ENGINEERING SCIENCE COURSE MODULES

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 - why not let us hone all these interests through the Diploma in Engineering Science [ES]?

With a curriculum designed in consultation with Nanyang Technological University [NTU], National University of Singapore [NUS] and Singapore University of Technology and Design [SUTD], ES prepares you well for a wide range of careers and degrees in engineering fields such as aerospace, computer, electrical, electronic and mechanical as well as material 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 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 final-year project or R&D-oriented internship.

You may have the opportunity to spend about four days a week either in NTU, NUS, SUTD, or a research institute where you will be involved in projects supervised by university professors and researchers. These projects will cover a wide range of topics such as aerospace, robotics, biomedical engineering, green energy and material science.

LEVEL 2.1

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.

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.

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.
**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.

**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.

**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.

**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.

**World Issues: A Singapore Perspective (WISP, IS Module)**

The module will expand on the awareness of contemporary issues introduced in the communication module in Year 1 and allow for a continued engagement with real world issues in Year 2 while preparing them for the Year 3 interdisciplinary project. Students will be asked to examine issues from various perspectives so as to better appreciate the dynamism of real-world problems and their role as active citizens in society.

Experiential learning will continue to be the key pedagogical approach with more game-based learning included to further engage students. WISP will also continue to be the main mode of delivering Character & Citizenship Education in NP.
## COURSE CURRICULUM

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Credit Units</th>
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<tbody>
<tr>
<td><strong>YEAR 2</strong></td>
<td></td>
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<tr>
<td><strong>Level 2.1 (18 hours per week)</strong></td>
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<tr>
<td>Materials &amp; Manufacturing Technology</td>
<td>3</td>
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<tr>
<td>Thermofluids</td>
<td>3</td>
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<tr>
<td>Physics 1</td>
<td>4</td>
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<tr>
<td>Object Oriented Programming</td>
<td>4</td>
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<tr>
<td>Integrated Real-World Project 3</td>
<td>4</td>
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<tr>
<td><strong>Level 2.2 (19 hours per week)</strong></td>
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<tr>
<td>Data Structures &amp; Algorithms</td>
<td>4</td>
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<tr>
<td>Embedded System</td>
<td>5</td>
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<tr>
<td>Physics 2</td>
<td>4</td>
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<tr>
<td>Integrated Real-World Project 4</td>
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<tr>
<td>World Issues: A Singapore Perspective ^</td>
<td>2</td>
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**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.