

DIPLOMA IN AEROSPACE ELECTRONICS (AE) (3-YEAR COURSE)

SCHOOL OF ENGINEERING
AEROSPACE CLUSTER



The aerospace industry is a significant sector of Singapore's economy, with annual output exceeding \$6.9 billion in 2007. There are over 100 aerospace companies employing more than 18,000 people to serve both regional and global markets, and a projected 18,000 more jobs will be available in the aerospace industry by 2018.

The **Diploma in Aerospace Electronics (AE)** aims to cater to this growing demand for professionals with aerospace electronics skills. Going beyond mere maintenance and repair, this course gives a strong foundation in basic aircraft-related modules such as the Fundamentals of Aerospace Technology, and specialised modules like Aircraft Navigation and Communication Systems, and Aircraft Electrical and Instrumentation Systems.

First-year students take a number of common core engineering modules as well as specialised aircraft-related modules such as Avionics Systems and Fundamentals of Aerospace Technology. Second-year students have more hands-on exposure in a number of practice-oriented modules to enhance their knowledge and practical skills in electronic engineering.

Third-year students broaden their educational experience through specialised modules and a six-month internship with leading aerospace organisations such as Singapore Technologies Aerospace, The Republic of Singapore Air Force, Eurocopter SEA, Rockwell Collins and Honeywell, to learn and apply their knowledge in a real-time environment.

The AE course is also designed to meet the Singapore Airworthiness Requirements (SAR 66) standard, stipulated by the Civil Aviation Authority of Singapore (CAAS).

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examination (or equivalent) results and fulfill the aggregate computation requirements:

Subject	'O' Level Grade
English Language	1-7**
Mathematics (Elementary/Additional)	1-6
Science (with Physics or Chemistry or Biology component) or Design & Technology or Computer Studies	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology or Computer Studies and two other subjects.

** Candidates with English as a second language must have attained a minimum grade of 6.

Candidates with hearing deficiency or severe vision deficiency including colour appreciation deficiency should not apply for the course.

CAREER PROSPECTS

Career prospects for AE graduates are bright. Graduates can work as aircraft maintenance engineers, be involved in R&D activities, provide engineering support, or work in sales and marketing.

ACCREDITATION FOR FURTHER STUDIES

AE graduates can pursue an electrical or electronic engineering degree at local universities or an avionics degree with overseas universities such as:

- Queensland University of Technology (Australia)
- University of Glasgow (UK)
- University of Bristol (UK)
- Queen Mary University of London (UK)

COURSE CURRICULUM (INTERNSHIP)

Module Name	Credit Units
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YEAR 1

Level 1.1 (26 hours per week)

Electrical Technology	6
Engineering Mechanics	5
Engineering Mathematics 1	5
Electrical & Electronic Drawing & Computer-Aided Design	3
Fundamentals of Aerospace Technology	3
Sports & Wellness [^]	2
Creativity & Applied Thinking Skills [^]	2

Level 1.2 (26 hours per week)

Analogue Electronics	5
Digital Electronics	5
Engineering Mathematics 2	5
Computer Programming	4
Avionics Systems	3
Communication Toolkit [^]	4

YEAR 2

Level 2.1 (24 hours per week)

Aircraft Maintenance Practices	3
Electronic Practical Skills	4
Analogue Circuit Design and Application	5
Applications Programming	4
Engineering Mathematics 3A	4
Interdisciplinary Studies (IS) module [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 2.2 (24 hours per week)

Microcontroller Programming & Interfacing	6
Telecommunication Principles	6
Fundamentals of Control Systems	5
Aircraft Materials	3
Innovation & Enterprise in Action [^]	4

YEAR 3

Level 3.1 (19 hours per week)

Aircraft Navigation & Communication Systems	5
Aircraft Electrical & Instrumentation Systems	6
Avionics Project Design	4
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 3.2 (25 hours per week)

Six-month Internship	25
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Module Name	Credit Units
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Across Level Modules (Level 1.2 onwards) (6 hours per week)

School of Engineering (SoE) elective module*	3
School of Engineering (SoE) elective module*	3

