engineering applications.

Fundamentals of Aerospace Technology

This activity-based module introduces students to the principles of flight and traces the historical development of aerospace technology and its impact on society, economics, safety and environmental issues. It highlights the nature and scope of the aerospace industry in Singapore, and the broad technical training for the profession with specific reference to the structure of the course. The module aims to create professional awareness in students.

LEVEL 1.2

Analogue Electronics

The aim of this module is to introduce the fundamental concepts of analogue electronic devices and circuits. It covers semiconductor physics as well as the device characteristics, operating principles and common applications of diodes and transistors. The module will equip students with a thorough understanding of DC biasing and AC operation of transistor amplifier circuits. This will be achieved through worked examples, tutorials, laboratory sessions and e-learning materials.

Digital Electronics

This module covers the fundamentals of digital electronics. The basic principles and techniques of digital system and design are covered. It is also intended to prepare students for subsequent subjects involving microprocessors and microcomputers. The main topics covered are number systems, Boolean Algebra, combinational logic circuits and minimisation techniques, flip-flops and multivibrators, IC counters, and data handling devices.

Engineering Mathematics 2
This module provides students with further mathematical skills to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation, and integration with applications.

Electrical & Electronic Drawing & CAD
This module introduces the concepts of electronic circuit drawing and printed circuit board (PCB) layout using a modern computer-based electronic design automation (EDA) package. Using the software, students will design PCBs, starting from schematic capture to PCB layout post-processing and library parts creation. The module, which adopts a completely hands-on approach, prepares them for final-year projects that involve electronic circuit design and manufacturing.

Avionics Systems
This module provides students with an appreciation of aircraft electronic systems. It includes topics such as cockpit instrumentation, aircraft navigation, communication, surveillance, control and lighting electronics. This module equips students with the knowledge required for the advanced modules on Aircraft Navigation & Communication Systems (ANCS) and Aircraft Electrical & Instrumentation Systems (AEIS).

LEVEL 2.1

Aircraft Maintenance Practices
This module aims to equip students with basic knowledge of good practices in the workshop. It covers various soldering methods such as welding, brazing, soldering and bonding; aircraft weight and balance; aircraft handling and storage; disassembly, inspection, repair and assembly techniques; and maintenance procedure.

Electronic Practical Skills
This is a hands-on module that aims to equip students with the necessary practical skills in electronic circuit construction, testing, measurement and analysis. Students will also put into practice concepts covered in the Level 1 module Electrical Technology.

Analogue Circuit Design and Applications
This module introduces students to the operating principles of commonly used analogue devices and circuits, such as operational amplifiers, oscillators and filters. Applications in various practical circuits are also illustrated.

Applications Programming
This practice-oriented module equips students with the fundamental skills required to develop Windows applications. The students will develop conceptual understanding to design and develop applications to solve business and engineering problems. Main topics include branch and loop, array, bitwise operation, datafiles accessing and methods.

Engineering Mathematics 3A
This module is a continuation of Engineering Mathematics 2. Topics in this module include integration with applications, differential equations, Laplace transform and Fourier Series.

LEVEL 2.2

Microcontroller Programming & Interfacing
This module introduces students to the fundamentals of microcontroller programming and interfacing. C language programming is used to illustrate the operation of the microcontroller. Interfacing the microcontroller to basic input-output devices such as switches, LEDs, 7-segment displays and keypads help to demonstrate the behaviour of the application software running on a working system.

Telecommunication Principles
In this module, students will deal with the fundamental concepts in analogue and digital communications. Basic principles of analogue, effects of noise, and digital modulation in communication systems will be covered. This module requires proficiency in trigonometry, complex numbers and basic calculus. In addition, knowledge of fundamental principles in analogue electronics with an emphasis on decibel and tuned amplifiers are pre-requisites for this module.

Fundamentals of Control Systems
This module provides students with a basic coverage of feedback control systems. The topics cover basic concepts of automatic control, control systems' components, simple analytical tools and stability analysis of systems. Students are also introduced to the use of Matlab/Simulink as a computer tool in control systems analysis.

Aircraft Materials
The module covers the family of common engineering materials comprising metals, ceramics, polymers and composites, with an emphasis on the structures, properties, performance and processing of such materials. Corrosion and various fasteners components are included. Learning is enhanced by laboratory work on microstructures and mechanical testing.

LEVEL 3.1

Aircraft Navigation & Communication Systems
This module provides students with the theory of operations and the functional description of airborne navigation and communication systems found in modern aircraft. For example, some systems covered are ADF, VOR, DME, IRS, HF and VHF. The standard digital data-bus communications protocol, such as ARINC 429 and ARINC 629 used by commercial aircraft and MIL-STD-1553B used by military aircraft, will also be covered.

LEVEL 3.1 (INDUSTRIAL ATTACHMENT PROGRAMME PATH) / 3.2 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Aircraft Electrical and Instrumentation Systems
This module provides students with the theory of operations and the functional description of aircraft instrument and electrical systems found in the modern aircraft. Students will also learn about the auto flight, flight control and management systems, emergency electronics, and cabin entertainment system.

LEVEL 3.1 (INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Avionics Project Design
Using a Problem-based Learning (PBL) approach that combines the fundamental learning process and engineering problem-solving, this module is designed to impart prerequisite skills and knowledge like problem analysis, defining and formulating a problem in engineering terms, and the use of software tools. Students will have the opportunity to apply these skills in real-life problem-solving.

LEVEL 3.2 (INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Industrial Attachment Programme

In this module, students will be attached to sponsoring companies for a period of approximately six months. During their attachments, they will undertake projects assigned by the company or be involved in operations or maintenance-related work. Student attachments may be undertaken locally or overseas.

LEVEL 3.1 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Embedded System Design

Based on the foundation gained from the Microcontroller Programming and Interfacing (MPI) module, this module introduces students to more microcontroller-based system design and programming. It covers various commonly used hardware and software building blocks of embedded systems.

Project Design and Development 1

In this module, students will work together in teams of three to design and implement a project that demonstrates their engineering skills as well as teamwork over a period of two semesters. The module is structured to encourage creativity and innovative thinking. This will also help students develop a positive work attitude and good team spirit.

LEVEL 3.2 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Radio Frequency and Microwave Engineering

The objective of this module is to present to the students the basic principles, characteristics and applications of a wide range of commonly used radio frequency and microwave integrated passive and active circuit hardware.

Project Design and Development 2

This module follows on from Project Design and Development 1. Students are required to demonstrate their ability and resourcefulness in implementing their selected project design solution. The scope of work includes printed circuit board fabrication, wiring, assembly and testing of the final prototype according to the specifications and requirements defined in Project Design and Development 1. In addition, software-based projects may require database coding, operating system implementation and testing, server and client system design, portable design field test and Web-based integration.

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

School of Engineering Elective Modules and the Diploma Plus Programme

Students take two modules from a wide range of clusters under the engineering and non-engineering categories to complete their diploma. Furthermore, students can qualify for a diploma plus by simply topping up with two additional modules from the same cluster as one of the electives. The Diploma Plus Certificate helps students if they wish to pursue a university degree or increase their employability in discipline-specific areas. Students can choose electives from the range listed below.

Engineering Category

- Advanced Engineering Mathematics Cluster*
- Aerospace Electronics Cluster
- Applied Physics Cluster*
- Biomedical Engineering Cluster
- Computer & Communication Systems Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Microelectronics Cluster
- Network Systems & Security Cluster
- Telecommunication Distribution Technology Cluster

Non-Engineering Category

- Economics & Financial Applications Cluster
- Green Development Cluster
- Leisure & Retail Management Cluster

Other Available Diploma Plus Certificates

- Business
- Innovation Management
- Languages (Japanese)

*Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The syllabus is based on the first-year engineering mathematics and science curricula of NUS.

For detailed module descriptions under each cluster, please refer to page 182.

COURSE CURRICULUM
INDUSTRIAL ATTACHMENT PROGRAMME (IAP) PATH

Module No.	Module Name	Credit Units
	YEAR 1	
	Level 1.1 (27 hours per week)	
1.	Electrical Technology	6
2.	Engineering Mechanics	5
3.	Engineering Mathematics 1	5
4.	Computer Programming	4
5.	Fundamentals of Aerospace Technology	3
6.	Sports & Wellness^	2
7.	Creativity & Applied Thinking Skills^	2
	Level 1.2 (25 hours per week)	
8.	Analogue Electronics	5
9.	Digital Electronics	5
10.	Engineering Mathematics 2	5
11.	Electrical & Electronic Drawing & CAD	3
12.	Avionics Systems	3
13.	Individual & the Community^	2
14.	Communication Toolkit^	2
	YEAR 2	
	Level 2.1 (24 hours per week)	
15.	Aircraft Maintenance Practices	3
16.	Electronic Practical Skills	4
17.	Analogue Circuit Design and Application	5
18.	Applications Programming	4
19.	Engineering Mathematics 3A	4
20.	Interdisciplinary Studies (IS) module^	2
21.	Interdisciplinary Studies (IS) module^	2
	Level 2.2 (24 hours per week)	
22.	Microcontroller Programming & Interfacing	6
23.	Telecommunication Principles	6
24.	Fundamentals of Control Systems	5
25.	Aircraft Materials	3
26.	Innovation & Enterprise in Action^	4

