



DIPLOMA IN AUDIO-VISUAL TECHNOLOGY (AVT) 3-YEAR COURSE

DESIGN, MEDIA & INFOCOMM CLUSTER

The **Diploma in Audio-visual Technology (AVT)** is designed to meet the growing demand for audiovisual technologists in MICE (Meetings, Incentive, Conventions and Exhibitions), arts and entertainment, audio video consumer electronics, broadcasting and multimedia industries. In Singapore, world class facilities like the multi-billion dollar Integrated Resort at Marina Bay and Resorts World Sentosa, as well as events such as mega concerts like Disney on Ice and Wang Lihong, and the F1 night race, require the support of audio-visual technologists.

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 strong hands-on training with leading industry players like the Esplanade and MediaCorp.

In the final year, students can opt to work on a fulltime project or take up an internship programme. Both options 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), Suntec, EXPO and Event Production houses have demonstrated strong support AVT.

In response to the increasing industry demand for engineering graduates to have skills in the area of business management, a Minor in Business Management was introduced. It aims to nurture

graduates who are technically competent and 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:

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

You must also fulfil the aggregate computation requirements.

* 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, audiovisual consultancy services, advertising, education, and theme parks.

ACCREDITATION FOR FURTHER STUDIES

AVT graduates will receive rigorous training that allows them to pursue further studies in local or overseas universities. They can pursue degree programmes related to audiovisual, 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
Idea Jumpstart^	2
Sports & Wellness^	2

Level 1.2 (26 hours per week)

Audio Electronics & Electrical Practical Skills	4
Analogue Electronics	5
Digital Electronics and Practices	2
Engineering Mathematics 2	5
Fundamentals of Audio & Acoustics	3
Music & Music Technology	3
Communication & Contemporary Issues^	4

YEAR 2

Level 2.1 (24 hours per week)

Audio Technology	5
Engineering Mathematics 3A	4
PC Networking	3
Digital Audio	3
Digital Photography & Graphics	3
Computer-Aided Drawing	2

Module Name	Credit Units
-------------	--------------

Idea Blueprint^	2
Interdisciplinary Studies (IS) module^	2

Level 2.2 (24 hours per week)

Video Technology	5
Media Transmission Systems	5
Video Production	3
Music Production	4
Audio Video Mini Projects	3
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2

YEAR 3

Level 3.1 (24 hours per week)

Stage Lighting	5
Audio Effect Processing	5
Video Conferencing & Streaming Technology	5
Live Sound Technology	5
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2

Level 3.2 (25 hours per week)

Six-month Local/Overseas Internship	25
or	
Project Design & Business Application	20
Engineering Planning & Design	5

MINOR IN BUSINESS MANAGEMENT#

YEAR 2

Level 2.1 (25 hours per week)

Audio Technology	5
Engineering Mathematics 3A	4
PC Networking	3
Digital Audio	3
Marketing Fundamentals	4
Computer-Aided Drawing	2
Business & the Economy^	2
Interdisciplinary Studies (IS) module^	2

Level 2.2 (25 hours per week)

Video Technology	5
Media Transmission Systems	5
Music Production	4

Module Name	Credit Units
-------------	--------------

Audio Video Mini Projects	3
Fundamentals of Financial Management	4
Idea Launchpad^	2
Interdisciplinary Studies (IS) module^	2

YEAR 3

Level 3.1 (22 hours per week)

Stage Lighting	5
Live Sound Technology	5
Starting & Managing an Enterprise	4
Business Management Elective	4
World Issues: A Singapore Perspective^	2
Interdisciplinary Studies (IS) module^	2

Level 3.2 (22 hours per week)

Six-month Local/Overseas Internship	22
or	
Project Design & Business Application	22

Level 3.2 (23 hours per week)

Building Family and Community Partnership	4
Field Practicum 3.2	13
Curriculum Design	4
Organisational Behaviour/ Human Resource Management	4

Notes:

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

The Minor in Business Management has the same Year 1 curriculum.

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 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.

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 multimeter, 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 covers basic principles of digital electronics. Topics include Number Systems and Codes, Logic Gates and Boolean Algebra, Combinational Logic Circuits, Counters, Flip-Flop and Data Handling Circuits. 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 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.