COURSE CURRICULUM (NON-INTERNSHIP)

Module Name	Credit Units
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YEAR 1

Level 1.1 (26 hours per week)

Electrical Technology	6
Engineering Mechanics	5
Engineering Mathematics 1	5
Electrical & Electronic Drawing & Computer-Aided Design	3
Fundamentals of Aerospace Technology	3
Sports & Wellness [^]	2
Creativity & Applied Thinking Skills [^]	2

Level 1.2 (26 hours per week)

Analogue Electronics	5
Digital Electronics	5
Engineering Mathematics 2	5
Computer Programming	4
Avionics Systems	3
Communication Toolkit [^]	4

YEAR 2

Level 2.1 (24 hours per week)

Aircraft Maintenance Practices	3
Electronic Practical Skills	4
Analogue Circuit Design and Application	5
Applications Programming	4
Engineering Mathematics 3A	4
Interdisciplinary Studies (IS) module [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 2.2 (24 hours per week)

Microcontroller Programming & Interfacing	6
Telecommunication Principles	6
Fundamentals of Control Systems	5
Aircraft Materials	3
Innovation & Enterprise in Action [^]	4

YEAR 3

Level 3.1 (21 hours per week)

Aircraft Navigation & Communication Systems	5
Embedded System Design	4
Project Design and Development 1	8
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 3.2 (23 hours per week)

Radio Frequency and Microwave Engineering	5
Aircraft Electrical & Instrumentation Systems	6
Project Design and Development 2	12

Module Name	Credit Units
Across Level Modules (Level 1.2 onwards) (6 hours per week)	
School of Engineering (SoE) elective module*	3
School of Engineering (SoE) elective module*	3
Notes:	
^ For more details on Interdisciplinary Studies (IS) modules, please log on to www.np.edu.sg/is/ .	
* For more details on School of Engineering elective modules, please refer to page 165.	
Students are required to own Notebook Computers.	
IS Modules	
The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge-based economy. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.	
School of Engineering (SOE) Elective Modules	
The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and deepen their discipline specific areas. Each cluster comprises a minimum of three 3-hour modules. Students are required to take two modules in order to satisfy the minimum graduating requirement.	

COURSE MODULES

LEVEL 1.1

Electrical Technology

This module introduces the necessary foundation for electrical circuit analysis covering electrical theorems and techniques for analysing and solving direct and alternating current circuit problems. Laboratory assignments include basic electrical measurement skills and concepts learnt in lectures and tutorials.

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 and rotational motion in two dimensions will be covered. Topics include Kinematics of linear and rotational motion, and Kinetics of linear and rotational motion.

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.

Electrical & Electronic Drawing & Computer-Aided Design

This module introduces the concepts of electronic circuit drawing and printed circuit board (PCB) layout using a modern computer-based electronic design automation (EDA) package. Using the software, students will design PCBs, starting from schematic capture to PCB layout post-processing and library parts creation. The module, which adopts a completely hands-on approach, prepares them for final-year projects that involve electronic circuit design and manufacturing.

Fundamentals of Aerospace Technology

This activity-based module introduces students to the principles of flight and traces the historical development of aerospace technology and its impact on society, economics, safety and environmental issues. It highlights the nature and scope of the aerospace industry in Singapore, and the broad technical training for the profession with specific reference to the structure of the course. The module aims to create professional awareness in students.

LEVEL 1.2

Analogue Electronics

The aim of this module is to introduce the fundamental concepts of analogue electronic devices and circuits. It covers semiconductor physics as well as the device characteristics, operating principles and common applications of diodes and transistors. The module will equip students with a thorough understanding of DC biasing and AC operation of transistor amplifier circuits. This will be achieved through worked examples, tutorials, laboratory sessions and e-learning materials.

Digital Electronics

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 subsequent subjects involving microprocessors and microcomputers. The main topics covered are number systems, Boolean Algebra, combinational logic circuits and minimisation techniques, flip-flops and multivibrators, IC counters, and data handling devices.

Engineering Mathematics 2

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

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 programs for simple engineering applications.