DIPLOMA IN AEROSPACE ELECTRONICS (AE) (3-YEAR COURSE)
SCHOOL OF ENGINEERING

Module No.	Module Name	Credit Units
	YEAR 3	
	Level 3.1 (19 hours per week)	
27.	Aircraft Navigation & Communication Systems	5
28.	Aircraft Electrical & Instrumentation Systems	6
29.	Avionics Project Design	4
30.	World Issues: A Singapore Perspective^	2
31.	Interdisciplinary Studies (IS) module^	2
	Level 3.2 (25 hours per week)	
32.	Industrial Attachment Programme	25
	Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
33.	School of Engineering (SoE) elective module°	3
34.	School of Engineering (SoE) elective module°	3

COURSE CURRICULUM
NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH

Module No.	Module Name	Credit Units
	YEAR 1	
	Level 1.1 (27 hours per week)	
1.	Electrical Technology	6
2.	Engineering Mechanics	5
3.	Engineering Mathematics 1	5
4.	Computer Programming	4
5.	Fundamentals of Aerospace Technology	3
6.	Sports & Wellness^	2
7.	Creativity & Applied Thinking Skills^	2
	Level 1.2 (25 hours per week)	
8.	Analogue Electronics	5
9.	Digital Electronics	5
10.	Engineering Mathematics 2	5
11.	Electrical & Electronic Drawing & CAD	3
12.	Avionics Systems	3
13.	Individual & the Community^	2
14.	Communication Toolkit^	2
	YEAR 2	
	Level 2.1 (24 hours per week)	
15.	Aircraft Maintenance Practices	3
16.	Electronic Practical Skills	4
17.	Analogue Circuit Design and Application	5
18.	Applications Programming	4
19.	Engineering Mathematics 3A	4
20.	Interdisciplinary Studies (IS) module^	2
21.	Interdisciplinary Studies (IS) module^	2
	Level 2.2 (24 hours per week)	
22.	Microcontroller Programming & Interfacing	6
23.	Telecommunication Principles	6
24.	Fundamentals of Control Systems	5
25.	Aircraft Materials	3
26.	Innovation & Enterprise in Action^	4
	YEAR 3	
	Level 3.1 (21 hours per week)	
27.	Aircraft Navigation & Communication Systems	5
28.	Embedded System Design	4
29.	Project Design and Development 1	8
30.	World Issues: A Singapore Perspective^	2
31.	Interdisciplinary Studies (IS) module^	2
	Level 3.2 (23 hours per week)	
32.	Radio Frequency and Microwave Engineering	5
33.	Aircraft Electrical & Instrumentation Systems	6
34.	Project Design and Development 2	12
	Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
35.	School of Engineering (SoE) elective module°	3
36.	School of Engineering (SoE) elective module°	3

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

° For more details on School of Engineering elective modules, please refer to page 182.

Students are required to own Notebook Computers.

IS Modules
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge-based economy. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

School of Engineering (SoE) Elective Modules
The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and deepen their discipline-specific areas. Each cluster comprises a minimum of three 3-hour modules. Students are required to take two modules in order to satisfy the minimum graduating requirement.

DIPLOMA IN BIOMEDICAL ENGINEERING (BME)
(3-YEAR COURSE)

SCHOOL OF ENGINEERING

The **Diploma in Biomedical Engineering (BME)** course is a multidisciplinary and practice-oriented programme that bridges engineering with life sciences, tapping into the fast-growing biomedical sciences and medical technology sectors. In Singapore, the BME segment accounts for more than half of all personnel employed in the entire biomedical sciences industry.

As the pioneering diploma in this field in Singapore, BME equips students with a strong grounding in engineering that complements the life sciences, including areas such as electronics, biophysics, medical instrumentation, cell and molecular biology, biomechanics and implants.

Students devote about 40 per cent of the curriculum to practical training such as laboratory experiments, workshops, projects and industrial attachments. They also acquire skills in the design and operation of medical devices and equipment.

Final-year students focus on specialised topics in clinical engineering, biomaterials and implants, diagnostic and therapeutic medical equipment, and medical imaging technology. They also work in teams to design and develop biomedical projects.

In addition, students can pursue a six-month industrial attachment in relevant local or overseas biomedical companies, or choose to do an in-house project. Some of our partners, such as the BME departments at local hospitals and multinational corporations, prefer students from our BME course for attachments.

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examinations (or equivalent) results:

Subject	'O' Level Grade
English	1-7**
Mathematics (Elementary/Additional)	1-6
Science (with Physics or Chemistry or Biology component) or Design & Technology	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology and two other subjects.

** Candidates with English as a second language (EL2) must have attained a minimum grade of 6.

Candidates with severe vision deficiency should not apply for the course. Those with colour appreciation deficiency may be considered, subject to an in-house test.

DIPLOMA IN BIOMEDICAL ENGINEERING (BME) (3-YEAR COURSE)
SCHOOL OF ENGINEERING

CAREER PROSPECTS

BME graduates can look forward to many exciting careers in the medical and healthcare sectors. They can work in sales and marketing and direct engineering support. There are also ample career opportunities in biomedical engineering research. They can be involved in research and design, and the development of new medical devices to improve healthcare.

BME graduates doing R&D are at the forefront of cutting-edge technologies. Their work can range from investigative clinical studies, analysis and synthesis, design and development, product prototyping, quality assurance and certification, to clinical trials and research publications.

Those who choose to work in a medical environment like hospitals will be involved in evaluating, purchasing and installing medical equipment, as well as maintenance and service work. They can teach and train end-users in the principles, proper use and care of the equipment. They can also work in healthcare product companies, handling the sales, marketing and technical support of medical instruments and devices.

ACCREDITATION FOR FURTHER STUDIES

BME has been accredited by both local and overseas universities. Many of these institutions grant either credit exemptions or direct entry into the second or third year of their courses. An impressive 65 per cent of BME graduates in 2007 secured places in the universities by July in the same year. Some of them even received multiple offers.

In Singapore, BME graduates can apply for bioengineering, electrical & electronic engineering, materials engineering or biological sciences courses at the Nanyang Technological University; bioengineering, electrical engineering or computer engineering courses at the National University of Singapore; or biomedical engineering or electronics courses at SIM University (UniSIM).

Examples of overseas universities that have accredited our courses and granted credit exemptions are the University of New South Wales and the University of Sheffield.

COURSE STRUCTURE

FIRST-YEAR MODULES

Level 1.1
- Computer Programming
- Electrical Technology
- Engineering Mathematics 1
- Engineering Mechanics
- Introduction to Biomedical Engineering
- Creativity & Applied Thinking Skills^
- Sports & Wellness^

Level 1.2
- Analogue Electronics
- BioPhysics
- Digital Electronics
- Electronic Practical Skills
- Engineering Mathematics 2
- Individual & the Community^
- Communication Toolkit^

SECOND-YEAR MODULES

Level 2.1
- Applications Programming
- Cell & Molecular Biology
- Electronic Design & Prototyping
- Engineering Mathematics 3A
- Medical Instrumentation
- Any 2 Interdisciplinary Studies (IS) modules^

Level 2.2
- Electronic Project Design Practice
- Embedded System (ARM)
- Fundamentals of Control Systems
- Physiological Systems
- Innovation & Enterprise in Action^

FINAL-YEAR MODULES

Industrial Attachment Programme (IAP) Path

Level 3.1
- BME Project Design
- Clinical Engineering
- Diagnostic, Therapeutic & Laboratory Equipment
- World Issues: A Singapore Perspective^
- Any 1 Interdisciplinary Studies (IS) module^

Level 3.2
- Industrial Attachment Programme (IAP)

Non-Industrial Attachment Programme Path

Level 3.1
- Biomaterials & Implants
- Biomechanics & Rehabilitation Engineering
- Project Design and Development 1
- Diagnostic, Therapeutic & Laboratory Equipment
- World Issues: A Singapore Perspective^
- Any 1 Interdisciplinary Studies (IS) module^

Level 3.2
- Project Design and Development 2
- Clinical Engineering
- Telecommunication Principles

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules°

^ Denotes Interdisciplinary Studies module. For more details on IS modules, please log on to www.np.edu.sg/is/

° Students take two elective modules to complete their diploma. Electives are chosen and customised from a wide range of clusters under the Engineering and Non-Engineering categories.

COURSE MODULES

LEVEL 1.1

Computer Programming

This practice-oriented module equips students with the basic knowledge and skills in computer programming using C language. The main topics include basic computing concepts, fundamentals of C, branching, loops, and C functions. On completion of the module, students will be able to explain and write C programs for engineering applications.

Electrical Technology

This module provides students with the necessary foundation for electrical circuit analysis. Students will learn electrical theorems and techniques for analysing and solving direct and alternating current circuit problems. Hands-on activities in laboratories will equip them with basic electrical measurement skills and reinforce concepts learnt in lectures and tutorials.

Engineering Mechanics
This module pertains to the study of external forces in two dimensions and their effects on particles and rigid bodies at rest. Students will learn to analyse forces acting on rigid bodies by drawing free-body diagrams and applying the conditions of static equilibrium. The module also covers linear and rotational motion of particles and rigid bodies. Topics include forces and resultants, moments and couples, equilibrium, plane friction, kinematics, and kinetics of linear and rotational motions.

Engineering Mathematics 1
This module is designed to equip students, with any level of mathematical ability, with the fundamental skills required to solve engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in this module is on applications and problem solving. Areas covered include algebra, trigonometry, logarithms, matrices and complex numbers.

