DIPLOMA IN MECHANICAL ENGINEERING

Mechanical engineering touches virtually every aspect of modern life. Imagine an autonomous car powered by renewable energy and a robotic exoskeleton that can help seniors improve their range of motions. With the Diploma in Mechanical Engineering (ME) to give you a head start into building such sleek technology, you'll soon be winning on all fronts. One of the core disciplines of engineering, mechanical engineering is needed practically everywhere - from precision engineering, facilities and infrastructure to environment and energy, as well as the transportation sectors.

A highly versatile course, ME provides a broad-based education that enables you to excel in diverse career choices. Its strong emphasis on applied design thinking skills gives you an edge in creating innovative solutions for using clean energy, developing new materials and processes, designing and manufacturing products that range from consumer products to medical devices.

In your first year, you will learn the fundamentals of mechanical engineering with a focus on materials and design skills. It covers modules such as Thermofluids, Materials & Manufacturing Technology and Mechanical Engineering Fundamentals. In your second year, you will deepen your understanding with modules such as Engineering System Design and Strength of Materials.

In your final year, you will get to work on a final-year project that involves the design and development of a new product prototype with real-world application. Or you can round off your learning journey with a local or overseas internship with established organisations such as ST Engineering and A*STAR.

YEAR 1 COURSE MODULES

LEVEL 1.1

Electrical Engineering Fundamentals
This module provides a foundation in electricity covering basic concepts of electrical circuits and the methods used to analyse them. The module emphasises the understanding of the basic electrical circuit laws (Ohm's Law, Kirchhoff's Voltage and Current Laws) and network theorems, and their application to electrical network analysis. Topics covered include fundamentals of electricity, network theorems, capacitance, electromagnetic induction and inductance.

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

Integrated Real-world Project 1
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and further enhanced through relevant contextualisation. Students will work in teams and undertake the project development underpinned by the design thinking approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects. Data analytics will be introduced using case-based approach and applied in the integrated real-world project. The Career & Professional Preparation 1 will be incorporated to give students a foundational introduction to their three-year diploma course curriculum and how it prepares them for industry. It will help them to embark on their course with the end in mind, through guided reflection of their personal characteristics, and producing an overall game plan for their future education and career goals.

Mechanical Engineering Fundamentals
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 motion in two dimensions will be covered. Topics include kinematics and kinetics of linear motion.

Programming
This practice-oriented module equips students with basic knowledge and skills in computer programming using a suitable high-level language. The main topics include basic computer programming concepts and fundamental programming constructs such as sequences, selection and repetition.

LEVEL 1.2

Electrical & Electronic Technology
The aim of this module is to introduce the fundamental concepts of digital electronic devices and circuits. It intends to deepen the electrical fundamentals learnt in the first semester. Topics include AC circuit theory and transformer fundamentals, number systems, Boolean algebra, combinational logic design, applications of latches, flip-flops, counters and registers.

Engineering Mathematics 2
This module is designed to provide students with the fundamental skills in mathematics required to solve basic engineering problems. Topics are introduced in an order that is intended to keep abreast of the application requirements in engineering modules. The emphasis in each topic is on simple applications and problem solving. Throughout the module, there is appropriate use of a Computer Algebra System. Topics include trigonometry, differentiation and simple integration with applications.

Integrated Real-world Project 2
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and understand the relevance and application of the modules learnt. Students will work in teams and undertake the project development underpinned by the design thinking approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects at the higher levels. This module will also imbue in students a sense of civic consciousness in the context of engineering and society. It serves to create awareness amongst students about the impact of engineering on society in general. In the process it introduces the application of cultural quotient (CQ) skills and mould students' disposition to understand and collaborate across diverse cultures in real world settings.

Materials & Manufacturing Technology
This module introduces students to 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 and composites. For manufacturing technology, students will acquire the basic knowledge and skills of manufacturing processes, including drilling, turning, milling, grinding, non-conventional machining, welding and assembly.

Thermofluids
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 application of thermofluid's principles in simple engineering systems.

