

# DIPLOMA IN AEROSPACE TECHNOLOGY (AT)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING



The **Diploma in Aerospace Technology (AT)** is designed to meet the growing demand for skilled professionals who can effectively support the manufacturing design, process development and maintenance functions of Singapore's aerospace industry. This industry is undergoing a major transformation as companies move up the value chain to design, development and other knowledge-intensive activities.

AT's integrated curriculum is grounded in engineering basics and supported by aerospace modules on aircraft structures, systems, propulsion, mechanics of flight, avionics, airworthiness, aerospace materials and processes.

Students develop the competencies and skill sets needed to provide engineering support in design and process development as well as technical services for aerospace manufacturing and maintenance activities.

AT students are assessed through a mix of examinations and coursework, including project-based learning. Final-year students must participate in a six-month Industrial Attachment Programme with leading aerospace companies, which is an important element of the total learning experience.

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 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

As Asia's Aerospace Hub, Singapore undertakes a wide spectrum of value-added activities relating to MRO and manufacturing design. These activities range from airframe maintenance and modification, engine overhaul to components design manufacturing and process development.

The development of the Seletar Airport will enhance Singapore's position as a global player in the industry. 2006 was a record-breaking year for the local aerospace industry with 17,700 jobs created and an annual output of S\$6.3 billion, a 20 percent increase over 2005. The rapid expansion of aviation activities by existing and new companies in capacities and work scope will certainly provide challenging job opportunities for AT graduates.

Graduates will also enjoy good employment prospects as Aerospace Technologists who provide technical support for aircraft maintenance, manufacturing design, process development and aerospace services for leading aerospace companies.

## ACCREDITATION FOR FURTHER STUDIES

The Diploma in Aerospace Technology is recognised by the Civil Aviation Authority of Singapore, with up to 11 basic papers of the Aircraft Maintenance Examination being granted credit exemption under Section 7 of the Singapore Airworthiness Requirement. With the introduction of SAR-66 for aircraft maintenance licensing, the curriculum is currently re-aligned to the syllabi of the new SAR 66 maintenance licensing examinations.

AT graduates with good academic results will be able to further their studies in local and established overseas universities offering aerospace degree programmes. Students will be given one to two years' exemption, depending on the total duration of the courses taken.

## COURSE STRUCTURE

### FIRST-YEAR MODULES

#### Level 1.1

- Engineering Mathematics 1
- Engineering Mechanics
- Electrical Technology & Electronics
- Fundamentals of Aerospace Technology
- Computer Programming
- Creativity & Applied Thinking Skills<sup>^</sup>
- Sports & Wellness<sup>^</sup>

#### Level 1.2

- Engineering Mathematics 2
- Thermofluid 1
- Aerospace Manufacturing & Maintenance Practices
- Aerospace Materials & Processes 1
- Engineering Drawing & CAD
- Individual & the Community<sup>^</sup>
- Communication Toolkit<sup>^</sup>

### SECOND-YEAR MODULES

#### Level 2.1

- Applied Mechanics
- Engineering Design
- Strength of Materials
- Aircraft Structures & Systems 1
- Airworthiness Legislation
- Any 2 Interdisciplinary Studies (IS) modules<sup>^</sup>

#### Level 2.2

- Engineering Mathematics 3
- Thermofluid 2
- Mechanics of Flight
- Aerospace Materials & Processes 2
- Avionics Systems
- Innovation & Enterprise in Action<sup>^</sup>

### FINAL-YEAR MODULES

#### Level 3.1

- System Dynamics & Control
- Aircraft Structures & Systems 2
- Aircraft Propulsion Systems
- World Issues: A Singapore Perspective<sup>^</sup>
- Any 1 Interdisciplinary Studies (IS) module<sup>^</sup>

#### Level 3.2

- Industrial Attachment Programme
- Quality System & Manufacturing Management
- Human Factors

### ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules<sup>°</sup>

<sup>^</sup> Denotes Interdisciplinary Studies module. For more details on IS modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

<sup>°</sup> 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

#### Engineering Mathematics 1

This module is designed to equip students with the basic mathematical skills to solve engineering problems. The topics are introduced in an order that is intended to keep abreast of the application requirements in other engineering modules. Topics covered include algebra, trigonometry, logarithms, matrices and complex numbers.

#### 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.

#### Electrical Technology & Electronics

This module equips students with fundamental electrical and electronics principles, and the necessary practical skills in handling basic test equipment, electrical circuits as well as electronic devices and circuits. Major topics include basic circuit elements, direct current circuits, Ohm's law, Kirchhoff's laws, transistors as well as common analogue and digital integrated circuits. This module provides the background knowledge for students to progress to the Avionics Systems module.

#### Fundamentals of Aerospace Technology

This activity-based module introduces students to the principles of flight, and traces the historical development of aerospace technology; its impact on society; and 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.

### **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**

#### **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.

#### **Thermofluid 1**

Students will learn the basic laws governing the behaviour of fluids under the influence of energy transfer. Topics include systems concept, temperature and pressure, fluid statics, fluid in motion, continuity equation, laminar and turbulent flows, ideal incompressible flow, Bernoulli's equation, flow measurement and Pitot tube, external flow and thermofluid applications in aircraft components and systems.

#### **Aerospace Manufacturing & Maintenance Practices**

This module aims to equip students with the basic knowledge and practical skills in aerospace manufacturing processes and maintenance practices. The topics include turning, milling, grinding, CNC machining, non-conventional machining, jigs and fixtures, finishing operations, measurements, sheet metal forming, welding, non-destructive test, wire locking, fasteners, assembly, and aircraft weight and balancing. Students learn through practical projects, reinforcing the theory covered in lectures with hands-on practice. Safety and a positive work attitude are emphasised in both theory and practical sessions.

#### **Aerospace Materials & Processes 1**

The module covers the family of common engineering materials comprising metals, ceramics, polymers and composites; with emphasis on the structures, properties, performance and processing of such materials. Learning is enhanced by laboratory work on microstructures and mechanical testing.

#### **Engineering Drawing & CAD**

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.

### **LEVEL 2.1**

#### **Applied Mechanics**

This module pertains to the study of external forces 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.

#### **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, and the 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.

#### **Strength of Materials**

This module aims at providing students with the foundational knowledge of the 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.

#### **Aircraft Structures & Systems 1**

The module covers the characteristics and design features of aircraft structures, general construction of the fuselage and main control surfaces, basic analysis of the stress and strain due to forces within the operating flight envelope, and the structural requirements imposed by the various aircraft systems. The module also covers other aircraft systems, such as the hydraulic system and landing gear, fuel and flight controls systems as well as fuselage construction and failure concepts.

#### **Airworthiness Legislation**

Students are introduced to the main aviation regulations and airworthiness requirements governing the aerospace industry, approval and certification of aircraft products, governing bodies and agencies responsible for safety standards and aviation regulations, as well as the international treaties and bilateral agreements signed by Singapore and their impact on the development of the local industry. Due emphasis is given to the Civil Aviation Authority of Singapore and the Singapore Airworthiness Requirements.

### **LEVEL 2.2**

#### **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.

## Thermofluid 2

This follow-on module of Thermofluid 1 covers the application of thermodynamics principles in flow and non-flow processes as well as power cycles. Topics include perfect gases and perfect gas laws, the first and second laws, flow and non-flow processes, steady flow energy equation, gas cycles, combustion, rotary expanders and compressors, one-dimensional compressible flow, and dimensionless groups.

## Mechanics of Flight

The module covers the fundamentals of aerodynamics and the principles of aircraft maintenance. Topics include forces acting on an aircraft, aircraft thrust analysis of airflow at different flow regimes, performance characteristics and factors affecting flight, take-off and landing, manoeuvres, stability, and control. Practical sessions include model construction projects, software simulation and wind tunnel experiments.

## Aerospace Materials & Processes 2

This module focuses on the design and selection of aerospace materials and processes including aluminium, magnesium, titanium and nickel-based systems, super alloys, ceramics and composites. Topics include materials specifications, design guidelines, choice of materials and processes, fatigue and creep, corrosion and corrosion control, materials forming, selective surface hardening and surface modification techniques, surface integrity, and non-destructive techniques.

## Avionics Systems

This module covers the various avionics instruments and systems used in modern aircraft, the requirement for zero-visibility flying, the functions and operation of various cockpit instruments, flight environmental systems, and sensing devices and electrical power systems used in aircraft. Due emphasis is given to electronics for navigation, communications, surveillance and control.