Fundamentals of Audio & Acoustics

The module will cover introduction to the application & physics of sound, sound reproduction systems, followed by sound production systems. Audio electronics, electro-acoustic devices, analogue versus digital sound, acoustic and psychoacoustic will be introduced timely, with tight integration to specific applications and platforms.

Music & Music Technology

The module will cover basic music theory and ear training, to build foundation for music and audio production. This is followed by an introduction to MIDI and music synthesis, complete with projects applying sequencing techniques to produce sequenced music based on synthesized sound and audio loops.

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 a continuation of Engineering Mathematics 2. 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.

Digital Audio

The module will cover applied digital audio, providing fundamentals of digital audio know-how in audio production and reproduction, audio installation and digital audio design. Core topics include audio coding, CD technology, digital audio editing and effects, digital audio production and reproduction systems, digital audio interconnects and networking, to support AVT audio production modules.

Digital Photography & Graphics

This workshop-based module encompasses practical training in 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.

Computer-Aided Drawing

This workshop-based module introduces the basic concepts of engineering drawing such as the construction of basic lines and shapes, dimensioning, editing and drawing manipulation. Commonly used engineering drawing layouts are included.

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

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, colour 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.

Video Production

In this module, students are introduced to single and multiple camera film-style video production. This module provides students with a basic theoretical and practical introduction to video camera operations, basic production techniques and equipment, film arts, and how to plan and organise a video production.

Music Production

In this module students learn how to apply reverb, treble, mid-tone and bass on to recorded music. 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 the placement of mono and stereo microphones and music sensors.

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.

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.

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.

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.

Video Conferencing & Streaming Technology

This module provides training in streaming technologies that include local network, internet audio and video streaming technology, webcasting 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 customise a recording setup based on the ambience and multimedia requirements.

Starting & Managing an Enterprise

Through this module, students 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.

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 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 emphasises 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.

LEVEL 3.2

Six-month Local/Overseas 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, 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.

Project Design and Business Application

In this module, students are expected to integrate the knowledge they gained during the first two years of study and undertake a six-month long project in the field of AVT. They will also be required to develop a business proposal/plan which forms an integral part of the whole project.

Engineering Planning & Design

This module uses a hands-on approach to take students through the complete engineering design cycle used to develop a successful project. Students are taught how to develop a good project plan and to effectively manage its progress using tools like Microsoft

Project software, Gantt charts and PERT charts. Students will also be trained in relevant technologies and technical skills to develop technical aptitude in design, implementation, testing and troubleshooting of prototypes.

DIPLOMA PLUS PROGRAMME

The Diploma Plus Programme (DPP) is designed to provide students with 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.

Engineering Clusters

- Applied Physics*
- Industrial Control (World Skills Singapore)
- Leisure & Retail Management
- Stage Management & Technology

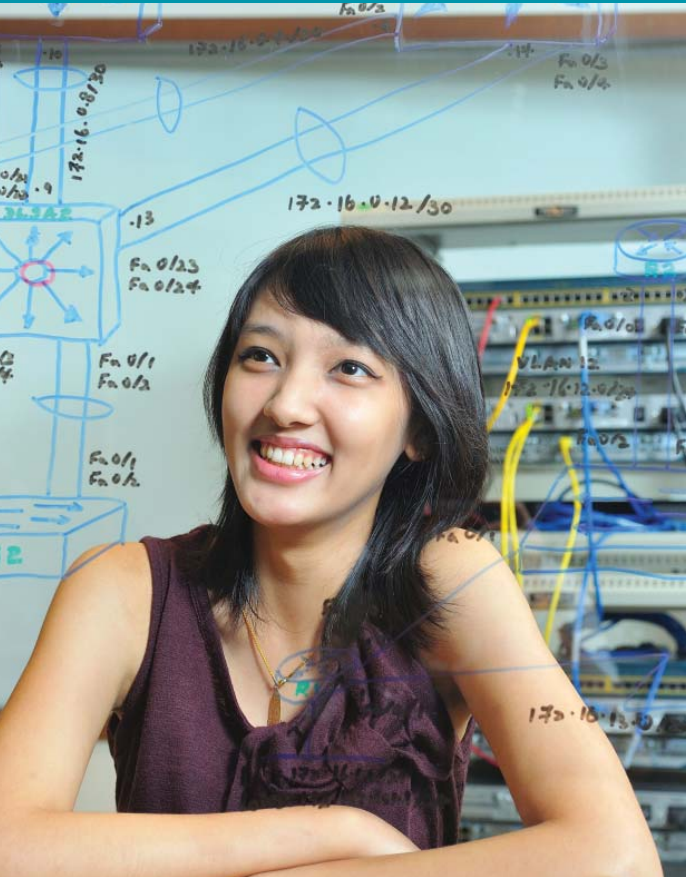
Other Available Diploma Plus Certificates

- Advanced Engineering Mathematics*
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The programme aims to bridge the gaps between the curriculum of engineering mathematics at polytechnics and that of first-year engineering mathematics in universities.

