

DIPLOMA IN AEROSPACE ELECTRONICS (AE) 3-YEAR COURSE

AEROSPACE CLUSTER



The **Diploma in Aerospace Electronics (AE)** aims to provide students with broad-based engineering core-skills with a specialisation in aviation electronics. This encompasses the skills-set required for Maintenance, Repair & Overhaul (MRO) work of modern aircraft. The AE course curriculum is designed to meet the Singapore Airworthiness Requirements (SAR 66) standard, stipulated by the Civil Aviation Authority of Singapore (CAAS). It is also aligned with the Air Transport Pilot License (ATPL) ground theory examination requirements. The ATPL is the highest level of aircraft pilot license, and those certified as airline transport pilots can become pilot-in-command of commercial aircraft.

AE involves the application of electronics to aviation. It deals with all the electronics on-board modern aircraft including communication, navigation, flight control, instrument, in-flight entertainment, microprocessor, sensor and electrical systems.

Final-year students work in teams to design and build exciting and challenging aerospace and electronic projects such as a remote control airship with GPS capabilities and smart electronic systems. Students will also have an opportunity to work on industry-based projects granted by leading aerospace companies.

Final-year students may pursue a six-month internship with leading aerospace companies such as ST Aerospace, Eurocopter SEA, Thales Aerospace, Rockwell Collins, the Republic of Singapore Air Force and SIA Engineering.

In 2009, a cooperative educational agreement was signed with EMBRY-RIDDLE AERONAUTICAL UNIVERSITY (USA). This agreement allows selected AE students to participate in overseas educational activities such as internships, projects and research work.

An agreement with Eurocopter SEA allows students to work on more activities such as off-campus training and internships.

In addition, students will be taught the basics of flying. This will be coupled with hands-on training on a flight

simulator to acquire skills in flying with navigation aids.

In response to the increasing industry demand for engineering graduates to have good combinational skill set in the area of business management, a new Minor in Business Management has been included. It aims to produce graduates who are technically competent yet equipped with business knowledge to succeed in the changing industry environment.

ENTRY REQUIREMENTS

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

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

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology or Food & Nutrition (Grade 1-9) or a relevant OSIE / Applied Subject 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

With over 100 aerospace companies that serve global and regional markets based in Singapore, your job prospects are bright. Graduates can work in the aerospace and electronics industries in areas such as engineering and maintenance support, research and development and sales and marketing, to name a few.

AE curriculum's alignment with SAR 66 requirements gives graduates a head start should they decide to become a Licensed Aircraft Maintenance Engineer (AME). At the same time, by acquiring the basics of flying skills using the Cessna flight simulator, graduates will enjoy an advantage if they decide to pursue a career in flying. A number of AE graduates have joined the Republic of Singapore Air Force as trainee pilots.

ACCREDITATION FOR FURTHER STUDIES

AE graduates can pursue either an electrical and electronics degree or related degree at a local or overseas university or an avionics/aerospace related degree from Singapore Institute of Management University or at overseas universities such as:

- Embry Riddle Aeronautical University (USA)
- The University of Sheffield (UK)
- University of Bristol (UK)
- University of Bath (UK)
- University of Liverpool (UK)
- Queensland University of Technology (Australia)
- University of Adelaide (Australia)

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Electrical Technology	6
Engineering Mechanics	5
Engineering Mathematics 1	5
Electronic Practical Skills	4
Avionics Systems	3
Sports & Wellness^	2
Idea Jumpstart^	2

Module Name	Credit Units
Level 1.2 (27 hours per week)	
Analogue Electronics	5
Digital Electronics	6
Engineering Mathematics 2	5
Computer Programming	4
Fundamentals of Aerospace Technology	3
Communication & Contemporary Issues^	4
YEAR 2	
Level 2.1 (23 hours per week)	
Aircraft Maintenance Practices	3
Electrical & Electronic Drawing & Computer-Aided Design	3
Analogue Circuit Design and Applications	5
Applications Programming	4
Engineering Mathematics 3A	4
Idea Blueprint^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (23 hours per week)	
Microcontroller Programming & Interfacing	6
Telecommunication Principles	6
Electronic Design & Prototyping	4
Aircraft Materials	3
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (25 hours per week)	
Aircraft Navigation & Communication Systems	5
Fundamentals of Control Systems	5
Aircraft Electrical & Instrumentation Systems	6
Avionics Project Design	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (25 hours per week)	
Six-month Internship	25
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (27 hours per week)	
Aircraft Navigation & Communication Systems	5
Radio Frequency and Microwave Engineering	5
Digital System Design & Applications	5
Project Design and Development 1	8
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (23 hours per week)	
Fundamentals of Control Systems	5
Aircraft Electrical & Instrumentation Systems	6
Project Design and Development 2	12