## LEVEL 3.1

### System Dynamics & Control

The module focuses on modelling the dynamic behaviour of systems, including vibration in aircraft systems, and shaping the dynamic response through closed-loop control, with case studies on flight control surfaces and landing gear systems. Major topics include modelling single-discipline systems and mixed systems, Laplace transform, s-plane, time-domain specifications, effects of control actions on system performance, frequency response analysis, and introduction to state-space.

### Aircraft Structures & Systems 2

The module covers aircraft hydraulic components and their working principles, hydraulic circuits, operating characteristics, hydraulic drives and application circuits, control of landing gears and flight control surfaces, Environmental control systems encompassing air-conditioning, cabin pressurisation, the oxygen system and various auxiliary systems such as the fire and ice protection system; and the rain removal, water and waste system are also covered.

## Aircraft Propulsion Systems

This module equips students with the basic principles of aircraft propulsion systems and a general understanding of the design features of some of the components and subsystems. Topics include gas turbine cycles, various jet and rocket propulsion systems, design features of inlets, compressors, combustion chambers, turbines and other elements of propulsion systems.

## LEVEL 3.2

### Industrial Attachment Programme

A six-month attachment to aerospace companies gives students the opportunity to apply the knowledge acquired in the classroom to work situations and to associate work experience with classroom learning. Students learn to demonstrate their skills in problem solving and communication in a work environment. They will work independently and in a team, and have practitioners in the aerospace industry as mentors to enhance their learning process.

### Quality System & Manufacturing Management

Students learn to apply quality management techniques and principles. Topics include total quality management concepts and philosophy, quality systems and audits, benchmarking and quality costs, quality tools and techniques, statistical quality control techniques, sampling plans and inspection techniques, design of experiments to optimise and improve products and processes, and lean manufacturing in the aerospace industry.

### Human Factors

This module introduces students to human factors and how they affect performance at work. Topics include social psychology, physical environment, type of tasks, communication, and human errors, with special reference to the aerospace industry.

## 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 Design Cluster
- Applied Physics Cluster\*
- Applied Technology Cluster
- Biomedical Engineering Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Telecommunication Distribution Technology Cluster
- Workplace Safety & Health 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
<b>LEVEL 1</b>		
<b>Level 1.1(26 hours per week)</b>		
1.	Engineering Mathematics 1	5
2.	Engineering Mechanics	5
3.	Electrical Technology & Electronics	5
4.	Fundamentals of Aerospace Technology	3
5.	Computer Programming	4
6.	Creativity & Applied Thinking Skills <sup>^</sup>	2
7.	Sports & Wellness <sup>^</sup>	2
<b>Level 1.2 (27 hours per week)</b>		
8.	Engineering Mathematics 2	5
9.	Thermofluid 1	4
10.	Aerospace Manufacturing & Maintenance Practices	5
11.	Aerospace Materials & Processes 1	4
12.	Engineering Drawing & CAD	5
13.	Individual & the Community <sup>^</sup>	2
14.	Communication Toolkit <sup>^</sup>	2
<b>LEVEL 2</b>		
<b>Level 2.1(24 hours per week)</b>		
15.	Applied Mechanics	5
16.	Engineering Design	4
17.	Airworthiness Legislation	2
18.	Strength of Materials	4
19.	Aircraft Structures & Systems 1	5
20.	Interdisciplinary Studies module <sup>^</sup>	2
21.	Interdisciplinary Studies module	2
<b>Level 2.2 (24 hours per week)</b>		
22.	Engineering Mathematics 3	4
23.	Thermofluid 2	5
24.	Mechanics of Flight	4
25.	Aerospace Materials & Processes 2	4
26.	Avionics Systems	3
27.	Innovation & Enterprise in Action <sup>^</sup>	4

Module No.	Module Name	Credit Units
<b>LEVEL 3</b>		
<b>Level 3.1(19 hours per week)</b>		
28.	System Dynamics & Control	5
29.	Aircraft Propulsion Systems	5
30.	Aircraft Structures & Systems 2	5
31.	World Issues: A Singapore Perspective <sup>^</sup>	2
32.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (24 hours per week)</b>		
33.	Industrial Attachment Programme (6 months)	20
34.	Quality System & Manufacturing Management	2
35.	Human Factors	2
<b>Across-Level Modules (Level 1.2 onwards) (6 hours per week)</b>		
36.	School of Engineering (SoE) elective module <sup>°</sup>	3
37.	School of Engineering (SoE) elective module <sup>°</sup>	3

<sup>^</sup> Denotes Interdisciplinary Studies (IS) module. For more details on IS modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

**IS Modules**

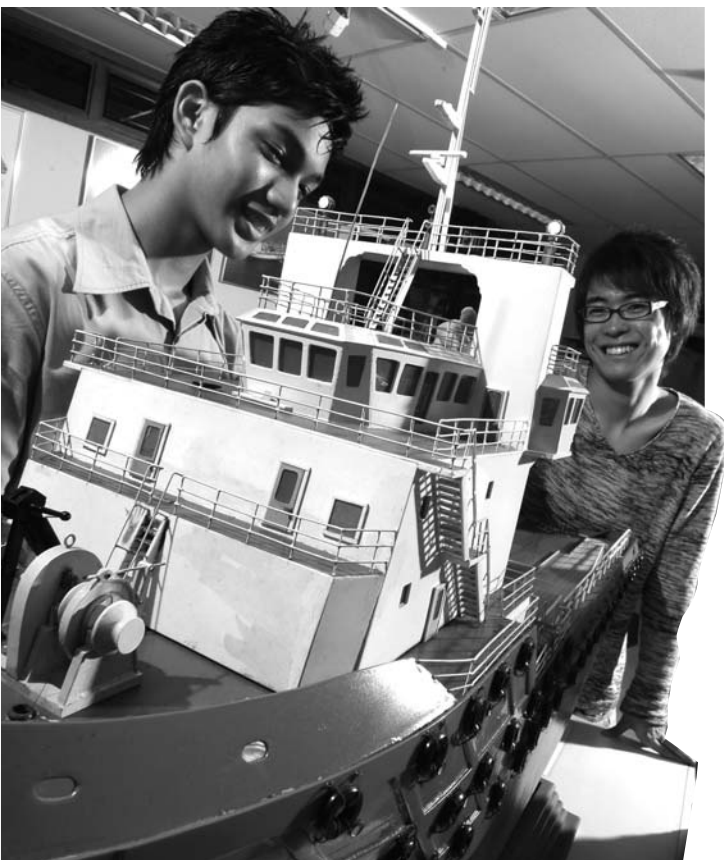
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge-based economy. IS modules challenge boundaries and 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 MARINE & OFFSHORE TECHNOLOGY (MOT) (3-YEAR COURSE)

SCHOOL OF ENGINEERING



As the world's busiest port, a leading ship conversion centre, the largest base of oil and gas equipment manufacturing companies in Asia, and home to 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 the highest level of qualification in naval architecture and offshore technology in Singapore, one of the top three specialist qualifications in high demand here.

The 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 specialise in ship design or offshore oil and gas technology.

A close relationship with the industry, especially 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 go on industrial attachments.

There are also 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.

Also unique to MOT is the number of scholarships available to students; for example, the MOT-ASMI scholarship offers \$10,000 annually over three years.

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 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 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 can gain admission to degree courses in Naval Architecture, Offshore Engineering, Marine Engineering, Mechanical Engineering and Civil Engineering in local and established overseas universities. They will be given one to two years of exemption, depending on the total duration of the courses chosen.

Graduates can obtain a bachelor's degree on NP's campus grounds through a tie-up with a Foreign Specialised Institution, in the areas of naval architecture and marine engineering from a reputable overseas university.

## 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 with tuition and all other compulsory fees included. In addition, a monthly allowance of \$600 and a notebook computer allowance of \$1,500 are awarded to the recipients. Successful applicants will work with their sponsor companies for three years. The total value of this scholarship is \$30,000.

### ASMI Scholarships

A total of 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 – one year for \$5,000, two years for \$10,000 and three years for \$15,000.

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 Pan United Marine.

