DIPLOMA IN AUDIO-VISUAL TECHNOLOGY (AVT)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

DESIGN, MEDIA & INFOCOMM CLUSTER

To support super-sized world-class facilities like the multi-billion dollar Integrated Resort at Marina Bay, and given the healthy demand for modern gadgets and systems, it is critical that Singapore has a pool of qualified audio-visual technologists to draw upon.

The **Diploma in Audio-visual Technology (AVT)** is designed to meet this growing demand in the MICE (Meetings, Incentive, Conventions and Exhibitions), arts and entertainment, audio video consumer electronics, broadcasting, and multimedia industries.

AVT focuses on training in audio-visual technology, multimedia communication technology such as video conferencing and streaming, live performance system integration and management, stage lighting and live sound control, and digital media applications. The course is also supported by studies in electrical, electronic and computer engineering. From the first year, there is a strong emphasis on hands-on industry exposure with leading players like the Esplanade and MediaCorp.

In the final year, students can opt to work on a full-time project or take up an internship programme. Both programmes strongly promote creativity and innovative thinking, inculcate adaptability, and enhance independent learning. Most importantly, they serve as a platform through which students express their passions, ideas and aspirations.

Corporations and associations like the Esplanade, MediaCorp, Singapore Association of Convention & Exhibition Organisers & Suppliers (SACEOS), Audio Acoustics Society and Philips have demonstrated strong support for this exciting course.

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 should not apply for the course. Those with colour appreciation deficiency may be considered, subject to an in-house test.

CAREER PROSPECTS

AVT graduates are empowered to be audio-visual technologists and audio video engineering professionals in the MICE (Meetings, Incentive, Conventions and Exhibitions), arts and entertainment, audio video consumer electronics industries, broadcasting and multimedia industries.

They are employed in sectors that require audio-visual professionals, such as hotels and resorts, audio video equipment supply, audio-visual consultancy services, advertising, education, and theme parks.

ACCREDITATION FOR FURTHER STUDIES

Graduates with a Diploma in Audio-visual Technology will receive rigorous training allowing them to pursue further studies in local or overseas universities, and gain admission to degree programmes related to audio-visual, broadcast or digital media technology. As the course is supported by studies in electrical, electronic and computer engineering, graduates may also gain admission to degree courses in electrical, electronic and computer engineering disciplines.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27 hours per week)	
Electrical Technology	6
Engineering Mathematics 1	5
Computer Programming	4
Multimedia Authoring	3
Engineering Mechanics	5
Sports & Wellness^	2
Creativity & Applied Thinking Skills^	2
Level 1.2 (26 hours per week)	
Analogue Electronics	5
Digital Electronics and Practices	2
Engineering Mathematics 2	5
Acoustics & Music Technology	4
Audio Electronics & Electrical Practical Skills	4
Computer-Aided Drawing	2
Communication Toolkit^	4
YEAR 2	
Level 2.1 (24 hours per week)	
Audio Technology	6
Engineering Mathematics 3A	4
PC Networking	3
Music & Music Production	4
Digital Sound Processing	3
Interdisciplinary Studies (IS) module^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (24 hours per week)	
Video Technology	5
Media Transmission Systems	5
Digital Photography & Graphics	3
Digital Media Player Technology	3
Audio Video Mini Projects	4
Innovation & Enterprise in Action^	4
Elective Discipline Modules	
Introduction to Technical Theatre	3
Introduction to Live Performing Arts	3
YEAR 3	
Level 3.1 (18 hours per week)	
Stage Lighting	5
Video Conferencing & Streaming Technology	4
Live Sound Technology	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Elective Discipline Modules	
Audio Effect Processing	3
Stage Management	3
Level 3.2	
(Student to do one)	
Six-month Internship	25
Six-month Design and Development Project	25
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/.

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.

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 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.

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.

Multimedia Authoring
This is a workshop-based module that covers the editing of animated pictures, audio and video, and the authoring of a multimedia package using computer technology such as digital cameras and recorders, soundcards, video cards, and DVD recorders. The module is hands-on in simple post-audio productions for different multimedia movies or animations. Students will be able to produce short DVD movies with sound, video, simple online text and narration effects.

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.

LEVEL 1.2

Audio Electronics & Electrical Practical Skills
This workshop-based module equips students with practical skills in electronic component identification, correct wiring methods, and the building and testing of audio electronic circuits on breadboards and printed circuit boards. Students will learn to use various test and measurement equipment such as the digital multi-meter, oscilloscope and function generator.

Analogue Electronics
This module expounds 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 & Practices
This module aims to provide students the basic knowledge and fundamental principles in digital electronics. Topics include Number Systems and Codes, Logic Gates and Boolean Algebra, Combinational Logic Circuits, Counters, Flip-Flop and Data Handling Circuits. In this module, students will be able to explain and analyse the workings of digital circuits through hands-on experiments in the laboratory.

