DIPLOMA IN ENGINEERING SCIENCE

You're passionate about engineering applications, but also love the sciences. You're strong in both math and physics. You're also keen to explore scientific research and discover new ways to solve real-world problems. You don't have to settle on a compromise – how about honing all these interests through the Diploma in Engineering Science (ES)?

The unique ES diploma prepares you well for a wide range of degrees and careers in fields such as artificial intelligence and machine learning, as well as computer, electrical, electronic, and mechanical engineering, material and even medical science.

During the first two years, you will be equipped with a strong foundation in engineering and related domains such as mathematics, physics, applied science and research. You will attend distinguished guest lectures and go on industry visits. You may also be exposed to short stints with research establishments and institutes such as NUS, NTU, SUTD, and A*STAR.

In your second year, you may also get to visit top overseas universities such as Tokyo Metropolitan University (Japan), Tokyo Metropolitan College of Industrial Technology (Japan) or Nanjing University of Science & Technology (China). There, you will interact with students and professors, and be exposed to the latest developments in technology and innovation.

In the third year, you will be exposed to the skills and knowledge in emerging technologies in artificial intelligence and machine learning, and embark on a final year project or R&D-oriented internship. You may have the opportunity to be attached to Nanyang Technological University (NTU), National University of Singapore (NUS), Singapore University of Technology & Design (SUTD), a research institute, or Technology Centres, where you will be involved in projects supervised by university professors and researchers. You could also get a chance to work on a R&D-oriented internship with local startups and multinational companies, as well as an overseas internship. These projects and internships will cover a wide range of topics such as artificial intelligence, automotive vehicles, additive manufacturing, Internet of Things (IoT), robotics, biomedical engineering, green energy and material science.

YEAR 1 COURSE MODULES

LEVEL 1.1

Applied Mathematics 1
This module aims to provide students with the fundamental skills in applying mathematics to solve engineering problems. Topics are introduced to keep abreast of the application requirements in engineering modules. The emphasis in each topic is on applications and problem solving. Topics include exponential functions, logarithmic functions, trigonometric functions, plane analytic geometry, complex numbers and applications, differentiation and applications, basic integration and applications. Materials on MOOC platform could be adapted in the module delivery.

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.

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

AC Circuits
The aim of the module is to provide first year students with a basic knowledge of the fundamental principles in electric circuit analysis. The module first explores DC network theorems such as Kirchhoff's Laws, Thevenin's Theorem and Principle of Superposition. Application of the theorems are then extended to AC circuits which involve impedances such as capacitance and inductance. The module also includes analysis of simple AC series, parallel and series-parallel combination circuits, concept of AC power and understanding of power factor and its effect on electrical energy usage.

Analogue Electronics
The aim of this module is to lay the foundations in analogue electronics. At the end of this module, students will acquire content knowledge and understanding on the basic concepts of analogue electronics and some applications. Key topics covered in this module include operating characteristics, working principles and applications of discrete electronic devices such as various types of diodes, MOSFETs and BJTs. Practical circuits will be used to enhance and strengthen the learners' knowledge so that they will acquire the relevant competencies to move on to more specialised modules.

Applied Mathematics 2A
This module aims to provide students with the fundamental skills in applying mathematics to solve engineering problems. Topics are introduced to keep abreast of the application requirements in engineering modules. The emphasis in each topic is on applications and problem solving. Topics include further techniques of integration, applications of using exponential, logarithmic & trigonometric integrals, Fourier series, first-order differential equations, Laplace transform and applications, matrices and determinants. Materials on MOOC platform could be adapted in the module delivery.

Digital Fundamentals
This module introduces the basic concepts of digital systems. It covers the basics of combinational and sequential logic circuits. Flip-flops and their application in counters and registers will also be discussed. This basic knowledge is essential for students to be able to understand, analyse, and design basic digital circuit system.

Integrated Real-World Project 2
This module aims to integrate the knowledge learnt in the semester and apply to a real-world projects with service learning as the main emphasis. 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 designing solutions to problems faced at service learning partners' premises.

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.