### 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 STRUCTURE

### FIRST-YEAR MODULES

#### Level 1.1

- Engineering Mechanics
- Electrical Technology
- Computer Programming
- Engineering Mathematics 1
- Creativity & Applied Thinking Skills<sup>^</sup>
- Sports & Wellness<sup>^</sup>

#### Level 1.2

- Engineering Materials
- Engineering Mathematics 2
- Engineering Drawing & Computer Aided Design
- Naval Architecture 1
- Manufacturing Technology & Practice
- Individual & the Community<sup>^</sup>
- Communication Toolkit<sup>^</sup>

### SECOND-YEAR MODULES

#### Level 2.1

- Computer-Aided Design & Manufacturing 1
- Engineering Mathematics 3
- Marine Engineering 1
- Marine Industry Safety
- Thermodynamics
- Industrial Attachment
- Any 2 Interdisciplinary Studies (IS) modules<sup>^</sup>

#### Level 2.2

- Marine Practices
- Naval Architecture 2
- Project Management
- Ship Drawing
- Strength of Materials
- Industrial Attachment
- Innovation & Enterprise in Action<sup>^</sup>

### FINAL-YEAR MODULES

#### Level 3.1

- Computer-Aided Design & Manufacturing 2
- Marine Engineering 2
- Ship Production Technology
- Project 1
- World Issues: A Singapore Perspective<sup>^</sup>
- Any 1 Interdisciplinary Studies (IS) module<sup>^</sup>

#### Level 3.2

- Five modules from one Option (Design or Oil & Gas)

### ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules<sup>°</sup>

<sup>^</sup> Denotes Interdisciplinary Studies module. For more details on IS modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

<sup>°</sup> 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 MODULES UNDER THE OPTIONS

### Design Option

- Offshore Engineering
- Theory and Practice of Ship Design
- Naval Architecture 3
- Floating Production Technology
- Project 2

### Oil & Gas Option

- Offshore Oil & Gas Process Technology
- Offshore Systems
- Drilling Technology
- Floating Production Technology
- Project 2

## COURSE MODULES

### LEVEL 1.1

#### 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.

### **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.

### **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 Mathematics 1**

This module is designed to equip students with the basic mathematical skills to solve engineering problems. The topics are introduced in an order that is intended to keep abreast of the application requirements in other engineering modules. Topics covered 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, and selection and applications of such materials. Topics include classification of materials, mechanical testing, alloys, steels, non-ferrous alloys, plastics, ceramics, composites, corrosion and selection of materials and shaping processes. Classroom knowledge is reinforced and enhanced by interactive tutorial exercises, e-learning, practical sessions and industry visits.

### **Engineering Mathematics 2**

This module is a follow-on module to 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 moments of area of waterplane, and metacentric height.

### **Manufacturing Technology & Practice**

Students will acquire the basic knowledge and skills in 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 & Manufacturing 1**

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, the pumping system, heat transfer and heat exchangers, prime movers, the fuel system, the 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.

### **Industrial Attachment**

The industrial attachment to marine-related companies allows 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.

#### **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 to Naval Architecture 1. Topics covered include intact stability, subdivision, damage stability, launching, tonnage measurement and load line.

### **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.

### **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.

### **Strength of Materials**

This module aims at providing students with a foundational knowledge of the strength of materials with an 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.

### **Industrial Attachment**

The industrial attachment to marine-related companies allows 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.

## **LEVEL 3.1**

### **Computer-Aided Design & Manufacturing 2**

This is a follow-on module of Computer-Aided Design & Manufacturing 1. 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.

### **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.

### **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.

## **Project 1**

Project 1 requires students to understand the engineering problem before them, and to generate and evaluate possible solutions before coming up with a final approach to implement the solution, or a detailed design, including the methods of fabrication and materials used. Students may choose their own projects or carry out industrial projects.

## **LEVEL 3.2**

### **DESIGN OPTION MODULES**

#### **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 and 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 MODULES**

#### **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 develops 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.

## MODULES COMMON TO BOTH OPTIONS

### Floating Production Technology

The module covers the various aspects of offshore oil production, including marine drilling, types of drilling rigs, floating production systems, mooring arrangements, storage systems, subsea production systems, flow lines and risers, and remote operated vehicles. Students will also be introduced to the technical considerations of floating production, storage, and offloading (FPSO) conversions.

### Project 2

In Project 2, students implement the solution or the design proposed in Project 1, in the form of either a detailed investigative report with the relevant data, evidence and conclusions, or the fabrication, assembly and testing of the design. The complete project cycle, which spans two semesters, provides the experience of conceptualising solutions to open-ended problems, managing the project, and ensuring its successful implementation to meet the set objectives.

### 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 Design Cluster
- Applied Physics Cluster\*
- Applied Technology Cluster
- Biomedical Engineering Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Telecommunication Distribution Technology Cluster
- Workplace Safety & Health 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
<b>YEAR 1</b>		
<b>Level 1.1 (24 hours per week)</b>		
1.	Engineering Mechanics	5
2.	Electrical Technology	6
3.	Computer Programming	4
4.	Engineering Mathematics 1	5
5.	Sport & Wellness ^	2
6.	Creativity & Applied Thinking Skills ^	2
<b>Level 1.2 (27 hours per week)</b>		
7.	Engineering Materials	4
8.	Engineering Mathematics 2	5
9.	Engineering Drawing & Computer Aided Design	5
10.	Naval Architecture 1	5
11.	Manufacturing Technology & Practice	4
12.	Individual & the Community ^	2
13.	Communications Toolkit ^	2
<b>YEAR 2</b>		
<b>Level 2.1 (26 hours per week)</b>		
14.	Computer Aided Design & Manufacturing 1	2
15.	Engineering Mathematics 3	4
16.	Marine Engineering 1	5
17.	Marine Industry Safety	2
18.	Thermodynamics	5
19.	Industrial Attachment	4
20.	Interdisciplinary Studies (IS) module ^	2
21.	Interdisciplinary Studies (IS) module ^	2
<b>Level 2.2 (26 hours per week)</b>		
22.	Marine Practices	3
23.	Naval Architecture 2	5
24.	Project Management	4
25.	Ship Drawing	2
26.	Strength of Materials	4
27.	Industrial Attachment	4
28.	Innovation & Enterprise In Action^	4
<b>YEAR 3</b>		
<b>Level 3.1 (20 hours per week)</b>		
29.	Computer Aided Design & Manufacturing 2	4
30.	Marine Engineering 2	5
31.	Ship Production Technology	4
32.	Project 1	3
33.	World Issues: A Singapore Perspective^	2
34.	Interdisciplinary Studies (IS) module ^	2

**DIPLOMA IN MARINE & OFFSHORE TECHNOLOGY (MOT) (3-YEAR COURSE)**  
SCHOOL OF ENGINEERING

**COURSE CURRICULUM**

Module No.	Module Name	Credit Units
<b>YEAR 3</b>		
<b>Level 3.2 (21 hours per week)</b>		
35.	Modules from one option (Design or Oil & Gas)	
<b>Across-Level Modules (Level 1.2 onwards) (6 hours per week)</b>		
36.	School of Engineering (SoE) elective module <sup>°</sup>	3
37.	School of Engineering (SoE) elective module <sup>°</sup>	3

**Notes:**

<sup>^</sup> For more details on Interdisciplinary Studies (IS) modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

**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**

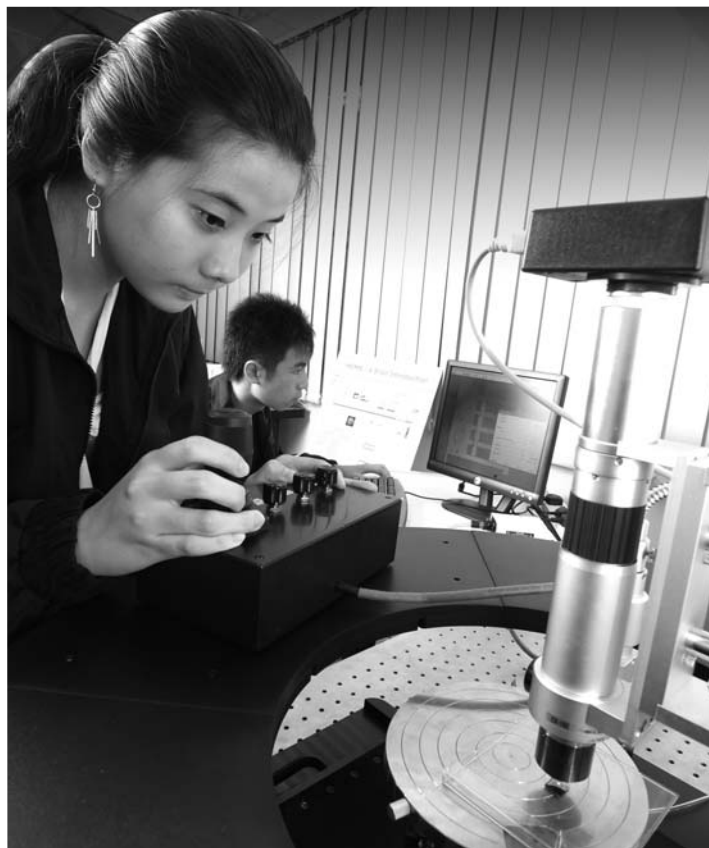
The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and deepen their discipline-specific areas. Each cluster comprises a minimum of three 3-hour modules. Students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