COURSE CURRICULUM (MINOR IN BUSINESS MANAGEMENT)

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Electrical Technology	6
Engineering Mechanics	5
Engineering Mathematics 1	5
Electronic Practical Skills	4
Avionics Systems	3
Sports & Wellness^	2
Idea Jumpstart^	2
Level 1.2 (27 hours per week)	
Analogue Electronics	5
Digital Electronics	6
Engineering Mathematics 2	5
Computer Programming	4
Fundamentals of Aerospace Technology	3
Communication & Contemporary Issues^	4
YEAR 2	
Level 2.1 (24 hours per week)	
Electrical & Electronic Drawing & Computer-Aided Design	3
Analogue Circuit Design and Applications	5
Applications Programming	4
Engineering Mathematics 3A	4
Marketing Fundamentals	4
Business & the Economy^	2
Idea Blueprint^	2
Level 2.2 (24 hours per week)	
Microcontroller Programming & Interfacing	6
Telecommunication Principles	6
Electronic Design & Prototyping	4
Fundamentals of Financial Management	4
Effective People Management^	2
Idea Launchpad^	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (23 hours per week)	
Aircraft Navigation & Communication Systems	5
Aircraft Electrical & Instrumentation Systems	6
Starting and Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2

Module Name	Credit Units
Level 3.2 (25 hours per week) Six-month Internship	25
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (25 hours per week)	
Aircraft Navigation & Communication Systems	5
Project Design and Business Application 1	8
Starting and Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2
Level 3.2 (23 hours per week)	
Fundamentals of Control Systems	5
Aircraft Electrical & Instrumentation Systems	6
Project Design and Business Application 2	12

Notes:

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

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****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 provides students with mathematical skills for solving basic engineering problems. Topics are organised to keep pace with applications in the engineering modules. They include algebra, trigonometry, logarithms, matrices and complex numbers. A Computer Algebra System will be used where appropriate.

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.

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 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. Characteristics of standard TTL and high speed CMOS are also discussed.

Engineering Mathematics 2

This module equips students with further mathematical skills to solve engineering problems. Topics include further trigonometry, trigonometric graphs, plane analytic geometry, differentiation with applications, 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,

COURSE MODULES

loops, and C functions. On completion of the module, students will be able to explain and write C programs for simple engineering applications.

Fundamentals of Aerospace Technology

This activity-based module introduces students to the basics of aerodynamics and principles of flight and traces the development of the aerospace technology. It highlights the nature and scope of the aerospace industry, and the broad technical training for the profession. The module aims to create professional awareness in students.

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.

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.

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 knowledge and 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, data files accessing and methods.

Engineering Mathematics 3A

This module is a continuation of Engineering Mathematics 2. Topics include Integration Techniques & Applications, First Order Differential Equation, Fourier series and Laplace Transform.

Marketing Fundamentals

The module introduces concepts and principles of the 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 P's in marketing, topics covered also include segmentation, targeting and positioning, product mix, service marketing, channel decisions and branding.

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. The characteristics of a basic communication system and the environmental factors that affect communication will be first discussed. 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.

Electronic Design & Prototyping

The main objectives of this module are to introduce students to the techniques of PCB computer-aided design, and to provide opportunities for the acquisition of practical skills in electronic project design. Students will learn the planning, development, construction and testing of electronic prototypes. The focus of the module is on hands-on practice for basic PCB design, PCB fabrication and technical writing skills. Fault finding on electronic circuits, an essential skill in construction, is also introduced.

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.

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.

COURSE MODULES

LEVELS 3.1 & 3.2

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.