Avionics Systems

This module provides students with an appreciation of aircraft electronic systems. It includes topics such as cockpit instrumentation, aircraft navigation, communication, surveillance, control and lighting electronics. This module equips students with the knowledge required for the advanced modules on Aircraft Navigation and Communication Systems (ANCS) and Aircraft Electrical & Instrumentation Systems (AEIS).

LEVEL 2.1

Aircraft Maintenance Practices

This module aims to equip students with basic knowledge of and good practices in the workshop. It covers various soldering methods such as welding, brazing, soldering and bonding, aircraft weight and balance, aircraft handling and storage, disassembly, inspection, repair and assembly techniques, and maintenance procedure.

Electronic Practical Skills

This is a hands-on module that aims to equip students with the necessary practical skills in electronic circuit construction, testing, measurement and analysis. Students will also put into practice concepts covered in the level 1 module Electrical Technology.

Analogue Circuit Design and 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.

Applications Programming

This practice-oriented module equips students with the fundamental skills required to develop Windows applications. The students will develop conceptual understanding to design and develop applications to solve business and engineering problems. Main topics include branch and loop, array, bitwise operation, datafiles accessing and methods.

Engineering Mathematics 3A

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

LEVEL 2.2

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 displays and keypads help to demonstrate the behaviour of the application software running on a working system.

Telecommunication Principles

This module is the introductory module to radio communication. This module gives an understanding of the basic concepts of analog communication systems. Characteristics of a basic communication system and the environmental factors that affect communication will be first discussed. A review of the mathematical groundwork of signal

analysis will also be done and the concepts that are necessary for the understanding of linear systems will be developed, with emphasis on resonance and filters. Students will be taught the fundamental concepts of analog modulation techniques like AM and FM and their applications. The demodulation process will subsequently be taught so that the students can understand the electrical characteristics underlying AM/FM reception and learn to appreciate the features of a good quality receiver.

Fundamentals of Control Systems

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

Aircraft Materials

The module covers the family of common engineering materials comprising metals, ceramics, polymers and composites, with an emphasis on the structures, properties, performance and processing of such materials. Corrosion & various fasteners components are included. Learning is enhanced by laboratory work on microstructures and mechanical testing.



LEVEL 3.1 AND 3.2

COMMON MODULES

Aircraft Navigation & Communication Systems

This module provides students with the theory of operations and the functional description of airborne navigation and communication systems found in modern aircraft. For example, systems covered are ADF, VOR, DME, IRS, HF & VHF. The standard digital data-bus communications protocol, such as ARINC 429 and ARINC 629 used by commercial aircraft and MIL-STD-1553B used by military aircraft, will also be covered.

Aircraft Electrical and Instrumentation Systems

This module provides students with the theory of operations and the functional description of aircraft instrument and electrical systems found in the modern aircraft. Students will also learn about the auto flight, flight control and management systems, emergency electronics, and cabin entertainment system.

INTERNSHIP PATHWAY

Avionics Project Design

Using a Problem-based Learning (PBL) approach that combines the fundamental learning process and engineering problem-solving, this module is designed to impart prerequisite skills and knowledge like problem analysis, defining and formulating a problem in engineering terms, and the use of software tools. Students will have the opportunity to apply these skills in real-life problem solving.

Six-month Internship

In this module, students will be attached to sponsoring companies for a period of approximately six months. During their attachments, they will undertake projects assigned by the company or be involved in operations or maintenance-related work. Student attachments may be undertaken locally or overseas.

NON-INTERNSHIP PATHWAY

Embedded System Design

Based on the foundation gained from the Microcontroller Programming and Interfacing (MPI) module, this module introduces students to more microcontroller-based system design and programming. It covers various commonly used hardware and software building blocks of embedded systems.

Project Design and Development 1

In this module, students will work together in teams of three to design and implement a project that demonstrates their engineering skills as well as teamwork over a period of two semesters. The module is structured to encourage creativity and innovative thinking. This will also help students develop a positive work attitude and good team spirit.

