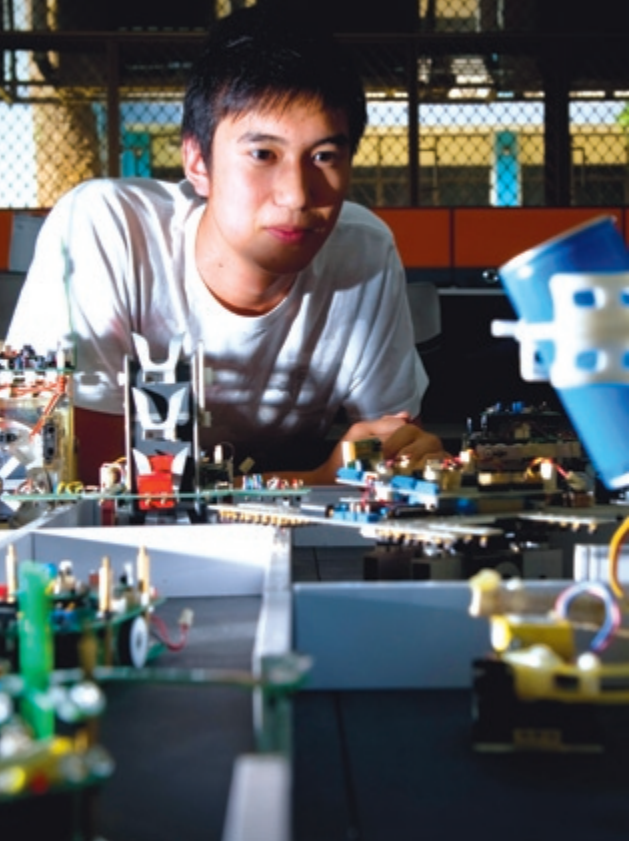
DIPLOMA IN ENGINEERING SCIENCE (ES)

NEW

3-YEAR COURSE

SPECIAL PROGRAMME / COURSE CLUSTER



Through a curriculum that was designed in collaboration with Nanyang Technological University (NTU), the new **Diploma in Engineering Science (ES)** is a premier diploma that is dedicated to preparing students, with a strong passion for applied science, to become leaders in the field of engineering.

ES, the first diploma of its kind among the local polytechnics, has a strong emphasis on engineering fundamentals and relevant domains knowledge which include computing, mathematics, applied sciences and research. It especially prepares 'O' level students with strong passion in applied science for further studies.

An Engineering Induction Programme will give students further exposure to various fields through industry visits, guest lectures, overseas study visits and short stints with research establishments.

In the final year, students will spend at least two days a week in NTU where they will take on projects supervised by NTU professors in areas such as aerospace, nanotechnology and integrated circuit design.

All ES students will also be invited to visit top universities in Japan and China - an initiative that is in addition to the overseas trips offered to all Ngee Ann students. There, they will interact with postgraduate students and professors, and be exposed to the latest developments in technology and innovation!

One in four ES students may also be offered a prestigious scholarship (worth more than S$20,000) that covers tuition fees and notebook allowances, and scholars will be placed on a special talent development track!

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examination (or equivalent) results and fulfil the aggregate computation requirements:

Subject	'O' Level Grade
English Language*	1-7
Mathematics (Elementary/Additional)	1-6
Science (with Physics, Chemistry or Biology component) or Computer Studies or Design & Technology or Fundamentals of Electronics	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology or Food & Nutrition (Grade 1-9) or a relevant OSIE / Applied Subject and two other subjects.

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

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

CAREER PROSPECTS

The first option of ES graduates would be to pursue an engineering degree at NTU or other universities. Nevertheless, ES graduates also enjoy good career prospects in research & development, product design & development and manufacturing & services. The industry fully supports the launch of this diploma and they will be willing to employ ES graduates.

ACCREDITATION FOR FURTHER STUDIES

ES graduates are well-prepared for further studies at NTU. They may pursue NTU's wide range of engineering degrees in the fields of computer engineering, electrical and electronic engineering, mechanical engineering, aerospace engineering and material science.

ES graduates can also pursue a degree in Engineering Science at other prestigious universities, including National University of Singapore, The University of Toronto (Canada), The University of Oxford (UK), The Pennsylvania State University (USA) and The University of Auckland (New Zealand).