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 RF and Microwave Integrated Passive and Active Circuit hardware.

Digital System Design & Applications

This module builds on the fundamental digital concepts covered in Digital Electronics and Microcontroller Programming & Interfacing modules. It introduces Programmable Logic Devices, more advanced microcontroller programming, interfacing and applications.

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.

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 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.

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.

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.

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 aerospace electronics. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

Starting and Managing an Enterprise

Through this module, students undertake to generate business ideas and propose how these ideas can be developed into a business plan incorporating operational and financial requirements and marketing strategies for 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.

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 aerospace electronics. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

BUSINESS MANAGEMENT ELECTIVES

(Students to choose one of the four electives below)

E-Business in Practice

The module introduces database concepts, information systems, value chains and the integrated enterprise systems. Students will develop multi-table database applications for e-business, incorporating interactive digital media functionalities and also gain exposure in buying and selling on the Web using auction sites with payment settlement functions. They will learn business workflow modelling through the business value chain to improve business processes using IT systems and tools within an integrated enterprise system.

COURSE MODULES

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 organizational 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, 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 emphasizes 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 the different types of buying decision processes and the 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 adequate proficiency in a selected domain area, either to broaden or deepen a student's knowledge/skills in his/her main discipline of study, or to equip a student with additional professional knowledge that would better prepare him/her 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 range listed below. The offer of a DPP cluster is subject to the condition that the minimum class size is met and based on available vacancies.

Clusters

- Applied Physics*
- Computer & Communication Systems
- Computing Methodology
- Leisure & Retail Management

Other Available Diploma Plus Certificates

- Advanced Engineering Mathematics*
- Business
- Economics & Financial Applications^
- 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.

^ DPP cluster will not be offered to students taking the Minor in Business Management.

For detailed module descriptions under each cluster, please refer to page 176.

DIPLOMA IN AEROSPACE TECHNOLOGY (AT) 3-YEAR COURSE

AEROSPACE CLUSTER



The **Diploma in Aerospace Technology (AT)** covers the key disciplines of the aviation industry. 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 and technologists in the aerospace industry.

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

AT's 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.

Students are well-prepared for careers in the aerospace industry, in design and development, manufacturing, and MRO 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 practical element of the total learning experience.

In response to the increasing industry demand for engineering graduates to have good combinational skill set in the area of business management, a pathway with Minor in Business Management has been included. It aims to produce graduates who are technically competent yet equipped with business knowledge to succeed in the changing industry environment and take up management positions as they progress in their careers.

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 including the basic ground school preparation for pilots.

ENTRY REQUIREMENTS

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

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

The aggregate computation for selection is based on grades obtained for English, Mathematics, Science or Design & Technology or Food & Nutrition (Grade 1-9) or a relevant OSIE / Applied Subject 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

As Asia's Aerospace Hub, Singapore is home to the regional headquarters of many leading multinational aerospace companies, where they carry out a wide spectrum of value-added activities relating to product support, 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 as a business aviation centre will further enhance Singapore's position as a global player in the aerospace industry.

According to a 2010 study by the aviation industry the global aircraft fleet is expected to nearly double as the demand for air travel grows by an average rate of 5.3% a year, from 2010 to 2029. In this period, the Asia Pacific region will require about 219,900 new aircraft maintenance crew.

Many lucrative and challenging job opportunities await AT graduates. With the AT curriculum aligned to SAR 66 requirements, graduates can be placed on an accelerated programme towards a professional qualification as a Licensed Aircraft Maintenance Engineer. They also enjoy good employment prospects as Aerospace Technologists providing technical support for aircraft 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. Some of the university courses to which AT graduates gain advanced standing are as follows:

- 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 (United Kingdom)
Bachelor of Engineering in Aerospace and Aeronautical Engineering
- University of Sheffield (United Kingdom)
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