Engineering Mathematics 2
This module is designed to provide students with the further 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. Topics include trigonometry, coordinate geometry, differentiation and integration with applications.

Acoustics and Music Technology
This workshop-based module trains students in the principles of acoustics, synthesized music (midi) and audio recording techniques. Topics include the nature of sound, the human hearing process, psychoacoustics, and audio measurement terms and concepts. Other topics include sound reproduction equipments, source and load impedances, power output, loudness levels, sound pressure levels, and distortion. Hands-on topics include acoustic measurement of ambience, microphone positioning, frequency response, direct and reverberant sound, and precedence effects.

Computer-Aided Drawing
With the use of powerful drawing software, this workshop-based module enables students to learn about the construction of basic lines and shapes, dimensioning, editing, and drawing manipulation. Advanced topics such as 3-D and electrical schematic drawings, customisation of symbols, and audio and video system layout plans are also included in this module.

LEVEL 2.1

Audio Technology
This module trains students in the principles of sound and hearing, audio signal analysis, audio processing and sound spectrum. Topics include structure and electronic principles of microphones, amplifiers, sound reproduction systems such as loud speakers, headphones, crossovers, low noise op-amps, solid state devices and thermionic valves, noise reduction techniques, signal enhancers & equalisers, and signal processors. Also included are digital audio, analogue-to-digital, and digital-to-analogue conversion for audio signals.

Engineering Mathematics 3A
This module is an extension of the Engineering Mathematics 2 module. Topics include Integration Techniques & Applications, First Order Differential Equation, Fourier series and Laplace Transform.

PC Networking
Computer networks are essential to organisations. In this module, students will study PC Networking (PCN) with a focus on data networking knowledge. The Open System Interconnection (OSI) reference model and Transmission Control Protocol/Internet Protocol (TCP/IP) model will be used to explain important networking concepts. Standards and products associated with each OSI layer, and data flow in networking devices will be discussed. Premises structured cabling systems standards, media types and performance criteria, system design, and installation recommendations are also covered.

Music & Music Production
This module gives an introduction to basic music theory, hearing techniques, reading of notes and chords, as well as understanding reverb, treble, mid-tone and bass. Students get hands-on experience with recording studio equipment, music recording, and setting up recording devices for musical instruments such as the guitar, acoustic

guitar, organ, piano and trumpet. Students will also learn about the functions and connections of the mixer, midi set-up, and the placement of mono and stereo microphones and music sensors.

Digital Sound Processing

This workshop-based module equips students with practical knowledge and skills in sound effects and filtering techniques. These include adding special audio effects and combining sounds in a mix-down system and generating the recording on a stereo-track recorder. The audio effects and reverberations are artificially generated using various signal processing circuits and devices. Students will learn how to use processing techniques such as delay, multiple echo, reverberation, flanging and equalising to produce hall, stadium, open air and disco effects, as well as other simulated sound-enhanced effects such as vocal suppression, rock and roll, classical, and heavy metal.

LEVEL 2.2

Video Technology

In this module, students learn the characteristics of human vision, vision wavelength, video signals, saturation, luminance, display device standards, and colorimetric computer display. Electron gun deflection, fly-back, color sub-carrier, NTSC and PAL TV system will also be discussed. For digital video and computer visual systems, the principles of pixels, display format (RGB) and HDTV will be covered. The module also teaches the operating principles of the LCD display and plasma TV, and video camera technologies like charge-coupled devices (CCD) and CMOS sensors and imagers.

Media Transmission Systems

This module allows students to learn about media data communication, analogue and digital transmission systems that include AM, FM, cable TV, satellite TV, DAB, and DVB. For data communication, students will gain an understanding of the base-band concept, data encoder and decoder, error detection and correction, routing information, reconstruction and lock synchronisation. For wireless systems, students will study system configurations, transmitters and receivers, error performance, path loss, signal processing, bandwidth, data rate, relative complexity, advantages and disadvantages, and transmission standards.

Digital Photography & Graphics

This workshop-based module encompasses practical training on using digital cameras to shoot creative and artistic photos, including portrait, dawn, party and night scenes, and moving objects. Students will cover the use of digital imaging software including Flash, as well as how to use photographic effects, filter, hue control, advertisement, poster, movie flash, and flyer design to create digital arts beyond the imagination.

