COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (26.5 hours per week)	
Career & Professional Preparation I	1.5
Computer Programming	4
Electrical Technology	4
Engineering Mathematics 1	5
Engineering Mechanics	4
Engineering Skills & Practice	4
Innovation Toolkit 1 ^	2
Sports & Wellness ^	2
Level 1.2 (26 hours per week)	
Discrete Analogue Electronics	6
Engineering Mathematics 2	5
Fundamentals of Object Oriented Programming	4
Strength of Materials	5
Communication & Contemporary Issues ^	4
Innovation Toolkit 2 ^	2

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

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

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.

Electrical Technology
This module provides a foundation in electricity to prepare students for more specialised subjects. It deals with the 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, AC circuit theory and transformer fundamentals.

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

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 and at simple linear motion. 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, plane friction, kinematics and kinetics of linear motion.

Engineering Skills & Practice
This module aims to provide students with the necessary practical knowledge and engineering skills. Topics covered include computer-aided drafting (AutoCAD), mechanical skills in milling, turning & sheet metal work, electrical & electronic measurement & test instrumentation as well as breadboard fabrication & testing.

Career & Professional Preparation I
This module helps 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 three-year 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. The module aims to deepen students' commitment to the sector that the course prepares them for.

LEVEL 1.2

Discrete Analogue Electronics
The aim of this module is to lay the foundation in electronics. It will cover concepts pertaining to analogue devices. With the fundamentals of basic circuit theory frequently revisited, the module will deal with the operating characteristics, and working principles and applications of discrete electronic devices such as the various types of diodes, MOSFETs and BJTs. Practical circuits will be used to enhance and strengthen the students' knowledge so that they will acquire the relevant competencies to move on to more specialised modules. This module is the prerequisite for the Analogue Circuit Design and Applications module.

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

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

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.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 2	
Level 2.1 (25 hours per week)	
Data Structures & Algorithms	4
Digital Electronic Circuits	6
Engineering Mathematics 3A	4
Physics 1	4
Thermodynamics	5
Interdisciplinary Studies (IS) elective ^	2
Level 2.2 (25 hours per week)	
Analogue Circuit Design & Applications	5
Career & Professional Preparation II	2
Engineering Design	3
Fluid Mechanics	4
Microcontroller Programming & Interfacing	5
Physics 2	4
Interdisciplinary Studies (IS) elective ^	2

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COURSE MODULES

LEVEL 2.1

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

Digital Electronic Circuits
This module covers the fundamentals of digital electronics. The basic principles and techniques of digital system and design are covered. It is also intended to prepare students for higher level modules involving microprocessors and microcomputers. The main topics covered are number systems, Boolean algebra, combinational logic circuits and minimisation techniques, flip-flops and multi-vibrators, Integrated Circuit (IC) counters and data handling devices. IC electrical characteristic including TTL & CMOS devices and application of IC buffer/driver will also be covered.

Engineering Mathematics 3A
This module is a continuation of Engineering Mathematics 2. Topics include integration with applications, differential equations, Laplace transform and Fourier Series.

Physics 1
This module covers the topics of Classical Mechanics. Students learn the laws of motion in both one and two dimensions. They also study concepts of work and energy for linear systems including linear momentum and collision. The practical sessions will introduce students to system modelling and simulation using MATLAB.

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.

LEVEL 2.2

Analogue Circuit Design & Applications
This module introduces students to the operating principles of commonly used analogue devices and circuits, such as operational amplifiers, oscillators and filters. Applications in various practical circuits are also illustrated.

Career & Professional Preparation II
This module helps 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.

Engineering Design
This module will guide students to integrate various domain knowledge acquired to develop working models of engineering systems (e.g. two-arm robots, autonomous vehicles and DSP-based control systems). Students will work on mini-projects in teams under supervision and formulate and present solutions to the review panel at the end of the semester. The module serves as a stepping stone to prepare students for their Final-Year Projects.

