COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (22.5 hours per week)	
Career & Professional Preparation I	1.5
Computer Programming	4
Electrical Technology	4
Engineering Mathematics 1	5
Engineering Mechanics	4
Innovation Toolkit: Acquiring the Skills ^	2
Sports & Wellness ^	2
Level 1.2 (26 hours per week)	
Manufacturing Technology & Practice	4
Electronics Technology	4
Engineering Materials	4
Engineering Mathematics 2	5
Automation in a Mechatronic World	3
Communication & Contemporary Issues ^	4
Innovation Toolkit: Applying the Skills ^	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

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.

Computer Programming
This practice-oriented module equips students with 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 the 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. Topics include algebra, trigonometry, logarithms, plane analytic geometry, matrices and complex numbers. Throughout the module, there is appropriate use of a Computer Algebra System.

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

LEVEL 1.2

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.

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

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.

Manufacturing Technology & Practice

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

COURSE CURRICULUM

Module Name	Credit Units
YEAR 2	
Level 2.1 (26 hours per week)	
Computer-Aided Design & Drafting	4
Engineering Design Analysis	4
Engineering Design Thinking	3
Engineering Mathematics 3B	4
Fluid Mechanics	4
Thermodynamics	5
Interdisciplinary Studies (IS) elective ^	2
Level 2.2 (27 hours per week)	
Applied Mechanics	5
Career & Professional Preparation II	2
Industrial Automation	5
Mechatronic Design Practice	3
Microcontroller & Interfacing	5
Strength of Materials	5
Interdisciplinary Studies (IS) elective ^	2

MINOR IN BUSINESS MANAGEMENT[#]

Module Name	Credit Units
YEAR 2	
Level 2.1 (27 hours per week)	
Computer-Aided Design & Drafting	4
Engineering Design Analysis	4
Engineering Design Thinking	3
Marketing Fundamentals	4
Microcontroller & Interfacing	5
Strength of Materials	5
Business & the Economy ^	2
Level 2.2 (25 hours per week)	
Applied Mechanics	5
Career & Professional Preparation II	2
Engineering Mathematics 3B	4

Fundamentals of Financial Management	4
Industrial Automation	5
Mechatronic Design Practice	3
Effective People Management ^	2

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

COURSE MODULES

LEVEL 2.1

Computer-Aided Design & Drafting
This practice-oriented module is designed to give students an appreciation of the scope of computer graphics and hands-on practice in the applications of CAD (Computer-Aided Design) in engineering design. This module aims to help students in the application of the drafting concepts and modelling techniques for development of product models in the design process. Students will learn the principles and capabilities of CAD through three dimensional (3D) solid modelling of engineering components and assembly. A project is used to consolidate the concepts and techniques learnt in the CAD module and EDA (Engineering Design Analysis) module. An appreciation of finite element analysis is also included in the module.

Engineering Design Analysis
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 motors, coupling, gears, bearing, shaft, key and chain drives.

Engineering Design Thinking
This module aims to teach students the engineering design thinking process that designers adopt to define the problem, do relevant research to acquire information, analyse knowledge and provide creative solutions to the problem in the design and planning fields. With the thinking process, problems can be framed, the right questions can be asked, more ideas can be created, and the best answers can be chosen.

Engineering Mathematics 3B
This module is a continuation of Engineering Mathematics 2. Topics include integration techniques and applications, first order differential equation, Laplace transform, probability and statistics.

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.

Marketing Fundamentals
The module introduces concepts and principles of 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 Ps in marketing, topics covered also include segmentation, targeting and positioning, product mix, service marketing, channel decisions and branding.

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

Applied Mechanics
This is a follow-on module from 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, 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.

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.

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.

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

Mechatronic Design Practice
This is a hands-on module that aims to provide students with the opportunities to translate the knowledge and skills learnt from module Engineering Design Thinking into practice through the detailed design, fabrication and testing of an engineering application prototype. In the process, students will hone their design knowledge and skills required for their final-year project or internship.