For detailed module descriptions under each cluster, please refer to page 180.





DIPLOMA IN NETWORK SYSTEMS & SECURITY (NSS) 3-YEAR COURSE

DESIGN, MEDIA & INFOCOMM
CLUSTER

The unique **Diploma in Network Systems & Security (NSS)**, the result of an industry-academia partnership between Ngee Ann Polytechnic and Cisco Systems (USA), provides world-class infocomm training to students, in areas such as design, implementation, security and maintenance of network infrastructure and data centres to support server farms & cloud computing. Students will learn from industry experts and work on real-life projects.

Come 2012, two new final-year specialisations in Network & Cloud Architecture and Data Security & Forensics will be offered. Students who pursue the Network & Cloud Architecture will enhance their skills and knowledge in the areas of network infrastructure and cloud technology. Students who opt for the Data Security & Forensics specialisation will learn more about the vulnerabilities of networks and servers as well as how to protect them.

Final-year students will also, as part of the course curriculum, go on a six-month internship that gives them hands-on exposure in one of the following areas:

- Design, implementation and maintenance of enterprise-level corporate network projects
- Involvement in research projects with national research organisations such as A*Star Institute for Infocomm Research, A*Star Data Storage Institute and DSO National Laboratories

ENTRY REQUIREMENTS

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

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

You must also fulfill the aggregate computation requirements.

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

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

Candidates who have successfully completed the Cisco Certified Network Associate (CCNA) course at ITE (for holders of Higher NITEC in relevant disciplines with a GPA of at least 3.5) or at local secondary schools 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 globally recognised Cisco Certifications (Cisco Certified Network Associate and Cisco Certified Network Professional) as well as other internationally recognised professional certifications such as IPv6 Forum Certified Network Engineer, Linux Professional Institute Certifications, ITIL, EC-Council Certifications and Cloud Certifications. These certifications will enhance their market value.

Graduates can look forward to a spectrum of exciting and challenging infocomm-related careers in network systems or architecture, network security, wired and wireless network solutions, convergence networks, system administration and support, security risks

assessment, data centre administration and support, 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 National University of Singapore and Nanyang Technological University to pursue degree courses in Computing, Computer Science, Computer Engineering and Business & Computing. The Singapore Management University recognises the Diploma as fulfilling its entry requirement for the Bachelor of Science (Information Systems Management).

Most Australian universities recognise the Diploma as an entry requirement for their related undergraduate degree courses with advance standing. The following are some examples:

- Australian National University
- Queensland University of Technology
- University of Melbourne
- University of Western Australia
- University of Queensland
- University of Adelaide

COURSE CURRICULUM

Module Name	Credit Units
-------------	--------------

YEAR 1

Level 1.1 (26 hours per week)

Computer Programming	4
Engineering Mathematics 1	5
Network Fundamentals	6
Windows Servers	4
IT Service Management	3
Sports & Wellness [^]	2
Idea Jumpstart [^]	2

Module Name	Credit Units
-------------	--------------

Level 1.2 (26 hours per week)

Applications Programming	4
Engineering Mathematics 2	5
Digital Logic	3
Routing	5
Local Area Networks	5
Communication Toolkit [^]	4

YEAR 2

Level 2.1 (25 hours per week)

Object-Oriented Programming	5
Engineering Mathematics 3A	4
Wide Area Networks	4
Information Security	4
Linux Servers	4
Idea Blueprint [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 2.2 (25 hours per week)

Data Communications	3
Enterprise Networks	5
Cloud Computing & Data Centres	5
Network Security	5
Project Management	3
Idea Launchpad [^]	2
Interdisciplinary Studies (IS) module [^]	2

YEAR 3

Level 3.1 (25 hours per week)

Cloud Architecture & Security	4
Network & Cloud Design	4
World Issues: A Singapore Perspective [^]	2
Interdisciplinary Studies (IS) module [^]	2

Network & Cloud Architecture Option

Advanced Routing	5
Collaboration Networks	4
Network Maintenance & Troubleshooting	4

Data Security & Forensics Option

Computer & Network Forensics	4
Ethical Hacking & Countermeasures	4
Servers Administration & Security	5

Level 3.2 (22 hours per week)

Six-month Internship	22
----------------------	----

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

Computer Programming

This practice-oriented module equips students with 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.