Radio Frequency and Microwave Engineering

The objective of this module is to present to the students the basic principles, characteristics and applications of a wide range of commonly used radio frequency and microwave integrated passive and active circuit hardware.

Project Design and Development 2

This module follows on from Project Design and Development 1. 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 according to the specifications and requirements defined in Project Design and Development 1. In addition, software based projects may require database coding, operating system implementation and testing, server and client system design, portable design field test and Web-based integration.



ACROSS LEVEL MODULES (LEVEL 1.2 ONWARDS)

School of Engineering Elective Modules and the Diploma Plus Programme

Students take two modules from a wide range of clusters under the engineering and non-engineering elective clusters to complete their diploma. Furthermore, students can qualify for a diploma plus by simply topping up with two additional modules from the same cluster as one of the electives. The Diploma Plus Certificate helps students if they wish to pursue a university degree or increase their employability in discipline-specific areas. Students can choose electives from the range listed below.

Engineering Clusters

- Advanced Engineering Mathematics*
- Aerospace Electronics
- Applied Physics*
- Biomedical Engineering
- Computer & Communication Systems
- Industrial Control
- Industrial Electronics
- Information Technology
- Mechanical Technology
- Microelectronics
- Network Systems & Security
- Telecommunication Distribution Technology

Non-engineering Clusters

- Economics & Financial Applications
- Green Development
- Leisure & Retail Management

Other Available Diploma Plus Certificates

- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The syllabus is based on the first-year engineering mathematics and science curricula of NUS.

For detailed module descriptions under each cluster, please refer to page 165.

DIPLOMA IN AEROSPACE TECHNOLOGY (AT) (3-YEAR COURSE)

SCHOOL OF ENGINEERING
AEROSPACE CLUSTER



The **Diploma in Aerospace Technology (AT)** covers the key disciplines of aviation. These include aerodynamics, propulsion, aircraft structures and systems, and aircraft stability and control. It prepares students for careers in the design, development and production of aircraft components and systems, as well as in aircraft maintenance, repair and overhaul (MRO), as Licensed Aircraft Maintenance Engineers. It is designed to meet the growing demand for skilled professionals in the aerospace industry.

Singapore's aviation industry is undergoing a major transformation as companies move up the value chain to design, development and other knowledge-intensive activities.

The integrated curriculum is grounded firmly in engineering fundamentals and supported by core aerospace modules on aircraft structures and systems, aircraft propulsion, mechanics of flight, avionics, airworthiness legislation, aerospace materials and processes.

On completing the course, students are well-prepared for careers in the aerospace industry and are able to provide engineering support in design and process development as well as technical services for aerospace manufacturing and maintenance activities.

Students are assessed through a mix of examinations and coursework, including project-based learning. Final-year students are also required to undergo a six-month internship with leading aerospace companies as an important element of the total learning experience.

A salient feature of the course is its flexibility. Students can choose to graduate with additional Diploma Plus and/or Enhancement Certificates depending on abilities and interests. These are optional programmes designed to broaden students' knowledge and deepen their skills in specific areas in preparation for higher degree courses and specialisations.

ENTRY REQUIREMENTS

To be eligible for consideration, candidates must have the following GCE 'O' Level examination (or equivalent) results and fulfill the aggregate computation requirements:

Subject	'O' Level Grade
English Language	1-7**
Mathematics (Elementary/Additional)	1-6
Science (with Physics or Chemistry or Biology component) or Design & Technology or Computer Studies	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology or Computer Studies and two other subjects.

** Candidates with English as a second language must attain a minimum grade of 6.

Candidates with hearing deficiency or severe vision deficiency including colour appreciation deficiency should not apply for the course.

CAREER PROSPECTS

As Asia's Aerospace Hub, Singapore undertakes a wide spectrum of value-added activities relating to MRO, component manufacturing and design. These activities range from airframe maintenance and modification, to engine overhaul and components design for manufacturing and process development.

The development of the Seletar Airport will further enhance Singapore's position as a global player in the industry. Over the past 16 years, the Singapore aerospace industry has grown by an average of more than 13 per cent a year. In 2007 alone, the aerospace industry grew by 10.4 per cent, with an output of \$6.9 billion.