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

Microcontroller Programming & Interfacing
This module introduces students to the fundamentals of microcontroller programming and interfacing. C language programming is used to illustrate the operation of the microcontroller. Interfacing the microcontroller to basic input-output devices such as switches, LEDs, 7-segment display and keypads helps to demonstrate the behaviour of the application software running on a working system.

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

COURSE CURRICULUM

Module Name	Credit Units
YEAR 3	
Level 3.1 (25 hours per week)	
Nanotechnology Fundamentals & Applications	5
Project Design & Development	20
Level 3.2 (24 hours per week)	
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
AUTOMATION & MECHATRONIC SYSTEM SPECIALISATION	
Digital Signal Processing	5
Emerging Mechatronic Technologies	5
Industrial Automation	5
System Modelling & Control	5
ELECTRICAL & ELECTRONIC ENGINEERING SPECIALISATION	
Circuit Analysis & Processing	5
Digital Signal Processing	5
Fundamentals of Control Systems	5
Telecommunication Principles	5
MECHANICAL ENGINEERING SPECIALISATION	
Applied Thermodynamics	5
Fundamentals of Control Systems	5
Mechanics of Machines & Materials	5
Industrial Automation	5

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COURSE MODULES

LEVEL 3.1

COMMON MODULES:

Nanotechnology Fundamentals & Applications

Conventionally, nanotechnology education has been limited to postgraduate students working in specially settings, such as cleanrooms, within research-based universities. This module aims to take nanotechnology education out of these settings and infuse it into a diploma curriculum using desktop-based nanotechnology instruments/in-house case studies. It provides an opportunity for students to experience nanotechnology in a hands-on learning environment and understand the sciences, intricacies, and instruments necessary to work at the nanoscale.
The module aims to equip students with a suite of skill sets that are relevant to industries such as semiconductors, imprint, solar cells, aerospace and biomedical engineering in Singapore. The same skill sets also provide students a level of competency required in universities should they decide to pursue further studies.

Project Design & Development

In this module, students will work together in teams of two to design and implement a project that exposes them to engineering skills as well as teamwork, over a period of one semester. Students are required to demonstrate their ability and resourcefulness in implementing their selected project design solution. The scope of work includes printed circuit board fabrication, wiring, assembly and testing of the final prototype.

LEVEL 3.2

Modules under the specialisations

Applied Thermodynamics

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

Circuit Analysis & Design

This module aims to provide students with a sound grounding of the concepts and methods in circuit analysis and design. Topics covered include impedance, transient behaviors of RLC circuits, frequency response, spectrum & resonance, filters and two ports network functions. The practical sessions will introduce students to circuit design and simulation.

Digital Signal Processing

This module provides students with knowledge of Digital Signal Processing (DSP) technology, and equips them with practical skills in DSP software and hardware implementation. It will also provide students with the ability to work on various advanced digital signal processors.

Emerging Mechatronic Technologies

The aim of the module is to provide the students with a platform to keep abreast of 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.

Fundamentals of Control Systems

This module provides students with a basic coverage of feedback control systems. The topics cover the basic concepts of automatic control, the components of control systems, simple analytical tools, and stability analysis of systems. Students are also introduced to the use of MATLAB/Simulink a computer tool in control systems analysis.

Industrial Automation

In this module, students will first be introduced to electrical control systems, which cover sequential motor control circuits, direct-on-line and star-delta motor starter circuits. Students will then be taught the PLC (programmable logic controller) theory of operation, basic functions, the I/O addressing and interfacing, and the design of ladder logic programmes. Students will design PLC-based systems related to industrial applications through numerous hands-on exercises.

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.

System 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.

Telecommunication Principles

This module introduces students to radio communication. It builds an understanding of the basic concepts of analogue communication systems. The characteristics of a basic communication system and the environmental factors that affect communication will be discussed. The concepts that are necessary for an understanding of linear systems will be explained, with an emphasis on resonance and filters. Students will be taught the fundamental concepts of analogue modulation and demodulation techniques such as AM and FM and their applications.