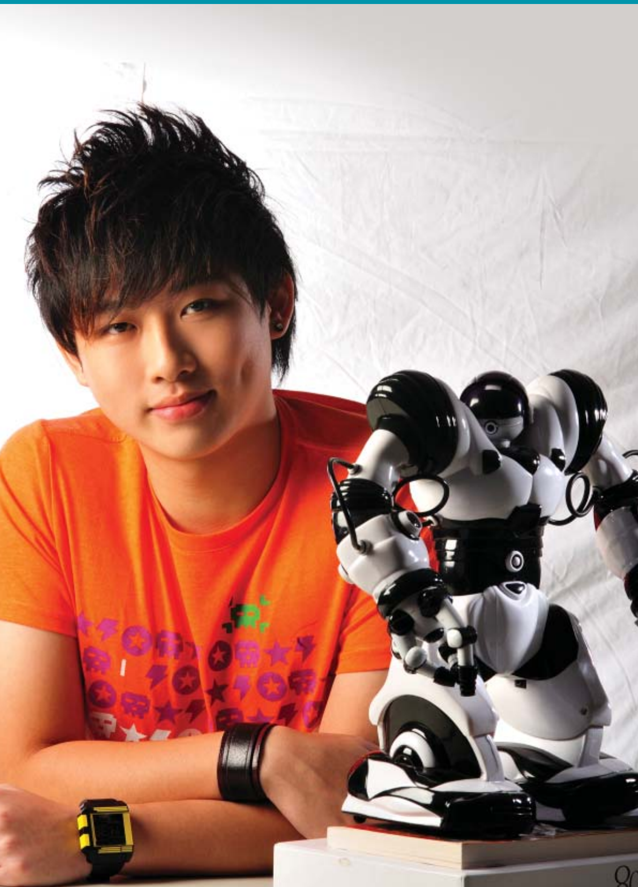

DIPLOMA IN AUTOMATION & MECHATRONIC SYSTEMS (AMS)

3-YEAR COURSE

MARINE, MECHANICAL & MECHATRONICS CLUSTER

The **Diploma in Automation & Mechatronic Systems (AMS)** offers students an exciting experience with modern-day computer-controlled intelligent automated and mechatronic systems and products. AMS offers mechanical, electronics and computer modules that work as an integrated whole, from aircraft fly-by-wire systems and automotive fuel injection, to robot surgeons and robot pets.

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

In the final year, students can opt for a six-month internship, locally or overseas in countries such as Australia, China and Germany. Alternatively, students can choose to do the Project Design and Development programme. In both the Internship and Project Design & Development paths, students can choose a final-year option in either Aerospace Systems or Marine & Offshore Systems.

AMS gives students the opportunity to apply the knowledge and skills they have acquired in designing and developing innovative automation and mechatronic products or processes.

In response to the increasing industry demand for engineering graduates to have skills in the area of business management, a Minor in Business Management was introduced. It aims to nurture graduates who are technically competent and equipped with business knowledge to succeed in the changing industry environment.

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

ENTRY REQUIREMENTS

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

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

You must also fulfil the aggregate computation requirements.

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

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

CAREER PROSPECTS

With the nation's emphasis on productivity and growing need for integrating mechanical, electronics and computer technologies in products, machines, processes and systems, AMS graduates will enjoy good employment prospects in a wide range of industries such as precision engineering, electronics, chemicals and petrochemicals, biomedical science, information and communication, aerospace and marine & offshore.

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

ACCREDITATION FOR FURTHER STUDIES

The AMS Diploma is well recognised by local and overseas universities. Students may further their studies in degree programmes in Mechatronic Engineering, Mechanical Engineering, and Electrical or Electronic Engineering.

The Singapore Institute of Technology together with the University of Glasgow now offers AMS graduates the opportunity to pursue a Bachelor of Engineering with Honours in Mechatronics on Ngee Ann campus. Graduates also enjoy advanced standing and subsidised fees.

Some of the university courses to which AMS graduates enjoy advanced standing are as follows.

- Nanyang Technological University
  Bachelor of Engineering in Mechanical Engineering, Electrical & Electronic Engineering, Aerospace Engineering, Computer Engineering, Computer Science, Information Engineering and Media, Bioengineering or Materials Engineering
- National University of Singapore
  Bachelor of Engineering in Mechanical Engineering, Electrical Engineering or Computer Engineering
- Singapore Institute of Technology & the University of Glasgow
  Bachelor of Engineering with Honours in Mechanical Design Engineering or Mechatronics
- University of Manchester (United Kingdom)
  Bachelor of Engineering in Mechatronic Engineering
- University of Sheffield (United Kingdom)
  Bachelor of Engineering in Mechatronic Engineering or Systems and Control Engineering
- University of New South Wales (Australia)
  Bachelor of Engineering in Mechatronic Engineering
- Monash University (Australia)
  Bachelor of Engineering in Mechatronic Engineering or IT & Systems