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Engineering Mathematics 1	5
Engineering Mechanics	5
Electrical Technology & Electronics	6
Fundamentals of Aerospace Technology	3
Computer Programming	4
Sports & Wellness [^]	2
Idea Jumpstart [^]	2
Level 1.2 (27 hours per week)	
Engineering Mathematics 2	5
Thermofluid 1	4
Aerospace Manufacturing & Maintenance Practices	5
Engineering Materials	4
Engineering Drawing & Computer-Aided Design	5
Communication & Contemporary Issues [^]	4
YEAR 2	
Level 2.1 (28 hours per week)	
Applied Mechanics	5
Engineering Design	4
Computer Aided Design & Manufacturing	5
Strength of Materials	5
Aircraft Structures & Systems 1	5
Idea Blueprint [^]	2
Interdisciplinary Studies (IS) module [^]	2

Module Name	Credit Units
Level 2.2 (25 hours per week)	
Engineering Mathematics 3B	4
Thermofluid 2	5
Mechanics of Flight	4
Aerospace Materials & Processes	3
Avionics Systems	3
Airworthiness Legislation	2
Idea Launchpad [^]	2
Interdisciplinary Studies (IS) module [^]	2
YEAR 3 (INTERNSHIP)	
Level 3.1 (19 hours per week)	
System Dynamics & Control	5
Aircraft Propulsion Systems	5
Aircraft Structures & Systems 2	5
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2
Level 3.2 (24 hours per week)	
Six-month Internship	20
Quality System & Manufacturing Management	2
Human Factors	2
YEAR 3 (NON-INTERNSHIP)	
Level 3.1 (19 hours per week)	
System Dynamics & Control	5
Aircraft Propulsion Systems	5
Aircraft Structures & Systems 2	5
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2
Level 3.2 (24 hours per week)	
Project Design and Development 1	6
Project Design and Development 2	10
Design & Development of Aero-Components & Processes	4
Quality System & Manufacturing Management	2
Human Factors	2

COURSE CURRICULUM (MINOR IN BUSINESS MANAGEMENT)

Module Name	Credit Units
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YEAR 1

Level 1.1 (23 hours per week)

Engineering Mathematics 1	5
Engineering Mechanics	5
Electrical Technology & Electronics	6
Fundamentals of Aerospace Technology	3
Sports & Wellness [^]	2
Idea Jumpstart [^]	2

Level 1.2 (27 hours per week)

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

YEAR 2

Level 2.1 (27 hours per week)

Applied Mechanics	5
Engineering Design	4
Strength of Materials	5
Aircraft Structures & Systems 1	5
Marketing Fundamentals	4
Business & the Economy [^]	2
Idea Blueprint [^]	2

Level 2.2 (26 hours per week)

Engineering Mathematics 3B	4
Thermofluid 2	5
Mechanics of Flight	4
Aerospace Materials & Processes	3
Airworthiness Legislation	2
Fundamentals of Financial Management	4
Effective People Management [^]	2
Idea Launchpad [^]	2

YEAR 3 (INTERNSHIP)

Level 3.1 (22 hours per week)

Aircraft Propulsion Systems	5
Aircraft Structures & Systems 2	5
Starting and Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2

Module Name	Credit Units
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Level 3.2 (25 hours per week)

Six-month Internship	20
Avionics Systems	3
Human Factors	2

YEAR 3 (NON-INTERNSHIP)

Level 3.1 (22 hours per week)

Aircraft Propulsion Systems	5
Aircraft Structures & Systems 2	5
Starting and Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 3.2 (21 hours per week)

Project Design and Business Application 1	6
Project Design and Business Application 2	10
Avionics Systems	3
Human Factors	2

Notes:

[^]For more details on Interdisciplinary Studies (IS) modules, 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

Engineering Mathematics 1

This module provides students with mathematical skills for solving basic engineering problems. Topics are organised to keep pace with applications in the engineering modules. They include algebra, trigonometry, logarithms, matrices and complex numbers. A Computer Algebra System will be used where appropriate.

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, Kirchoff'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.

COURSE MODULES

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 equips students with further mathematical skills to solve engineering problems. Topics include further trigonometry, trigonometric graphs, plane analytic geometry, differentiation with applications, 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.

Engineering Materials

This module introduces students to the equilibrium phase diagrams, structures, and properties of common engineering materials with emphasis on mechanical testing methods, heat-treatment, international standard specifications, 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 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.