Many lucrative and challenging job opportunities await graduates of this course. They enjoy good employment prospects as Aerospace Technologists providing technical support for aircraft maintenance, manufacturing design, process development and aerospace services for leading aerospace companies.

ACCREDITATION FOR FURTHER STUDIES

The AT course is well recognised by both local and overseas universities, which grant advanced standing for their relevant degree programmes:

- **Nanyang Technological University**
Bachelor of Engineering in Aerospace Engineering, Mechanical Engineering or Materials Engineering
- **National University of Singapore**
Bachelor of Engineering in Mechanical Engineering, Electrical Engineering or Computer Engineering
- **University of Manchester (UK)**
Bachelor of Engineering in Aerospace and Aeronautical Engineering
- **University of Sheffield (UK)**
Bachelor of Engineering in Aerospace and Aeronautical Engineering
- **University of New South Wales (Australia)**
Bachelor of Engineering in Aerospace Engineering
- **University of Queensland (Australia)**
Bachelor of Engineering in Aerospace Engineering

With the AT diploma, you will also enjoy recognition from many established aerospace organisations. Apply for an SIA Engineering Company (SIAEC) Apprentice Aircraft Maintenance Programme and be placed on an accelerated programme towards a professional qualification as a Licensed Aircraft Maintenance Engineer.

COURSE CURRICULUM

Module Name	Credit Units
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YEAR 1

Level 1.1 (26 hours per week)

Engineering Mathematics 1	5
Engineering Mechanics	5
Electrical Technology & Electronics	5
Fundamentals of Aerospace Technology	3
Computer Programming	4
Creativity & Applied Thinking Skills [^]	2
Sports & Wellness [^]	2

Level 1.2 (27 hours per week)

Engineering Mathematics 2	5
Thermofluid 1	4
Aerospace Manufacturing & Maintenance Practices	5
Aerospace Materials & Processes 1	4
Engineering Drawing & Computer-Aided Design	5
Communication Toolkit [^]	4

YEAR 2

Level 2.1 (24 hours per week)

Applied Mechanics	5
Engineering Design	4
Airworthiness Legislation	2
Strength of Materials	4
Aircraft Structures & Systems 1	5
Interdisciplinary Studies (IS) module [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 2.2 (24 hours per week)

Engineering Mathematics 3	4
Thermofluid 2	5
Mechanics of Flight	4
Aerospace Materials & Processes 2	4
Avionics Systems	3
Innovation & Enterprise in Action [^]	4

YEAR 3

Level 3.1 (19 hours per week)

System Dynamics & Control	5
Aircraft Propulsion Systems	5
Aircraft Structures & Systems 2	5
Interdisciplinary Studies (IS) module [^]	2
World Issues: A Singapore Perspective [^]	2

Level 3.2 (24 hours per week)

Six-month Internship	20
Quality System & Manufacturing Management	2
Human Factors	2

Across Level Modules (Level 1.2 onwards)

School of Engineering (SoE) elective module*	3
School of Engineering (SoE) elective module*	3

Notes:

[^] For more details on Interdisciplinary Studies (IS) modules, please log on to www.np.edu.sg/is/.

* For more details on School of Engineering elective modules, please refer to page 165.

IS Modules

The School of Interdisciplinary Studies (IS) delivers the interdisciplinary curriculum under the Ngee Ann Learning Model (NLM). The NLM was introduced in 2001 to nurture a new generation of professionals with multidisciplinary skills to meet the challenges of a knowledge-based economy. The NLM incorporates core disciplines and Interdisciplinary Studies. It also nurtures innovative and entrepreneurial traits through the Innovation & Enterprise in Action (I & E in Action) module. IS modules challenge boundaries and offer insights into Communication, Entrepreneurship, Life Skills, Media & the Arts, and Science & Technology.

SoE Elective Modules

The SoE elective modules fall under a wide range of clusters under both Engineering and Non-Engineering categories. The aim is to provide students with the opportunity to broaden their knowledge and/or deepen their discipline specific areas. Each cluster comprises a minimum of three 3-hour modules. Students are required to take two modules in order to satisfy the minimum graduating requirement.