Introduction to Biomedical Engineering
This module aims to provide students with an understanding and appreciation of the field of Biomedical Engineering. Students will learn a list of common roots, prefixes and suffices in order to have a strong foundation of medical terminology. They will be introduced to the wide range of medical devices and equipment. The functions and responsibilities of the biomedical technician/engineer will be explored. Basic concepts of medical instrumentation which encompasses transducers and signal conditioning/processing will be taught. Finally, students learn the types of medical device classes and the various safety standards.

LEVEL 1.2
Analogue Electronics
This module aims to introduce the fundamental concepts of analogue electronic devices and circuits. It covers semiconductor physics as well as the device characteristics, operating principles and common applications of diodes and transistors. The module will equip students with a thorough understanding of DC biasing and AC operation of transistor amplifier circuits. This will be achieved through worked examples, tutorials, laboratory sessions and e-learning materials.

Biophysics
In this module, students are introduced to various principles of Physics as they apply to the human body. These include energy, work, power, heat, temperature, pressure and electricity within the body. They are also exposed to the use of Physics in medical applications such as hearing, sight and radiation. This module provides a strong foundation for subsequent Biomedical Engineering modules.

Digital Electronics
This module covers the fundamentals of digital electronics. The basic principles and techniques of a digital system and its design are covered. It is also intended to prepare students for subsequent subjects involving microprocessors and microcomputers. The main topics covered are number systems, Boolean Algebra, combinational logic circuits and minimisation techniques, flip-flops and multivibrators, IC counters, and data-handling devices.

Electronic Practical Skills
This is a hands-on module that aims to equip students with the necessary practical skills in electronic circuit construction, testing, measurement and analysis. Students will also put into practice concepts covered in the Level 1 module Electrical Technology.

Engineering Mathematics 2
This module equips students with further mathematical skills to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

LEVEL 2.1
Applications Programming
This practice-oriented module equips students with the fundamental skills required to develop Windows applications. The students will develop conceptual understanding to design and develop applications to solve business and engineering problems. Main topics include branch and loop, array, bitwise operation, datafiles accessing and methods.

Cell & Molecular Biology
This module provides a solid foundation in the area of cell and molecular biology. The topics covered include Eukaryotic cell structure and function, molecular biology, bioinformatics, cell communication and differentiation, and cancer.

Electronic Design and Prototyping
The main objectives of this module are to introduce students to the techniques of PCB computer-aid design, and to provide opportunities for the acquisition of practical skills in electronic project design. Students will learn the planning, development, construction and testing of electronic prototypes. The focus of the module is on hands-on practice for basic PCB design, PCB fabrication and technical writing skills. Fault finding on electronic circuits, an essential skill in construction, is also introduced.

Engineering Mathematics 3A
This module is a continuation of Engineering Mathematics 2. Topics include integration with applications, differential equations, Laplace transform and Fourier Series.

Medical Instrumentation
In this module, students will gain an understanding of electronic instrumentation and measurements with a focus on physiological signals. Topics covered include measurement errors, transduction of bioelectric signals, different types of amplifiers and filters, signals and noise, power supplies, batteries, oscillators, timers, ultrasound, fibre optics and lasers.

LEVEL 2.2

Electronic Project Design Practice

The main objective of this module is to enable students to appreciate the importance of project design from theory to practice. Students will learn the correct approach to the development, construction and testing of projects. The hands-on practice involves basic hardware design techniques and implementation. Fault-finding on electronic circuits is introduced to enhance the skills of the students. Hands-on practice , design of printed circuit boards using self-generated component footprints, and report writing skills are also essential components of this module.

Embedded System (ARM)

This module introduces the fundamentals of a typical modern embedded system based on the 32-bit Advanced RISC Microprocessor (ARM). It presents the basic processor architecture together with the concept of System-on-Chip (SoC). It covers the use of C programming language in modern embedded systems and is supplemented by assembly language. The Motorola i.mx application processor is used to demonstrate the basic hardware interfacing architecture of a typical integrated ARM SoC.

Fundamentals of Control Systems

This module provides students with basic knowledge of feedback control systems. The topics cover the basic concepts of automatic control, the components of control systems, simple analytical tools, and stability analysis of systems. Students are also introduced to the use of Matlab/Simulink as a computer tool in control systems analysis.

Physiological Systems

Students will study the anatomy and physiology of the human body. This module will emphasise the importance of the cardiovascular and neurological systems in the integration of our physiological processes. The respiratory, endocrine, skeletal, muscular, digestive and excretory systems will also be studied.

LEVEL 3.1 (INDUSTRIAL ATTACHMENT PROGRAMME PATH)

BME Project Design

In this module, small groups of students will start project work during their Level 2.2 vacation (full-time over five weeks) and continue over the first semester in Level 3. Students will gain practical experience in the design and implementation of a project to demonstrate their engineering and presentation skills, and knowledge gained in the various academic subjects, especially in medical devices and equipment. This module provides the opportunity for students to demonstrate their creativity and initiative.

LEVEL 3.2 (INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Industrial Attachment Programme

In this module, students will be attached to sponsoring companies for a period of approximately six months. During their attachments, students will undertake projects assigned by the company or be involved in operations or maintenance-related work. Student attachments may be undertaken locally or overseas.

LEVEL 3.1 (INDUSTRIAL ATTACHMENT PROGRAMME PATH) &
LEVEL 3.2 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Clinical Engineering

Students will be taught biomedical equipment procurement, management, operation, calibration, testing and maintenance in order to provide quality patient care. They will discover the physiological effects of electricity and study the application of various electrical safety devices in a hospital environment. The IEC601-1 Electrical Safety Test procedures and safety limits are emphasised. Patient and operator safety, including the handling of chemicals, lasers, X-rays and radio-isotopes, are also taught. Other topics include inferential statistics and hypothesis testing.

LEVEL 3.1 (BOTH PATHS)

Diagnostic, Therapeutic & Laboratory Equipment

In this module, students will learn the functions, features and limitations of the most important hospital diagnostic and therapeutic equipment, as well as clinical lab instruments. Examples of diagnostic equipment are patient monitoring systems, respiratory measurement equipment and electroencephalography. Defibrillators, cardiac pacemakers and surgical equipment are some of the therapeutic equipment covered. The clinical lab instrumentation includes spectrophotometers, chromatographs and blood cell counters.

LEVEL 3.1 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Biomaterials & Implants

This module covers the types of biomaterials that can be used inside the human body, both for short- and long-term implantations, and their composition, properties and applications in skeletal, cardiovascular, dental, facial and breast implants. Students will also find out how the host body may react to the implantation of these foreign bodies. Current research on tissue engineering, which is seen as the alternative to implants, will also be covered.

Biomechanics & Rehabilitation Engineering

This module introduces students to the application of engineering statics and dynamics to perform simple force analyses of the musculoskeletal system. They will learn to appreciate the kinematics and kinetics of human motion. They will also learn about the role of an engineer in rehabilitation under different medical conditions.

Project Design & Development 1

In this module, students will work together in teams of three to design and implement a project that demonstrates their engineering skills as well as teamwork over a period of two semesters. The module is structured to encourage creativity and innovative thinking. This will also help students develop a positive work attitude and good team spirit.

LEVEL 3.2 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Project Design & Development 2

This module follows on from Project Design and Development 1. Students are required to demonstrate their ability and resourcefulness in implementing their selected project design solution. The scope of work includes printed circuit board fabrication, wiring, assembly and testing of the final prototype according to the specifications and requirements defined in Project Design and Development 1. In addition, software-based projects may require database coding, operating system implementation and testing, server and client system design, portable design field test and Web-based integration.

LEVEL 3.2 (NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH)

Telecommunication Principles

In this module, students will deal with the fundamental concepts in analogue and digital communications. Basic principles of analogue, effects of noise, and digital modulation in communication systems will be covered. This module requires proficiency in trigonometry, complex numbers and basic calculus. In addition, knowledge of fundamental principles in analogue electronics with an emphasis on decibel and tuned amplifiers are prerequisites for this module.

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

School of Engineering Elective Modules and the Diploma Plus Programme

Students take two modules from a wide range of clusters under the engineering and non-engineering categories to complete their diploma. Furthermore, students can qualify for a diploma plus by simply topping up with two additional modules from the same cluster as one of the electives. The Diploma Plus Certificate helps students if they wish to pursue a university degree or increase their employability in discipline-specific areas. Students can choose electives from the range listed below.

Engineering Category

- Advanced Engineering Mathematics Cluster *
- Aerospace Electronics Cluster
- Applied Physics Cluster *
- Biomedical Engineering Cluster
- Computer & Communication Systems Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Microelectronics Cluster
- Network Systems & Security Cluster
- Telecommunication Distribution Technology Cluster

Non-Engineering Category

- Economics & Financial Applications Cluster
- Green Development Cluster
- Leisure & Retail Management Cluster

Other Available Diploma Plus Certificates

- Business
- Innovation Management
- Languages (Japanese)

*Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The syllabus is based on the first-year engineering mathematics and science curricula of NUS.

For detailed module descriptions under each cluster, please refer to page 182.

