DIPLOMA IN MECHANICAL ENGINEERING (ME)
(3-YEAR COURSE)

SCHOOL OF ENGINEERING
MARINE, OFFSHORE & MECHANICAL CLUSTER

Being one of the fundamental and most important fields of engineering, the **Diploma in Mechanical Engineering (ME)** prepares students to solve problems with innovative solutions.

Mechanical Engineering is a very general and pervasive field. Most products and systems have some Mechanical Engineering components. The ME course thus offers a broad-based training programme with exciting specialisation options to give students a firm foundation to work at the forefront of changing technologies.

ME's strong emphasis on design gives students a competitive edge. After all, the field requires professionals in the design and manufacturing of products from home appliances to biomedical devices. Students are also trained in areas such as the generation and use of energy, and the creation of new materials.

First-year modules focus on engineering basics, as well as mathematical and computing tools, giving students a firm grounding in solving engineering problems. As they progress to higher levels in the course, they are systematically introduced to the core mechanical engineering modules such as machine components, dynamics and control, materials and manufacturing processes, energy conversion and transfer, and engineering design.

In their final year, students can opt for a six-month internship, locally or overseas in Australia, China and Germany. Alternatively, students can choose to do the Project Design and Development programme and select either a discipline-specific option in Cleanroom & Energy Systems, Biomedical Applications, and Design Innovation, or a business-related option in Business Management and Marketing & Entrepreneurship.

A salient feature of the course is its flexibility. Students can choose to graduate with additional Diploma Plus and/or Enhancement Certificates depending on abilities and interests. These are optional programmes designed to broaden students' knowledge and deepen their skills in specific areas.

ENTRY REQUIREMENTS

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

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

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

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

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

CAREER PROSPECTS

Due to the generic nature of Mechanical Engineering, students will have one of the most versatile professional qualifications upon completion of the course. ME graduates are in demand to fill a wide variety of interesting and challenging positions in both the public and private sectors.

Many career opportunities are found at the technologist and middle management levels in the design, manufacturing, aerospace, marine, oil and gas, facilities management and engineering services industries. The chemical processing, pharmaceutical and life sciences industries also offer career opportunities.

ACCREDITATION FOR FURTHER STUDIES

Being one of the fundamental fields, the ME course provides you excellent opportunity to pursue a degree in Mechanical Engineering. Most international universities have a degree programme in Mechanical Engineering. Many other degree programmes also accept the ME diploma. Some examples are Material Engineering, Aerospace Engineering, Marine Engineering, Mechatronic Engineering, Biomedical Engineering and Computer Engineering.

The ME course is well recognised by both local and overseas universities, which grant advanced standing for their relevant degree programmes.

- **Nanyang Technological University**
  Bachelor of Engineering in Mechanical Engineering, Aerospace Engineering, Bioengineering or Materials Engineering
- **National University of Singapore**
  Bachelor of Engineering in Mechanical Engineering
- **University of Manchester (UK)**
  Bachelor of Engineering in Mechanical Engineering
- **University of Edinburgh (UK)**
  Bachelor of Engineering in Mechanical Engineering
- **University of New South Wales (Australia)**
  Bachelor of Engineering in Mechanical Engineering
- **University of Melbourne (Australia)**
  Bachelor of Engineering in Mechanical Engineering

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Engineering Mathematics 1	5
Electrical Technology	6
Computer Programming	4
Engineering Mechanics	5
Engineering: A Creative Profession	3
Creativity & Applied Thinking Skills^	2
Sports & Wellness^	2
Level 1.2 (22 hours per week)	
Engineering Drawing & Computer-Aided Design	5
Engineering Mathematics 2	5
Engineering Materials	4
Manufacturing Technology & Practice	4
Communication Toolkit^	4
YEAR 2	
Level 2.1 (23 hours per week)	
Engineering Mathematics 3	4
Industrial Automation	5
Thermodynamics	5
Applied Mechanics	5
Interdisciplinary Studies (IS) module^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (23 hours per week)	
Computer-Aided Design	3
Computer-Aided Manufacturing	4
Fluid Mechanics	4
Strength of Materials	4
Engineering Design	4
Innovation & Enterprise in Action^	4
YEAR 3	
Internship Option	
Level 3.1 (24 hours per week)	
Instrumentation & Control	5
Applied Thermodynamics	5
Mechanics of Machines & Materials	5
Engineering System Design	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (25 hours per week)	
Six-month Internship	25
Discipline-specific Options (in Biomedical Applications, Design Innovation, Cleanroom & Energy Systems)	
Level 3.1 (27 hours per week)	
Instrumentation & Control	5
Mechanics of Machines & Materials	5
Option Module	5
Project Design and Development 1 (in a specific option)	8
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (22 hours per week)	
Applied Thermodynamics	5
Engineering System Design	5
Project Design and Development 2 (in a specific option)	12
Business Related Options (in Business Management (BM), Marketing & Entrepreneurship (M&E)	
Level 3.1 (27 hours per week)	
Instrumentation & Control	5
Mechanics of Machines & Materials	5
(For BM Option) – Customer Relationship Management	3
(For M&E Option) – Enterprise Development	

Module Name	Credit Units
(For BM Option) – Service Operation Management	4
(For M&E Option) – Business Creation	
Project 1	6
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (22 hours per week)	
Applied Thermodynamics	5
Engineering System Design	5
(For BM Option) – E-Commerce	4
(For M&E Option) – Product Design & Marketing	
Project 2	8
Across-Level Modules (Level 1.2 onwards)	
School of Engineering (SoE) elective module*	3
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 165.