Microcontroller & Interfacing
This practice-oriented module aims to equip students with a working knowledge of microcontroller applications and interfacing techniques, 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 into applying digital techniques over a wide range of automation and control applications.

Strength of Materials

This module aims to provide students with 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 3	
INTERNSHIP	
Level 3.1 (28 hours per week)	
Automation Systems Integration	4
Project Management	3
Systems Modelling & Control	5
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
AEROSPACE SYSTEMS SPECIALISATION	
Aircraft Propulsion Systems	4
Aircraft Structures & Systems	4
Avionics Theory & Systems	4
MARINE & OFFSHORE SYSTEMS SPECIALISATION	
Marine Engineering Systems	4
Offshore Production Systems	4
Shipyard Production Systems	4
INDUSTRIAL SYSTEMS SPECIALISATION	
Communication & Vision Systems	4
Industrial Drive Systems	4
Unmanned Systems	4
Level 3.2 (22 hours per week)	
6-Month Internship	22
NON-INTERNSHIP	
Level 3.1 (26 hours per week)	
Mechatronics Design Project 1	7
Project Management	3
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
AEROSPACE SYSTEMS SPECIALISATION	
Aircraft Propulsion Systems	4
Aircraft Structures & Systems	4
Avionics Theory & Systems	4
MARINE & OFFSHORE SYSTEMS SPECIALISATION	

Marine Engineering Systems	4
Offshore Production Systems	4
Shipyard Production Systems	4
INDUSTRIAL SYSTEMS SPECIALISATION	
Communication & Vision Systems	4
Industrial Drive Systems	4
Unmanned Systems	4
Level 3.2 (24 hours per week)	
Automation Systems Integration	4
Emerging Mechatronic Technologies	5
Mechatronic Design Project 2	10
Systems Modelling & Control	5

MINOR IN BUSINESS MANAGEMENT[#]

Module Name	Credit Units
YEAR 3	
INTERNSHIP	
Level 3.1 (25 hours per week)	
Automation Systems Integration	4
Business Management Elective	4
Fluid Mechanics	4
Starting & Managing an Enterprise	4
Thermodynamics	5
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
Level 3.2 (22 hours per week)	
6-Month Internship	22
NON-INTERNSHIP	
Level 3.1 (24 hours per week)	
Business Management Elective	4
Product Design & Business Application 1	7
Starting & Managing an Enterprise	4
Thermodynamics	5
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
Level 3.2 (23 hours per week)	
Automation Systems Integration	4
Fluid Mechanics	4
Project Design & Business Application 2	10
Systems Modelling & Control	5

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COURSE MODULES

LEVEL 3.1 & 3.2

6-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.

Automation Systems Integration
This practical-based module aims to equip students with a working knowledge of advanced process control involving both digital Input/Output and analogue Input/ Output, industrial standard PLC (Programmable Logic Controller) programming using IEC 6113 standard languages. Students will also be exposed to robot applications and programming using academic robots with programming environment.

Students will acquire PLC programming skills using Ladder Diagram, Structures Text (ST), and Sequential Function Chart (SFC) through practical sessions in programming on Modular Production System. Practical sessions in off-line (virtual) robot programming on DENSO VE206A robotic will enable students to understand the implementation of robot motion control for automated process.

Emerging Mechatronic Technologies
This module comprises three areas of engineering: Micro Electromechanical Systems (MEMS), Introduction to Digital Image Processing and Applied Optics. The topics covered in MEMS provide an understanding of MEMS devices, their fabrication techniques and applications. Digital Image Processing provides techniques of image processing using software and GUI commands. Students will also learn about image manipulation, analysis and video tracking. Applied Optics will expose students to the basic optical theories, equipment and effect of different lighting systems.

Mechatronic Design Project 1
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.

Mechatronic Design Project 2
This module follows on from Mechatronic Design Project

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, and prepare the refined design and a project report. Students are also required to do a final presentation to a panel of examiners.

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.