YEAR 1 COURSE CURRICULUM

Module Name	Credit Units
Level 1.1 (20 hours per week)	
Applied Mathematics 1	4
Electrical Engineering Fundamentals	3
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)	
AC Circuits	3
Analogue Electronics	3
Applied Mathematics 2A	4
Communication Essentials^	3
Digital Fundamentals	3
Health & Wellness^	1
Integrated Real-World Project 2	4

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
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.

YEAR 2 COURSE MODULES

LEVEL 2.1

Integrated Real-world Project 3
This module aims to integrate the knowledge learnt in the semester and apply to a real-world projects with service learning as the main emphasis. Students will work in teams and deploy their projects at service learning partners' premises. On completion of the module, students will be able to apply the skills and develop confidence in delivering 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.

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.

Object-oriented Programming
This module introduces object-oriented programming to students who already have a foundation in procedural programming. It covers the fundamental concepts of object-oriented programming with introduction to basic web and database applications.

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.

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 thermofluids' principles in simple engineering systems.

LEVEL 2.2

Data Structures & Algorithms
This module's focus is on algorithms, not user interface. Code implementation platform is mainly C++. Basic data structures covered in this module include array, linked-list, stack, queue and binary search tree. For each of these data structure, students learn to devise algorithms, where appropriate, to add, to delete, to search or to sort data etc. Brief introduction to encryption and hash coding concepts are covered in advanced topics leading to an appreciation of block-chain technology from software perspective.

Embedded System
This module aims to equip students with a basic fundamental in microcontroller and embedded System. Students will acquire the necessary skills and knowledge through a series of practical projects and real-world applications. Students will be able to implement a microcontroller based system and interfacing with various input/output components as well as sensors.

Integrated Real-World Projects 4
This module will guide students to integrate various domain knowledge acquired to develop working models of engineering systems. Students have the opportunity to participate in projects at local universities & research institutions, start-up companies and at various Technology Centres in NP.

The module serves as a step stone to prepare students for their Integrated Real-World Project 5. The projects aim to get students to learn the proper process of conducting a research & development project from the beginning to the finish, starting from identifying the problem(s), defining the specifications, project scheduling, researching for solutions, evaluating & selecting designs, implementation & refinement, and report writing and presentation.

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

Physics 2
This module builds on Physics 1 and extends the coverage into other aspects of Physics such as Electrostatics and Magnetism. Students will be required to work on two mini projects which are related to the different physical concepts covered in this module.

YEAR 2 COURSE CURRICULUM

Module Name	Credit Units
Level 2.1 (18 hours per week)	
Integrated Real-World Project 3	4
Materials & Manufacturing Technology	3
Object Oriented Programming	4
Physics 1	4
Thermofluids	3
Level 2.2 (19 hours per week)	
Data Structures & Algorithms	4
Embedded System	5
Integrated Real-World Project 4	4
Physics 2	4
World Issues: A Singapore Perspective^	2

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YEAR 3 COURSE MODULES

LEVEL 3.1

Artificial Intelligence & Machine Learning
The module aims to cover knowledge representation and reasoning which are fundamentals of artificial intelligence (AI) with a focus on the computing aspect of AI and machine learning. Students will learn AI's underlying enabling technologies such as machine learning and neural networks. They will also learn how to use Python to develop simple applications for machine learning.

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, and filters. The practical sessions will introduce students to circuit design and simulation.

Integrated Real-world Project 5
This module will give students an opportunity to integrate and apply knowledge in research and development projects at local universities & research institutions, start-up companies and at various Technology Centres in NP. Besides research, design and project management skills, the emphasis will also be on innovation, creativity, teamwork and enterprise.

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.

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

Final Year Project
In this module, students will work in teams to design and develop a product or system related to a real world project. 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.

6-Month Internship (Local/Overseas)
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.

YEAR 3 COURSE CURRICULUM

Module Name	Credit Units
Level 3.1 (20 hours per week)	
Artificial Intelligence & Machine Learning	4
Circuit Analysis & Design	4
Integrated Real-World Project 5	4
Project ID - Connecting the Dots^	4
System Modelling & Control	4
Level 3.2 (20 hours per week)	
Final Year Project OR 6-Month Internship (Local/Overseas)	20

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