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.

Network Fundamentals 1[®]

This module covers theoretical concepts and practical applications needed to design networks in small-to-medium businesses. Key concepts include the data networks, protocols in communications, OSI model, TCP/IP model, addressing & naming schemes in network communication.

Windows Servers

This module covers server manager roles, features of server, implementation of Windows Server in a network. Concepts include DNS, server core, network policies & access protection, deployment services, server virtualisation, high availability features, and performance monitoring and optimisation.

IT Service Management

This module covers organisation of IT resources to deliver business value, documenting the processes, functions and roles of IT Service Management (ITSM) in the context of project management. Concepts include detailed descriptions of important IT practices with comprehensive checklists, tasks and procedures IT organisation can use to meet its business needs.

LEVEL 1.2

Applications Programming

This practice-oriented module equips students with the knowledge and skills required to develop Windows applications. Students will acquire the 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 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.

Digital Logic

This module provides students with fundamental knowledge and skills in logic design. Students will learn about the combinational and sequential logics and how to design and use them to control digital systems. A project will be used to reinforce students' learning and help them to relate their learning to real-life examples.

Routing®

This module covers router operations in networks. Concepts include both static and dynamic routing protocols (RIP v1 & v2, EIGRP & OSPF). Students

also learn to implement, verify, and troubleshoot router operations in networks.

Local Area Networks®

This module covers switching and wireless access operations in an enterprise networks. Concepts include VLANs, trunks, VTP, STP (802.1d, PVST, RSTP & PVRST), inter-VLAN routing (router-on-stick), basic switch security, wireless network operations & security protocols and Access Control Lists (ACLs).

LEVEL 2.1

Object-Oriented Programming

The aim of this module is to build on the foundation built by the Applications Programming module. Students will be introduced to the concepts of Object-Oriented Programming. This module covers the area from the fundamental concepts of Object-Oriented programming to Web forms, database access, and some graphics and animation.

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.

Wide Area Networks®

This module covers implementation and configuration of common data link protocols and application of WAN security concepts, principles of traffic, access control, and addressing services. Concepts include PPP, Frame Relay, NAT & PAT, DHCP and IPv6.

Information Security

This module covers management and administration of Information Security. Concepts include security threats, security incidents, risk assessment and mitigation, information security policy, procedures, guidelines and standards, security administration, physical security and configurations and administrations of current OS systems. Relevant Singapore IT Law & governance issues will also be covered.

Linux Servers

This module covers the basics of Linux operating

system and server. Concepts include the use of Linux commands to access and manage directories, files, setting of file security and access rights and basic servers' implementation, such as DNS and DHCP, in a network.

LEVEL 2.2

Data Communications

This module provides the foundation for understanding principles in data communications and networking. Students will acquire understanding of and be able to apply key concepts and processes associated with data transmission of information, transmission media, the OSI reference model, network topologies, protocols and TCP/IP protocol suite.

Enterprise Network

This module covers campus switched network construction, implementation of advanced Spanning Tree concepts, VLANs and Inter-VLAN routing, high availability, wireless client access, access layer voice concepts, minimising service loss and data theft in a campus network.

Cloud Computing & Data Centre

This module provides an overview of cloud computing and data centre. Concepts include virtualisation as a foundation for cloud computing, issues related to implementation of cloud computing and data centres, cloud services like Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

Network Security

This module covers network security, intrusion detection, securing an organisation wired and wireless network infrastructure. Concepts include network security threats and attacks, designing resilient networks, configuring network components like firewall, setting up Virtual Private Network (VPN) and securing wireless connections.