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Electrical Technology	6
Engineering Mathematics 1	5
Engineering Mechanics	5
Computer Programming	4
Physics 1	3
Sports & Wellness^	2
Idea Jumpstart^	2
Level 1.2 (26 hours per week)	
Circuit Analysis	4
Strength of Materials	5
Engineering Mathematics 2	5
Fundamentals of Object Oriented Programming	4
Physics 2	4
Communication & Contemporary Issues^	4
YEAR 2	
Level 2.1 (22 hours per week)	
Analogue Electronics	5
Thermodynamics	5
Engineering Mathematics 3A	4
Data Structures & Algorithms	4
Idea Blueprint^	2
Interdisciplinary Studies (IS) module^	2

COURSE CURRICULUM

Module Name	Credit Units
Level 2.2 (23 hours per week)	
Digital Electronics	6
Fluid Mechanics	4
Fundamentals of Control Systems	5
Engineering Design Practices	4
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2
YEAR 3	
Level 3.1 (26 hours per week)	
Project Design and Development 1	8
Marketing Fundamentals	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Electrical & Electronic Engineering (EEE) Option	
Select Two Electives (Assume 10 CUs in total):	
Microcontroller Programming & Interfacing #	6
Analogue Circuit Design & Applications @	5
Microchip Technology %	5
Mechanical Engineering (ME) Option	
Mechanics of Machines & Materials	5
Engineering System Design	5
Automation and Mechatronic Systems (AMS) Option	
Select One EEE Elective (Assume 5 CUs):	
Microcontroller Programming & Interfacing #	6
Analogue Circuit Design & Applications @	5
Select One ME Elective:	
Mechanics of Machines & Materials %	5
Engineering System Design	5
Level 3.2 (26 hours per week)	
Project Design and Development 2	12
Fundamentals of Financial Management	4

Module Name	Credit Units
Electrical & Electronic Engineering (EEE) Option	
Select Two Electives (Assume 10 CUs in total):	
Optoelectronics #	4
Communication Systems @	5
Integrated Circuit Design & Layout %	5
Mechanical Engineering (EE) Option	
Engineering Materials Science	5
Applied Thermodynamics	5
Automation and Mechatronic Systems (AMS) Option	
Select One EEE Elective (Assume 5 CUs):	
Optoelectronics #	4
Communication Systems @	5
Select One ME Elective:	
Engineering Materials Science %	5
Applied Thermodynamics	5

Notes:
@ % are Electives Pairs in Levels 3.1 and 3.2 which must be taken together.
^ For more details on Interdisciplinary Studies (IS) modules, please log on to www.np.edu.sg/is/.
Students are required to own Notebook Computers.

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

COURSE MODULES

LEVEL 1.1

Electrical Technology
This module introduces the necessary foundation for electrical circuit analysis covering electrical theorems and techniques for analysing and solving direct and alternating current circuit problems. Laboratory assignments include basic electrical measurement skills and concepts learnt in lectures and tutorials.

Engineering Mathematics 1
This module provides students with mathematical skills for solving basic engineering problems. Topics are organised to keep pace with applications in the engineering modules. They include algebra, trigonometry, logarithms, matrices and complex numbers. A Computer Algebra System will be used where appropriate.

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

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 simple engineering applications.

Physics 1
This module covers the topics of Classical Mechanics. Students learn the laws of motion in both one and two dimensions. They also study concepts of work and energy for linear systems including linear momentum and collision.

LEVEL 1.2

Circuit Analysis
This module provides students with fundamentals in circuit analysis concepts and methods. It gives a good understanding of general analogue circuit performance measurements and parameters. Topics covered include impedance, transient behaviours of RLC circuits, frequency response, spectrum & resonance, filters and two ports network functions.

Strength of Materials
This module aims to provide students with the foundational knowledge of strength of materials with emphasis on applications and problem solving. Topics include simple stresses and strains, torsion in shaft, shear force and bending moment diagrams, stresses in beams, combined stresses and experimental stress analysis.

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

Fundamentals of Object Oriented Programming
This module builds on the basis of the earlier module (Computer Programming) and brings students into the realm of Object Oriented Programming. Students learn how to encapsulate data and behaviour, apply polymorphism, and re-use codes through inheritance mechanism.

Physics 2
This module builds on the Physics 1 and extends the coverage into other aspects of Physics such as Angular Kinematics, Universal Gravitation, Fluid Mechanics, Thermodynamics, Electricity and Magnetism.

LEVEL 2.1

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.

Thermodynamics
This module covers the properties of working fluids, the first law of thermodynamics and its application to both non-flow and flow processes. Topics include the first law of thermodynamics, properties of liquids and vapours, non-flow processes with steam, steady flow processes with steam, properties of perfect gases, and non-flow processes with perfect gases.

Engineering Mathematics 3A
This module is a continuation of Engineering Mathematics 2. Topics include Integration Techniques & Applications, First Order Differential Equation, Fourier series and Laplace Transform.

Data Structures & Algorithms
This module introduces the basics of data structures including linked-list, binary search tree and sorting algorithms. Various sorting algorithms will be discussed and compared.