Digital Media Player Technology

This is a workshop-based module that trains students in downloadable Audio (MP2, MP3, MP4), Downloadable Video (Flash video, Real Media, Windows Media, CD, VCD, SVCD, DVD standards), streaming formats (Real streams, Windows Media streams), TV standards (PAL, SECAM, NTSC), and the various H standards including H.323 (an ITU standard for computers, equipment, and services for multimedia communication over networks). Audio and video recording standards, transmission media, storage media and cables will also be covered in this module, including a brief discussion of safety and legal issues concerning audio video equipment and media content.

Audio Video Mini Projects

This workshop-based module provides students with extensive hands-on practice in building and troubleshooting audio and video circuits. Mini projects include audio amplifier, audio mixer, video preamplifier, audio/video switch, video modulator, VGA-to-video converter, and video-to-VGA converter. Students will learn to build and test audio and video circuits on breadboard and printed circuit board, and to use test and measurement equipment such as the distortion meter, function generator, oscilloscope, waveform monitor and pattern generator.

ELECTIVE DISCIPLINE MODULES

Introduction to Technical Theatre

The module gives students brief knowledge of topics such as lighting, makeup, production, scene setting, sound for stage, theatrical property and costuming. Students will study the effect of lighting for scenes, the basics of makeup to accentuate an actor's features and the production process. They will also study aspects of scenery such as set construction and scenic painting, as well as learn about special effects and sound, including musical underscoring, vocal and instrument mixing, and theatrical sound effects. They also gain an understanding of props, such as furnishings, set dressings, hand props and actors' costumes.

Introduction to Live Performing Arts

The performing arts include theatre, motion pictures, drama, comedy, music, dance, opera, magic and the marching arts. In this module, students will learn to identify, analyse and appreciate the different types of performing arts. They will study staging, ambience, audio reinforcement, genre of music, costumes, background, and storyline.

LEVEL 3.1

Stage Lighting

This module enables students to learn the technical and creative aspects of stage lighting. Topics include basic design, colour and exposure theory, types of lighting instruments, power distribution, control, safety, proper hanging, connection, focus, and control of instruments. Upon completion of this module, students will be able

to perform creative lighting layout, install concert lighting, explain colour theory, integrate lighting control instrumentation, and set up a variety of motion lighting instruments.

Video Conferencing & Streaming Technology

This module provides training in streaming technologies that include local network, internet audio and video streaming technology, web-casting and voice over IP (VoIP). Students will acquire knowledge of hardware configurations, transmitters and receivers, quality of service, routing, re-sequence, signal processing and streaming standards. The module also includes an overview of the MPEG-4 data compression mechanism; and issues related to shooting video for streaming, editing, quality control, and the formatting of streaming audio and video to fit various applications such as video conferencing, web-casting, pod-casting and mobile entertainment systems.

Live Sound Technology

This hands-on module teaches students the concepts and technical skills required for live event sound reinforcement. Topics include the operation of a basic sound system using interconnected components such as consoles, amplifiers, speakers, processors and microphones. Upon completion of this module, students will be able to apply the concepts of live sound reinforcement to set up and operate a small to medium-scale sound system for a live event, and to customize a recording setup based on the ambience and multimedia requirements.

ELECTIVE DISCIPLINE MODULES

Stage Management

This workshop-based module enables students to learn the roles and responsibilities of the stage manager. Students learn the techniques of successfully managing the numerous aspects of a production – both on stage and backstage – in the pre-rehearsal, rehearsal, performance, and post-performance phases. This module covers the planning of a master calendar and prompt script, as well as aspects of coordination with production designers using light, sound and costume plots effectively. Students also learn about coordinating the efforts of the cast to stay on scripts, performing checks on safety, legal issues, lighting and sets as well as coordinating technical and dress rehearsals.

Audio Effect Processing

This workshop-based module offers intensive hands-on sessions where students learn to create, edit and mix music and special sound effects onto multiple audio tracks. It also provides theoretical and practical training on digital audio effects techniques that convert 2-channel stereo audio track to 5.1 surround-sound tracks, the professional use of AC-3, re-direction to speakers through digital Dolby and surround sound decoders, and spatial enhancement in theatre and audio entertainment application.

LEVEL 3.2

Six-month Internship

In this module, students will have the opportunity to apply the skills and knowledge acquired in the classroom in a real-time environment. Students are given on-the-job training in actual companies to develop skills in problem solving, interpersonal communications, project planning and implementation, industrial liaisons and character building. Participating companies will also have the opportunity to assess prospective employees and secure the services of these students in advance.

Six-month Design and Development Project

The module will promote essential traits like leadership, team spirit, positive work attitudes, independence, and an innovative spirit. This module also aims to help students develop their project management abilities through effective project planning, scheduling, group discussions, project load balancing, and planning project milestones using the Gantt chart. Students will also be able to polish their oral and written communication skills by submitting reports and making presentations.