**MODULES UNDER AN OPTION**

Module No.	Module Name	Credit Units
<b>Design Option</b>		
<b>Level 3.2 (21 hours per week)</b>		
1.	Offshore Engineering	4
2.	Theory & Practice of Ship Design	6
3.	Naval Architecture 3	5
4.	Floating Production Technology	3
5.	Project 2	3
<b>Oil &amp; Gas Option</b>		
<b>Level 3.2 (21 hours per week)</b>		
6.	Offshore Oil & Gas Process Technology	5
7.	Offshore Systems	5
8.	Drilling Technology	5
9.	Floating Production Technology	3
10.	Project 2	3

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

SCHOOL OF ENGINEERING



The **Diploma in Mechanical Engineering (ME)** offers a broad-based training programme with exciting specialisation options to give students a firm foundation that allows them to work at the forefront of changing technologies.

ME's strong emphasis on design gives students a competitive edge in the provision of engineering services. These services include the design of products to meet the many needs of humankind, the generation and use of energy, the creation of new materials, and the process design and manufacturing of products, from home appliances to biomedical devices.

First-year modules focus on the engineering basics, and mathematical and computing tools, giving students a firm grounding to solve engineering problems. As they progress to higher levels in the course, students 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 Industrial Attachment Programme, locally or overseas in Australia, China and Germany. Alternatively, students can choose either a discipline-specific option in Biomedical Applications, Design Innovation, Photonics & Laser Technology and Cleanroom & Energy Systems, 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 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 should not apply for the course.

## CAREER PROSPECTS

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. Career opportunities are also available in the chemical processing, pharmaceutical, and life sciences industries.

## ACCREDITATION FOR FURTHER STUDIES

ME graduates with good academic results may further their studies at the National University of Singapore and Nanyang Technological University.

Many overseas universities in the United Kingdom, Europe, the United States and Australia admit our graduates into their degree courses with one- or two-year exemptions, depending on the total duration of the courses taken.

## COURSE STRUCTURE

### FIRST-YEAR MODULES

Level 1.1	Level 1.2
<ul style="list-style-type: none"> <li>Engineering Mathematics 1</li> <li>Electrical Technology</li> <li>Computer Programming</li> <li>Engineering Mechanics</li> <li>Engineering: A Creative Profession</li> <li>Creativity &amp; Applied Thinking Skills<sup>^</sup></li> <li>Sports &amp; Wellness<sup>^</sup></li> </ul>	<ul style="list-style-type: none"> <li>Engineering Drawing &amp; Computer-Aided Design</li> <li>Engineering Mathematics 2</li> <li>Engineering Materials</li> <li>Manufacturing Technology &amp; Practice</li> <li>Individual &amp; the Community<sup>^</sup></li> <li>Communication Toolkit<sup>^</sup></li> </ul>

### SECOND-YEAR MODULES

Level 2.1	Level 2.2
<ul style="list-style-type: none"> <li>Engineering Mathematics 3</li> <li>Industrial Automation</li> <li>Thermodynamics</li> <li>Applied Mechanics</li> <li>Any 2 Interdisciplinary Studies (IS) modules<sup>^</sup></li> </ul>	<ul style="list-style-type: none"> <li>Computer-Aided Design</li> <li>Computer-Aided Manufacturing</li> <li>Fluid Mechanics</li> <li>Strength of Materials</li> <li>Engineering Design</li> <li>Innovation &amp; Enterprise in Action<sup>^</sup></li> </ul>

### FINAL-YEAR MODULES

Core Modules	Options
<ul style="list-style-type: none"> <li>Engineering System Design</li> <li>Instrumentation &amp; Control</li> <li>Mechanics of Machines &amp; Materials</li> <li>Applied Thermodynamics</li> <li>World Issues: A Singapore Perspective<sup>^</sup></li> <li>Any 1 Interdisciplinary Studies (IS) module<sup>^</sup></li> </ul>	<ul style="list-style-type: none"> <li>Six-month Industrial Attachment Programme (IAP)</li> <li>Biomedical Applications</li> <li>Design Innovation</li> <li>Photonics &amp; Laser Technology</li> <li>Cleanroom &amp; Energy Systems</li> <li>Business Management</li> <li>Marketing &amp; Entrepreneurship</li> </ul>

### ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules<sup>°</sup>

<sup>^</sup> Denotes Interdisciplinary Studies (IS) module. For more details on IS modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

## COURSE MODULES

### LEVEL 1.1

#### Engineering Mathematics 1

This module is designed to equip students with the basic mathematical skills to solve engineering problems. The topics are introduced in an order that is intended to keep abreast of the application requirements in other engineering modules. Topics covered include algebra, trigonometry, logarithms, matrices and complex numbers.

#### 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.

#### 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 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: 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 methods 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 in the essential tools needed to succeed in this dynamic profession.

### **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, and the selection and applications of such materials. Topics include classification of materials, mechanical testing, alloys, steels, non-ferrous alloys, plastics, ceramics, composites, corrosion and selection of materials and shaping processes. Classroom knowledge is reinforced and enhanced by interactive tutorial exercises, e-learning, practical sessions and industry visits.

#### **Manufacturing Technology & Practice**

Students will acquire the basic knowledge and skills in 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 Engineering Drawing & CAD, students reinforce their drafting concepts and techniques by applying an industry-standard Computer-Aided Design (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.

### **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 at providing students with a foundational knowledge of the 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, and the 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)**

### **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 such as 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.

### **Applied Thermodynamics**

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.

## **LEVEL 3 (OPTIONS)**

### **Six-month Industrial Attachment Programme (IAP)**

The six-month IAP 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.

### **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.

### **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, and 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.

### **Photonics & Laser Technology**

Students take an activity-based module covering optical systems and laser technology, laser-based industrial applications, interferometry and material processing. The module prepares students to undertake photonics projects, which take them through the complete cycle of idea generation, design, manufacturing, testing and presentation. The projects span two semesters.

### **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 the 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.

### **Business Management**

The programme is aimed at helping students with technical background 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 three modules, namely, Customer Relationship Management, Service Operation Management and E-commerce. Students will go through whole process of managing a business operation from creating value for customers at the front end, to the back end of service transformation process. Students' mindset are broaden from being technologically focused to more entrepreneurial, seeing the importance of value creation and relationship building with customers, and establishing good business management practices.