Project Management

This module uses case studies to teach project management principles, strategies & tools, planning the project, estimating project costs, developing the project

schedule, executing the project, justifying project costs, managing project quality, managing project risk, software configuration management, interacting with project stakeholders and outsourcing the project.

LEVEL 3.1

COMMON MODULES

Cloud Architecture & Security

This module covers the design, implementation, management and security of public and private clouds. Concepts include the architecture of cloud and establishment of data integrity and privacy for Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).

Network & Cloud Design

This module equips students with the skill-sets needed to design high availability secure enterprise networks with server farms, data centres and remote access to all these servers to deliver cloud services.

NETWORK & CLOUD ARCHITECTURE OPTION

Advanced Routing®

This module teaches students how to implement, monitor and maintain routing services in an enterprise network. Students will learn how to plan, configure, and verify the implementation of complex enterprise LAN and WAN routing solutions, using a range of routing protocols in IPv4 and IPv6 environments. The module also covers the configuration of secure routing solutions to support branch offices and mobile workers. Comprehensive labs emphasize hands-on learning and practice to reinforce configuration skills.

Collaboration Networks

This module covers IP communications, mobile applications, tele-presence, conferencing, messaging and enterprise social applications. Concepts include inter-operable and open architecture, secure inter-company collaboration, flexible deployment and integrated experience.

Network Maintenance & Troubleshooting

This module covers the monitoring and maintenance

of complex, enterprise routed and switched IP networks. Concepts include the planning and execution of periodic network maintenance, support and troubleshooting using technology-based processes in a systematic approach.

DATA SECURITY & FORENSICS OPTION

Computer & Network Forensics

This module covers the techniques and tools for computer and network forensics investigations. Skill-sets include the use of the most popular forensic tools for hands-on activities in practical lessons.

Ethical Hacking & Countermeasures

This module covers the offensive and defensive knowledge of network security. Concepts include understanding and appreciation of the need for network security, securing the network effectively from anomalous traffics, mitigating risk from worm and virus infections, detection of SYN and spoofing attacks using various network tools.

Servers Administration & Security

This module covers provisioning and management of secured server systems, software services and hosting environment. Concepts include secured configuration, system hardening, access and activity authentication, authorisation and monitoring of DNS server, Web server & security, SSL, DHCP, Mail Server, Samba server, Proxy server, SSH server and FTP server.

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 internships, they will undertake projects assigned by the company or be involved in operations or maintenance-related work. Student internships may be undertaken locally or overseas.

®Note:

Network Fundamentals, Routing, Local Area Networks & Wide Area Networks will help students prepare for CCNA certification while Advanced Routing, Resilient Networks and Network Maintenance & Troubleshooting

for CCNP certification (provided by external test centres).

DIPLOMA PLUS PROGRAMME

The Diploma Plus Programme (DPP) is designed to provide students with 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*
- Computing Methodology
- Information Technology (World Skills Singapore)
- Leisure & Retail Management

Other Available Diploma Plus Certificates

- Advanced Engineering Mathematics*
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The programme aims to bridge the gaps between the curriculum of engineering mathematics at polytechnics and that of first-year engineering mathematics in universities.

For detailed module descriptions under each cluster, please refer to page 180.



DIPLOMA IN PRODUCT DESIGN & INNOVATION (PDI) 3-YEAR COURSE

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 who has 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 production.

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

PDI students will have the opportunity to work in our modern design studios and workshops, and realise their 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:

Subject	'O' Level Grade
English Language*	1-7
Mathematics (Elementary/Additional)	1-6
Any three other subjects	1-6

You must have also sat for a Science or Art / Higher Art or Design & Technology or Food & Nutrition or a relevant OSIE / Applied Subject and fulfil the aggregate computation requirements.

* Candidates with English as a second language must have attained 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 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.

PDI graduates 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

PDI graduates enjoy good opportunities for further study. They can pursue degree programmes at local and overseas universities in Product Design & Innovation, Product Design, Industrial Design, Fine Arts, Product Design Engineering, and Mechanical Engineering.