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Engineering Mathematics 1	5
Electrical Technology	6
Computer Programming	4
Engineering Mechanics	5
Engineering: A Creative Profession	3
Sports & Wellness^	2
Idea Jumpstart^	2
Level 1.2 (24 hours per week)	
Engineering Mathematics 2	5
Electronics Technology	4
Engineering Materials	4
Manufacturing Technology & Practice	4
Automation in a Mechatronic World	3
Communication & Contemporary Issues^	4
YEAR 2	
Level 2.1 (25 hours per week)	
Engineering Mathematics 3	4
Thermodynamics	5
Fluid Mechanics	4
Engineering Design	4
Mechanical Drawing & Computer-Aided Design	4
Idea Blueprint^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (24 hours per week)	
Strength of Materials	5
Applied Mechanics	5
Microcontroller & Interfacing	5
Industrial Automation	5
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (25 hours per week)	
Systems Modelling & Control	5
Automation Systems Integration	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Aerospace Systems Option	
Aircraft Systems & Propulsion	4
Mechanics of Flight	4
Aerospace Quality & Manufacturing Management	4
Marine & Offshore Systems Option	
Marine Engineering Systems	4
Marine Propulsion & Auxiliaries	4
Offshore Drilling & Production Technology	4
Level 3.2 (25 hours per week)	
Six-month Internship	25
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (25 hours per week)	
Project Design & Development 1	6
Supervisory Management	3
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Aerospace Systems Option	
Aircraft Systems & Propulsion	4
Mechanics of Flight	4
Aerospace Quality & Manufacturing Management	4
Marine & Offshore Systems Option	
Marine Engineering Systems	4
Marine Propulsion & Auxiliaries	4
Offshore Drilling & Production Technology	4
Level 3.2 (25 hours per week)	
Project Design & Development 2	12
Systems Modelling & Control	5
Emerging Mechatronic Technologies	4
Automation Systems Integration	4
MINOR IN BUSINESS MANAGEMENT#	
YEAR 2	
Level 2.1 (25 hours per week)	
Engineering Mathematics 3B	4
Thermodynamics	5

Module Name	Credit Units
Fluid Mechanics	4
Mechanical Drawing & Computer-Aided Design	4
Marketing Fundamentals	4
Idea Blueprint^	2
Business & the Economy^	2
Level 2.2 (28 hours per week)	
Strength of Materials	5
Applied Mechanics	5
Microcontroller & Interfacing	5
Industrial Automation	5
Fundamentals of Financial Management	4
Idea Launchpad^	2
Effective People Management^	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (20 hours per week)	
Starting & Managing an Enterprise	4
Business Management Elective	4
Engineering Design	4
Automation Systems Integration	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (25 hours per week)	
Six-month Internship	25
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (22 hours per week)	
Project Design & Business Application 1	6
Starting & Managing an Enterprise	4
Business Management Elective	4
Engineering Design	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (24 hours per week)	
Project Design & Business Application 2	12
Supervisory Management	3
Systems Modelling & Control	5
Automation Systems Integration	4

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

The Minor in Business Management has the same Year 1 curriculum.

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

COURSE MODULES

LEVEL 1.1

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

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

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

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

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

LEVEL 1.2

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

Electronics Technology
The aim of this module is to introduce the fundamental concepts of electronics which include analogue and digital electronic devices and circuits. The first section

covers concepts pertaining to analogue electronics. These include understanding the analogue electronic circuitry, diodes, transistors, and their applications. The second half of the module covers concepts on digital electronics. Topics include number systems, Boolean algebra, combinational logic design, applications of latches, flip-flops, counters and registers.

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

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

Automation in a Mechatronic World
This module consists of two main components: assembly and programming. Students will first learn the assembly of drive mechanisms and mechatronic products, such as NXT robots and various drive mechanisms. Through these practical exercises, students will learn about mechanical designs, assembly skills, commissioning, troubleshooting and diagnostic techniques of mechatronic systems. Students will then learn how to build and program robots to perform a number of automation-related tasks using tools such as Lego Mindstorms NXT and Logicator for PIC microcontroller. They will also learn interfacing of simple input and output devices to the microcontroller to simulate real-life applications in the field of automation control.

LEVEL 2.1

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

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.

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.

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

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

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

LEVEL 2.2

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

Applied Mechanics
This is a follow-on module of Engineering Mechanics. It aims to equip students with the necessary skills to analyse problems of rigid bodies at rest and in motion. Topics include Trusses, Friction, Centroid, Relative motion, Work energy method, Power and efficiency & Impulse momentum method. This knowledge plays an important role in many diverse engineering applications of the modern world, such as the design of cars, structures, airplanes, and various types of machines. Students will be guided to solve engineering problems using these mechanics principles.