**Marketing & Entrepreneurship**

The module 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 three modules, namely, Business Creation, Product Design & Marketing, and Enterprise Development. Students will go through the whole process of business creation, development and establishment. Students become more entrepreneurial, seeing product design and development from marketing perspectives, and see the benefit of 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 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 Design Cluster
- Applied Physics Cluster\*
- Applied Technology Cluster
- Biomedical Engineering Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Telecommunication Distribution Technology Cluster
- Workplace Safety & Health 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
<b>YEAR 1</b>		
<b>Level 1.1 (27 hours per week)</b>		
1.	Engineering Mathematics 1	5
2.	Electrical Technology	6
3.	Computer Programming	4
4.	Engineering Mechanics	5
5.	Engineering: A Creative Profession	3
6.	Creativity & Applied Thinking Skills <sup>^</sup>	2
7.	Sports & Wellness <sup>^</sup>	2
<b>Level 1.2 (22 hours per week)</b>		
8.	Engineering Drawing & Computer Aided Design	5
9.	Engineering Mathematics 2	5
10.	Engineering Materials	4
11.	Manufacturing Technology & Practice	4
12.	Individual & the Community <sup>^</sup>	2
13.	Communication Toolkit <sup>^</sup>	2
<b>YEAR 2</b>		
<b>Level 2.1 (23 hours per week)</b>		
14.	Engineering Mathematics 3	4
15.	Industrial Automation	5
16.	Thermodynamics	5
17.	Applied Mechanics	5
18.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
19.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 2.2 (23 hours per week)</b>		
20.	Computer-Aided Design	3
21.	Computer-Aided Manufacturing	4
22.	Fluid Mechanics	4
23.	Strength of Materials	4
24.	Engineering Design	4
25.	Innovation & Enterprise in Action <sup>^</sup>	4
<b>YEAR 3</b>		
<b>Level 3.1 – Industrial Attachment Programme Option (24 hours per week)</b>		
26.	Instrumentation & Control	5
27.	Applied Thermodynamics	5
28.	Mechanics of Machines & Materials	5
29.	Engineering System Design	5
30.	World Issues: A Singapore Perspective <sup>^</sup>	2
31.	Interdisciplinary Studies (IS) module <sup>^</sup>	2

Module No.	Module Name	Credit Units
<b>YEAR 3</b>		
<b>Level 3.2 (25 hours per week)</b>		
32.	Six-month Industrial Attachment Programme	25
<b>YEAR 3</b>		
<b>Level 3.1 – Discipline-specific Options (in Biomedical Applications, Design Innovation, Photonics &amp; Laser Technology, Cleanroom &amp; Energy Systems) (27 hours per week)</b>		
33.	Instrumentation & Control	5
34.	Mechanics of Machines & Materials	5
35.	Option Module	5
36.	Project Design and Development 1 (in a specific option)	8
37.	World Issues: A Singapore Perspective <sup>^</sup>	2
38.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (22 hours per week)</b>		
39.	Applied Thermodynamics	5
40.	Engineering System Design	5
41.	Project Design and Development 2 (in specific option)	12
<b>YEAR 3</b>		
<b>Level 3.1 – Business Related Options (in Business Management [BM], Marketing &amp; Entrepreneurship [M&amp;E]) (27 hours per week)</b>		
42.	Instrumentation & Control	5
43.	Mechanics of Machines & Materials	5
44.	(For BM Option) – Customer Relationship Management (For M&E Option) – Enterprise Development	3
45.	(For BM Option) – Service Operation Management (For M&E Option) – Business Creation	4
46.	Project 1	6
47.	World Issues: A Singapore Perspective <sup>^</sup>	2
48.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (22 hours per week)</b>		
49.	Applied Thermodynamics	5
50.	Engineering System Design	5
51.	(For BM Option) – E-Commerce (For M&E Option) – Product Design & Marketing	4
52.	Project 2	8

Module No.	Module Name	Credit Units
<b>YEAR 3</b>		
<b>Across Level Modules (Level 1.2 onwards) (6 hours per week)</b>		
53.	School of Engineering (SoE) elective module <sup>°</sup>	3
54.	School of Engineering (SoE) elective module <sup>°</sup>	3

**Notes:**

<sup>^</sup> For more details on Interdisciplinary Studies (IS) modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

**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 MECHATRONIC ENGINEERING (MTE) (3-YEAR COURSE)

SCHOOL OF ENGINEERING



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. Ngee Ann is the first local polytechnic to offer such a diploma.

MTE is a well-integrated programme that provides balance between theory and practice, and a systematic building of knowledge and skills. Students are assessed through a good mix of examinations and coursework, including project-based learning. They are also given the opportunity to apply the knowledge and skills acquired, see the fruits of their creativity taking shape in a mechatronic product or process, and experience the importance of planning, co-ordination and teamwork.

In the final year, students can opt for a six-month industrial attachment programme, locally or overseas in Australia, China, Germany and Finland. Alternatively, students can choose either a discipline-specific option in Aerospace Applications, Sports Engineering, Automation & Robotics and Micro Electromechanical Systems, 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 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 should not apply for the 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 enjoy good employment prospects in a wide range of industries from precision engineering, electronics, chemicals and petrochemicals to the biomedical sciences, infocomm and aerospace sectors.

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, maintenance and operation of high-tech equipment and facilities.

## ACCREDITATION FOR FURTHER STUDIES

MTE graduates with good academic results can further their studies in local and overseas universities offering mechanical, mechatronic, electrical/electronic or bioengineering degrees.

Graduates may be given one or two years' exemption, depending on the total duration of the degree taken.

## COURSE STRUCTURE

### FIRST-YEAR MODULES

#### Level 1.1

- Engineering Mathematics 1
- Electrical Technology
- Computer Programming
- Engineering Mechanics
- Engineering: A Creative Profession
- Creativity & Applied Thinking Skills<sup>^</sup>
- Sports & Wellness<sup>^</sup>

#### Level 1.2

- Engineering Materials
- Engineering Mathematics 2
- Analogue Electronics
- Manufacturing Technology
- Individual & the Community<sup>^</sup>
- Communication Toolkit<sup>^</sup>

### SECOND-YEAR MODULES

#### Level 2.1

- Engineering Mathematics 3
- Digital Electronics
- Strength of Materials
- Engineering Design
- Mechanical Drawing & CAD
- Any two Interdisciplinary Studies (IS) modules<sup>^</sup>

#### Level 2.2

- Sensors & Actuators
- Mechanical Aspects of Mechatronic Systems
- Applications Programming
- Industrial Automation
- Mechatronic Engineering Practice
- Innovation & Enterprise in Action<sup>^</sup>

### FINAL-YEAR MODULES

- Microcontroller Programming & Interface
- Mechatronic Systems Design
- Systems Modelling & Control
- World Issues: A Singapore Perspective<sup>^</sup>
- Any 1 Interdisciplinary Studies (IS) module<sup>^</sup>

#### Optional Modules

- Six-month Industrial Attachment Programme (IAP)
- Aerospace Applications
- Sports Engineering
- Automation & Robotics
- Micro Electromechanical Systems (MEMS)
- Business Management
- Marketing & Entrepreneurship

### ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules<sup>°</sup>

<sup>^</sup> Denotes Interdisciplinary Studies (IS) module. For more details on IS modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

## COURSE MODULES

### LEVEL 1.1

#### Engineering Mathematics 1

This module is designed to equip students with the basic mathematical skills to solve engineering problems. The topics are introduced in an order that is intended to keep abreast of the application requirements in other engineering modules. Topics covered include algebra, trigonometry, logarithms, matrices and complex numbers.

#### 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.

#### 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 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: 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

#### 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, and 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. Classroom knowledge is reinforced and enhanced by interactive tutorial exercises, e-learning, practical sessions and industry visits.

### **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 emphasised 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, Microcontroller 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 a foundational knowledge of the 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 the electric motor, coupling, gears, bearing, shaft, key and chain drives.

### **Mechanical Drawing & CAD**

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, and application of sensors and actuators in typical mechatronic systems. Topics include displacement sensors, torque sensors, temperature 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, bitwise operation, datafiles accessing and methods.

#### **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 practical projects, 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 (CORE MODULES)

#### Microcontroller Programming & Interface

This module covers the fundamentals, architecture, programming and interfacing of a typical microcontroller used in mechatronic systems. Topics include microcontroller 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 programs. 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, analogue/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.

### LEVEL 3 (OPTIONS)

#### Six-month Industrial Attachment Programme

The six-month Industrial Attachment Programme (IAP) 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.

#### Aerospace Applications

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

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

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 Electromechanical Systems (MEMS)

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

The programme is aimed at helping students with technical background 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, namely, Customer Relationship Management, Service Operation Management and E-commerce. Students will go through the whole process of managing a business operation from creating values for customers at the front end, to the back end of service transformation process. Students' mindset are broadened from being technologically focused to more entrepreneurial, seeing the importance of value creation and relationship building with customers, and establishing good business management practices.