YEAR 1 COURSE CURRICULUM

Module Name	Credit Units
Level 1.1 (20 hours per week)	
Electrical Engineering Fundamentals	3
Engineering Mathematics 1	4
English Language Express*	NA
Innovation Made Possible^	3
Integrated Real-world Project 1	4
Mechanical Engineering Fundamentals	3
Programming	3
Level 1.2 (21 hours per week)	
Communication Essentials^	3
Electrical & Electronics Technology	3
Engineering Mathematics 2	4
Health & Wellness^	1
Integrated Real-world Project 2	4
Materials & Manufacturing Technology	3
Thermofluids	3

Notes:
^ For more details on Interdisciplinary Studies (IS) electives, please log on to www.np.edu.sg/is
* This module is only offered to students who are weaker in the English Language.

IS Modules
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School of Engineering

YEAR 2 COURSE MODULES

LEVEL 2.1

Advanced Materials
The module aims to provide students with the knowledge of heat treatment, microstructure of alloys, composites materials and high-performance materials. The module will teach student on analysing materials based on engineering design and applications. It covers basic principle of the processing and characterisation of materials in engineering.

Applied Thermofluids
Thermofluids is a module of science and engineering encompassing two intersecting fields namely Thermodynamics and Fluid mechanics. In relation to mechanical engineering, Thermodynamics is the science of converting energy involving heat to mechanical work and Fluid Mechanics is the study of physical forces in a system in the presence of fluid when at rest or in motion. Heat energy had to be transported by fluid in order to undergo various thermodynamic processes and becomes mechanical work eventually. The way fluid would flow ultimately dominates the entire thermal energy conversion process.

This module extends the coverage of Thermofluids in year 1, which further the basic concepts and principles of Thermodynamics and Fluid mechanics concepts. Behaviour of fluids under different conditions like static, dynamic and under the influence of heat will be covered in further details. The most important 2nd law of Thermodynamics will be introduced. Subsequently, Basic Engineering cycles developed from the 2nd law including Steam power cycles and Gas power cycles will be discussed. Students will also be taught on the methods of Engine performance testing.

Industrial Automation
This module aims to equip students with the basic knowledge of automation technologies and their applications in the manufacturing and process industries. With the rise of new digital industrial technology, known as Industry 4.0, students will also be introduced to smart sensors which have the ability to collect data that can be used for data analysis.

Major topics include electro-pneumatics technology, programmable logic control and IO-Linked technology (for smart sensors). The essential hardware components used in automated systems, such as sensors, valves and actuators will be applied to the automated systems. Widely accepted industrial control programming language ladder and inline structured text will be covered, in conjunction with the learning of programming logic controllers and computer interfaces.

Laboratory work involves hands-on circuit construction and implementation using these various technologies and techniques, which enhances students' understanding of the practical aspects of circuit designs.

Integrated Real-world Project 3
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and understand its relevancy and applications. Students will work individually and in teams to undertake the project development underpinned by the design thinking and computer-aid design (3D modification skills) approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects at the higher levels.

The Career and Professional Preparation 2 will be incorporated to equip students with skills necessary to seek and secure work. They will also be equipped to communicate their personal brand in a positive way. As students sharpen their communication skills, they will also learn how to market themselves effectively.

Project Management
This module provides students with an understanding of the various aspects of project management procedures. The module also equips students with various project management tools. The module is supplemented with tutorial

assignments, and case studies are included to reinforce basic understanding and concepts which can be applied in practical situations.

LEVEL 2.2

Advanced Manufacturing Technology
This module aims to supplement the students' knowledge of Manufacturing Technology Theory and Practice which they had learned in the first year. The module aims to equip students' with the theoretical knowledge in some major manufacturing processes in Singapore and the necessary practical skills in CNC machining and programming for other follow-on modules. Workshop Practice, Hands-on Demonstration and Practical Assignments are designed to enhance students' understanding of the subject and enable them to work confidently with CNC machines in students' future career. Major topics cover the study CNC machining and programming and precision engineering.