Microcontroller & Interfacing
This practical-oriented module aims to equip students with a working knowledge on microcontroller applications and interfacing techniques as the backbone of typical industrial process control operations. Major topics include basic numbering

system, microcontroller application and programming, sensor interfacing and motor control. Students will gain a practical insight on applying digital techniques over a wide range of automation and control applications.

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.

Fundamentals of Financial Management

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

LEVELS 3.1 & 3.2

Project Design & Development 1

In this module, students will in teams to design and develop a product or system in the field of Automation & Mechatronic Engineering. In the project, students learn to apply their knowledge and skills in creative problem solving, engineering and design, teamwork and project management. This module focuses on the identification of problem or need, research and design.

Supervisory Management

The module aims at providing the students with an understanding and appreciation of management concepts and supervisory skills and techniques. Topics cover aspects in planning, managing, organising, monitoring and control of operation resources so as to give the students a competitive edge for their management and leadership role in the economy.

Project Design & Development 2

This module follows on from Project Design and Development 1. Based on the design prepared in the first semester, students are required to fabricate the prototype, assemble the parts, test and refine the prototype, prepare the refined design and a project report. The students are also required to do a final presentation to a panel of examiners.

Systems Modelling & Control

The module focuses on modelling the dynamics of process and servo 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.

Emerging Mechatronic Technologies

The aim of the module is to provide the students with a platform to keep abreast with recent advances and developments in the newly emerging areas of technology, as well as actual and potential applications to industrial and factory automation. Topics include Micro-electro Mechanical Systems (MEMS), Nanotechnology, Photonics, and wireless- & web-enabled automation systems.

Automation Systems Integration

This project-based learning module focuses on the integration knowledge of discrete and continuous systems. This module equips students with system perspectives to implement automation solutions with IEC61131 process controllers and communications at different levels such as Fieldbus, PLC to PLC and PLC to PC levels. Supervisory Control and Data Acquisition (SCADA) is also used in the module to integrate, control, modify, analyse and report on the automated processes.

Six-month Internship

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

Starting & Managing an Enterprise

Through this module, students generate business ideas and propose how these ideas can be developed into a business plan incorporating operational and financial requirements and marketing strategies needed to set up a new enterprise. In addition, students will learn how the principles of management can be applied to organise and develop the enterprise. Topics covered include entrepreneurial concepts and issues, business entry and exit strategies, types of business ownership, sources of business financing, venture launch and management principles.

Project Design & Business Application 1

In this module, students are expected to integrate the knowledge they gained during the first two years of study and undertake a year-long project in the field of Automation & Mechatronic Engineering. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

Project Design & Business Application 2

This module is a continuation of Project Design & Business Application 1 where students undertake a year-long project on a topic in the field of Automation & Mechatronic Engineering. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

AEROSPACE SYSTEMS OPTION

Aircraft Systems and Propulsion

This module aims to provide students with a fundamental knowledge of aircraft structures and systems, as well as design features of aircraft structures, general construction of the fuselage and main control surfaces. Auxiliary systems such as hydraulic systems, pneumatic systems, electrical systems, fuel systems, de-icing and anti-icing systems, auxiliary power units, environmental control, communications systems and weapon systems will be explained in this module. As for the aircraft power plant, students will also learn 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.

Mechanics of Flight

This module aims to provide students with an understanding of the fundamental principles of aircraft flight in subsonic conditions and an appreciation of transonic and supersonic flights. Topics include the study of forces acting on an aircraft, the behaviour of the aerofoil at subsonic speed, aircraft lift, drag, thrust and propulsion, performance characteristics and factors affecting flight, take-off, landing and manoeuvres. Laboratory experiments to reinforce students' theoretical knowledge include model design and simulation in a wind tunnel, experiments on drag, stability and control as well as team projects on aerodynamics design and construction.

Aerospace Quality System and Manufacturing Management

This module prepares students to apply quality system management techniques and principles in their future workplace. Topics include total quality management concepts and philosophies, quality systems, quality audits and quality costs; quality tools and techniques including statistical quality control techniques for process control, acceptances sampling and acceptance sampling system, design of experiments to optimise and improve products and processes. Lean manufacturing and six sigma initiatives and benchmarking in the aerospace industry will also be discussed.

MARINE & OFFSHORE SYSTEMS OPTION

Marine Engineering Systems

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

Marine Propulsion Engines and Auxiliaries

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 system reliability. Practical hands-on work includes heat balance of diesel engines, hydraulic system for steering gears and propeller shaft dynamics.

Offshore Drilling & Production Technology

The student will be introduced to offshore oil and gas production covering marine well-drilling, types of drilling rigs and floating production systems. Students will learn about separators, gas-treatment, gas flaring, enhanced recovery using water and gas injection, produced water treatment, utility systems, subsea production systems, flow lines and risers, as well as remote-operated vehicles will also be covered. Students will also be given a functional understanding of the operation of various equipment, processes and systems involved in the drilling operations.