ACROSS LEVEL MODULES (LEVEL 1.2 ONWARDS)

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*
- Applied Physics*
- Biomedical Engineering
- Electrical Control & Measurement
- Industrial Control
- Industrial Electronics
- Information Technology
- Mechanical Technology
- Stage Management & Technology
- 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 NETWORK SYSTEMS & SECURITY (NSS)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

DESIGN, MEDIA & INFOCOMM CLUSTER

The unique **Diploma in Network Systems & Security (NSS)** is the result of an industry-academia partnership between Ngee Ann Polytechnic and Cisco Systems (USA) to provide world-class infocomm training for students in everything from PC hardware and software to network cabling and design, network security, converging voice and data networks, network management and administration, and basic programming.

Final-year students undergo a six-month internship programme that gives them exposure to real-life corporate environments.

With certification from industry leader Cisco Systems (USA), as well as the use of Cisco equipment in training, students enjoy being members of the only institution in Singapore that allows them remote access anytime, anywhere, to a set of training equipment, instead of working on desktop simulations.

Ngee Ann Polytechnic is a Cisco Systems training academy for the Cisco Certified Network Associate and Cisco Certified Network Professional certifications.

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 severe vision deficiency including colour appreciation deficiency should not apply for the course.

Candidates who have successfully completed the Cisco Certified Network Associate (CCNA) course at local secondary schools or at ITE (for holders of Higher NITEC in relevant disciplines with GPA of at least 3.5) will be granted exemptions for relevant modules if they pass a practical test on a module that is equivalent to their highest completed CCNA module.

CAREER PROSPECTS

NSS graduates are equipped with the knowledge and practical skills to sit for the widely recognised Cisco Career Certifications (Associate to Professional level).

Graduates can look forward to a spectrum of exciting and challenging infocomm-related careers in network systems design, network security design, wired and wireless network solutions, data and voice convergence networks, system administration and support, security risks assessment, and sales and marketing.

For more information on infocomm manpower requirements and careers, visit www.singaporeinfocomm.sg.

ACCREDITATION FOR FURTHER STUDIES

NSS graduates can apply to the National University of Singapore and Nanyang Technological University to pursue computing, engineering, business and arts courses. The Singapore Management University recognises the diploma as an entry requirement for the Bachelor of Science (Information Systems Management).

The following universities in Australia also recognise the Diploma as an entry requirement for their degree courses:

- **The Australian National University**
  Bachelor of Engineering, Bachelor of Information Technology
- **University of Queensland**
  Bachelor of Information Technology
- **University of Adelaide**
  Bachelor of Engineering
- **University of Western Australia**
  Bachelor of Computer Science
- **University of Newcastle**
  Bachelor of Engineering, Bachelor of Computer Science
- **University of Technology Sydney**
  Bachelor of Engineering
- **University of Western Sydney**
  Bachelor of Engineering
- **University of Tasmania**
  Bachelor of Computing
- **University of South Australia**
  Bachelor of Information and Communication Technology (Networking), Bachelor of Software Engineering
- **University of Melbourne**
  Bachelor of Information Systems

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (25 hours per week)	
Electrical Technology	6
Internetworking 1	6
Engineering Mathematics 1	5
Computer Programming	4
Sports & Wellness^	2
Creativity & Applied Thinking Skills^	2
Level 1.2 (24 hours per week)	
Digital Electronics	5
Internetworking 2	6
Engineering Mathematics 2	5
Applications Programming	4
Communication Toolkit^	4
YEAR 2	
Level 2.1 (26 hours per week)	
Network Cabling	4
Communication Systems Fundamentals	5
Engineering Mathematics 3B	4
Internetworking 3	4
Object-Oriented Programming	5
Interdisciplinary Studies (IS) module^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (20 hours per week)	
Fundamentals of Network Security	6
Internetworking 4	4
Voice Convergence Networks	6
Innovation & Enterprise in Action^	4
YEAR 3	
Level 3.1 (24 hours per week)	
Advanced Routing	5
Multilayer Switching Networks	5
Computer Forensics	5
Advanced Network Security	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (25 hours per week)	
Six-month Internship	25
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 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.

Internetworking 1
Internetworking 1 (IN1) is the first of the four courses leading to the Cisco Certified Network Associate (CCNA) designation. IN1 introduces Cisco Networking Academy Program students to the networking field. The course focuses on network terminology and protocols, local-area networks (LANs), wide-area networks (WANs), Open System Interconnection (OSI) models, cabling, cabling tools, routers, router programming, Ethernet, Internet Protocol (IP) addressing, and network standards. In addition, students are trained in the proper care, maintenance, and use of networking software, tools, and equipment.

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.

LEVEL 1.2

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.