#### Marketing & Entrepreneurship

The module 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 three modules, namely, Business Creation, Product Design & Marketing, and Enterprise Development. Students will go through the whole process of business creation, development and establishment. Students become 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 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 Design Cluster
- Applied Physics Cluster\*
- Applied Technology Cluster
- Biomedical Engineering Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Telecommunication Distribution Technology Cluster
- Workplace Safety & Health 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
<b>YEAR 1</b>		
<b>Level 1.1 (27 hours per week)</b>		
1.	Engineering Mathematics	5
2.	Electrical Technology	6
3.	Computer Programming	4
4.	Engineering Mechanics	5
5.	Engineering: A Creative Profession	3
6.	Creativity & Applied Thinking Skills <sup>^</sup>	2
7.	Sports & Wellness <sup>^</sup>	2
<b>Level 1.2 (21 hours per week)</b>		
8.	Engineering Materials	4
9.	Engineering Mathematics 2	5
10.	Analogue Electronics	5
11.	Manufacturing Technology	3
12.	Individual & the Community <sup>^</sup>	2
13.	Communication Toolkit <sup>^</sup>	2
<b>YEAR 2</b>		
<b>Level 2.1 (25 hours per week)</b>		
14.	Engineering Mathematics	4
15.	Digital Electronics	5
16.	Strength of Materials	4
17.	Engineering Design	4
18.	Mechanical Drawing & CAD	4
19.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
20.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 2.2 (26 hours per week)</b>		
21.	Sensors & Actuators	5
22.	Mechanical Aspects of Mechatronic Systems	5
23.	Applications Programming	4
24.	Industrial Automation	5
25.	Mechatronic Engineering Practice	3
26.	Innovation & Enterprise in Action <sup>^</sup>	4
<b>YEAR 3</b>		
<b>Level 3.1 – Industrial Attachment Programme Option (20 hours per week)</b>		
27.	Microcontroller Programming & Interface	6
28.	Mechatronic Systems Design	5
29.	Systems Modelling & Control	5
30.	World Issues: A Singapore Perspective <sup>^</sup>	2
31.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (25 hours per week)</b>		
32.	Six-month Industrial Attachment Programme	25

## COURSE CURRICULUM

Module No.	Module Name	Credit Units
<b>YEAR 3</b>		
<b>Level 3.1 – Discipline-specific Options (in Aerospace Applications [AA], Sports Engineering [SE], Automation &amp; Robotics [AR], Micro Electromechanical Systems [MEMS]) (23 hours per week)</b>		
33.	Microcontroller Programming & Interface	6
34.	Option Module	5
35.	Project Design & Development 1 (in a specific option)	8
36.	World Issues: A Singapore Perspective <sup>^</sup>	2
37.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (22 hours per week)</b>		
38.	Mechatronic Systems Design	5
39.	Systems Modelling & Control	5
40.	Project Design & Development 2 (in a specific option)	12
<b>YEAR 3</b>		
<b>Level 3.1 – Business Related Options (in Business Management [BM], Marketing &amp; Entrepreneurship [M&amp;E]) (23 hours per week)</b>		
41.	Project 1	6
42.	Microcontroller Programming & Interface	6
43.	(For BM Option) – Customer Relationship Management (For M&E Option) – Enterprise Development	3
44.	(For BM Option) – Service Operation Management (For M&E Option) – Business Creation	4
45.	World Issues: A Singapore Perspective <sup>^</sup>	2
46.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (22 hours per week)</b>		
47.	Project 2	8
48.	Mechatronic Systems Design	5
49.	Systems Modelling & Control	5
50.	(For BM Option) – E-commerce (For M&E Option) – Product Design & Marketing	4
<b>Across-Level Modules (Level 1.2 onwards) (6 hours per week)</b>		
51.	School of Engineering (SoE) elective module <sup>°</sup>	3
52.	School of Engineering (SoE) elective module <sup>°</sup>	3

### Notes:

<sup>^</sup> For more details on Interdisciplinary Studies (IS) modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

### 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 PRODUCT DESIGN & INNOVATION (PDI) (3-YEAR COURSE)

SCHOOL OF ENGINEERING



Ever wonder why some products are more successful than others? When you are looking for a new MP3 player or a mobile phone, what is the first thing that captures your attention? The **Diploma in Product Design & Innovation (PDI)** offers students an insight into the success factors of some of the popular products in the market. The course is designed to unleash students' potential as a creative product designer with the competencies to design and develop innovative products, which are attractive, practical and marketable.

The curriculum integrates the three important disciplines of product design – Arts, Engineering and Business. It focuses on the design process and methodology from the conceptualisation of creative ideas to the realisation of innovative designs with quality design folios, working prototypes, digital models, drawings and documentation for mass production.

Learning is facilitated through practice-oriented and project-driven modules with emphasis on aesthetics, functions and markets. In the final year, students attend an industrial internship, and undertake an evolutionary design-and-prototype project, or a revolutionary futuristic-and-exploratory product design project.

PDI students have the opportunity to work in the newly-renovated design studios and workshops, and realise design prototypes using state-of-the-art model-making and rapid-prototyping equipment and facilities.

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 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.

### CAREER PROSPECTS

As industries take on higher value-added activities, more design functions are being undertaken by both multinational and local companies. Singapore is fast becoming the regional headquarters and nerve centre for many high-technology product design and manufacturing supply chains. Well-known companies have set up design, R&D and innovation centres here. Many local companies have also started or are starting design and development activities.

PDI graduates enjoy good employment prospects in multinational corporations as well as small and medium enterprises that design and manufacture products or provide product design and development services. Graduates can work as product designers, design consultants and engineering designers, to name a few occupations. With some years of working experience, they may even start design-consultancies or design-and-manufacturing companies.

### ACCREDITATION FOR FURTHER STUDIES

PDI graduates with good results can further their studies at local and established overseas universities offering degree programmes in industrial design, product design, mechanical engineering, and other engineering degree programmes, including mechatronic, electrical/electronic and bioengineering courses.

Typically, graduates are given one to two years' advanced standing, depending on the total duration of the degrees they undertake.

## COURSE STRUCTURE

### FIRST-YEAR MODULES

Level 1.1	Level 1.2
<ul style="list-style-type: none"><li>• Visual Thinking &amp; Design Sketching</li><li>• History &amp; Principles of Design</li><li>• Engineering Mathematics 1</li><li>• Manufacturing Processes</li><li>• Materials &amp; Design Applications 1</li><li>• Creativity &amp; Applied Thinking Skills<sup>^</sup></li><li>• Sports &amp; Wellness<sup>^</sup></li></ul>	<ul style="list-style-type: none"><li>• Design Specification &amp; Conceptual Design</li><li>• Design Presentation &amp; Methods</li><li>• Engineering Mathematics 2</li><li>• Engineering Mechanics</li><li>• Computer-Aided Design &amp; Drawing 1</li><li>• Individual &amp; the Community<sup>^</sup></li><li>• Communication Toolkit<sup>^</sup></li></ul>

### SECOND-YEAR MODULES

Level 2.1	Level 2.2
<ul style="list-style-type: none"><li>• Product Form &amp; Aesthetics</li><li>• Materials &amp; Design Applications 2</li><li>• Computer-Aided Design &amp; Drawing 2</li><li>• Electrical Technology &amp; Electronics</li><li>• Any 2 Interdisciplinary Studies (IS) modules<sup>^</sup></li></ul>	<ul style="list-style-type: none"><li>• Ergonomics &amp; User-Centred Design</li><li>• Business &amp; Project Management</li><li>• Thermofluid &amp; Design Applications</li><li>• Component Design &amp; Development</li><li>• Innovation &amp; Enterprise in Action<sup>^</sup></li></ul>

### FINAL-YEAR MODULES

Level 3.1	Level 3.2 (Pathway 1)
<ul style="list-style-type: none"><li>• Product Development &amp; Innovation</li><li>• Design for Manufacturability</li><li>• Entrepreneurship &amp; Business Plan</li><li>• Automation &amp; Smart Product Design</li><li>• World Issues: A Singapore Perspective<sup>^</sup></li><li>• Any 1 Interdisciplinary Studies (IS) module<sup>^</sup></li></ul>	<ul style="list-style-type: none"><li>• Internship and Project Programme</li></ul>

### ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

- Any 2 School of Engineering (SoE) elective modules<sup>o</sup>

<sup>^</sup> Denotes Interdisciplinary Studies (IS) module. For more details on IS modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

<sup>o</sup> Students take two elective modules to complete their diploma. Electives are chosen and customised from a wider range of clusters under the Engineering and Non-Engineering categories.

## COURSE MODULES

### LEVEL 1.1

#### Visual Thinking & Design Sketching

The module covers the principles and practice of creative thinking and idea generation, and equips students with the important skills of visual thinking, design visualisation and freehand design sketching for product design. The emphasis is on hands-on practices to enhance students' creative thinking abilities through design visualisation and design sketching, from basic lines to two-dimensional (2D) sketches, and also from design idea thumbnails to three-dimensional (3D) perspective sketches. The module also provides students with an understanding of the generic product design process, and the related tasks and attributes involved. It also includes an introduction to the course and thus sets the context of the course by providing an overview of the curriculum.