COURSE CURRICULUM
INDUSTRIAL ATTACHMENT PROGRAMME (IAP) PATH

Module No.	Module Name	Credit Units
	YEAR 1	
	Level 1.1 (27 hours per week)	
1.	Computer Programming	4
2.	Electrical Technology	6
3.	Engineering Mathematics 1	5
4.	Engineering Mechanics	5
5.	Introduction to Biomedical Engineering	3
6.	Sports & Wellness^	2
7.	Creativity & Applied Thinking Skills^	2
	Level 1.2 (27 hours per week)	
8.	Analogue Electronics	5
9.	BioPhysics	4
10.	Digital Electronics	5
11.	Electronic Practical Skills	4
12.	Engineering Mathematics 2	5
13.	Individual & the Community^	2
14.	Communication Toolkit^	2
	YEAR 2	
	Level 2.1 (24 hours per week)	
15.	Applications Programming	4
16.	Cell & Molecular Biology	3
17.	Electronic Design & Prototyping	4
18.	Engineering Mathematics 3A	4
19.	Medical Instrumentation	5
20.	Interdisciplinary Studies (IS) module^	2
21.	Interdisciplinary Studies (IS) module^	2
	Level 2.2 (23 hours per week)	
22.	Electronic Project Design Practice	4
23.	Embedded System (ARM)	6
24.	Fundamentals of Control Systems	5
25.	Physiological Systems	4
26.	Innovation & Enterprise in Action^	4
	YEAR 3	
	Level 3.1 (18 hours per week)	
27.	BME Project Design	7
28.	Clinical Engineering	4
29.	Diagnostic, Therapeutic & Laboratory Equipment	3
30.	World Issues: A Singapore Perspective^	2
31.	Interdisciplinary Studies (IS) module^	2
	Level 3.2 (25 hours per week)	
32.	Industrial Attachment Programme	25
	Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
33.	School of Engineering (SoE) elective module°	3
34.	School of Engineering (SoE) elective module°	3

DIPLOMA IN BIOMEDICAL ENGINEERING (BME) (3-YEAR COURSE)
SCHOOL OF ENGINEERING

COURSE CURRICULUM
NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH

Module No.	Module Name	Credit Units
	YEAR 1	
	Level 1.1 (27 hours per week)	
1.	Computer Programming	4
2.	Electrical Technology	6
3.	Engineering Mathematics 1	5
4.	Engineering Mechanics	5
5.	Introduction to Biomedical Engineering	3
6.	Sports & Wellness^	2
7.	Creativity & Applied Thinking Skills^	2
	Level 1.2 (27 hours per week)	
8.	Analogue Electronics	5
9.	BioPhysics	4
10.	Digital Electronics	5
11.	Electronic Practical Skills	4
12.	Engineering Mathematics 2	5
13.	Individual & the Community^	2
14.	Communication Toolkit^	2
	YEAR 2	
	Level 2.1 (24 hours per week)	
15.	Applications Programming	4
16.	Cell & Molecular Biology	3
17.	Electronic Design & Prototyping	4
18.	Engineering Mathematics 3A	4
19.	Medical Instrumentation	5
20.	Interdisciplinary Studies (IS) module^	2
21.	Interdisciplinary Studies (IS) module^	2
	Level 2.2 (23 hours per week)	
22.	Electronic Project Design Practice	4
23.	Embedded System (ARM)	6
24.	Fundamentals of Control Systems	5
25.	Physiological Systems	4
26.	Innovation & Enterprise in Action^	4
	YEAR 3	
	Level 3.1 (21 hours per week)	
27.	Biomaterials & Implants	3
28.	Biomechanics & Rehabilitation Engineering	3
29.	Diagnostic, Therapeutic & Laboratory Equipment	3
30.	Project Design and Development 1	8
31.	World Issues: A Singapore Perspective^	2
32.	Interdisciplinary Studies (IS) module^	2

Module No.	Module Name	Credit Units
	YEAR 3	
	Level 3.2 (22 hours per week)	
33.	Clinical Engineering	4
34.	Telecommunication Principles	6
35.	Project Design and Development 2	12
	Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
36.	School of Engineering (SoE) elective module°	3
37.	School of Engineering (SoE) elective module°	3

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

For more details on School of Engineering elective modules, please refer to page 182.

° Students are required to own Notebook Computers.

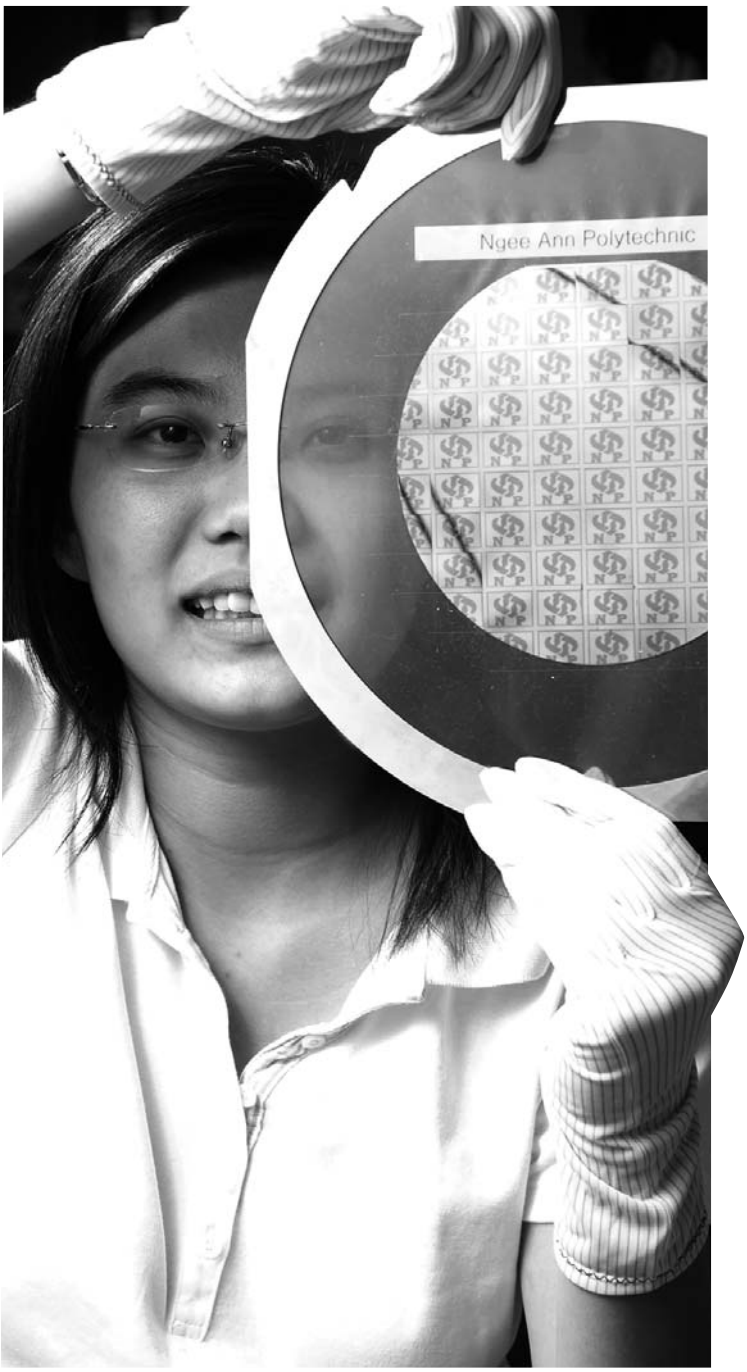
IS Modules
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge-based economy. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

School of Engineering (SoE) Elective Modules
The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and deepen their discipline-specific areas. Each cluster comprises a minimum of three 3-hour modules. Students are required to take two modules in order to satisfy the minimum graduating requirement.

DIPLOMA IN ELECTRONIC & COMPUTER ENGINEERING (ECE)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING



Electronic devices have a pivotal role in how we live, work and play. The **Diploma in Electronic & Computer Engineering (ECE)** delivers modules that provide a strong foundation and knowledge in electronic circuit design, telecommunications, computer architecture and computer programming, among others. The curriculum also caters to the diverse interests of students by allowing them to choose either engineering or non-engineering options in the final year.

The engineering options are Aerospace Electronics, Computer & Communication Systems and Microelectronics. The non-engineering options are Business Management and Marketing & Entrepreneurship.

The Aerospace Electronics (AE) Option was designed to align with the Singapore Airworthiness Requirements (SAR) as set out by the Civil Aviation Authority of Singapore. Graduates from the AE Option may be exempted from most of the SAR avionics papers to become a Licensed Aircraft Maintenance Engineer, with further training in the aerospace industry.

The non-engineering track provides students with the opportunity to progress to the fast-growing business and marketing industries.

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examinations (or equivalent) results:

Subject	'O' Level Grade
English	1-7**
Mathematics (Elementary/Additional)	1-6
Science (with Physics or Chemistry or Biology component) or Design & Technology	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology and two other subjects.

** Candidates with English as a second language (EL2) must have attained a minimum grade of 6.

Candidates with severe vision deficiency should not apply for the course. Those with colour appreciation deficiency may be considered, subject to an in-house test.

DIPLOMA IN ELECTRONIC & COMPUTER ENGINEERING (ECE) (3-YEAR COURSE)
SCHOOL OF ENGINEERING

CAREER PROSPECTS

ECE graduates will have opportunities to work in areas such as design and development, operations, sales, technical support, and maintenance. Graduates from the AE Option can find employment in the aerospace industry, providing maintenance and technical support for electronic systems and instrumentations on board an aircraft.

Graduates from the Computer & Communication Systems Option can seek employment in the IT, telecommunications and manufacturing sectors dealing with computer-related products. They may be involved in the design and development of telecommunication equipment and systems, computer software and hardware, Internet applications and maintenance of computer network systems.