IS Modules
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum under the Ngee Ann Learning Model (NLM). The NLM was introduced in 2001 to nurture a new generation of professionals with multidisciplinary skills to meet the challenges of a knowledge-based economy. The NLM incorporates core disciplines and Interdisciplinary Studies. It also nurtures innovative and entrepreneurial traits through the Innovation & Enterprise in Action (I & E in Action) module. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

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/or 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.

COURSE MODULES

LEVEL 1.1

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

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.

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.

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.

Engineering: A Creative Profession
This continuous assessment module provides students the opening exposure to engineering analysis, design, and problem-solving through case studies and projects. It excites students with a view of what to expect in engineering, facilitate them with a foundation of essential development tools commonly used, and inspires them in a profession driven by the passion to advance society through technology.

LEVEL 1.2

Engineering Drawing & Computer-Aided Design
This module covers the basic principles of engineering drafting and the application of an industry-standard Computer Aided Design & Drafting tool to produce detailed drawings of engineering parts. This practice-oriented module comprises short lectures complemented by hands-on exercises with emphasis on practical examples and industry practices. Topics include orthographic projection, sectioning, dimensioning, conventional representation and assembly drawing.

Engineering Mathematics 2
This module is a follow-on module of Engineering Mathematics 1. It further develops students' mathematical ability to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

Engineering Materials
This module introduces students to equilibrium phase diagrams, structures, and properties of common engineering materials with emphasis on mechanical testing methods, heat-treatment, international standard specifications, selection and applications of such materials. Topics include classification of materials, mechanical testing, alloying, steels, non-ferrous alloys, plastics, ceramics, composites, corrosion and selection of materials and shaping processes.

Manufacturing Technology & Practice
Students will acquire the basic knowledge and skills of manufacturing processes, including drilling, turning, milling, grinding, non-conventional machining, welding, plastic moulding and assembly. The module is practice-oriented with classroom lectures complemented by practical sessions involving the making of specially-designed work pieces.

LEVEL 2.1

Engineering Mathematics 3
This is the third module in the course to equip students with the mathematical tools and techniques to meet the computational requirements of the other engineering modules. Throughout the module, there is appropriate use of a Computer Algebra System. Topics include integration with applications, differential equations, Laplace transform, probability and statistics.

Industrial Automation
Students will explore the concepts of logic and sequential control, and their applications in industrial automation. They are introduced to a spectrum of technologies, ranging from pneumatics and electro-pneumatics to programmable controllers, with emphasis on component technology leading to circuit design and implementation. Topics include automated mechanisms, ladder diagrams, basic and advanced features of programmable controllers, design techniques and applications.

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.

Applied 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 be equipped with the necessary skills 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.

LEVEL 2.2

Computer-Aided Design (CAD)
In this follow-on module of Mechanical Drawing & CAD, students reinforce their drafting concepts and techniques by applying an industry-standard CAD tool for the design of engineering parts and assembly as well as the preparation of detailed manufacturing drawings. Through hands-on projects and assignments, students develop the proficiency in using a parametric, feature-based solid modelling software to capture the intent of the designer.

Computer-Aided Manufacturing
Students will acquire the basic knowledge and skills in handling modern manufacturing processes. The module is practice-oriented with classroom lectures complemented by practical sessions on computer-numerical-control (CNC) turning and milling, PRO/NC, reverse engineering,coordinate measuring machines, automation and assembly. There is also coverage on electronics manufacturing and automatic assembly processes. Safety and a positive work attitude form an integral part of the module.

Fluid Mechanics
The 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 system, pump performance, and system characteristics.

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 Design
Students apply engineering principles systematically to the selection and design of mechanical elements and systems. Through short design projects and case studies, students learn the design process, the use of Computer Aided Design (CAD) tools, code of practice and engineering judgment in design. Topics include the selection and design of common engineering elements and systems such as electric motor, coupling, gears, bearing, shaft, key and chain drives.

LEVEL 3

CORE MODULES

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

Engineering System Design
This module covers practical design methodologies, including Design for Manufacture and Assembly (DFMA) for metal, sheet-metal and plastic parts. 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.

Instrumentation & Control
The module covers instruments, feedback control systems, control components, system performance and stability. Topics include concepts of feedback control, principles and application of measuring sensors, control valves, control modes, use of analytical tools for system performance and stability analysis, servo control systems, and process control applications.

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.

OPTIONS

Biomedical Applications
Students take an activity-based module covering biomechanics and rehabilitation engineering, biomaterials and implant, and medical imaging with rapid prototype. The module prepares students to undertake biomedical applications projects, which take them through the complete cycle of idea generation, design, manufacturing, testing and presentation. The projects span two semesters.