Engineering Design

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

BUSINESS MANAGEMENT ELECTIVES

(Students to choose one of the four electives below)

E-Business in Practice

The module introduces database concepts, information systems, value chains and the integrated enterprise systems. Students will develop multi-table database applications for e-business, incorporating interactive digital media functionalities and also gain exposure in buying and selling on the Web using auction sites with payment settlement functions. They will learn business workflow modelling through the business value chain, and improve business processes using IT systems and tools within an integrated enterprise system.

Managing Service Operations

This module introduces the operations in service organisations and the use of techniques for designing, planning, organising and controlling resources for the delivery of goods and services to meet customers' needs and organisational objectives. Concepts covered include service facility, managing facilitating goods, forecasting demand, managing waiting lines, process improvement, inventory management, service supply relationship and service quality.

Supply Chain Management

This module introduces students to the process of planning, implementing, and controlling the operations of the supply chain. It will cover the movement and storage of raw materials, work-in-process inventory and finished goods from point-of-origin to point-of-consumption. The module also emphasises the effect supply chain management has on the success and profitability of the organisation.

Understanding Buyer Behaviour

The module provides students with a basic understanding of buyer behaviour concepts. It explores the different types of buying decision processes and the various influencing factors that affect buyer decisions. Buyers could be consumers or corporate buyers. Topics covered include consumer decision-making processes, perceptions and attitudes, consumer demographics and lifestyles, and cultural and group influences.

DIPLOMA PLUS PROGRAMME

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

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

Clusters
- Aerospace Design
- Applied Physics*
- Computer-Aided Design Skills (World Skills Singapore)
- Leisure & Retail Management
- Mechatronics Application Skills (World Skills Singapore)
- Workplace Safety & Health

Other Available Diploma Plus Certificates
- Advanced Engineering Mathematics*
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The programme aims to bridge the gaps between the curriculum of engineering mathematics at polytechnics and that of first-year engineering mathematics in universities.

For detailed module descriptions under each cluster, please refer to page 180.

DIPLOMA IN MARINE & OFFSHORE TECHNOLOGY (MOT)

3-YEAR COURSE

MARINE, MECHANICAL & MECHATRONICS CLUSTER

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

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

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 opt to specialise in ship design or offshore oil and gas technology. With the ship design specialisation, students will learn to design and analyse various marine platforms while in the oil and gas technology specialisation, students will learn about the design and construction of off-shore oil rigs. In this option, students will also learn about drilling technology, offshore systems and off-shore oil and gas processing.

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

Unique to MOT is the number of scholarships available to students. These include the prestigious ASMI-MOT scholarship at $10,000 annually over three years where you would be groomed for top management as a management trainee when you graduate. Other scholarships include Keppel Offshore & Marine, Sembcorp Marine and ST Marine scholarships.

In response to the increasing industry demand for engineering graduates to have skills in the area of business management, a Minor in Business Management was introduced. It aims to nurture graduates who are technically competent and equipped with business knowledge to succeed in the changing industry environment.

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

ENTRY REQUIREMENTS

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

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

You must also fulfil the aggregate computation requirements.

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

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

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 as starting positions. 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

Together with Newcastle University, the Singapore Institute of Technology now offers our MOT graduates the chance to pursue a 2-year degree programme right here on NP's campus. What's more, this programme is highly affordable as it is subsidised by the Singapore government!

The degree programmes you can pursue are Bachelor of Engineering in Marine Technology with Honours in Marine Engineering, Bachelor of Engineering in Marine Technology with Honours in Naval Architecture or Bachelor of Engineering in Marine Technology with Honours in Offshore Engineering.

MOT is well-recognised by both local and overseas universities, which grant advanced standing for their relevant degree programmes. Some of the university courses to which MOT graduates gain advanced standing are as follows:

- Nanyang Technological University
  Bachelor of Engineering in Mechanical Engineering or Materials Engineering
- National University of Singapore
  Bachelor of Engineering in Civil Engineering or Mechanical Engineering
- Newcastle University (United Kingdom)
  Bachelor of Engineering in Naval Architecture
- University of Strathclyde (United Kingdom)
  Bachelor of Engineering in Naval Architecture or Ocean Engineering
- University of Sydney (Australia)
  Bachelor of Engineering in Mechanical Engineering
- University of Tasmania (Australia)
  Bachelor of Engineering in Naval Architecture or Ocean Engineering or Marine & Offshore Systems

SCHOLARSHIPS

ASMI-MOT Scholarships

To maintain its international leadership position in the new economy, members of the Association of Singapore Marine Industries (ASMI) are offering scholarships to bright, dynamic and capable 'O' Level school leavers to join the world-class marine industry in Singapore. Scholarships are offered to Singapore citizens and Permanent Residents inclusive of tuition and all other compulsory fees. Recipients also get a monthly allowance of $600 and a notebook computer allowance of $1,500. Successful applicants will work with their sponsor companies for three years. The total value of this scholarship is $30,000.