Internetworking 2
This module was designed using a task analysis of current industry standards and occupational analysis in order to provide students with classroom and laboratory experience in current and emerging networking technology. Topics include the Open System Interconnection (OSI) Reference Model, local area networks (LANs), wide area networks (WANs), transmission control protocol/Internet protocol (TCP/IP) addressing, routers, router configuration, routing and routing protocols, internetwork operating system (IOS) images, and network troubleshooting. Particular attention is given to the nature and components of networks that make up LANs, WANs and the Internet. Students will become familiar with command protocols that are used when configuring networks.

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.

LEVEL 2.1

Network Cabling
This workshop-oriented module focuses on implementing fiber optic cabling, testing and measurement. Students will learn the different operating modes of fiber optics and the implications of dispersion and attenuation.

Communication Systems Fundamentals
This module explores fundamental concepts in data communications and radio frequency communications. Students will examine the OSIRM as a model for data communications, with examples and case studies used to illustrate and explain the application of the first two layers of this model for data communications. Topics covered in the field of radio frequency communications include concepts like transmission line basics, antenna theory, radio wave propagation, satellite systems, modulation and multiple access techniques.

Engineering Mathematics 3B
This module provides students with fundamental skills in Mathematics required to solve basic engineering problems. Each topic emphasises simple applications and problem solving. Students will use the Computer Algebra System throughout the module. Topics include integration with applications, differential equations, Laplace transform, probability and statistics.

Internetworking 3
This module is the third of four courses preparing students for the Cisco Certified Network Associate (CCNA) certification. The topics covered follow the Cisco Networking Academy CCNA3 course on Switching Basics and Intermediate Routing very closely.

Object-Oriented Programming
The aim of this module is to build on the foundation of Applications Programming and introduce the concepts of Object Oriented Programming. Its key coverage includes the object oriented programming paradigm, Web related programming and database access.

LEVEL 2.2

Fundamentals of Network Security
This module provides students with the knowledge and skills required to implement standard practices to secure and manage network infrastructures. Students will learn about techniques and security considerations to put in place firewalls to protect workplace productivity and reduce costs.

Internetworking 4
This module follows on from Internetworking 1, 2 and 3. It focuses on Advanced IP addressing techniques, Network Address Translation (NAT), Port Address Translation (PAT), Dynamic Host Configuration Protocol (DHCP), WAN technology and terminology, PPP, ISDN, DDR, Frame Relay, and network management. Students will be required to apply knowledge from IN1, IN2 and IN3 to a network, and should be able to explain how and why a particular strategy is used. At the end of the module, students will be required to sit for and pass a Network Design and Implementation practical test.

Voice Convergence Networks
This module focuses on integrating voice communication into underlying network architectures. Students learn how to create a telephony solution that is transparent, scalable, and manageable. The hands-on training will provide them with a robust set of skills to implement, operate, configure and troubleshoot a converged Internet Protocol (IP) network.

LEVEL 3.1

Advanced Routing
In this module, students will cover routing techniques and technologies for designing and implementing scalable routed Internet Protocol (IP) networks using link-state routing protocols. They will be taught how to select and configure the appropriate services to simplify IP address management, and configure edge routers to effectively interconnect into an Internet Service Provider's (ISP) network.

Multilayer Switching Networks
The module focuses on how to build scalable multilayer switched networks. Topics covered include Spanning Tree Protocol, VLANs and inter-VLAN routing, high availability, and multicasting. Students will learn how to improve traffic flow, reliability, redundancy, and performance for Layer 2 and Layer 3 switched networks.

Computer Forensics
Computer crimes are here to stay. Corporate IT, Law Enforcement and Information Security professionals are often required to perform computer forensics duties on their jobs. They are required to determine the root cause of a hacker attack, collect evidence that is legally admissible in court, and protect corporate assets and reputation. This module teaches the students the basic concepts and techniques to perform systematic identification of evidence in computer related crimes and abuse cases. This includes tracing the hacker of a client's system, tracing the originator of defamatory emails and recovering signs of fraud.

Advanced Network Security
This module intends to provide students with knowledge of offensive and defensive aspect of network security. Students will understand and appreciate the need for network security and how to secure the network properly from anomalous traffics from both an offensive and defensive approach. Students will also learn how to mitigate risk from worm and virus infections, and detection of SYN and spoofing attacks using various network tools.

LEVEL 3.2

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.

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 PRODUCT DESIGN & INNOVATION (PDI)

(3-YEAR COURSE)

SCHOOL OF ENGINEERING

DESIGN, MEDIA & INFOCOMM CLUSTER

The **Diploma in Product Design & Innovation (PDI)** offers you an insight into the success factors of some of the popular products in the market. The course is designed to unleash your potential as a creative product designer with the ability to design and develop innovative products which are attractive, practical and marketable.