Business Management
The programme is aimed at helping students with technical backgrounds to develop the relevant skills for managing a business operation. It seeks to equip students pursuing engineering/technology-based diploma courses, with the business operation management skills through the three modules of Customer Relationship Management, Service Operation Management and E-commerce. Students will go through the whole process of managing a business operation from the front end of creating value for customers, to the back end of the service transformation process. This broadens their mindset from being technologically focused to becoming more entrepreneurial, seeing the importance of value creation and relationship building for customers, and establishing good business management practices.

Cleanroom & Energy Systems
Students take an activity-based module covering heat transfer principles and design requirements and applications of air-conditioning systems in cleanroom facilities for microelectronics and life sciences industries. The module prepares students to undertake cleanroom and energy system related projects, which take them through the complete cycle of idea generation, design, manufacturing, testing and presentation. The projects span two semesters.

Design Innovation
Students take an activity-based module covering the design, innovation and development process involving problem research and definition, target user group and product design specifications, aesthetic and ergonomic requirements. The module prepares them to undertake design innovation projects, which take them through the complete cycle of idea generation, design, manufacturing, testing and presentation. The projects span two semesters.

Six-month Internship
The six-month internship provides students with the opportunity to apply the knowledge acquired in the classroom to work situations, and demonstrate problem solving, communication and interpersonal skills in a work environment. The programme enables students to hone their ability to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to develop a professional approach to work based on the relevant code of practice.

Marketing & Entrepreneurship
The programme is aimed at helping students with technical background develop the skills necessary for starting a successful, profitable business. It seeks to imbue in students pursuing engineering/technology-based diploma courses, a mindset for entrepreneurship through the three modules of Business Creation, Product Design & Marketing and Enterprise Development. Students will go through the whole process of business creation, development and establishment. This broadens their mindset from being technologically focused to becoming more entrepreneurial, seeing product design and development from marketing perspectives, and establishing strong business enterprises through different means.

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 elective clusters 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 Clusters
- Advanced Engineering Mathematics*
- Aerospace Design
- Applied Physics*
- Applied Technology
- Biomedical Engineering
- Industrial Control
- Industrial Electronics
- Information Technology
- Mechanical Technology
- Telecommunication Distribution Technology
- Workplace Safety & Health

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

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 165.

DIPLOMA IN MARINE & OFFSHORE TECHNOLOGY (MOT)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

MARINE, OFFSHORE & MECHANICAL CLUSTER

As the world's busiest port, a leading ship conversion centre, the largest base of oil and gas equipment manufacturing companies in Asia, and the home of over 3,400 marine companies, Singapore is a leader in the international marine industry.

The **Diploma in Marine & Offshore Technology (MOT)** is designed to meet the growing demand of the buoyant marine industry for skilled professionals in sectors such as ship design and production, ship conversion, offshore engineering, and offshore oil and gas. The MOT diploma confers graduates a qualification in naval architecture and offshore technology, one of the top three specialist skills in high demand in Singapore.

The course curriculum focuses on the three main sectors of the industry – ship design and production, ship conversions, and offshore engineering. In the final year, students can opt to specialise in ship design or offshore oil and gas technology.

The division's close relationship with the industry, especially with the Association of Singapore Marine Industries (ASMI), ensures that the curriculum reflects the latest industry practices. Students will work with leading organisations such as Keppel FELS, ST Marine and Sembcorp Marine when they undergo their internship. There will be frequent study visits for exposure, and the opportunity to build and test ship models in Singapore's only towing tank, located within the Ngee Ann Polytechnic campus.

Unique to MOT is the number of scholarships available to students. These include the ASMI-MOT scholarship at $10,000 annually over three years, and scholarships from shipyards like Keppel Offshore & Marine.

Another salient feature of the course is its flexibility. Students can choose to graduate with additional Diploma Plus and/or Enhancement Certificates depending on abilities and interests. These are optional programmes designed to broaden students' knowledge and deepen their skills in specific areas.

ENTRY REQUIREMENTS

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

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

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

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

Candidates with hearing deficiency and severe vision deficiency should not apply for the course.

CAREER PROSPECTS

MOT graduates enjoy excellent employment prospects as project supervisors, designers, assistant engineers, planners, commercial officers, quality control inspectors, assistant project managers and safety officers. Positions are also available in the oil and gas sector for technical support, sales or commissioning services.

As the marine industry moves into higher value-added activities, career options in the industry are also growing for female graduates in areas such as design, marketing, procurement, planning, safety and human resource.

ACCREDITATION FOR FURTHER STUDIES

MOT graduates with good academic results will have the opportunity to pursue a two-year degree programme in Naval Architecture offered by Newcastle University (UK). The programme, a tie-up between Ngee Ann Polytechnic and Newcastle University, is conducted in Singapore at the Ngee Ann Polytechnic campus. This program is heavily subsidized by the Ministry of Education.

MOT graduates gain advanced standing at the following local and overseas universities:

- **Nanyang Technological University**
  Bachelor of Engineering in Mechanical Engineering or Materials Engineering
- **National University of Singapore**
  Bachelor of Engineering in Civil Engineering or Mechanical Engineering
- **Newcastle University (UK)**
  Bachelor of Engineering in Naval Architecture
- **University of Glasgow (UK)**
  Bachelor of Engineering in Naval Architecture or Ocean Engineering
- **University of New South Wales (Australia)**
  Bachelor of Engineering in Mechanical Engineering
- **University of Sydney (Australia)**
  Bachelor of Engineering in Mechanical Engineering

SCHOLARSHIPS

- ASMI-MOT Scholarships
  To maintain its international leadership position in the new economy, members of the Association of Singapore Marine Industries (ASMI) are offering scholarships to bright, dynamic and capable 'O' Level school leavers to join the world-class marine industry in Singapore.