ASMI Scholarships

About 30 ASMI scholarships are sponsored by members each year. Each scholarship has a value of $5,000 for each year of study. Recipients of these scholarships are guaranteed jobs in sponsoring organisations such as Sembcorp Marine, ST Marine Ltd, Keppel Offshore & Marine and Drydocks World.

K C Lee Scholarships and Bursaries

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

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (24 hours per week)	
Engineering Mechanics	5
Engineering Mathematics 1	5
Electrical Technology	6
Programming with Marine Applications	4
Sports & Wellness^	2
Idea Jumpstart^	2
Level 1.2 (27 hours per week)	
Manufacturing Technology & Practice	4
Engineering Mathematics 2	5
Engineering Materials	4
Naval Architecture 1	5
Engineering Drawing & Computer-Aided Design	5
Communication & Contemporary Issues^	4
YEAR 2	
Level 2.1 (24 hours per week)	
Computer-Aided Design (Outfit)	2
Engineering Mathematics 3B	4
Marine Engineering 1	5
Marine Industry Safety	2
Thermodynamics	5
Ship Drawing	2
Idea Blueprint^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (23 hours per week)	
Naval Architecture 2	5
Strength of Materials	5
Ship Production Technology	5
Computer-Aided Design (Hull)	4
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2
YEAR 3	
Level 3.1 (26 hours per week)	
Oil & Gas Option	
Marine Practices	3
Marine Engineering 2	5
Offshore Oil & Gas Process Technology	5
Offshore Systems	5
Drilling Technology	4
World Issues: A Singapore Perspective^	2

Module Name	Credit Units
Interdisciplinary Studies (IS) module^	2
Design Option	
Marine Practices	3
Marine Engineering 2	5
Offshore Engineering	4
Theory & Practice of Ship Design	5
Naval Architecture 3	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (26 hours per week)	
Three-month Internship	11
Project	9
Project Management	3
Floating Production Technology	3
MINOR IN BUSINESS MANAGEMENT#	
YEAR 2	
Level 2.1 (24 hours per week)	
Engineering Mathematics 3B	4
Marine Engineering 1	5
Thermodynamics	5
Ship Drawing	2
Marketing Fundamentals	4
Business & the Economy^	2
Idea Blueprint^	2
Level 2.2 (23 hours per week)	
Naval Architecture 2	5
Strength of Materials	5
Ship Production Technology	5
Fundamentals of Financial Management	4
Effective People Management^	2
Idea Launchpad^	2
YEAR 3	
Level 3.1 (26 hours per week)	
Offshore Engineering	4
Theory & Practice of Ship Design	5
Naval Architecture 3	5
Starting & Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2

Module Name	Credit Units
Level 3.2 (26 hours per week)	
Three-month Internship	11
Project Management	3
Floating Production Technology	3
Project Design & Business Application	9

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

The Minor in Business Management has the same Year 1 curriculum.

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

COURSE MODULES

LEVEL 1.1

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

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

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

Programming with Marine Applications
This practical-oriented module equips students with basic knowledge and skills in computer programming using Visual Basic.Net language. The main topics include basic computing concepts such as data types, variables, conditional logic, loops, procedures, event handlers and object oriented programming. Upon completion of the module, students will be able to explain and write VB.Net programs for simple engineering applications.

LEVEL 1.2

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

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

Engineering Materials

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

Naval Architecture 1

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

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.

LEVEL 2.1

Computer-Aided Design (Outfit)

In this module, students use 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 3B

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

Marine Engineering 1

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

Marine Industry Safety

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

Thermodynamics

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

Ship Drawing

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

Marketing Fundamentals

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

LEVEL 2.2

Naval Architecture 2

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

Strength of Materials

This module aims to provide students with the foundational knowledge of 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.

Ship Production Technology

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

Computer-Aided Design (Hull)

Students apply TRIBON to complete the full procedure of hull design and production, including hull form generation, lines fairing, curved surface modelling, planar structure modelling, and generation of production information.

Fundamentals of Financial Management

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

LEVEL 3.1

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.

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.

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

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

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

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 have the opportunity to explore the capabilities of a software package for the structural analysis of offshore platforms.

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

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

Starting & Managing an Enterprise
In this module, students learn to generate business ideas and transform their ideas into a sound business plan. They will propose operational and financial requirements and marketing strategies needed to set up a new enterprise. In addition, students will learn how the principles of management can be applied to organise and develop the enterprise. Topics covered include entrepreneurial concepts and issues, business entry and exit strategies, types of business ownership, sources of business financing, venture launch and management principles.