#### History & Principles of Design

The module provides students with a historical perspective of design against the backdrop of developments in civilisation, culture, art and technology. There are discussions on the design movements and iconic works of past and contemporary designers and innovators. The second part of the module covers the elements of design, which include points, lines, planes, textures and space; followed by the principles of design with emphasis on concepts such as balance, proportion, symmetry, harmony, and contrast and their applications in product design.

### Engineering Mathematics 1

This module is designed to equip students with the basic mathematical skills to solve engineering problems. The topics are introduced in an order that is intended to keep abreast of the application requirements in other engineering modules. Topics covered include algebra, trigonometry, logarithms, matrices and complex numbers.

### Manufacturing Processes

The module provides students with an understanding of the common manufacturing processes, leading to the principles and applications of Design for Manufacturability. Through hands-on practices and integrated projects, students acquire the knowledge and skills of turning, milling, grinding, assembly, dimensional tolerances, joining processes, surface texture, and so forth. Students hone their skills by taking on projects involving producing parts according to the design drawings and specifications given, as well as designing simple products and producing them with suitable manufacturing processes. Shopfloor safety is emphasised throughout the module.

### Materials & Design Applications 1

The module covers the characteristics and properties of commonly used materials for products, including metals, plastics, rubber, ceramic, wood and composites. The module also includes the applications and criteria for selection and design considerations for common materials. Students acquire the knowledge and skills through lectures, discussions, case studies and projects, complemented by practical sessions on materials testing and manufacturing processes for polymers and composites.

### LEVEL 1.2

#### Design Specification & Conceptual Design

In this hands-on and project-driven module, students apply their creativity to the first two phases of the design cycle – writing a design brief and design specifications and generating design concepts. They learn to identify target user groups, define user needs, identify product markets, search for information and conduct a basic market study, generate creative design concepts and evaluate and refine design concepts. This is followed by the concept generation phase to hone design sketching skills and idea generation techniques, in accordance to the design specification. The module also includes workshop sessions in which students learn about making 3D models using materials including foam, acrylic, foam core, paper board, and with techniques in model finishing using air brush and painting.

#### Design Presentation & Methods

The focus of this module is on the presentation of design concepts and relevant details in digital media. It includes an introduction to graphic and communication design. The students then learn, in a practice-oriented manner, the commonly-used software packages for graphic and communication design that include image editing as well as text and graphic creation functions for product design presentation via digital means and also for poster printing purposes. The module leverages on a project to deepen students' understanding of the design presentation methods, principles and techniques.

### 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 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.

### **Computer-Aided Design & Drawing 1**

The module equips students with the knowledge and skills in using a computer-aided design (CAD) tool to produce 3D solid and surface models as well as 2D detailed and assembly drawings. Students will also learn the fundamentals, conventions and practices of engineering drawing based on the International Standards Organisation (ISO) and Singapore Standards (SS) guidelines. Topics include 3D CAD modelling, 2D CAD drawings, orthographic projection, sectioning, dimensioning, conventional representations, assembly drawing and blueprint reading.

#### **LEVEL 2.1**

##### **Product Form & Aesthetics**

This project-driven module focuses on the study of the relationships between form and function, and the principles and applications of aesthetics in product design. Topics include principles of good product form and aesthetics and colour theory and its applications. Students also learn the use of computer-aided industrial design software tool, and design rendering for presentations using markers. The module project requires students to carry out product design tasks up to preparing preliminary assemblies and detailed drawings.

##### **Materials & Design Applications 2**

This module is a follow-on module of Materials & Design Applications 1, and focuses on the selection of plastic materials and design of plastic parts for given design requirements. It also covers knowledge on the characteristics and design considerations for parts made of other materials, including metals, wood and fabric, and other new materials for biomedical science and nanotechnology, with emphasis on their properties and applications. The module includes the principles and applications of Geometric Tolerance and Dimensioning. The students learnt through projects, assignments, lectures and discussions.

##### **Computer-Aided Design & Drawing 2**

In this follow-on module of Computer-Aided Design & Drawing 1, students are required to apply their knowledge and skills of CAD for the design of relatively more complex parts and assemblies. Through these assignments, students acquire more advanced techniques in 3D modelling and production drawings. Topics include advanced 3D solid and surface modelling, assembly analysis, limits and fits, application of linear and geometric tolerances in CAD and drawings, specifications and representations for surface finish and joints, and so forth. The module includes an elementary treatment of mechanism design.

### **Electrical Technology & Electronics**

This module equips students with fundamental electrical and electronics principles applied to product design. Laboratory sessions enhance students' practical skills in handling basic test equipment, electrical circuits as well as electronic devices and circuits. Major topics include basic circuit elements, direct current circuits, Ohm's law, Kirchhoff's laws, transistors as well as common analogue and digital integrated circuits.

#### **LEVEL 2.2**

##### **Ergonomics & User-Centred Design**

This module covers the principles of ergonomics (or human factors) and user-centred design, their applications in product design, the influence of these design factors in users' preference for a particular product or system, as well as the codes and standards governing product safety. It covers anthropometrics, user-centred design principles and approach, environmental factors in the application of products, and so forth. The emphasis is on research and good understanding of the target users' needs, requirements and limitations, and application in product design. The module project requires students to carry out tasks in product design up to the phase of detailed assembly drawings, including bill of materials and cost estimation.

##### **Business & Project Management**

This module provides an overview of a business organisation, its functions and general management, as well as a detailed treatment of the organisational and operational aspects of project management in the context of product design and development. Topics include introduction to business organisation and management, organisation of projects, roles of the project manager, project planning, scheduling and controlling using network analysis such as Critical Path Method (CPM), Gantt Charts, and Program Evaluation and Review Technique (PERT). The importance of concurrent or simultaneous product design and development in order to achieve short time-to-market is also emphasised.

##### **Thermofluid & Design Applications**

This module covers the fundamental concepts of thermodynamics and fluid mechanics, and their applications in the design of products and systems. Topics include system concepts, the laws of thermodynamics, properties of working fluids, non-flow and steady processes with steam and perfect gas, thermodynamic processes, basic heat transfer, principles of fluid mechanics, hydrostatic forces and buoyancy, energies of liquids in motion, and losses of energy in pipelines. Case studies on applications of thermodynamics and fluid mechanics in products and systems, and practice-oriented assignments and projects will be emphasised.

##### **Component Design & Development**

This module covers the engineering principles underlying the analysis, design and selection of standard components as well as non-standard parts for products. Students learn the characteristics, applications, design analysis and selection procedure of common standard components including motor, bearings, belt and pulley, gears and shafts. Projects are used to reinforce learning along with assignments and case studies on existing products. Students also learn to prepare parts list and bill of materials, an important process in product design and development.

### LEVEL 3.1

#### Product Development & Innovation

In this project-driven module, students undertake a major individual project that considers future trends and includes application of innovation methods and further factors in product design. In the project, students are required to complete the product design process involving the conceptualisation of product idea to the product design, with 3D CAD model, mock-up or prototype if applicable, and drawings and documentation for production purposes. There will be short lectures, case study discussions and exercises on topics that include innovation methods, further factors, and topics in product design and development. In addition, students have to complete an e-learning course on intellectual property management and commercial laws.

#### Design for Manufacturability

The module covers the principles of Concurrent Engineering, with focus on Design for Manufacturability (DFM) and Design for Assembly (DFA). It includes the concepts and applications of the DFM and DFA methods, and also includes topics on Value Analysis, Group Technology and Quality Function Deployment, in the context of product design and development. Students gain an appreciation of the importance of these methods in reducing manufacturing costs, enhancing product quality, reducing product development cycle time and enhancing innovation. Case studies, assignments and projects are used to enhance learning.

#### Entrepreneurship & Business Plan

This module provides students with an understanding of the nature and attributes of entrepreneurship. Through projects and case studies, students learn how to start a business and develop it into a successful enterprise. Students will also learn the importance of a good business plan, and the skills to write one.

#### Automation & Smart Product Design

This module equips students with the basic knowledge in implementing automation technology and mechatronics, or smart product design, through practical assignments and projects. The module covers both hard-wired and programmable logic solutions for the control of pneumatic and electric actuators, and the design of smart products incorporating microcontrollers and sensors. A practice-oriented approach is emphasised.