  Scholarships are offered to Singapore citizens and Permanent Residents inclusive of tuition and all other compulsory fees. In addition, recipients also get a monthly allowance of $600 and a notebook computer allowance of $1,500. Successful applicants will work with their sponsor companies for three years. The total value of this scholarship is $30,000.

- ASMI Scholarships
  About 30 ASMI scholarships are sponsored by members each year. Each scholarship has a value of $5,000 per year for each year of study. The bond period varies with the value of the scholarship received – $5,000 for one year, $10,000 for two years and $15,000 for three years.

  Recipients of these scholarships are assured of jobs in sponsoring organisations such as Sembcorp Marine, ST Marine Ltd, Jurong Shipyard Pte Ltd, Keppel Offshore & Marine and Drydocks World.

- K C Lee Scholarships and Bursaries
  Each year, the K C Lee Scholarship Fund awards scholarships of $2,000 and bursaries of $1,000 to selected MOT students.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (24 hours per week)	
Engineering Mechanics	5
Electrical Technology	6
Computer Programming	4
Engineering Mathematics 1	5
Creativity & Applied Thinking Skills^	2
Sports & Wellness^	2
Level 1.2 (27 hours per week)	
Engineering Materials	4
Engineering Mathematics 2	5
Engineering Drawing & Computer-Aided Design	5
Naval Architecture 1	5
Manufacturing Technology & Practice	4
Communication Toolkit^	4
YEAR 2	
Level 2.1 (26 hours per week)	
Computer-Aided Design (Outfit)	2
Engineering Mathematics 3	4
Marine Engineering 1	5
Marine Industry Safety	2
Thermodynamics	5
Ship Drawing	2
Interdisciplinary Studies (IS) module^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (26 hours per week)	
Marine Practices	3
Naval Architecture 2	5
Ship Production Technology	4
Computer-Aided Design (Hull)	3
Strength of Materials	4
Innovation & Enterprise in Action^	4
YEAR 3	
Level 3.1 (23 hours per week)	
Modules from an Option	14
Marine Engineering 2	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) Module^	2

Module Name	Credit Units
Level 3.2 (23 hours per week)	
Three-month Internship	11
Project	6
Project Management	3
Floating Production Technology	3
Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
School of Engineering (SoE) elective module*	3
School of Engineering (SoE) elective module*	3
Options	
Design Option	
Offshore Engineering	4
Theory & Practice of Ship Design	5
Naval Architecture 3	5
Oil & Gas Option	
Offshore Oil & Gas Process Technology	5
Offshore Systems	5
Drilling Technology	4

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 165.

IS Modules
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COURSE MODULES

LEVEL 1.1

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.

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.

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.

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

LEVEL 1.2

Engineering Materials
This module introduces students to equilibrium phase diagrams, structures, and properties of common engineering materials with emphasis on mechanical testing methods, heat-treatment, international standard specifications, selection and applications of such materials. Topics include classification of materials, mechanical testing, alloying, steels, non-ferrous alloys, plastics, ceramics, composites, corrosion and selection of materials and shaping processes.

Engineering Mathematics 2
This module is a follow-on module of Engineering Mathematics 1. It further develops students' mathematical ability to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

Engineering Drawing & Computer-Aided Design
This module covers the basic principles of engineering drafting and the application of an industry-standard Computer-Aided Design & Drafting tool to produce detailed drawings of engineering parts. This practice-oriented module comprises short lectures complemented by hands-on exercises with emphasis on practical examples and industry practices. Topics include orthographic projection, sectioning, dimensioning, conventional representation and assembly drawing.

Naval Architecture 1
This module introduces students to important branches of naval architecture and basic principles relating to shipbuilding. Topics include ship geometry, hydrostatics calculations relating to area of waterplane, buoyancy, first and second moment of area of waterplane, and metacentric height.

Manufacturing Technology & Practice
Students will acquire the basic knowledge and skills of manufacturing processes, including drilling, turning, milling, grinding, non-conventional machining, welding, plastic moulding and assembly. The module is practice-oriented with classroom lectures complemented by practical sessions involving the making of specially-designed work pieces.

LEVEL 2.1

Computer-Aided Design (Outfit)
In this module, students apply an industry-standard CAD system, TRIBON, to carry out 2-D drafting, and then proceed to create marine components as 3-D objects. The module also covers the TRIBON piping programme for pipe routing and pipe assemblies.

Engineering Mathematics 3
This is the third module in the course to equip students with the mathematical tools and techniques to meet the computational requirements of the other engineering modules. Throughout the module, there is appropriate use of a Computer Algebra System. Topics include integration with applications, differential equations, Laplace transform, probability and statistics.