ECE graduates from the Microelectronics Option can find jobs in the semiconductor and wafer fabrication and advanced displays industries. They can be employed in areas of design, production, assembly, testing and R&D activities.

The non-engineering Options provide an even wider choice of paths for graduates to apply their engineering and business knowledge, which can lead to success in technology and business.

In the public sector, ECE graduates can be employed as Technical Officers, responsible for installing and maintaining essential public services and even sophisticated military electronics and related hardware in Singapore's Ministry of Defence.

ACCREDITATION FOR FURTHER STUDIES

ECE graduates can apply to the National University of Singapore and Nanyang Technological University to pursue electrical and electronic engineering or computer engineering degrees.

Most ECE graduates gain direct admission to the second or third year of electronic, computer engineering or IT degree courses at universities in the United Kingdom, the United States, Australia and Canada.

COURSE STRUCTURE

FIRST-YEAR MODULES

Level 1.1
- Electrical Technology
- Engineering: A Creative Profession
- Computer Programming
- Engineering Mathematics 1
- Engineering Mechanics
- Creativity & Applied Thinking Skills^ Sports & Wellness^

Level 1.2
- Analogue Electronics
- Electronic Practical Skills
- Engineering Mathematics 2
- Electrical & Electronics Drawing and
- Computer Aided Design
- Digital Electronics
- Individual & the Community^
- Communication Toolkit^

SECOND-YEAR MODULES

Level 2.1
- Analogue Circuit Design & Applications
- Applications Programming
- Digital System Design & Applications
- Engineering Mathematics 3A
- Electronic Design & Prototyping
- Any 2 Interdisciplinary Studies (IS) modules^

Level 2.2
- Telecommunication Principles
- Electronic Project Design Practice
- Object-Oriented Programming
- Microcontroller Programming and Interfacing
- Innovation & Enterprise in Action^

FINAL-YEAR MODULES

Level 3.1
- Modules from 1 Option
- World Issues: A Singapore Prespective^
- Any 1 Interdisciplinary Studies (IS) module^

Level 3.2
- Modules from 1 Option

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules°

^ Denotes Interdisciplinary Studies module. For more details on IS modules, please log on to www.np.edu.sg/is/

° Students take two elective modules to complete their diploma. Electives are chosen and customised from a wide range of clusters under the Engineering and Non-Engineering categories.

LIST OF OPTIONS

AEROSPACE ELECTRONICS OPTION

Level 3.1
- Project Design and Development 1
- Aircraft Electrical & Instrumentation Systems

Level 3.2
- Project Design and Development 2
- Aircraft Navigation & Communication Systems
- Fundamentals of Control Systems

BUSINESS MANAGEMENT OPTION

Level 3.1
- Project Design and Development 1
- Customer Relationship Management
- Service Operation Management

Level 3.2
- Fundamentals of Control Systems
- Project Design and Development 2
- E-Commerce

COMPUTER AND COMMUNICATION SYSTEMS OPTION [INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Level 3.1
- Data Communications and Networking
- Fundamentals of Control Systems

Level 3.2
- Industrial Attachment Programme

COMPUTER AND COMMUNICATION SYSTEMS OPTION [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Level 3.1
- Project Design and Development 1
- Data Communications and Networking

Level 3.2
- Fundamentals of Control Systems
- Project Design and Development 2
- Computer Systems Architecture & Administration

MARKETING AND ENTREPRENEURSHIP OPTION

Level 3.1
- Project Design and Development 1
- Enterprise Development
- Product Design & Marketing

Level 3.2
- Fundamentals of Control Systems
- Project Design and Development 2
- Business Creation

MICROELECTRONICS OPTION [INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Level 3.1
- Microelectronics Test Systems
- Fundamentals of Control Systems

Level 3.2
- Industrial Attachment Programme

MICROELECTRONICS OPTION [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Level 3.1
- Project Design and Development 1
- Wafer Fabrication Technology

Level 3.2
- Fundamentals of Control Systems
- Project Design and Development 2
- Advanced Wafer Fabrication Technology

COURSE MODULES

LEVEL 1.1

Electrical Technology
This module provides students with the necessary foundation for electrical circuit analysis. Students will learn electrical theorems and techniques for analysing and solving direct and alternating current circuit problems. Hands-on activities in laboratories will equip them with basic electrical measurement skills and reinforce concepts learnt in lectures and tutorials.

Engineering Mechanics
This module pertains to the study of external forces in two dimensions and their effects on particles and rigid bodies at rest. Students will learn to analyse forces acting on rigid bodies by drawing free-body diagrams and applying the conditions of static equilibrium. The module also covers linear and rotational motion of particles and rigid bodies. Topics include forces and resultants, moments and couples, equilibrium, plane friction, kinematics, and kinetics of linear and rotational motions.

Engineering Mathematics 1
This module is designed to equip students, with any level of mathematical ability, with the fundamental skills required to solve engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in this module is on applications and problem solving. Areas covered include algebra, trigonometry, logarithms, matrices and complex numbers.

Computer Programming
This practice-oriented module equips students with the basic knowledge and skills in computer programming using C language. The main topics include basic computing concepts, fundamentals of C, branching, loops, and C functions. On completion of the module, students will be able to explain and write C programs for engineering applications.

Engineering: A Creative Profession
This activity-driven module introduces students to the vocabulary, skills, applications and excitement of the engineering discipline, creating professional awareness early in their course. Through case studies and projects, students enjoy their first exposure to the techniques of analysis, design and problem solving. The module offers students an exciting glimpse of what to expect later in their course and provides them with a foundation of the essential tools needed to succeed in this dynamic profession.

LEVEL 1.2

Analogue Electronics
The aim of this module is to introduce the fundamental concepts of analogue electronic devices and circuits. It covers semiconductor physics as well as the device characteristics, operating principles and common applications of diodes and transistors. The module will equip students with a thorough understanding of DC biasing and AC operation of transistor amplifier circuits. This will be achieved through worked examples, tutorials, laboratory sessions and e-learning materials.

Electrical & Electronic Drawing & Computer-Aided Design
This module introduces the concepts of electronic circuit drawing and printed circuit board (PCB) layout using a modern computer-based electronic design automation (EDA) package. Using the software, students will design PCBs, starting from schematic capture to PCB layout post-processing and library parts creation. The module, which adopts a completely hands-on approach, prepares them for final-year projects that involve electronic circuit design and manufacturing.

Electronic Practical Skills
This is a hands-on module that aims to equip students with the necessary practical skills in electronic circuit construction, testing, measurement and analysis. Students will also put into practice concepts covered in the Level 1 module Electrical Technology.

Engineering Mathematics 2
This module provides students with further mathematical skills to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

Digital Electronics
This module covers the fundamentals of digital electronics. The basic principles and techniques of digital system and design are covered. It is also intended to prepare students for subsequent modules involving microprocessors and microcomputers. The main topics covered are number systems, Boolean Algebra, combinational logic circuits and minimisation techniques, flip-flops and multivibrators, IC counters, and data handling devices.

LEVEL 2.1

Analogue Circuit Design & Applications
This module introduces students to the operating principles of commonly used analogue devices and circuits, such as operational amplifiers, oscillators and filters. Applications in various practical circuits are also illustrated.

Applications Programming
This practice-oriented module equips students with the fundamental skills required to develop Windows applications. The students will develop conceptual understanding to design and develop applications to solve business and engineering problems. Main topics include branch and loop, array, bitwise operation, datafiles accessing and methods.

Digital System Design & Applications
This module builds on the fundamental digital concepts covered in Digital Electronics and uses Programmable Logic Devices to implement various combinational and sequential logic circuits. It also covers various practical aspects of digital interfacing and applications.

Engineering Mathematics 3A
This module is a continuation of Engineering Mathematics 2. Topics in this module include integration with applications, differential equations, Laplace transform and Fourier Series.

Electronic Design and Prototyping
The main objectives of this module are to introduce students to the techniques of PCB computer-aid design, and to provide opportunities for the acquisition of practical skills in electronic project design. Students will learn the planning, development, construction and testing of electronic prototypes. The focus of the module is on hands-on practice for basic PCB design, PCB fabrication and technical writing skills. Fault-finding on electronic circuits, an essential skill in construction, is also introduced.

LEVEL 2.2
Telecommunication Principles
In this module, students will deal with the fundamental concepts in analogue and digital communications. Basic principles of analogue, effects of noise, and digital modulation in communication systems will be covered. This module requires proficiency in trigonometry, complex numbers and basic calculus. In addition, knowledge of fundamental principles in analogue electronics with an emphasis on decibel and tuned amplifiers are prerequisites for this module.

Microcontroller Programming & Interfacing
This module introduces students to the fundamentals of microcontroller programming and interfacing. C language programming is used to illustrate the operation of the microcontroller. Interfacing the microcontroller to basic input-output devices, such as switches, LEDs, 7-segment display and keypads, helps to demonstrate the behaviour of the application software running on a working system.

Object-Oriented Programming
The aim of this module is to build on the foundation of AP (Application Programming) and introduce the concepts of Object-Oriented Programming. Its key coverage includes the object oriented programming paradigm, Web-related programming and database access.

Electronic Project Design Practice
The main objective of this module is to enable students to appreciate the importance of project design from theory to practice. Students will learn the correct approach to the development, construction and testing of projects. The hands-on practice involves basic hardware design techniques and implementation. Fault-finding on electronic circuits is introduced to enhance the skills of the students. Hands-on practice, design of printed circuit boards using self-generated component footprints, and report writing skills are also essential components of this module.