BUSINESS MANAGEMENT ELECTIVES
(Students to choose one of the four electives below)

E-Business in Practice
The module introduces database concepts, information systems, value chains and the integrated enterprise systems. Students will develop multi-table database applications for e-business, incorporating interactive digital media functionalities and also gain exposure in buying and selling on the Web using auction sites with payment settlement functions. They will learn business workflow modelling through the business value chain, and improve business processes using IT systems and tools within an integrated enterprise system.

Managing Service Operations
This module introduces the operations in service organisations and the use of techniques for designing, planning, organising and controlling resources for the delivery of goods and services to meet customers' needs and organisational objectives. Concepts covered include service facility, managing facilitating goods, forecasting demand, managing waiting lines, process improvement, inventory management, service supply relationship and service quality.

Supply Chain Management
This module introduces students to the process of planning, implementing, and controlling the operations of the supply chain. It will cover the movement and storage of raw materials, work-in-process inventory and finished goods from point-of-origin to point-of-consumption. The module also emphasises the effect supply chain management has on the success and profitability of the organisation.

Understanding Buyer Behaviour
The module provides students with a basic understanding of buyer behaviour concepts. It explores the different types of buying decision processes and the various influencing factors that affect buyer decisions. Buyers could be consumers or corporate buyers. Topics covered include consumer decision-making processes, perceptions and attitudes, consumer demographics and lifestyles, and cultural and group influences.

LEVEL 3.2

Three-month Internship

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

Project

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

Project Management

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

Floating Production Technology

Students will be introduced to offshore oil production covering marine well-drilling, types of drilling rigs and floating production systems. Topics include separators, gas-treatment, gas flaring, enhanced recovery using water and gas injection, produced water treatment, utility systems, mooring arrangements, storage and export systems. Technical consideration of FPSO conversions, subsea product on systems flow lines and risers, as well as remote-operated vehicles will also be covered.

Project Design & Business Application

In this module, students are expected to integrate the knowledge they gained during the first two years of study and undertake a year-long project in the field of Marine & Offshore Technology. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

DIPLOMA PLUS PROGRAMME

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

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

Clusters
- Aerospace Design
- Applied Physics*
- Computer-Aided Design Skills (World Skills Singapore)
- Leisure & Retail Management
- Workplace Safety & Health

Other Available Diploma Plus Certificates
- Advanced Engineering Mathematics*
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The programme aims to bridge the gaps between the curriculum of engineering mathematics at polytechnics and that of first-year engineering mathematics in universities.

For detailed module descriptions under each cluster, please refer to page 180.

DIPLOMA IN MECHANICAL ENGINEERING (ME)

3-YEAR COURSE

MARINE, MECHANICAL & MECHATRONICS CLUSTER

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

Mechanical Engineering is a very important, general but pervasive branch of engineering. Most products and systems consist of Mechanical Engineering components. The ME course thus offers a broad-based programme with exciting specialisation options to give students a firm foundation to work at the forefront of changing and emerging technologies.

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

First-year modules focus on engineering basics, mathematical skills and computing tools, thus giving students a firm grounding in solving engineering problems. As they progress to higher levels, students are systematically introduced to the core mechanical engineering modules such as thermodynamics, fluid mechanics, computer-aided design, strength of materials and engineering design.

In their final year, students can opt for a six-month internship with established local or overseas companies. Alternatively, students can choose to do the Project Design and Development programme and select a final-year discipline-specific option in Automotive Technology & Motorsports, Environment & Energy Systems, Biomedical Applications, Design Innovation, or Automation & Robotics Technology.

In response to the increasing industry demand for engineering graduates to have skills in the area of business management, a Minor in Business Management was introduced. It aims to nurture graduates who are technically competent and equipped with business knowledge to succeed in the changing industry environment.

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

ENTRY REQUIREMENTS

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

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

You must also fulfil the aggregate computation requirements.

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

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

CAREER PROSPECTS

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

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

ACCREDITATION FOR FURTHER STUDIES

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

The Singapore Institute of Technology together with the University of Glasgow now offers ME graduates the opportunity to pursue a Bachelor of Engineering with Honours in Mechanical Design Engineering on Ngee Ann campus. Graduates also enjoy advanced standing and subsidised fees.

ME is well-recognised by both local and overseas universities, which grant advanced standing for their relevant degree programmes. Some of the university courses to which ME graduates gain advanced standing are as follows.