### LEVEL 3.2

#### Internship and Project Programme

The Internship and Project Programme provides students with the opportunity to apply the knowledge and skills acquired in the classroom to work and project situations, and demonstrate problem-solving, communication and interpersonal skills in a working environment. The programme consists of two parts: (1) Students are attached to a company for three months, and (2) Students focus on a product design and development project for three months, either at the company or at Ngee Ann Polytechnic.

### 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 Design Cluster
- Applied Physics Cluster\*
- Applied Technology Cluster
- Biomedical Engineering Cluster
- Industrial Control Cluster
- Industrial Electronics Cluster
- Information Technology Cluster
- Mechanical Technology Cluster
- Telecommunication Distribution Technology Cluster
- Workplace Safety & Health 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
<b>YEAR 1</b>		
<b>Level 1.1 (28 hours per week)</b>		
1.	Visual Thinking & Design Sketching	6
2.	History & Principles of Design	3
3.	Engineering Mathematics 1	5
4.	Manufacturing Processes	5
5.	Materials & Design Applications 1	5
6.	Creativity & Applied Thinking Skills <sup>^</sup>	2
7.	Sports & Wellness <sup>^</sup>	2
<b>Level 1.2 (28 hours per week)</b>		
8.	Design Specification & Conceptual Design	6
9.	Design Presentation & Methods	3
10.	Engineering Mathematics 2	5
11.	Engineering Mechanics	5
12.	Computer-Aided Design & Drawing 1	5
13.	Individual & the Community <sup>^</sup>	2
14.	Communication Toolkit <sup>^</sup>	2

**COURSE CURRICULUM**

Module No.	Module Name	Credit Units
<b>YEAR 2</b>		
<b>Level 2.1 (23 hours per week)</b>		
15.	Product Form & Aesthetics	6
16.	Materials & Design Applications 2	3
17.	Computer-Aided Design & Drawing 2	5
18.	Electrical Technology & Electronics	5
19.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
20.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 2.2 (22 hours per week)</b>		
21.	Ergonomics & User-Centred Design	6
22.	Business & Project Management	3
23.	Thermofluid & Design Applications	4
24.	Component Design & Development	5
25.	Innovation & Enterprise in Action <sup>^</sup>	4
<b>YEAR 3</b>		
<b>Level 3.1 (21 hours per week)</b>		
26.	Product Development & Innovation	7
27.	Design for Manufacturability	4
28.	Entrepreneurship & Business Plan	2
29.	Automation & Smart Product Design	4
30.	World Issues: A Singapore Perspective <sup>^</sup>	2
31.	Interdisciplinary Studies (IS) module <sup>^</sup>	2
<b>Level 3.2 (22 hours per week)</b>		
32.	Internship and Project Programme	22
<b>Across-Level Modules (Level 1.2 onwards) (6 hours per week)</b>		
33.	School of Engineering (SoE) elective module <sup>°</sup>	3
34.	School of Engineering (SoE) elective module <sup>°</sup>	3

**Notes:**

<sup>^</sup> For more details on Interdisciplinary Studies (IS) modules, please log on to [www.np.edu.sg/is/](http://www.np.edu.sg/is/)

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

**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  
(MECHANICAL)  
(3-YEAR PART-TIME COURSE)**

SCHOOL OF ENGINEERING

The programme is a modular 3-year course designed for working adults who wish to upgrade and update themselves in their current field of work. Candidates need to meet the minimum entry requirements including at least 3 years of relevant working experience. To graduate with a Diploma in Technology, a student is required to complete at least 80 credit units (CU), comprising core modules and elective modules. Elective modules can be selected from a wide range of subjects offered by various schools. Diploma in Technology graduates have benefited much from the programme as industry and government extend more support and recognition of their upgrading and updating efforts. Graduates are eligible to further their studies in local and overseas universities. The Singapore Workforce Development Agency (WDA) has approved a fees subsidy scheme for eligible students enrolled in this programme.

**COURSE STRUCTURE**

**Stage 1**

- Principles of DC Circuits
- Engineering Materials & Processes
- Engineering Maths A

**Stage 2**

- Applied Mechanics I
- Computer-Aided Engineering Drafting
- Engineering Maths B

**Stage 3**

- Applied Mechanics II
- Mechanical Design
- Electives

**Stage 4**

- Fundamentals of Thermofluid
- Principles of AC Circuits
- Electives

**Stage 5**

- Applied Fluid Mechanics
- Applied Thermodynamics
- Electives

**Stage 6**

- Applied Strength of Materials
- Engineering System Design
- Electives

**Note on Electives**

For the electives, students can choose from a list of core/non-core electives offered. They can also select from a list of on-line elective modules. The electives offered can be viewed at <http://www.np.edu.sg/cpd/prguide.htm>

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/](http://www.np.edu.sg/cpd/) or contact the CPD at 64606353.

## DIPLOMA IN TECHNOLOGY (MECHATRONICS) (3-YEAR PART-TIME COURSE)

SCHOOL OF ENGINEERING

The programme is a modular 3-year course designed for working adults who wish to upgrade and update themselves in their current field of work. Candidates need to meet the minimum entry requirements including at least 3 years of relevant working experience. To graduate with a Diploma in Technology, a student is required to complete at least 80 credit units (CU), comprising core modules and elective modules. Elective modules can be selected from a wide range of subjects offered by various schools. Diploma in Technology graduates have benefited much from the programme as industry and government extend more support and recognition of their upgrading and updating efforts. Graduates are eligible to further their studies in local and overseas universities. The Singapore Workforce Development Agency (WDA) has approved a fees subsidy scheme for eligible students enrolled in this programme.

### COURSE STRUCTURE

#### Stage 1

- Principles of DC Circuits
- Engineering Maths A
- Computer Programming

#### Stage 2

- Applied Mechanics I
- Basic Electronic Devices
- Engineering Maths B

#### Stage 3

- Applied Mechanics II
- Principles of Digital Electronics
- Computer-Aided Engineering Drafting
- Electives

#### Stage 4

- Applied Strength of Materials
- Mechanical Design
- Automation Technology
- Electives

#### Stage 5

- Mini Electronic Control Project
- Instrumentation & Control Technology
- Electives

#### Stage 6

- Engineering System Design
- Basic Micro-controller Programming
- Electives

#### Note on Electives

For the electives, students can choose from a list of core/non-core electives offered. They can also select from a list of on-line elective modules. The electives offered can be viewed at

<http://www.np.edu.sg/cpd/prguide.htm>

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/](http://www.np.edu.sg/cpd/) or contact the CPD at 64606353.

## DIPLOMA IN TECHNOLOGY (MARINE & OFFSHORE) (3-YEAR PART-TIME COURSE)

SCHOOL OF ENGINEERING

The programme is a modular 3-year course designed for working adults who wish to upgrade and update themselves in their current field of work. Candidates need to meet the minimum entry requirements including at least 3 years of relevant working experience. To graduate with a Diploma in Technology, a student is required to complete at least 80 credit units (CU), comprising core modules and elective modules. Elective modules can be selected from a wide range of subjects offered by various schools. Diploma in Technology graduates have benefited much from the programme as industry and government extend more support and recognition of their upgrading and updating efforts. Graduates are eligible to further their studies in local and overseas universities. The Singapore Workforce Development Agency (WDA) has approved a fees subsidy scheme for eligible students enrolled in this programme.

### COURSE STRUCTURE

#### Stage 1

- Applied Mechanics I
- Engineering Materials & Processes
- Engineering Maths A

#### Stage 2

- Applied Mechanics II
- Naval Architecture 1
- Engineering Maths B

#### Stage 3

- Applied Strength of Materials
- Naval Architecture 2
- Principles of DC Circuits
- Electives

#### Stage 4

- Fundamentals of Thermofluid
- Offshore Engineering
- Principles of AC Circuits
- Electives

#### Stage 5

- Naval Architecture 3
- Marine Engineering 1
- Electives

#### Stage 6

- Marine Engineering 2
- Ship Design
- Electives

#### Note on Electives

For the electives, students can choose from a list of core/non-core electives offered. They can also select from a list of online elective modules. The electives offered can be viewed at

<http://www.np.edu.sg/cpd/prguide.htm>

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/](http://www.np.edu.sg/cpd/) or contact the CPD at 64606353.