LEVEL 3.1 – (ALL OPTIONS) [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]
Project Design and Development 1
In this module, students will work together in teams of three to design and implement a project that demonstrates their engineering skills as well as teamwork over a period of two semesters. The module is structured to encourage creativity and innovative thinking. This will also help students develop a positive work attitude and good team spirit.

LEVEL 3.1 AND LEVEL 3.2 – (ALL OPTIONS)
Fundamentals of Control Systems
This module provides students with a basic knowledge of feedback control systems. The topics cover the basic concepts of automatic control, control systems' components, simple analytical tools, and stability analysis of systems. Students are also introduced to the use of Matlab/Simulink as a computer tool in control systems analysis.

LEVEL 3.1 – (AEROSPACE ELECTRONICS OPTION)
Aircraft Electrical & Instrumentation Systems
This module examines the theory of operations and the functional description of aircraft instruments and electrical systems found in the modern aircraft. Students will learn about the auto flight, flight control and management systems; emergency electronics; and cabin entertainment system.

LEVEL 3.1 – (BUSINESS MANAGEMENT OPTION)
Customer Relationship Management
The module aims at providing students with an understanding of the concepts and principles of excellent customer service. It also covers practical service skills for service interaction, building customer satisfaction and exceeding customer expectation. On completion of the module, the student should be able to understand the basics of fostering positive quality attitude, use techniques and behaviour to win customer loyalty, get others to give quality service, and apply winning telephone and website techniques.

Service Operation Management
Students will be introduced to the concepts and techniques related to all aspects of the management and operation of services. The module is designed to develop students' skills in both strategic and operational issues pertaining to services. Topics cover both qualitative and quantitative aspects of service management, and also the balanced scorecard, and Six Sigma so as to give students the wide-ranging techniques for ensuring quality and evaluating long-term strategy planning. Students will be able to apply this knowledge in service innovations and management.

LEVEL 3.1 – (MICROELECTRONICS OPTION) [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]
Wafer Fabrication Technology
This module aims to provide students with a basic knowledge of Integrated Circuit (IC) fabrication. The processes that are required to convert a blank wafer to one that is covered with complex circuits are explored, as well as topics on the various supporting technologies required in the wafer fabrication industry. Finally, process and device simulations are covered, with students undertaking a simulation exercise in building and operating their own virtual transistors.

LEVEL 3.1 – (MICROELECTRONICS OPTION) [INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Microelectronics Test Systems

This module introduces students to test engineering for electronic circuits. It provides them with the basic concepts of testing for both design and test aspects. At the end of the module, students will be able to apply the concept of Design for Testability as well as perform actual testing on a printed circuit board (PCB) in circuit tester and a digital Integrated Circuit (IC) tester.

LEVEL 3.1 – (COMPUTER & COMMUNICATION SYSTEMS OPTION)

Data Communications & Networking

This module provides the foundation for understanding principles in data communications and networking. Students will acquire an understanding of and be able to apply key concepts and processes associated with digital and data transmission of information, transmission media, the OSI reference model, network topologies, protocols and TCP/IP protocol suite.

LEVEL 3.1 – (MARKETING & ENTREPRENEURSHIP OPTION)

Enterprise Development

The module focuses on enterprise development. It introduces and discusses the types and sources of funds necessary for enterprise development, and strategies for sustainability and growth in the era of rapid technological developments.

LEVEL 3.1 – (MARKETING & ENTREPRENEURSHIP OPTION)

Product Design and Marketing

This module focuses on the importance of product design from marketing perspectives. The product design and development process focuses on what it takes to sell the products based on consumers' needs and wants rather than product features alone. This module also focuses on marketing principles, concepts and strategies. Students are also given opportunities to develop their own business plan for their products.

LEVEL 3.2 – (ALL OPTIONS) [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Project Design and Development 2

This module follows on from Project Design and Development 1. Students are required to demonstrate their ability and resourcefulness in implementing their selected project design solution. The scope of work includes printed circuit board fabrication, wiring, assembly and testing of the final prototype according to the specifications and requirements defined in Project Design and Development 1. In addition, software-based projects may require database coding, operating system implementation and testing, server and client system design, portable design field test and Web-based integration.

LEVEL 3.2 - (AEROSPACE ELECTRONICS OPTION)

Aircraft Navigation & Communication Systems

This module provides students with the theory of operations and the functional description of airborne navigation and communication systems found in modern aircraft. The systems covered are ADF, VOR, DME, IRS, HF and VHF. The standard digital data-bus communications protocol, such as ARINC 429 and ARINC 629 used by commercial aircraft and MIL-STD-1553B used by military aircraft, will also be discussed.

LEVEL 3.2 – (BUSINESS MANAGEMENT OPTION)

E-Commerce

This course is designed to provide students with an insight to the role of Electronic Commerce in the e-Business world. It links the e-Commerce to e-Business. In line with this, the module aims to provide students with an understanding of the e-Supply Chain Management with synchronisation of the supply chain through e-Marketplaces. It discusses value creation in e-Supply Chain and the various e-Business trends. Major topics covered in this module include an introduction to Electronic Commerce, the linkage of e-Commerce to e-Business, value chain concept and competition, e-Procurement and strategic sourcing, e-Fulfillment in B2B and B2C e-Commerce, Customer Relationship Management, Enterprise Resource Planning, and Internet applications and collaborative tools with hands-on practical sessions using Movie Maker and Dreamweaver software.

LEVEL 3.2 – (MICROELECTRONICS OPTION) [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Advanced Wafer Fabrication Technology

This module focuses on the silicon wafer fabrication process with emphasis on hands-on training in the cleanroom. Liquid Crystal Display Technology will also be covered.

LEVEL 3.2 – (COMPUTER & COMMUNICATION SYSTEMS, MICROELECTRONICS OPTIONS) [INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Industrial Attachment Programme

In this module, students will be attached to sponsoring companies for a period of approximately six months. During their attachments, they will undertake projects assigned by the company or be involved in operations or maintenance-related work. Student attachments may be undertaken locally or overseas.

LEVEL 3.2 – (COMPUTER AND COMMUNICATION SYSTEMS OPTION) [NON-INDUSTRIAL ATTACHMENT PROGRAMME PATH]

Computer Systems Architecture & Administration

This module aims to educate students on a general-purpose computer system in terms of its hardware, architecture and administration in a network environment.

LEVEL 3.2 – (MARKETING & ENTREPRENEURSHIP OPTION)

Business Creation

This module focuses on mindset change of technologists into entrepreneurial mindset that enables them to create their own business. It discusses entrepreneur traits and what it takes to become a successful entrepreneur through case studies and discussions, youths entrepreneur networks, and personal experiences and close encounter with entrepreneurial mentors. This module also gives an introduction to the essential elements in starting and running a business.

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

School of Engineering Elective Modules and the Diploma Plus Programme

Students take two modules from a wide range of clusters under the engineering and non-engineering categories to complete their diploma. Furthermore, students can qualify for a diploma plus by simply topping up with two additional modules from the same cluster as one of the electives. The Diploma Plus Certificate helps students if they wish to pursue a university degree or increase their employability in discipline-specific areas. Students can choose electives from the range listed below.

Engineering Category

- Advanced Engineering Mathematics Cluster *
- Aerospace Electronics Cluster
- Applied Physics Cluster *
- Biomedical Engineering Cluster
- Computer & Communication Systems Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Microelectronics Cluster
- Network Systems & Security Cluster
- Telecommunication Distribution Technology Cluster

Non-Engineering Category

- Economics & Financial Applications Cluster
- Green Development Cluster
- Leisure & Retail Management Cluster

Other Available Diploma Plus Certificates

- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The syllabus is based on the first-year engineering mathematics and science curricula of NUS.

For detailed module descriptions under each cluster, please refer to page 182.

COURSE CURRICULUM

Module No.	Module Name	Credit Units
	YEAR 1	
	Level 1.1 (27 hours per week)	
1.	Electrical Technology	6
2.	Engineering: A Creative Profession	3
3.	Computer Programming	4
4.	Engineering Mathematics 1	5
5.	Engineering Mechanics	5
6.	Sports and Wellness^	2
7.	Creativity & Applied Thinking Skills^	2
	Level 1.2 (26 hours per week)	
8.	Analogue Electronics	5
9.	Electronic Practical Skills	4
10.	Engineering Mathematics 2	5
11.	Electrical & Electronics Drawing and CAD	3
12.	Digital Electronics	5
13.	Individual & the Community^	2
14.	Communication Toolkit^	2
	YEAR 2	
	Level 2.1 (26 hours per week)	
15.	Analogue Circuit Design & Applications	5
16.	Applications Programming	4
17.	Digital System Design & Applications	5
18.	Engineering Mathematics 3A	4
19.	Electronic Design & Prototyping	4
20.	Interdisciplinary Studies (IS) module^	2
21.	Interdisciplinary Studies (IS) module^	2
	Level 2.2 (25 hours per week)	
22.	Telecommunication Principles	6
23.	Electronic Project Design Practice	4
24.	Object-Oriented Programming	5
25.	Microcontroller Programming and Interfacing	6
26.	Innovation & Enterprise in Action^	4
	YEAR 3	
	Level 3.1 (15-19 hours per week depending on the Option)	
27.	Semester 1 modules from an Option	11 –15
28.	World Issues: A Singapore Perspective ^	2
29.	Interdisciplinary Studies (IS) module^	2
	Level 3.2 (21-25 hours per week)	
30.	Semester 2 modules from an Option	21 – 25

Module No.	Module Name	Credit Units
	YEAR 3	
	Across-Level Modules (Level 1.2 onwards)	
	(6 hours per week)	
31.	School of Engineering (SoE) elective module°	3
32.	School of Engineering (SoE) elective module°	3

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

° For more details on School of Engineering elective modules, please refer to page 182.