Marine Engineering 1
The module aims to equip students with knowledge of marine piping, pumping, heating and cooling, and auxiliary machinery that supports the diesel propulsion plant. Learning is reinforced through practical work involving common marine equipment. Topics include fluid flows, pipe design, pumping system, heat transfer and heat exchangers, prime movers, fuel system, cooling system and lubricating system.

Marine Industry Safety
This module aims to increase students' awareness of safety at the workplace. Topics include statutory requirements, hazards and safety considerations, fire and explosion, electrical hazards, safety in scaffolding, accident investigation, safety in material handling, and occupational health.

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.

Ship Drawing
Students will acquire the fundamental knowledge and computer-based drafting skills required in a ship drawing/design office. Topics include lines fairing, general arrangement and layout drawings, and structural arrangement drawings together with connection details.

LEVEL 2.2

Marine Practices
This module provides students with hands-on computer and field practices used in the ship conversion, shipbuilding and offshore industry. Topics include CAD/CAM in ship production, oxy-fuel cutting, numerical-controlled plate cutting, lofting, numerical-controlled pipe bending, and LASER shaft alignment.

Naval Architecture 2
This is a follow-on module of Naval Architecture 1. Topics covered include intact stability, subdivision, damage stability, launching, tonnage measurement and load line.

Ship Production Technology
The module focuses on various aspects of shipbuilding, ship repair and conversion, as well as economic evaluation and computer applications in shipbuilding. Topics covered include plate preparation, lofting, prefabrication, erection, outfitting, corrosion control, dry-docking, ship surveys, steel work renewals, ship "jumboisation" to lengthen the ship, metallurgical behaviour of metals during welding, and the non-destructive testing of welds.

Computer-Aided Design (Hull)
Students apply TRIBON to complete the full procedure of hull design and production, including hull form generation, lines fairing, curved surface modelling, planar structure modelling, and generation of production information.

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.

LEVEL 3.1

COMMON MODULES

Marine Engineering 2
This module equips students with knowledge of the main propulsion systems in merchant ships, propeller and shafting systems, steering gears and rudder, marine pollution control, compressed air systems and machine reliability. Practical hands-on work includes heat balance of diesel engines, hydraulic system for steering gears and propeller shaft dynamics.

DESIGN OPTION

Offshore Engineering
The module focuses on the engineering concepts and practices of offshore design, construction and installation, as well as the exploration and exploitation processes, and piping design relating to oil and gas recovery. Students will have the opportunity to explore the capabilities of a software package for the structural analysis of offshore platforms.

Theory & Practice of Ship Design
Students will study the overall ship design process. Topics include preliminary dimensions, stability, hull forms, powering, mass and centre of gravity (CG) estimation, rules and regulations, capacities, general arrangement, design economics and sea keeping. Learning is facilitated by group work on ship design using a software package.

Naval Architecture 3
In this module, students will carry out a detailed study of the various aspects of naval architecture such as the structural strength of a ship, hull vibration, propulsion, steering and manoeuvring, and rudder forces. Experiments include testing ship models in the towing tank.

OIL & GAS OPTION

Offshore Oil & Gas Process Technology
This module aims to develop an understanding of the process engineering operations and facilities required to bring oil and natural gas under the sea to shuttle tankers. It develops the basic science and engineering fundamentals necessary to understand the thermophysical properties and phase behaviour of fluids, and to describe and analyse the processing of such fluids.

Offshore Systems
This module provides a basic understanding of some engineering aspects of offshore oil and gas production facilities, including the commissioning and operation of the equipment, the instrumentation and control, safety standards, design specifications, and governing codes and regulations. Some aspects of manufacturing of selected subsea production system components will also be covered.

Drilling Technology
This module gives an overview of the drilling operations from planning to completion for production. It helps students develop a functional understanding of the operation and commissioning of various equipment processes and systems involved in the drilling and completion operations. Students are also introduced to analytical methods to select various components of drilling operations, and the demonstration of some design problems.

LEVEL 3.2

Three-month Internship
Internships in marine-related companies allow students to develop a professional approach to engineering work through immersion in real-life situations. Students will have the opportunity to apply knowledge acquired in the classroom, and to demonstrate their problem solving, communication and interpersonal skills in a work environment.

Project
This module requires students to identify and define marine engineering-related problems, generate and evaluate possible solutions, and implement the solution. Depending on the nature of the project, detailed design and fabrication of prototypes may be needed. Students may work on industrial collaboration projects. The complete project cycle provides the experience of conceptualising solutions to open-ended problems, managing the project, and ensuring its successful implementation to meet the set objectives. Through this module, students learn to integrate their knowledge and skills acquired during the diploma course.

Project Management
In this module, students will learn project management techniques, and the use of a commercial software tool to plan, organise and control projects. Topics covered include the responsibilities of a project manager, the time-cost behaviour of projects, work breakdown structure, precedence diagramming, resource planning and earned value method. The module will also teach students how to define a project, perform calculations, customise layout, assign resources with or without costs, and update data using industry standard software.

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 elective clusters 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 Clusters
- Advanced Engineering Mathematics*
- Aerospace Design
- Applied Physics*
- Applied Technology
- Biomedical Engineering
- Industrial Control
- Industrial Electronics
- Information Technology
- Mechanical Technology
- Telecommunication Distribution Technology
- Workplace Safety & Health

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

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 165.