COURSE MODULES

LEVEL 1.1

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. 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 and rotational motion in two dimensions will be covered. Topics include Kinematics of linear and rotational motion, and Kinetics of linear and rotational motion.

Electrical Technology & Electronics

This module equips students with fundamental electrical and electronics principles, and the necessary practical skills in handling basic test equipment, electrical circuits as well as electronic devices and circuits. Major topics include basic circuit elements, direct current circuits, Ohm's law, Kirchhoff's laws, transistors as well as common analogue and digital integrated circuits. This module provides the background knowledge for students to progress to the module Avionics Systems.

Fundamentals of Aerospace Technology

This activity-based module introduces students to the principles of flight, and traces the historical development of aerospace technology, its impact on society, and economics, safety and environmental issues. It highlights the nature and scope of the aerospace industry in Singapore, and the broad technical training for the profession with specific reference to the structure of the course. The module aims to create professional awareness in students.

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.

LEVEL 1.2

Engineering Mathematics 2

This module is a follow-on module of Engineering Mathematics 1. It further develops students' mathematical ability to solve engineering problems. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

Thermofluid 1

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 thermofluid applications in aircraft components and systems.

Aerospace Manufacturing & Maintenance Practices

This module aims to equip students with the basic knowledge and practical skills of aerospace manufacturing processes and maintenance practices. The topics include turning, milling, grinding, CNC machining, non-conventional machining, jigs and fixtures, finishing operations, measurements, sheet metal forming, welding, non-destructive test, wire locking, fasteners, assembly, and aircraft weight and balancing. Students learn through practical projects, reinforcing the theories covered in lectures with hands-on practice. Safety and a positive work attitude are emphasised in both theory and practical sessions.

Aerospace Materials & Processes 1

The module covers the family of common engineering materials comprising metals, ceramics, polymers and composites with emphasis on the structures, properties, performance and processing of such materials. Learning is enhanced by laboratory work on microstructures and mechanical testing.

Engineering Drawing & Computer-Aided Design

This module covers the basic principles of engineering drafting and the application of an industry-standard Computer Aided Design & Drafting tool to produce detailed drawings of engineering parts. This practice-oriented module comprises short lectures complemented by hands-on exercises with emphasis on practical examples and industry practices. Topics include orthographic projection, sectioning, dimensioning, conventional representation and assembly drawing.



LEVEL 2.1

Applied Mechanics

This module pertains to the study of external forces in two dimensions and their effects on particles and rigid bodies at rest. Students will be equipped with the necessary skills to analyse forces acting on rigid bodies by drawing free-body diagrams and applying the conditions of static equilibrium. The module also covers linear and rotational motion of particles and rigid bodies. Topics include forces and resultants, moments and couples, equilibrium, plane friction, kinematics and kinetics of linear and rotational motions.

Engineering Design

Students apply engineering principles systematically 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 motor, coupling, gears, bearing, shaft, key and chain drives.

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.

Aircraft Structures & Systems 1

The module covers the characteristics and design features of aircraft structures, general construction of the fuselage and main control surfaces, basic analysis of the stress and strain due to forces within the operating flight envelope, and the structural requirements imposed by the various aircraft systems. The module also covers other aircraft systems, such as hydraulic systems and landing gears, fuel and flight controls systems, as well as fuselage construction and failure concepts.

Airworthiness Legislation

Students are introduced to the main aviation regulations and airworthiness requirements governing the aerospace industry, approval and certification of aircraft products, governing bodies and agencies responsible for safety standards and aviation regulations, as well as the international treaties and bilateral agreements signed by Singapore and their impact on the development of the local industry. Due emphasis is given to the Civil Aviation Authority of Singapore and the Singapore Airworthiness Requirements.

LEVEL 2.2

Engineering Mathematics 3

This is the third module in the course to equip students with the mathematical tools and techniques to meet the computational requirements of the other engineering modules. Throughout the module, there is appropriate use of a Computer Algebra System. Topics include integration with applications, differential equations, Laplace transform, probability and statistics.