- Nanyang Technological University
  Bachelor of Engineering in Mechanical Engineering, Aerospace Engineering, Bioengineering or Materials Engineering
- National University of Singapore
  Bachelor of Engineering in Mechanical Engineering
- Singapore Institute of Technology & the University of Glasgow
  Bachelor of Engineering with Honours in Mechanical Design Engineering or Mechatronics
- University of Manchester (United Kingdom)
  Bachelor of Engineering in Mechanical Engineering
- University of Warwick (United Kingdom)
  Bachelor of Engineering in Mechanical Engineering
- University of New South Wales (Australia)
  Bachelor of Engineering in Mechanical Engineering
- University of Melbourne (Australia)
  Bachelor of Engineering in Mechanical Engineering

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Engineering Mathematics 1	5
Electrical Technology	6
Computer Programming	4
Engineering Mechanics	5
Engineering: A Creative Profession	3
Sports & Wellness^	2
Idea Jumpstart^	2
Level 1.2 (26 hours per week)	
Engineering Drawing & Computer-Aided Design	5
Engineering Mathematics 2	5
Engineering Materials	4
Manufacturing Technology & Practice	4
Electronics Technology	4
Communication & Contemporary Issues^	4
YEAR 2	
Level 2.1 (23 hours per week)	
Engineering Mathematics 3B	4
Industrial Automation	5
Thermodynamics	5
Applied Mechanics	5
Idea Blueprint^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (25 hours per week)	
Computer-Aided Design	4
Computer-Aided Manufacturing	4
Fluid Mechanics	4
Strength of Materials	5
Engineering Design	4
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (24 hours per week)	
Instrumentation & Control	5
Mechanics of Machines & Materials	5
Applied Thermodynamics	5
Engineering System Design	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2

Module Name	Credit Units
Level 3.2 (25 hours per week)	
Six-month Internship	25
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (27 hours per week)	
Instrumentation & Control	5
Mechanics of Machines & Materials	5
Option Module (Automotive Technology & Motorsports, Biomedical Applications, Design Innovation, Environment & Energy Systems, or Automation & Robotics Technology)	5
Project Design & Development 1 (in the specific option)	6
Project Management	2
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (22 hours per week)	
Applied Thermodynamics	5
Engineering System Design	5
Project Design & Development 2 (in the specific option)	12
MINOR IN BUSINESS MANAGEMENT#	
YEAR 2	
Level 2.1 (27 hours per week)	
Engineering Mathematics 3B	4
Industrial Automation	5
Thermodynamics	5
Applied Mechanics	5
Marketing Fundamentals	4
Business & the Economy^	2
Idea Blueprint^	2
Level 2.2 (25 hours per week)	
Computer-Aided Design	4
Fluid Mechanics	4
Strength of Materials	5
Engineering Design	4
Fundamentals of Financial Management	4
Effective People Management^	2
Idea Launchpad^	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (20 hours per week)	
Mechanics of Machines & Materials	5

Module Name	Credit Units
Mechanical System Design	3
Starting & Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (25 hours per week)	
Six-month Internship	25
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (23 hours per week)	
Mechanics of Machines & Materials	5
Project Design & Business Application 1	6
Starting & Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (22 hours per week)	
Applied Thermodynamics	5
Engineering System Design	5
Project Design & Business Application 2	12

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

The Minor in Business Management has the same Year 1 curriculum.

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

COURSE MODULES

LEVEL 1.1

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

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

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

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

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

LEVEL 1.2

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

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

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

Manufacturing Technology & Practice
Students will acquire the basic knowledge and skills of manufacturing processes, including drilling, turning, milling, grinding, non-conventional machining, welding,

plastic moulding and assembly. The module is practice-oriented with classroom lectures complemented by practical sessions involving the making of specially-designed work pieces.

Electronics Technology

The aim of this module is to introduce the fundamental concepts of electronics which include analogue and digital electronic devices and circuits. The first section covers concepts pertaining to analogue electronics. These include understanding the analogue electronic circuitry, diodes, transistors and their applications. The second half of the module covers concepts on digital electronics. Topics include number systems, Boolean algebra, combinational logic design, applications of latches, flip-flops, counters and registers.

LEVEL 2.1

Engineering Mathematics 3B

This module is a continuation of Engineering Mathematics 2. Topics include Integration Techniques & Applications, First Order Differential Equation, 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 is a follow-on module of Engineering Mechanics. It will equip students with the necessary skills to analyse problems of rigid bodies at rest and in motion. Topics include Trusses, Friction, Centroid, Relative motion, Work energy method, Power and efficiency & Impulse momentum method. This knowledge plays an important role in many diverse engineering applications of the modern world, such as the design of cars, structures, airplanes, and various types of machines. Students will be guided to solve engineering problems using these mechanics principles.

Marketing Fundamentals

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

LEVEL 2.2

Computer-Aided Design

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 and feature-based solid modelling software system in creating 3-dimensional models and engineering drawings.

Computer-Aided Manufacturing

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

Fluid Mechanics

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

Strength of Materials

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

Engineering Design

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

Fundamentals of Financial Management

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

LEVELS 3.1 & 3.2

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.

Project Management

The module covers the organisational and operational aspects of project management. Topics include 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).

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.