DIPLOMA IN MECHATRONIC ENGINEERING (MTE)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

MARINE, OFFSHORE & MECHANICAL CLUSTER

The **Diploma in Mechatronic Engineering (MTE)** offers students an exciting experience with a technology that integrates electronics, mechanics and software design to produce a new generation of computer-controlled intelligent products and systems, from aircraft fly-by-wire systems and automotive fuel injection, to robot surgeons and robot pets.

The course is conducted jointly by the Mechanical Engineering Division and the Electronic & Computer Engineering Division of the School of Engineering. Ngee Ann is the first local polytechnic to offer such a Diploma.

The course is a well-integrated programme that provides a balance between theory and practice, and builds knowledge and skills systematically through the three years of study. Students are assessed through a good mix of examinations and coursework, including project-based learning.

In the final year, students can opt for a six-month internship, locally or overseas in Australia, China and Germany. Alternatively, students can choose either a discipline-specific option in Aerospace Applications, Automation & Robotics, Sports Engineering, and Micro Electro Mechanical Systems, or a business-related option in Business Management and Marketing & Entrepreneurship.

The course not only gives students the opportunity to apply the knowledge and skills they have acquired, but also to see their creativity take shape in a mechatronic product or process. They also learn about the importance of planning, co-ordination and teamwork.

A salient feature of the course is its flexibility. Students can choose to graduate with additional Diploma Plus and/or Enhancement Certificates depending on abilities and interests. These are optional programmes designed to broaden students' knowledge and deepen their skills in specific areas.

ENTRY REQUIREMENTS

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

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

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

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

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

CAREER PROSPECTS

With the growing need for integrating mechanical, electronics and computer technologies in machines, processes and systems, MTE graduates will enjoy good employment prospects in a wide range of industries such as precision engineering, electronics, chemicals and petrochemicals, biomedical science, infocomm, and aerospace.

New areas of growth in these sectors require highly-skilled manpower. As technologists, graduates will be involved in process development, process automation, engineering and product design, R&D and product development, engineering tests, as well as the maintenance and operation of high-tech equipment and facilities.

ACCREDITATION FOR FURTHER STUDIES

The Diploma in MTE is well recognised by local and overseas universities. In general, you will be able to further your studies in degree programmes in Mechatronic Engineering, Mechanical Engineering, and Electrical or Electronic Engineering, for example at the following schools:

- **Nanyang Technological University**
  Bachelor of Engineering in Mechanical Engineering, Electrical & Electronic Engineering, Aerospace Engineering, Computer Engineering, Computer Science, Information Engineering and Media, Bioengineering or Materials Engineering
- **National University of Singapore**
  Bachelor of Engineering in Mechanical Engineering, Electrical Engineering or Computer Engineering
- **University of Manchester (UK)**
  Bachelor of Engineering in Mechatronic Engineering
- **University of Sheffield (UK)**
  Bachelor of Engineering in Mechatronic Engineering or Systems and Control Engineering
- **University of New South Wales (Australia)**
  Bachelor of Engineering in Mechatronic Engineering
- **University of Sydney (Australia)**
  Bachelor of Engineering in Mechatronic, Mechanical or Biomedical Engineering

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Engineering Mathematics 1	5
Electrical Technology	6
Computer Programming	4
Engineering Mechanics	5
Engineering: A Creative Profession	3
Creativity & Applied Thinking Skills^	2
Sports & Wellness^	2
Level 1.2 (21 hours per week)	
Engineering Materials	4
Engineering Mathematics 2	5
Analogue Electronics	5
Manufacturing Technology	3
Communication Toolkit^	4
YEAR 2	
Level 2.1 (25 hours per week)	
Engineering Mathematics 3	4
Digital Electronics	5
Strength of Materials	4
Engineering Design	4
Mechanical Drawing & Computer-Aided Design	4
Interdisciplinary Studies (IS) module^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (26 hours per week)	
Sensors & Actuators	5
Mechanical Aspects of Mechatronic Systems	5
Applications Programming	4
Industrial Automation	5
Mechatronic Engineering Practice	3
Innovation & Enterprise in Action^	4
YEAR 3	
Level 3.1 (20 – 23 hours per week depending on the Option)	
Micro-controller Programming & Interface	6
Semester 1 modules from an Option	10 - 13
Interdisciplinary Studies (IS) module^	2
World Issues: A Singapore Perspective^	2
Level 3.2 (22 – 25 hours per week depending on the Option)	
Semester 2 modules from an Option	22 - 25
Across-Level Modules (Level 1.2 onwards) (6 hours per week)	
School of Engineering (SoE) elective module*	3
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 165.

IS Modules
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum under the Ngee Ann Learning Model (NLM). The NLM was introduced in 2001 to nurture a new generation of professionals with multidisciplinary skills to meet the challenges of a knowledge-based economy. The NLM incorporates core disciplines and Interdisciplinary Studies. It also nurtures innovative and entrepreneurial traits through the Innovation & Enterprise in Action (I & E in Action) module. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

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/or 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.