Thermofluid 2

This follow-on module of Thermofluid 1 covers the application of thermodynamics principles to flow and non-flow process as well as power cycles. Topics include perfect gases and perfect gas laws, the first and second laws, flow and non-flow processes, steady flow energy equation, gas cycles, combustion, rotary expanders and compressors, one-dimensional compressible flow, and dimensionless groups.

Mechanics of Flight

The module covers the fundamentals of aerodynamics and the principles governing flight and control. Topics include forces acting on an aircraft, the behaviour of the aerofoil at subsonic speed, aircraft thrust and propulsion, performance characteristics, and factors affecting flight, take-off, landing, maneuvers, stability and control. Practical sessions include model construction projects, software simulation and wind tunnel experiments.

Aerospace Materials & Processes 2

This module focuses on the design and selection of aerospace materials and processes including aluminium, magnesium, titanium and nickel-based systems, super alloys, ceramics and composites. Topics include materials specifications, design guidelines and choice of materials and processes, fatigue and creep, corrosion and corrosion control, materials forming, selective surface hardening and surface modification techniques, surface integrity and non-destructive techniques.

Avionics 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.

LEVEL 3.1

System Dynamics & Control

The module focuses on modeling the dynamic behaviour of systems including vibration in aircraft systems, and shaping the dynamic response through closed-loop control, with case studies on flight control surfaces and landing gear systems. Major topics include modeling single-discipline systems and mixed systems, Laplace transform, s-plane, time-domain specifications, effects of control actions on system performance, frequency response analysis and introduction to state-space.

Aircraft Structures & Systems 2

This module covers aircraft hydraulic components and their working principles, hydraulic circuits, operating characteristics, hydraulic drives and application circuits, control of landing gears and flight control surfaces. It also covers environmental control systems encompassing air-conditioning, cabin pressurisation, oxygen system and the various auxiliary systems such as fire and ice protection system, water and waste system, and rain removal.

Aircraft Propulsion Systems

This module equips students with 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.

LEVEL 3.2

Six-month Internship

A six-month attachment to aerospace companies gives students the opportunity to apply the knowledge acquired in the classroom to work situations and to associate work experience with classroom learning. Students learn to demonstrate their skills in problem solving and communication in a work environment. They will work independently and in a team, and have practitioners in the aerospace industry as mentors to enhance their learning process.

Quality System & Manufacturing Management

Students learn to apply quality management techniques and principles. Topics include total quality management concepts and philosophy, quality systems and audits, benchmarking and quality costs, quality tools and techniques, statistical quality control techniques, sampling plans and inspection techniques, design of experiments to optimise and improve products and processes, and lean manufacturing in the aerospace industry.

Human Factors

This module introduces students to human factors and how they affect performance at work. Topics include social psychology, physical environment, type of tasks, as well as communication and human errors, with special reference to the aerospace industry.



ACROSS-LEVEL MODULES (LEVEL 1.2 ONWARDS)

School of Engineering Elective Modules and the Diploma Plus Programme

Students take two modules from a wide range of clusters under the engineering and non-engineering elective clusters to complete their diploma. Furthermore, students can qualify for a diploma plus by simply topping up with two additional modules from the same cluster as one of the electives. The Diploma Plus Certificate helps students if they wish to pursue a university degree or increase their employability in discipline-specific areas. Students can choose electives from the range listed below.

Engineering Clusters

- Advanced Engineering Mathematics*
- Aerospace Design
- Applied Physics*
- Applied Technology
- Biomedical Engineering
- Industrial Control
- Industrial Electronics
- Information Technology
- Mechanical Technology
- Telecommunication Distribution Technology
- Workplace Safety & Health

Non-engineering Clusters

- Economics & Financial Applications
- Green Development
- Leisure & Retail Management

Other Available Diploma Plus Certificates

- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The syllabus is based on the first-year engineering mathematics and science curricula of NUS.

For detailed module descriptions under each cluster, please refer to page 165.