The curriculum integrates the three important disciplines of product design – Arts, Engineering and Business. It focuses on the design process and methodology from the conceptualisation of creative ideas to the realisation of innovative designs with quality design folios, working prototypes, digital models, drawings and documentation for mass production.

Learning is facilitated through practice-oriented and project-driven modules with emphasis on aesthetics, functions and markets. In the final year, you will attend an industrial internship, undertake an evolutionary design-and-prototype project, and a revolutionary futuristic-and-exploratory product design project.

In taking up the PDI programme at Ngee Ann Polytechnic, you will have the opportunity to work in our newly-renovated design studios and workshops, and realise your design prototypes using state-of-the-art model-making and rapid-prototyping equipment and facilities.

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.

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
Any three other subjects	1-6

The aggregate computation for selection is based on grades obtained for English, Mathematics, Art/Higher Art (Grade 1-9) or Design & Technology (Grade 1-9) or Computer Studies (Grade 1-9) or Science (excluding Additional Science, Food & Nutrition, General Science, Human & Social Biology) (Grade 1-9) and two other subjects.

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

Candidates with severe vision deficiency should not apply for the course.

CAREER PROSPECTS

As industries in Singapore take on higher value-added activities, more design functions are being undertaken by both multinational and local companies. Singapore is fast becoming the regional headquarters and nerve centre for many high-technology product design and manufacturing supply chains. Well-known companies have set up design, R&D and innovation centres here. Many local companies have also started, or are starting, design and development activities.

Graduates of the course will enjoy good employment prospects in multinational corporations as well as small and medium enterprises that design and manufacture products or provide product design and development services. Upon graduation, some of the career options available to you include product designer, design consultant and engineering designer. In the future, you may even consider starting your own design-consultancy company or design-and-manufacture company.

ACCREDITATION FOR FURTHER STUDIES

The PDI diploma gives you lots of opportunities for further study. You can choose to pursue a degree programme in local and overseas universities in Product Design & Innovation, Product Design, Industrial Design, Fine Arts, and Product Design Engineering, at the following schools:

- **Nanyang Technological University**
  Bachelor of Fine Arts in Product Design, Digital Animation, Digital Filmmaking, Interactive Media, Photography and Digital Imaging, and Visual Communication
- **National University of Singapore**
  Bachelor of Industrial Design
- **University of Strathclyde (UK)**
  Bachelor of Science in Product Design & Innovation and Bachelor of Engineering in Product Design Engineering
- **Monash University (Australia)**
  Bachelor of Industrial Design
- **University of New South Wales (Australia)**
  Bachelor of Industrial Design
- **University of Western England (UK)**
  Bachelor of Science in Creative Product Design, and Product Design Technology

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (28 hours per week)	
Visual Thinking & Design Sketching	6
History & Principles of Design	3
Engineering Mathematics 1	5
Manufacturing Processes	5
Materials & Design Applications 1	5
Creativity & Applied Thinking Skills^	2
Sports & Wellness^	2

COURSE CURRICULUM

Module Name	Credit Units
Level 1.2 (28 hours per week)	
Design Specification & Conceptual Design	6
Design Presentation & Methods	3
Engineering Mathematics 2	5
Engineering Sciences for Design 1	5
Computer-Aided Design & Drawing 1	5
Communication Toolkit^	4
YEAR 2	
Level 2.1 (23 hours per week)	
Product Form & Aesthetics	6
Materials & Design Applications 2	3
Computer-Aided Design & Drawing 2	5
Engineering Sciences for Design 2	5
Interdisciplinary Studies (IS) module^	2
Interdisciplinary Studies (IS) module^	2
Level 2.2 (22 hours per week)	
Ergonomics & User-Centred Design	6
Business & Project Management	3
Product Design Project	4
Component Design & Development	5
Innovation & Enterprise in Action^	4
YEAR 3	
Level 3.1 (21 hours per week)	
Product Innovation Project	7
Design for Manufacturability	4
Entrepreneurship & Business Plan	2
Smart Product Design	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2
Level 3.2 (22 hours per week)	
Three-month Internship	11
Product Design & Development Project	11
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.

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/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 MODULE

LEVEL 1.1

Visual Thinking & Design Sketching
The module covers the principles and practice of creative thinking and idea generation techniques, and equips students with the important skills of visual thinking, design visualization and freehand design sketching for product design. The emphasis is on hands-on practices to enhance students' creative thinking abilities through design visualization and design sketching, from basic lines to two-dimensional (2D) sketches, and then design idea thumbnails to three-dimensional (3D) perspective sketches. The module also provides students with an understanding of the generic product design process, and the related tasks and attributes involved. It also includes an introduction to the course and thus sets the context of the course by providing an overview of the curriculum.