Students are required to own Notebook Computers.

IS Modules
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge-based economy. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

School of Engineering (SoE) Elective Modules
The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and deepen their discipline-specific areas. Each cluster comprises a minimum of three 3-hour modules. Students are required to take two modules in order to satisfy the minimum graduating requirement.

MODULES IN THE OPTION

Module No.	Module Name	Credit Units
	Aerospace Electronics Option	
	Year 3	
	Level 3.1 (14 hours per week)	
1.	Project Design and Development 1	8
2.	Aircraft Electrical & Instrumentation Systems	6
	Level 3.2 (22 hours per week)	
3.	Project Design and Development 2	12
4.	Aircraft Navigation & Communication Systems	5
5.	Fundamentals of Control Systems	5
	Business Management Option	
	Year 3	
	Level 3.1 (15 hours per week)	
6.	Project Design and Development 1	8
7.	Customer Relationship Management	3
8.	Service Operation Management	4
	Level 3.2 (21 hours per week)	
9.	Project Design and Development 2	12
10.	E-Commerce	4
11.	Fundamentals of Control Systems	5
	Marketing and Entrepreneurship Option	
	Year 3	
	Level 3.1 (15 hours per week)	
12.	Project Design and Development 1	8
13.	Enterprise Development	3
14.	Product Design & Marketing	4
	Level 3.2 (21 hours per week)	
15.	Project Design and Development 2	12
16.	Business Creation	4
17.	Fundamentals of Control Systems	5
	Computer and Communication Systems Option	
	Year 3 – Industrial Attachment Programme (IAP) Path	
	Level 3.1 (11 hours per week)	
18.	Fundamentals of Control Systems	5
19.	Data Communications and Networking	6
	Level 3.2 (25 hours per week)	
20.	Industrial Attachment Programme	25
	Year 3 – Non-Industrial Attachment Programme Path	
	Level 3.1 (14 hours per week)	
21.	Project Design and Development 1	8
22.	Data Communications and Networking	6
	Level 3.2 (22 hours per week)	
23.	Project Design and Development 2	12
24.	Computer Systems Architecture & Administration	5
25.	Fundamentals of Control Systems	5
	Microelectronics Option	
	Year 3 – Industrial Attachment Programme Path	
	Level 3.1 (11 hours per week)	
26.	Fundamentals of Control Systems	5
27.	Microelectronics Test Systems	6
	Level 3.2 (25 hours per week)	
28.	Industrial Attachment Programme	25
	Year 3 – Non-Industrial Attachment Programme Path	
	Level 3.1 (13 hours per week)	
29.	Project Design and Development 1	8
30.	Wafer Fabrication Technology	5
	Level 3.2 (23 hours per week)	
31.	Project Design and Development 2	12
32.	Advanced Wafer Fabrication Technology	6
33.	Fundamentals of Control Systems	5

DIPLOMA IN NETWORK SYSTEMS & SECURITY (NSS)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

The unique **Diploma in Network Systems & Security (NSS)** is the result of an industry-academia partnership between Ngee Ann Polytechnic (NP) and Cisco Systems (USA) to provide world-class infocomm training for students in everything, from PC hardware and software to network cabling and design, network security, converging voice and data networks, network management and administration, and basic programming.

Final-year students undergo a six-month internship programme that gives them exposure to real-life corporate environments.

NP is a Cisco Systems training academy for the Cisco Certified Associate and Cisco Certified Network Professional Certifications. Not only will NSS students obtain certification from an industry leader, they will also have the opportunity to train with Cisco equipment instead of working with desktop simulations. This is because NP is the only institution in Singapore that allows remote access to training equipment anytime, anywhere.

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examinations (or equivalent) results:

Subject	'O' Level Grade
English	1-7**
Mathematics (Elementary/Additional)	1-6
Science (with Physics or Chemistry or Biology component) or Design & Technology	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology and two other subjects.

** Candidates with English as a second language (EL2) must have attained a minimum grade of 6.

Candidates with colour appreciation deficiency may be considered, subject to an in-house test.

Candidates who have successfully completed the Cisco Certified Network Associate (CCNA) course at ITE (for holders of Higher NITEC in relevant disciplines with GPA of at least 3.5) or at the local secondary schools will be granted exemptions for relevant modules if they pass a practical test on a module that is equivalent to their highest completed CCNA module.

CAREER PROSPECTS

NSS graduates are equipped with the knowledge and practical skills to sit for the widely recognised Cisco Career Certifications (Associate to Professional level).

Graduates can look forward to a spectrum of exciting and challenging infocomm-related careers in network systems design, network security design, wired and wireless network solutions, data and voice convergence networks, system administration and support, security risks assessment, and sales and marketing.

For more information on infocomm manpower requirements and careers, visit www.singaporeinfocomm.sg

ACCREDITATION FOR FURTHER STUDIES

NSS graduates can apply to the National University of Singapore and Nanyang Technological University to pursue computing, engineering business and arts courses.

The Singapore Management University recognises the diploma as an entry requirement for the Bachelor of Science (Information Systems Management). Many universities in Australia accept NSS graduates into their degree programmes. For example, the University of Melbourne recognises the diploma for entry into its Bachelor of Information Systems.

The following universities in Australia also recognise the Diploma as an entry requirement for their degree courses.

University	Degree courses
The Australian National University	Bachelor of Engineering Bachelor of Information Technology
University of Queensland	Bachelor of Information Technology
University of Adelaide	Bachelor of Engineering
University of Western Australia	Bachelor of Computer Science
University of Newcastle	Bachelor of Engineering Bachelor of Computer Science
University of Technology Sydney	Bachelor of Engineering
University of Western Sydney	Bachelor of Engineering
University of Tasmania	Bachelor of Computing
University of South Australia	Bachelor of Information and Communication Technology (Networking) Bachelor of Software Engineering

COURSE STRUCTURE

FIRST-YEAR MODULES

Level 1.1
- Electrical Technology
- Engineering Mathematics 1
- Internetworking 1
- Computer Programming
- Creativity & Applied Thinking Skills^
- Sports & Wellness^

Level 1.2
- Digital Electronics
- Engineering Mathematics 2
- Internetworking 2
- Applications Programming
- Individual & the Community^
- Communication Toolkit^

SECOND-YEAR MODULES

Level 2.1
- Network Cabling
- Communication Systems Fundamentals
- Engineering Mathematics 3B
- Internetworking 3
- Object-Oriented Programming
- Any 2 Interdisciplinary Studies (IS) modules^

Level 2.2
- Fundamentals of Network Security
- Internetworking 4
- Voice Convergence Networks
- Innovation & Enterprise in Action^

FINAL-YEAR MODULES

Level 3.1
- Advanced Routing
- Multilayer Switching Networks
- Wireless LAN Technologies
- Advanced Network Security
- World Issues: A Singapore Perspective^
- Any 1 Interdisciplinary Studies (IS) module^

Level 3.2
- Industrial Attachment Programme (IAP)

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules°

^ Denotes Interdisciplinary Studies module. For more details on IS modules, please log on to www.np.edu.sg/is/

° Students take two elective modules to complete their diploma. Electives are chosen and customised from a wide range of clusters under the Engineering and Non-Engineering categories.

COURSE MODULES

LEVEL 1.1

Electrical Technology

This module provides the necessary foundation for electrical circuit analysis. Students will learn electrical theorems and techniques for analysing and solving direct and alternating current circuit problems. Hands-on activities in laboratories will equip them with basic electrical measurement skills and reinforce concepts learnt in lectures and tutorials.

Engineering Mathematics 1

This module is designed to equip students, with any level of mathematical ability, with the fundamental skills required to solve engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in this module is on applications and problem solving. Areas covered include algebra, trigonometry, logarithms, matrices and complex numbers.

Internetworking 1
Internetworking 1 (IN1) is the first of the four courses leading to the Cisco Certified Network Associate (CCNA) designation. IN1 introduces Cisco Networking Academy Program students to the networking field. The course focuses on network terminology and protocols, local-area networks (LANs), wide-area networks (WANs), Open System Interconnection (OSI) models, cabling, cabling tools, routers, router programming, Ethernet, Internet Protocol (IP) addressing, and network standards. In addition, students are trained in the proper care, maintenance and use of networking software, tools and equipment.

Computer Programming
This practice-oriented module equips students with the basic knowledge and skills in computer programming using C language. The main topics include basic computing concepts, fundamentals of C, branching, loops, and C functions. On completion of the module, students will be able to explain and write C programs for engineering applications.

LEVEL 1.2
Digital Electronics
This module covers the fundamentals of digital electronics. The basic principles and techniques of digital system and design are covered. It is also intended to prepare students for subsequent subjects involving microprocessors and microcomputers. The main topics covered are number systems, Boolean Algebra, combinational logic circuits and minimisation techniques, flip-flops and multivibrators, IC counters, and data handling devices.