LEVEL 2.2

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.

COURSE MODULES

Fluid Mechanics
This module provides an introduction to the principles of fluid mechanics and their application in analysing systems in which fluid is the working medium. Topics include fluid statics, pressure measurement, hydrostatic forces on submerged surfaces, buoyancy, fluid in motion, Bernoulli Equation, flow measurement, piping systems, pump performance and system characteristics.

Fundamentals of Control Systems
This module provides students with a basic coverage 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.

Engineering Design Practices
This module will guide students to integrate various domain knowledge acquired to develop working models of engineering systems, for examples, two-arm robots, autonomous vehicles and DSP-based control systems. The students will also be exposed to application software for engineering drawing, computer aided design (CAD) or simulation.

LEVEL 3.1

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.

Marketing Fundamentals
The module introduces concepts and principles of the marketing of goods and services to enable students to better understand and evaluate the marketing system in which products and services are planned, priced, promoted and distributed. Apart from the four P's in marketing, topics covered also include segmentation, targeting and positioning, product mix, service marketing, channel decisions and branding.

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.

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.

Microchip Technology
This module introduces students to various Integrated Circuit (IC) technologies. It provides students with basic concepts of Metal-Oxide-Semiconductor (MOS) digital integrated circuit design. At the end of the module, students will be able to design and layout simple MOS digital ICs both in theory and in practice.

Mechanics of Machines & Materials
This module provides students the experience of solving engineering problems based on the principles and theories covered in the earlier Mechanics modules. Topics include velocity and acceleration diagrams, effects of the mass of members of mechanism, friction mechanisms and the effects of friction on screw threads and belt drives, balancing of shafts and its application to gears and pulleys, and the causes and control of machinery vibration.

Engineering System Design
This project-driven module covers the system approach in engineering design, and includes design methodologies such as Design for Manufacture and Assembly (DFMA) and mechanism design. Through practical projects, students experience the complete design cycle from defining objectives, gathering information, generating, evaluating and refining concepts, selecting final design, designing and sizing components, to preparing assembly and detailed drawings, and communicating designs using quality folio, report and oral presentation.

LEVEL 3.2

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.

Fundamentals of Financial Management
This module covers basic accounting and financial concepts and principles to enable students to understand and interpret financial statements and reports. Students will also have an understanding of costing concepts and the financial techniques used in making financial decisions and evaluating capital investment projects.

Optoelectronics
This module provides students with a foundation in wave and geometrical optics, photonics materials and optoelectronics devices. Topics covered are geometrical optics, wave optics, light interaction in matters, semiconductor photonics materials, photo-detectors, light emitting diode (LEDs), display devices, photoelectric sensors and laser.

COURSE MODULES

Communication Systems
This module provides students with the fundamentals of telecommunication system. It gives a good understanding of important signal processing methods for transmission & reception communication systems. Topics covered are transmission of information, signal processing fundamentals & nonlinear networks, Amplitude Modulation (AM), Frequency Modulation (FM), AM & FM demodulation, and AM/FM transmitters & receivers.

Integrated Circuit Design & Layout
This module is will introduce students to fundamentals of IC design. It aims to equip students with the basic skills that are needed to layout analogue and digital circuits on silicon. Using computer-aided design tools, the students will gain an insight into IC layout methodologies.

Engineering Materials Science
This module introduces students to classification of engineering materials, material testing and properties, plain carbon steel, heat treatment of steels, various metals alloy steels, cast irons, non-ferrous metals such as aluminium and copper, plastic/polymers. Besides the common ferrous and non-ferrous metals, the module will also include composite materials, corrosion and corrosion control among other topics. The knowledge covered in theory will be reinforced by laboratory work and tutorials.

Applied Thermodynamics
Students will learn the applications of principles of Thermodynamics to energy conversion, energy transformation and energy management. Topics include thermodynamic processes, the second law of thermodynamics, gas power cycles, engine performance testing, nozzles, steam power plant, basic heat transfer and introductory of thermal management.

DIPLOMA PLUS PROGRAMME

The Diploma Plus Programme (DPP) is designed to provide students with adequate proficiency in a selected domain area, either to broaden or deepen a student's knowledge/skills in his/her main discipline of study, or to equip a student with additional professional knowledge that would better prepare him/her for further study or increase their employability. Students can select elective modules from a wide range of clusters to obtain their Diploma Plus Certificate. DPP is optional and it will not affect the graduating requirement for the award of a diploma.

Students can choose the DPP clusters from the range listed below. The offer of a DPP cluster is subject to the condition that the minimum class size is met and based on available vacancies.

Available Diploma Plus Certificate
- Advanced Engineering Mathematics*

* 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 176.