Computer-Aided Design and Manufacturing

This practice-oriented module focuses on the application of CAD/CAM systems in modern manufacturing. Through hands-on projects and assignments, students develop the proficiency in using a parametric, feature-based solid modelling software for the design of engineering parts and assembly as well as the preparation of detailed manufacturing

drawings. Simulation and verification of machining operations are carried out followed by the generation of numerically-controlled data.

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.

Marketing Fundamentals

The module introduces concepts and principles of the 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 P's in marketing, topics covered also include segmentation, targeting and positioning, product mix, service marketing, channel decisions and branding.

LEVEL 2.2

Engineering Mathematics 3B

This module is a continuation of Engineering Mathematics 2. Topics include Integration Techniques & Applications, First Order Differential Equation, 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,

COURSE MODULES

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 and moments acting on an aircraft, the behaviour of the aerofoil at subsonic speeds, aircraft thrust and propulsion, performance characteristics, and factors affecting range and endurance, takeoff and landing, flight manoeuvres, stability and control. Practical sessions include model construction projects, software simulation and wind tunnel experiments.

Aerospace Materials & Processes

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.

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 both the International Civil Aviation Organisation (ICAO), and the Civil Aviation Authority of Singapore and the Singapore Airworthiness Requirements.

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.

LEVELS 3.1 & 3.2

System Dynamics & Control

The module focuses on modelling the dynamic behaviour of systems including vibration in aircraft systems, and shaping the dynamic response through closedloop control, with case studies on flight control surfaces and landing gear systems. Major topics include modelling 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 statespace.

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.

Aircraft Structures & Systems 2

The 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.

Project Design & Development 1

In this module, students will work together in teams to design and develop a product or system related to aerospace technology. 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.

Project Design & Development 2

This module follows on from Project Design and Development 1. Based on the design prepared in the first semester, students are required to carry out further analysis, and may be required to fabricate the prototype, assemble the parts, test and refine the prototype, prepare the refined design and a project report. The students are also required to do a final presentation to a panel of examiners.

Design & Development of Aero-Components & Processes

Students apply CAD tools to carry out structural and fluid dynamics analyses and design aerospace components. On completing the module, students will have a good grasp of the design cycle, design methodology, airworthiness requirements on aero-component design and production approvals, major aerospace manufacturing processes and computational tools for design formulation and analysis.

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.

COURSE MODULES

Six-month Internship

The six-month internship to an aerospace company provides students the opportunity to apply the knowledge acquired in the classroom to practical work situations and to associate work experience with classroom learning. Students learn to demonstrate their skills in problem solving and communication in an actual work environment. They will work independently and in a team, and have practitioners in the aerospace industry as mentors to enhance their learning process.

Starting and Managing an Enterprise

Through this module, students undertake to generate business ideas and propose how these ideas can be developed into a business plan incorporating operational and financial requirements and marketing strategies for 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.

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 Mechanical 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 Mechanical Engineering. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

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.

BUSINESS MANAGEMENT ELECTIVES

(Students to choose one of the four electives below)

E-Business in Practice

The module introduces database concepts, information systems, value chains and the integrated enterprise systems. Students will develop multi-table database applications for e-business, incorporating interactive digital media functionalities and also gain exposure in buying and selling on the Web using auction sites with payment settlement functions. They will learn business workflow modelling through the business value chain to improve business processes using IT systems and tools within an integrated enterprise system.

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 good, 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, 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 emphasizes 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 the different types of buying decision processes and the 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 adequate proficiency in a selected domain area, either to broaden or deepen a student's knowledge/skills in his/her main discipline of study, or to equip a student with additional professional knowledge that would better prepare him/her 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 range listed below. The offer of a DPP cluster is subject to the condition that the minimum class size is met and based on available vacancies.

Clusters

- Aerospace Design
- Applied Physics*
- Aviation Fundamentals
- Computer-Aided Design Skills (World Skills Singapore)
- Leisure & Retail Management
- Workplace Safety & Health

Other Available Diploma Plus Certificates

- Advanced Engineering Mathematics*
- Business
- Economics & Financial Applications^
- 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.

^ DPP cluster will not be offered to students taking the Minor in Business Management.

For detailed module descriptions under each cluster, please refer to page 176.