Engineering Mathematics 2
This module provides students with further mathematical skills to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

Internetworking 2
This module was designed using a task analysis of current industry standards and occupational analysis in order to provide students with classroom and laboratory experience in current and emerging networking technology. Topics include the Open System Interconnection (OSI) Reference Model, local area networks (LANs), wide area networks (WANs), transmission control protocol/Internet protocol (TCP/IP) addressing, routers, router configuration, routing and routing protocols, internetwork operating system (IOS) images, and network troubleshooting. Particular attention is given to the nature and components of networks that make up LANs, WANs and the Internet. Students will become familiar with command protocols that are used when configuring networks.

Applications Programming
This practice-oriented module equips students with the fundamental skills required to develop Windows applications. The students will develop a conceptual understanding to design and develop applications to solve business and engineering problems. Main topics include branch and loop, array, bitwise operation, datafiles accessing and methods.

LEVEL 2.1
Network Cabling
This workshop-oriented module focuses on implementing fibre optic cabling, testing and measurement. Students will learn the different operating modes of fibre optics, and the implications of dispersion and attenuation.

Communication Systems Fundamentals
This module explores fundamental concepts in data communications and radio frequency communications. Students will examine the OSIRM as a model for data communications, with examples and case studies used to illustrate and explain the application of the first two layers of this model for data communications. Topics covered in the field of radio frequency communications include concepts like transmission line basics, antenna theory, radio wave propagation, satellite systems, modulation and multiple access techniques.

Engineering Mathematics 3B
This module provides students with fundamental skills in Mathematics required to solve basic engineering problems. Each topic emphasises simple applications and problem solving. Students will use the Computer Algebra System throughout the module. Topics include integration with applications, differential equations, Laplace transform, probability and statistics.

Internetworking 3
This module is the third of four courses preparing students for the Cisco Certified Network Associate (CCNA) certification. The topics covered follow the Cisco Networking Academy CCNA3 course on Switching Basics and Intermediate Routing very closely.

Object-Oriented Programming
The aim of this module is to build on the foundation of AP (Application Programming) and introduce the concepts of Object-Oriented Programming. Its key coverage includes the object-oriented programming paradigm, Web-related programming and database access.

LEVEL 2.2
Fundamentals of Network Security
This module provides students with the knowledge and skills required to implement standard practices to secure and manage network infrastructures. Students will learn about techniques and security considerations to put in place firewalls to protect workplace productivity and reduce costs.

Internetworking 4
This module follows on from Internetworking 1, 2 and 3. It focuses on Advanced IP addressing techniques, Network Address Translation (NAT), Port Address Translation (PAT), Dynamic Host Configuration Protocol (DHCP), WAN technology and terminology, PPP, ISDN, DDR, Frame Relay, and network management. Students will be required to apply knowledge from IN1, IN2 and IN3 to a network, and should be able to explain how and why a particular strategy is used. At the end of the module, students will be required to sit for and pass a Network Design and Implementation practical test.

Voice Convergence Networks
This module focuses on integrating voice communication into underlying network architectures. Students learn how to create a telephony solution that is transparent, scalable, and manageable. The hands-on training will provide them with a robust set of skills to implement, operate, configure and troubleshoot a converged Internet Protocol (IP) network.

LEVEL 3.1

Advanced Routing
In this module, students will cover routing techniques and technologies for designing and implementing scalable routed Internet Protocol (IP) networks using link-state routing protocols. They will be taught how to select and configure the appropriate services to simplify IP address management, and configure edge routers to effectively interconnect into an Internet Service Provider's (ISP) network.

Multilayer Switching Networks
The module focuses on how to build scalable multilayer switched networks. Topics covered include Spanning Tree Protocol, VLANs and inter-VLAN routing, high availability, and multicasting. Students will learn how to improve traffic flow, reliability, redundancy, and performance for Layer 2 and Layer 3 switched networks.

Wireless LAN Technologies
This module provides students with classroom and laboratory experience in current and emerging wireless LAN technologies. The module focuses on the design, planning, implementation, operation and troubleshooting of Wireless LANs. It covers a comprehensive overview of technologies, security, and design best practices with particular emphasis on hands-on skills in wireless LAN setup and troubleshooting; 802.11 (a, b, and g) technologies, products and solutions; radio technologies; WLAN applications and site surveys; resilient WLAN products, design, installation, configuration and troubleshooting; WLAN security; vendor interoperability strategies; and emerging wireless technologies.

Advanced Network Security
This module focuses on the overall security process, with particular emphasis on hands-on skills in security design and management, technologies, firewall design, authentication, authorising and accounting (AAA) implementation, intrusion detection, and virtual private networks (VPNs). The module begins with an overview of network security threats to help the student understand how to identify the causes of network security problems. Students will learn how to secure the network infrastructure and implement a secure virtual private network (VPN) solution using IPSecurity features as well as how to use intrusion detection and network auditing tools.

LEVEL 3.2

Industrial Attachment Programme
In this module, students will be attached to sponsoring companies for a period of approximately six months. During their attachments, they will undertake projects assigned by the company or be involved in operations or maintenance-related work. Student attachments may be undertaken locally or overseas.

ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

School of Engineering Elective Modules and the Diploma Plus Programme
Students take two modules from a wide range of clusters under the engineering and non-engineering categories to complete their diploma. Furthermore, students can qualify for a diploma plus by simply topping up with two additional modules from the same cluster as one of the electives. The Diploma Plus Certificate helps students if they wish to pursue a university degree or increase their employability in discipline-specific areas. Students can choose electives from the range listed below.

Engineering Category
- Advanced Engineering Mathematics Cluster*
- Aerospace Electronics Cluster
- Applied Physics Cluster*
- Biomedical Engineering Cluster
- Computer & Communication Systems Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Microelectronics Cluster
- Network Systems & Security Cluster
- Telecommunication Distribution Technology Cluster

Non-Engineering Category
- Economics & Financial Applications Cluster
- Green Development Cluster
- Leisure & Retail Management Cluster

Other Available Diploma Plus Certificates
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The syllabus is based on the first-year engineering mathematics and science curricula of NUS.

For detailed module descriptions under each cluster, please refer to page 182.

DIPLOMA IN NETWORK SYSTEMS & SECURITY (NSS) (3-YEAR COURSE)
SCHOOL OF ENGINEERING

COURSE CURRICULUM

Module No.	Module Name	Credit Units
	YEAR 1	
	Level 1.1 (25 hours per week)	
1.	Electrical Technology	6
2.	Internetworking 1	6
3.	Engineering Mathematics 1	5
4.	Computer Programming	4
5.	Sports & Wellness^	2
6.	Creativity & Applied Thinking Skills^	2
	Level 1.2 (24 hours per week)	
7.	Digital Electronics	5
8.	Internetworking 2	6
9.	Engineering Mathematics 2	5
10.	Applications Programming	4
11.	Individual & the Community^	2
12.	Communication Toolkit^	2
	YEAR 2	
	Level 2.1 (26 hours per week)	
13.	Network Cabling	4
14.	Communication Systems Fundamentals	5
15.	Engineering Mathematics 3B	4
16.	Internetworking 3	4
17.	Object-Oriented Programming	5
18.	Interdisciplinary Studies (IS) module^	2
19.	Interdisciplinary Studies (IS) module^	2
	Level 2.2 (20 hours per week)	
20.	Fundamentals of Network Security	6
21.	Internetworking 4	4
22.	Voice Convergence Networks	6
23.	Innovation & Enterprise in Action^	4
	YEAR 3	
	Level 3.1 (24 hours per week)	
24.	Advanced Routing	5
25.	Multilayer Switching Networks	5
26.	Wireless LAN Technologies	5
27.	Advanced Network Security	5
28.	World Issues: A Singapore Perspective^	2
29.	Interdisciplinary Studies (IS) module^	2
	Level 3.2 (25 hours per week)	
30.	Industrial Attachment Programme	25
	Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
31.	School of Engineering (SoE) elective module°	3
32.	School of Engineering (SoE) elective module°	3

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

° For more details on School of Engineering elective modules, please refer to page 182.

Students are required to own Notebook Computers.

IS Modules
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge-based economy. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

School of Engineering (SoE) Elective Modules
The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and deepen their discipline-specific areas. Each cluster comprises a minimum of three 3-hour modules. Students are required to take two modules in order to satisfy the minimum graduating requirement.

DIPLOMA IN TECHNOLOGY (ELECTRONIC)

(3-YEAR PART-TIME COURSE)

SCHOOL OF ENGINEERING

The **part-time Diploma in Technology (Electronic)** is a six-stage, part-time evening course. The course is structured in a modular form based on a module-credit system. To qualify for the award of the Diploma, students are required to complete core modules in all the six stages. Each of the core modules has four credit units. In addition, students are also required to complete another 24 credit units of elective modules.

COURSE STRUCTURE

Stage 1:
- Basic Electronics and Devices (BED)
- Principles of DC Circuits (PDC)
- Engineering Mathematics A (EMA)

Stage 2:
- Principles of Digital Electronics (PDE)
- Principles of AC Circuits (PAC)
- Engineering Mathematics B (EMB)

Stage 3:
- Analogue Circuits and Applications (ACA)
- Mini-Electronic Control Project (MECP)

Stage 4:
- Basic Internetworking (BI)
- Principles of Control Systems (PCS)

Stage 5:
- Principles of Photonics (PP)
- Routing Principles (RP)

Stage 6:
- Basic Microcontroller Programming (BMP)
- Digital Signal Processing and Applications (DSPA)

This diploma is administered by the Centre for Professional Development (CPD). For more information about this course, please log on to www.np.edu.sg/cpd/ or contact the CPD at 64606353.