Project Management

This module aims to provide students with a thorough understanding of Projects and Project Management techniques such as Project Planning, Scheduling and Controlling using network analysis such as Critical Path Method (CPM), Gantt Charts and Program Evaluation & Review Technique (PERT). The major topics include: Introduction to Projects and Project Management, CPM, Resource Scheduling, Project Costs, Project Control and PERT. The course is supplemented with tutorial assignments. Case studies are included to reinforce basic understanding and concepts which can be applied in practical situations.

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.

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 and mixed systems, Laplace transform, s-plane, standard forms, time-domain specifications, effects of control actions on system performance, and frequency response analysis.

AEROSPACE SYSTEMS SPECIALISATION

Aircraft Propulsion Systems

This module aims to provide students with fundamental knowledge of the aircraft power plant. Students will 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.

Aircraft Structures & Systems

This module aims to provide students with fundamental knowledge of aircraft structures and systems and 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.

Avionics Theory & Systems

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

MARINE & OFFSHORE SYSTEMS SPECIALISATION

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.

Offshore Production Systems

This module aims to equip students with the knowledge of offshore oil and gas production systems that include the various offshore oil and gas platforms, marine exploration, well-drilling and floating production systems. Students will be equipped with fundamental knowledge of automation principles about drilling, separation, gas and water treatment, gas flaring, and enhanced recovery and utility systems. Subsea production systems, flow lines and risers dynamics, as well as the dynamics and control of remote-operated vehicles will also be covered.

Shipyard Production Systems

This module aims to equip students with the knowledge of the shipyard production systems involved in the design, engineering and commissioning found in shipbuilding, rig-building, ship repair and conversion. Practical hands-on work includes programming CNC machines, plasma-cutting machines and commissioning equipment. The module has a mini capstone project on designing a shipyard with state-of-the-art automation systems for the next generation shipyard.

INDUSTRIAL SYSTEMS SPECIALISATION

Communication & Vision Systems

The module focuses on 2 areas of engineering: Data Communication and Networking, specifically on Fieldbuses and Industrial Networks, and Computer Vision. The topics covered in Data Communication and Networking provide a basic understanding of both wired and wireless communication technologies based on the various network standards and models. Fieldbuses and Industrial Networks aims to expose students to the various industrial networks protocols used in process control and automation. Computer Vision provides basic knowledge of various image processing techniques.

Industrial Drive Systems

This module builds on modules taught in Level 1 and 2 to equip students with knowledge of both electrical and mechanical drive systems which are the core manipulating and actuating systems of all machines. This module focuses on practical knowledge required to select (sizing), implement (commissioning) and maintain the multi axis system. Topics cover introduction of multi axes system and the components with many variations and types that are available in the industry. Motors, motor drives, encoders, power supply, mechanical drives and brakes, motion controller and structures required to mount these motors are also taught.

Unmanned Systems

This module introduces the system architecture of unmanned systems. Students will gain practical insight into both hardware and software aspects in developing, integrating and operating unmanned systems. Topics of hardware components such as battery systems, navigation sensors, and detection systems along with software components such as operating system and motion planning will be covered. Students will also review case studies of unmanned systems operating across land, sea and sky.

BUSINESS MANAGEMENT ELECTIVES

Students are to choose *one* of the three electives below:

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 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 their knowledge/skills in their main discipline of study, or to equip them with additional professional knowledge that would better prepare them 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 list below. The offer of a DPP cluster is subject to the condition that the minimum class size is met and based on available vacancies.

Engineering Clusters
- Applied Physics#
- Aviation Fundamentals
- Computer-Aided Design Skills (World Skills Singapore)
- Workplace Safety & Health

Other available Diploma Plus Certificates
- Advanced Engineering Mathematics*
- Business**
- Innovation Management
- Foreign Languages

The Applied Physics syllabus is aligned with the NTU's FE1012: Physics A module. NP students who obtain good grades in the Applied Physics modules will be granted exemption from the FE1012: Physics A module.
* The CAEM syllabus is aligned with the 'A' Level H2 Pure Mathematics syllabus. NP graduates who have successfully completed the revised CAEM will be granted exemption from the NUS' MA1301 Proficiency Test.
** Students pursuing the Minor in Business Management cannot take the DPP Certificate in Business (CIB).