Options

Module Name	Credit Units
Internship Option	
Level 3.1 (10 hours per week)	
Mechatronic Systems Design	5
Systems Modelling & Control	5
Level 3.2 (25 hours per week)	
Six-month Internship	25
Aerospace Applications (AA), Sports Engineering (SE), Automation & Robotics (AR), or Micro Electromechanical Systems (MEMS) Option	
Level 3.1 (13 hours per week)	
Option Module	5
Project Design & Development 1 (in the specific option)	8
Level 3.2 (22 hours per week)	
Mechatronic Systems Design	5
Systems Modelling & Control	5
Project Design & Development 2 (in the specific option)	12
Business Management (BM) Option	
Level 3.1 (13 hours per week)	
Project 1	6
Customer Relationship Management	3
Service Operation Management	4
Level 3.2 (22 hours per week)	
Project 2	8
Mechatronic Systems Design	5
Systems Modelling & Control	5
E-commerce	4
Marketing & Entrepreneurship (M&E) Option	
Level 3.1 (13 hours per week)	
Project 1	6
Enterprise Development	3
Business Creation	4
Level 3.2 (22 hours per week)	
Project 2	8
Mechatronic Systems Design	5
Systems Modelling & Control	5
Product Design & Marketing	4

COURSE MODULES

LEVEL 1.1

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

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.

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 programmes for simple engineering applications.

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.

Engineering: A Creative Profession
This continuous assessment module provides students the opening exposure to engineering analysis, design, and problem-solving through case studies and projects. It excites students with a view of what to expect in engineering, facilitate them with a foundation of essential development tools commonly used, and inspires them in a profession driven by the passion to advance society through technology.

LEVEL 1.2

Engineering Materials
This module introduces students to equilibrium phase diagrams, structures, and properties of common engineering materials with emphasis on mechanical testing methods, heat-treatment, international standard specifications, selection and applications of such materials. Topics include classification of materials, mechanical testing, alloying, steels, non-ferrous alloys, plastics, ceramics, composites, corrosion and selection of materials and shaping processes.

Engineering Mathematics 2
This module is a follow-on module of Engineering Mathematics 1. It further develops students' mathematical ability to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

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.

Manufacturing Technology
This module provides students with the fundamental knowledge and hands-on experience in basic manufacturing processes and technologies for engineering components. Machining processes include drilling, milling, turning and grinding operations. Plastic injection moulding, gauging, measurements, welding and general assembly techniques are also covered. Good manufacturing practices and safety measures are emphasized throughout the module.

LEVEL 2.1

Engineering Mathematics 3
This is the third module in the course to equip students with the mathematical tools and techniques to meet the computational requirements of the other engineering modules. Throughout the module, there is appropriate use of a Computer Algebra System. Topics include integration with applications, differential equations, Laplace transform, probability and statistics.

Digital Electronics
Students will learn the fundamental concepts of digital electronics in preparation for the follow-on module, Micro-controller Programming & Interfacing. Major topics include number systems and codes, logic circuit design techniques, flip-flops, counters, shift registers, and integrated circuit logic families.

Strength of Materials
This module aims at providing 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 Design
Students apply engineering principles systematically to the selection and design of mechanical elements and systems. Through short design projects and case studies, students learn the design process, the use of Computer-Aided Design (CAD) tools, code of practice and engineering judgment in design. Topics include the selection and design of common engineering elements and systems such as electric motor, coupling, gears, bearing, shaft, key and chain drives.

Mechanical Drawing & Computer-Aided Design
This is a practice-oriented module designed to provide students with the fundamental principles and practices of using an international graphic language based on International Standard Organisation (ISO). Students will be taught manual sketching techniques and emphasis will be on the use of Pro/Engineer CAD software for creating parts and assemblies and subsequently in producing working drawings for manufacture.

LEVEL 2.2

Sensors & Actuators
The module covers the principles, characteristics, selection and application of sensors and actuators in typical mechatronic systems. Topics include displacement sensors, torque sensors, sonic sensors, photoelectric sensors, signal processing and transmission, load characteristics, operating characteristics of AC and DC motors, stepper motors, matching load requirements, semiconductor power devices and their applications in motion control systems.

Mechanical Aspects of Mechatronic Systems
This is a follow-on module of Level-1 Engineering Mechanics. Students will learn to apply mechanics principles to the analysis of some typical mechanisms of mechatronic systems. Topics include work-energy and impulse-momentum methods, characteristics and analysis of various motion converters, effects of loading conditions, friction and inertia, selection of actuators and power transmission components.

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

Industrial Automation
Students will explore the concepts of logic and sequential control, and their applications in industrial automation. They are introduced to a spectrum of technologies, ranging from pneumatics and electro-pneumatics to programmable controllers with emphasis on component technology leading to circuit design and implementation. Topics include automated mechanisms, ladder diagrams, basic and advanced features of programmable controllers, design techniques and applications.

Mechatronic Engineering Practice

This is a practice-oriented module which aims to provide students with basic training in the design, development, planning, construction, testing and troubleshooting of mechatronic systems. Students learn through actual hands-on assembly of a practical project, such as the obstacles avoidance buggy. Case studies on existing mechatronic products and systems, practical programming, and interfacing of programmable logic controller are also included.