History & Principles of Design
The module provides students with a historical perspective of design against the backdrop of developments in civilization, culture, art and technology. There are discussions on the design movements and iconic works of past and contemporary designers and innovators. The second part of the module covers the elements of design, which include points, lines, planes, textures and space; followed by the principles of design with emphasis on the concepts of balance, proportion, symmetry, harmony, contrast, etc, and their applications in product design.

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.

Manufacturing Processes
The module provides students with an understanding of the common manufacturing processes, leading to the principles and applications of Design for Manufacturability. Through hands-on practices and integrated projects, students acquire the knowledge and skills of turning, milling, grinding, assembly, dimensional tolerances, joining processes, surface texture, etc. Students hone their skills by taking on projects involving producing parts according to the design drawings and specifications given, as well as designing simple products and producing them with suitable manufacturing processes. Shopfloor safety is emphasised throughout the module.

Materials & Design Applications 1
The module covers the characteristics and properties of commonly used materials for products, including metals, plastics, rubber, ceramic, wood and composites. The module also includes the applications and criteria for selection and design considerations for common materials. Students acquire the knowledge and skills through lectures, discussions, case studies and projects, complemented by practical sessions on materials testing and manufacturing processes for polymers and composites.

LEVEL 1.2

Design Specification & Conceptual Design
In this hands-on and project-driven module, students apply their creativity to the first two phases of the design cycle - writing design briefs and design specifications and generating design concepts. They learn to identify target user groups, define user needs, identify product markets, search for information and conduct a basic market study, generate creative design concepts, and evaluate and refine design concepts. This is followed by the concept generation phase to hone design sketching skills and idea generation techniques, in accordance to the design specification. The module also includes workshop sessions in which students learn about making 3D models using materials including foam, acrylic, foam core, paper board, and with techniques in model finishing using air brush and painting.

Design Presentation & Methods
The focus of this module is on the presentation of design concepts and relevant details in digital media. It includes an introduction to graphic and communication design. The students then learn, in a practice-oriented manner, the commonly-used software packages for graphic and communication design. These include image editing as well as text and graphic creation functions for and poster printing and product design presentation via digital means. The module leverages on a project to deepen students' understanding of the design presentation methods, principles and techniques.

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.

Engineering Sciences for Design 1
This module pertains to the study of fundamentals of mechanics and applications in product design. The syllabus covers external forces in two dimensions and their effects on particles and rigid bodies at rest. Students will learn 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. Applications of mechanics in product design are learnt through case studies and assignments.

Computer-Aided Design & Drawing 1
The module equips students with the knowledge and skills in using a computer-aided design (CAD) tool to produce 3D solid and surface

models as well as 2D detailed and assembly drawings. Students will also learn the fundamentals, conventions and practices of engineering drawing based on the International Standards Organisation (ISO) and Singapore Standards (SS) guidelines. Topics include 3D CAD modeling, 2D CAD drawings, orthographic projection, sectioning, dimensioning, conventional representations, assembly drawing and blueprint reading.

LEVEL 2.1

Product Form & Aesthetics

This project-driven module focuses on the study of the relationships between form and function, and the principles and applications of aesthetics in product design. Topics include principles of good product form and aesthetics, colour theory and applications. Students also learn the use of computer-aided industrial design software tool, and design rendering for presentations using markers. The module project requires students to carry out product design tasks to the extent of preparing preliminary assemblies and detailed drawings.

Materials & Design Applications 2

This module is a follow-on module of Materials & Design Applications 1, focusing on the selection of plastic materials and design of plastic parts for given design requirements. It also covers knowledge of the characteristics and design considerations for parts made of other materials, including metals, wood and fabric, and other new materials for biomedical science and nanotechnology, with emphasis on their properties and applications. The module includes the topic on the principles and applications of Geometric Tolerance and Dimensioning. Students learn through projects, assignments, lectures and discussions.

Computer-Aided Design & Drawing 2

In this follow-on module of Computer-Aided Design & Drawing 1, students are required to apply their knowledge and skills of CAD for the design of relatively more complex parts and assemblies. Through these assignments, students acquire more advanced techniques in 3D modeling and production drawings. Topics include advanced 3D solid and surface modeling, assembly analysis, limits and fits, application of linear and geometric tolerances in CAD and drawings, and specifications and representations for surface finish and joints. The module includes an elementary treatment of mechanism design.