Engineering System Design

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

Six-month Internship

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

Project Design & Business Application 1

In this module, students are expected to integrate the knowledge they gained during the first two years of study and undertake a year-long project in the field of Mechanical Engineering. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

Starting & Managing an Enterprise

Through this module, students undertake to generate business ideas and propose how these ideas can be developed into a business plan incorporating operational and financial requirements and marketing strategies for a new enterprise. In addition, students will learn how the principles of management can be applied to organise and develop the enterprise. Topics covered include entrepreneurial concepts and issues, business entry and exit strategies, types of business ownership, sources of business financing, venture launch and management principles.

Project Design & Business Application 2

This module is a continuation of Project Design & Business Application 1 where students undertake a year-long project on a topic in the field of Mechanical Engineering. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

Mechanical System Design

This module covers practical design methodologies, including Design for Manufacture and Assembly (DFMA) and mechanism design. Through practical projects, students experience the complete design cycle from defining objectives, gathering information, generating, evaluating and refining concepts, selecting final design, designing and sizing components, to preparing assembly and detailed drawings, and communicating designs using quality folio, report and oral presentation.

Project Design & Development 1

In this module, students will work in teams to design and develop a product or system related to the final-year option module. Through the project, students learn to apply their knowledge and skills in creative problem solving, engineering and design, teamwork and project management. This module focuses on the identification of problem or need, research and design.

Project Design & Development 2

This module follows on from Project Design and Development 1. Based on the design prepared in the first semester, students are required to fabricate the prototype, assemble the parts, test and refine the prototype, prepare the refined design and a project report. The students are also required to do a final presentation to a panel of examiners.

FINAL-YEAR OPTION MODULES

Automotive Technology & Motorsports

This activity-based module covers the structures, functions, main components and operations of land vehicles and motorsports, including recent development of ‘green’ vehicles. The module prepares students to undertake an automotive project, which takes them through the complete cycle of idea generation, design, manufacturing, testing and presentation.

Biomedical Applications
This activity-based module covers biomechanics and rehabilitation engineering, biomaterials and implant, and medical imaging with rapid prototype. The module prepares students to undertake a biomedical application project, which involves the complete cycle of idea generation, design, manufacturing, prototype testing, report and presentation.

Design Innovation
This activity-based module covers the design, innovation and development process involving problem research and definition, target user group and product design specifications, aesthetic and ergonomic requirements. The module prepares students to undertake a design innovation project, which involves the complete cycle of idea generation, design, manufacturing, prototype testing, report and presentation.

Environment & Energy Systems
This activity-based module covers environmental issues and energy saving in mechanical systems, alternative and renewable energy sources, and the heat transfer principles and design requirements and applications of air-conditioning systems. The module prepares students to undertake an environment and energy system project, which involves the complete cycle of idea generation, design, manufacturing, prototype testing, report and presentation.

Automation & Robotics Technology
This practical-oriented module aims to equip students with a working knowledge of computer control, interfacing techniques and microcontroller operation. Major topics include the basic numbering system, PIC microcontroller application development and programming, webpage authoring, industrial robot programming, motor control and application, and web-based device control. Students will gain a practical insight on applying digital techniques over a wide range of automation and control applications.

BUSINESS MANAGEMENT ELECTIVES
(Students to choose one of the four electives below)

E-Business in Practice
The module introduces database concepts, information systems, value chains and the integrated enterprise systems. Students will develop multi-table database applications for e-business, incorporating interactive digital media functionalities and also gain exposure in buying and selling on the Web using auction sites with payment settlement functions. They will learn business workflow modelling through the business value chain to improve business processes using IT systems and tools within an integrated enterprise system.

Managing Service Operations
This module introduces the operations in service organisations and the use of techniques for designing, planning, organising and controlling resources for the delivery of goods and services to meet customers' needs and organisational objectives. Concepts covered include service facility, managing facilitating goods, forecasting demand, managing waiting lines, process improvement, inventory management, service supply relationship and service quality.

Supply Chain Management
This module introduces students to the process of planning, implementing, controlling the operations of the supply chain. It will cover the movement and storage of raw materials, work-in-process inventory and finished goods from point-of-origin to point-of-consumption. The module also emphasises the effect supply chain management has on the success and profitability of the organisation.

Understanding Buyer Behaviour
The module provides students with a basic understanding of buyer behaviour concepts. It explores the different types of buying decision processes and the various influencing factors that affect buyer decisions. Buyers could be consumers or corporate buyers. Topics covered include consumer decision-making processes, perceptions and attitudes, consumer demographics and lifestyles, and cultural and group influences.

DIPLOMA PLUS PROGRAMME

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

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

Clusters
- Aerospace Design
- Applied Physics*
- Computer-Aided Design Skills (World Skills Singapore)
- Leisure & Retail Management
- Workplace Safety & Health

Other Available Diploma Plus Certificates
- Advanced Engineering Mathematics*
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The programme aims to bridge the gaps between the curriculum of engineering mathematics at polytechnics and that of first-year engineering mathematics in universities.

For detailed module descriptions under each cluster, please refer to page 180.