The PDI course is well recognised by both local and overseas universities, which grant advanced standing for relevant degree programmes. Some of the courses in which PDI graduates enjoy advanced standing are:

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

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
Sports & Wellness [^]	2
Idea Jumpstart [^]	2

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 & Contemporary Issues [^]	4

YEAR 2

Level 2.1 (25 hours per week)

Product Form & Aesthetics	8
Materials & Design Applications 2	3
Engineering Sciences for Design 2	5
Computer-Aided Design & Drawing 2	5
Idea Blueprint [^]	2
Interdisciplinary Studies (IS) module [^]	2

Level 2.2 (24 hours per week)

Ergonomics & User-Centred Design	6
Business & Project Management	3
Product Design Project	6
Component Design & Development	5
Idea Launchpad [^]	2
Interdisciplinary Studies (IS) module [^]	2

YEAR 3 (INTERNSHIP)

Level 3.1 (23 hours per week)

Product Innovation Project	8
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 (25 hours per week)

Three-month Internship	12
Product Design & Development Project	11

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

Visual Thinking & Design Sketching

The module equips students with important skills in visual thinking, design visualisation, freehand design sketching and rendering for product design. The emphasis on hands-on practice enhances students' creative thinking abilities from basic lines and two-dimensional (2D) sketches, to idea thumbnails and three-dimensional (3D) perspective sketches. The module also provides students with an understanding of the generic product design process as well as of the related tasks and attributes involved. The module also sets the context of the course by providing an overview of the curriculum.

History & Principles of Design

The module covers the principles and practice of creative thinking and idea generation techniques. It provides students with a historical perspective of design against the backdrop of developments in civilisation, culture, art and technology. Students will engage in discussions about design movements and iconic works of past and contemporary designers and innovators. The module also covers elements of design such as points, lines, planes, textures and space as well as the concepts of balance, proportion, symmetry and contrast, and how they can be applied to product design.

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.

Manufacturing Processes

The module provides students with an understanding of common manufacturing processes. Through hands-on practices and integrated projects, students acquire knowledge of turning, milling, grinding, assembly, dimensional tolerances, joining processes, surface texture, etc. Students will take on projects involving producing parts according to the design drawings and specifications given, as well as designing and producing simple products with suitable manufacturing processes. Shop floor safety is emphasised.

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 module, students will apply their creativity to the first two phases of the design cycle - writing design briefs and design specifications as well as generating design concepts. They will learn to identify target user groups, define user needs, identify product markets, conduct basic market studies, generate creative design concepts, and evaluate and refine design concepts. They will then hone their design sketching skills and generate ideas in accordance to the design specification. The module also includes workshops

on making 3D models using materials such as foam, acrylic, foam core and paper board. Students will also pick up techniques in model finishing.

Design Presentation & Methods

This module focuses 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 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 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.

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 detail 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 modelling, 2D CAD drawings, orthographic projection, sectioning, dimensioning, conventional representations, assembly drawing, bill of materials 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 which concentrate mainly on form and colour semantics.

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.

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 practical

sessions, design application assignments encourage students to apply the topics learnt to product design and development.

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 modelling and production drawings. Topics include advanced 3D solid and surface modelling, 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.

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 a good understanding of the target users' needs, requirements, limitations, and application in product design. The module project requires students to carry out tasks in product design, emphasising on human factors and user-centred design.

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, create mock-ups or models, if applicable, evaluate and refine the concepts, perform detailed design with 3D CAD models and detailed drawings, prepare design folio and report, and give a design presentation to a panel of lecturers and invited assessors. In addition, there will be short lectures, including guest lectures by practising designers, 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 of 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 both 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 such as problem solving, communication and interpersonal skills in a real-world setting. The internship enables students to hone their ability to work independently and in teams, while they take on one or more practical projects under the supervision of industry practitioners. The objective is to develop a professional approach to work, based on the relevant code of practice.

Product Design & Development Project

This three-month full-time project 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, mockup or model, working prototype, and drawings and documentation for production purposes.

DIPLOMA PLUS PROGRAMME

The Diploma Plus Programme (DPP) is designed to provide students with 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-Aided Design Skills (World Skills Singapore)
- Leisure & Retail Management
- Mechanical Technology
- Workplace Safety & Health

Other Available Diploma Plus Certificates

- Advanced Engineering Mathematics*
- Business
- Innovation Management
- Languages (Japanese)

* Designed in collaboration with the Department of Electrical and Computer Engineering, National University of Singapore (NUS). The programme aims to bridge the gaps between the curriculum of engineering mathematics at polytechnics and that of first-year engineering mathematics in universities.

For detailed module descriptions under each cluster, please refer to page 180.