Engineering Sciences for Design 2

This is a follow-on module of Engineering Sciences for Design 1 (ESD1). While ESD1 focuses on the fundamentals and design applications of Mechanics, ESD2 covers the essentials of Electrical Technology, Electronics, Thermofluid, Mechanics and Strength of Materials. These topics are discussed and analysed within the context of the basic principles and applications of product design and development. Practice-oriented learning methods are emphasised. In addition to lectures, tutorials and laboratory practicals, design application assignments encourage students to apply the topics learnt to product design and development.

LEVEL 2.2

Ergonomics & User-Centred Design

This module covers the principles of ergonomics (or human factors) and user-centred design, their applications in product design, the influence of these design factors in users' preference for a particular product or system, as well as codes and standards governing product safety. It also covers anthropometrics, user-centred design principles and approaches, and environmental factors in the application of products. The emphasis is on research and good understanding of the targetusers' needs, requirements and limitations, and application in product design. The module project requires students to carry out tasks in product design up to the phase of detailed assembly drawings, including bill of materials and cost estimation.

Business & Project Management

This module provides an overview of business organisation, functions and general management, leading to a detailed treatment of the organisational and operational aspects of project management in the context of product design and development. Topics include introduction to business organisation and management, organisation of projects, roles of the project manager, project planning, scheduling and controlling using network analysis such as Critical Path Method (CPM), Gantt Charts, and Programme Evaluation and Review Technique (PERT). The importance of concurrent or simultaneous product design and development in order to achieve short time-to-market is also emphasised.

Product Design Project

The main aim of this studio project module is for students to integrate and apply the knowledge and skills they have learnt from the various modules, into designing a product based on a given design brief. Students are required to carry out design research, prepare design specification, generate ideas and concepts, make mock-up and models, evaluate and refine the concepts, perform detailed design with 3D CAD models and detailed drawings, prepare design folio and report, and do a design presentation to a panel of lecturers and invited assessors. In addition, there will be short lectures, case study discussions, assignments and exercises on further product design factors and topics that include design research methods, mood board preparation, intellectual property, product market segmentation and positioning, cultural and social impacts related to design, psychological and emotional factors in design, design of service and experience, studies on contemporary styles and trends, and green and sustainable design.

Component Design & Development

This module covers the engineering principles underlying the analysis, design and selection of standard components as well as non-standard

parts for products. Students learn the characteristics, applications, design analysis and selection procedure of common standard components including motor, bearings, belt and pulley, gears, and shafts. Projects are used to reinforce learning along with assignments and case studies on existing products. Students also learn to prepare parts list and bill of materials, an important process in product design and development.

LEVEL 3.1

Product Innovation Project

In this studio project module, students undertake a major individual project in designing a revolutionary product that considers future trends, avant-garde design features and application of further factors in product design. Students are required to complete the product design process from the conceptualisation of the product idea to the product design, with 3D CAD model, mock-up or model if applicable, and drawings and documentation for production purposes. There will be guest lectures by practicing designers, case studies, discussions and exercises on contemporary design topics, product innovation topics and emerging design trends.

Design for Manufacturability

The module covers the principles of Concurrent Engineering, with focus on Design for Manufacturability (DFM) and Design for Assembly (DFA). It includes the concepts and applications of the DFM and DFA methods, and also includes topics on Value Analysis, Group Technology and Quality Function Deployment, in the context of product design and development. Students gain an appreciation of the importance of these methods in reducing manufacturing costs, enhancing product quality, reducing product development cycle time and enhancing innovation. Case studies, assignments and projects are used to enhance learning of the module.

Entrepreneurship & Business Plan

This module provides students with an understanding of the nature and attributes of entrepreneurship as well as issues relating to intellectual property rights. Through projects and case studies, students learn how to start a business and develop it into a successful enterprise, the various aspects of intellectual property rights, the importance of a good business plan, and the skills to write one.

Smart Product Design

This module equips students with the basic knowledge in implementing basic automation technology and mechatronics or smart product design through practical assignments and projects. The module covers oth hard-wired and programmable logic solutions for the control of pneumatic and electric actuators, and the design of smart products incorporating microcontrollers and sensors. A practice-oriented approach is emphasised.

Level 3.2

Three-month Internship

The internship exposes students to the work environment as well as practices related to product design. It also offers them the opportunity to apply the knowledge and skills acquired in the various modules to work and project situations, and demonstrate problem solving, communication and interpersonal skills in a real-world setting. The programme enables students to hone the ability to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to develop a professional approach to work, based on the relevant code of practice.

Product Design & Development Project

This three-month full-time module trains students in the process of successfully completing a given product design and development project. It aims to simulate the first major project that students undertake upon starting work in the industry. A design brief is given to students, and they are required to follow through with the conceptualisation of the product idea, to the product design - with 3D CAD model, mock-up or model, working prototype, and drawings and documentation for production purposes.

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.