Engineering System Design
This module aims to equip students with the fundamental knowledge and practice of the engineering design process, the applications of engineering principles and analysis in the design, sizing and selection of components such as electric motor, coupling, gears, bearing, chain drives, and fastener. This module will also introduce the basic concept of Geometrical Dimensioning & Tolerance (GD&T) to the students. Case studies of existing machines and systems, guided tutorials, quizzes, assignments, and a practical project will be used to reinforce the theoretical aspects.

Integrated Real-world Project 4
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and understand its relevancy and applications. Students will work individually and in teams to undertake the project development underpinned by the design thinking and computer-aid design (3D creation skills) approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects at the higher levels.

This module will also imbue in students a sense of civic consciousness in the context of engineering and safety. The module will also imbue in students' a safety-oriented mindset and develop students' workplace safety and health (WSH) competencies and raise their safety awareness of self and their surroundings.

Quality Systems & Analytics
This module prepares students to apply quality system management techniques and principles in their future workplace. Topics include Quality Systems and Audits, quality tools and techniques including the application of statistical software for process control, Gage Repeatability and Reproducibility, Hypothesis Testing, Design of Experiments, Statistical Process Control, and Mistake Proofing to optimise and improve products and processes. Process Capability Analysis, Lean Manufacturing for waste elimination and Six Sigma initiatives for defect reduction will also be discussed.

Strength of Materials
This module aims to provide students with the foundational knowledge of strength of materials with emphasis on applications and problem solving. It introduces to students the methods in the calculation of stresses and strains in various structural members such as beams, columns and shafts. Taking into account the material properties, students would then be able to apply the methods to predict the response of a structure under loading. Topics include simple stresses and strains, torsion in shaft, shear force and bending moment diagrams, stresses in beams, combined stresses and experimental stress analysis.

YEAR 2 COURSE CURRICULUM

Module Name	Credit Units
Level 2.1 (18 hours per week)	
Advanced Materials	3
Applied Thermofluids	4
Industrial Automation	4
Integrated Real-world Project 3	4
Project Management	3
Level 2.2 (20 hours per week)	
Advanced Manufacturing Technology	4
Engineering Systems Design	3
Integrated Real-world Project 4	4
Quality Systems and Analytics	3
Strength of Materials	4
World Issues: A Singapore Perspective^	2

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YEAR 3 COURSE MODULES

LEVEL 3.1

Applied Mechanics
This is a follow-on module from Mechanical Engineering Fundamentals. It will equip students with the necessary skills to analyse problems of rigid bodies at rest and in motion. Topics include trusses, friction, work energy method, power and efficiency and impulse momentum method. This knowledge plays an important role in many diverse engineering applications in 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.

Integrated Real-world Project 5
This module aims to integrate the knowledge learnt in the semester and apply to a real-world project and understand the relevance and application of the modules learnt. Students will work in teams and undertake the project development underpinned by the design thinking Computer-Aided Design approach. On completion of the module, students will be able to apply the skills and develop confidence in tackling projects.

This module will also imbue in students a sense of civic consciousness in the context of engineering and sustainability. It will develop students' competencies in sustainable development, raise their awareness of sustainability in the context of society and the environment, and appreciate the impact engineering solutions may have on the environment.

Mechanics of Machines & Materials
This module will provide students with 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.

System Modelling & Control
The module focuses on modelling the dynamics and servo systems, analysis of system responses 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 and mixed systems, Laplace transform, s-plane, standard forms, time-domain specifications, effects of control actions on system performance, and frequency response analysis.

LEVEL 3.2

6-Month Internship
The six-month internship will provide 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.

Final Year Project
In this module, students will work in teams to design and develop a product or system related to the final year specialisation module. 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. Student are required to fabricate the prototype, assemble the parts, test and refine the prototype, and prepare the refined design and a project report. Students are also required to do a final presentation to a panel of examiners.

YEAR 3 COURSE CURRICULUM

Module Name	Credit Units
Level 3.1 (20 hours per week)	
Applied Mechanics	4
Integrated Real-world Project 5	4
Mechanics of Machines & Materials	4
Project ID: Connecting The Dots^	4
System Modelling & Control	4
Level 3.2 (20 hours per week)	
6-Month Internship OR Final Year Project	20

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