LEVEL 3.1 AND 3.2

COMMON MODULES

Micro-controller Programming & Interface

This module covers the fundamentals, architecture, programming and interfacing of a typical micro-controller used in mechatronic systems. Topics include micro-controller sub-system programming, hardware and software design techniques, serial communication interface, and troubleshooting based on 8051 controller. Learning is reinforced by extensive practical sessions.

Mechatronic Systems Design

The module focuses on the implementation of mechatronic systems involving the integration of sensors, processors, actuators and electromechanical components with software programmes. A computer-based monitoring and control system will be used as an example of application to illustrate the implementation issues involved. Major topics include real-time systems, data acquisition, analog/digital conversion, input/output interfaces, digital control, system integration issues, and the application of software tools such as MATLAB and LabVIEW.

Systems Modelling & Control

The module focuses on modelling the dynamics of mechatronic systems and shaping the dynamic response through closed-loop control. Students will learn the principles of systems modelling, simulation, analysis and control, and the application of these principles in systems analysis and synthesis. Major topics include modelling single-discipline systems and mixed systems, Laplace transform, s-plane, standard forms, time-domain specifications, effects of control actions on system performance, and frequency response analysis.

INTERNSHIP OPTION

The six-month internship provides students with the opportunity to apply the knowledge acquired in the classroom to work situations, and demonstrate problem solving, communication and interpersonal skills in a work environment. The programme enables students to hone their ability to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to help students develop a professional approach to work based on the relevant code of practice.

AEROSPACE APPLICATIONS OPTION

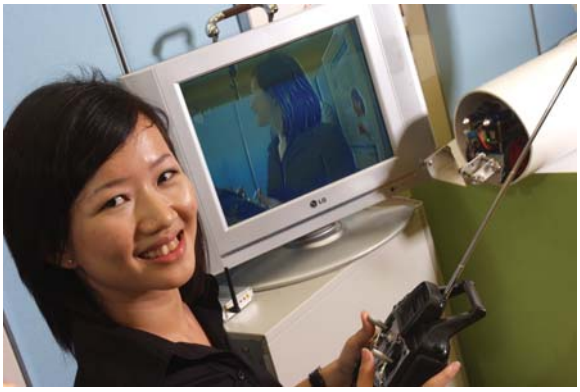
Students take an activity-based module that covers key topics like the principles of flight and avionics, aircraft sensors, instruments, power systems, environmental issues, and the aerospace industry. This prepares them for relevant projects, where they will experience idea generation, design, manufacturing and testing. Students also learn to conceptualise solutions, carry out analyses, prepare drawings, select components, manufacture parts, and integrate them into functional systems. The projects span two semesters.

SPORTS ENGINEERING OPTION

Students take an activity-based module covering the applications of engineering design, materials and mechanics in sports. This prepares them for projects ranging from building prototypes and evaluating sports training equipment to improving performance through design. During the projects, which span two semesters, students will experience idea generation, design, manufacturing and testing. They also learn to conceptualise solutions, carry out analyses, prepare drawings, select components, manufacture parts, and integrate them into functional systems.

AUTOMATION & ROBOTICS OPTION

Students take an activity-based module covering robotic systems and programming, computer interfacing, microcontroller application development, networking of programmable logic controllers, and Web-based device control. This prepares them for automation and robotics projects, where they will experience idea generation, design, manufacturing and testing. Students also learn to conceptualise solutions, carry out analyses, prepare drawings, select components, manufacture parts, and integrate them into functional systems. The projects span two semesters.



MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) OPTION

Students take an activity-based module covering MEMS devices, their applications and fabrication techniques. They use Computer-Aided Design tools for the design, analysis and simulation of MEMS devices to create designs for fabrication by an outside foundry. Working on MEMS projects, students will experience idea generation, design, manufacturing and testing. They learn to conceptualise solutions, carry out analyses, prepare drawings, select components, manufacture parts, and integrate them into functional systems. The projects span two semesters.

BUSINESS MANAGEMENT OPTION

The programme is aimed at helping students with technical backgrounds to develop the relevant skills for managing a business operation. It seeks to equip students pursuing engineering/technology-based diploma courses, with the business operation management skills through the three modules of Customer Relationship Management, Service Operation Management and E-commerce. Students will go through the whole process of managing a business operation from the front end of creating value for customers, to the back end of the service transformation process. This would broaden their mindset from being technologically focused to becoming more entrepreneurial, seeing the importance of value creation and relationship building for customers, and establishing good business management practices.

MARKETING & ENTREPRENEURSHIP OPTION

The programme is aimed at helping students with technical background develop the skills necessary for starting a successful, profitable business. It seeks to imbue in students pursuing engineering/technology-based diploma courses, a mindset for entrepreneurship through the three modules of Business Creation, Product Design & Marketing and Enterprise Development. Students will go through the whole process of business creation, development and establishment. This would broaden their mindset from being technologically focused to becoming more entrepreneurial, seeing product design and development from marketing perspectives, and establishing strong business enterprises through different means.

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 elective clusters 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 Clusters

- Advanced Engineering Mathematics*
- Aerospace Design
- Applied Physics*
- Applied Technology
- Biomedical Engineering
- Industrial Control
- Industrial Electronics
- Information Technology
- Mechanical Technology
- Telecommunication Distribution Technology
- Workplace Safety & Health

Non-Engineering Clusters

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

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 165.