ELECTRICAL ENGINEERING COURSE MODULES

From everyday conveniences such as robotic vacuum cleaners, computers and electric cars to industrial technologies such as power distribution, medical instruments and manufacturing, electrical engineers are practically needed everywhere. If you want to be grounded in one of the most fundamental and flexible engineering fields, the Diploma in Electrical Engineering [EE] is a good pick.

In the first two years, you will gain a good grasp of electrical and electronic engineering and computing applications. The broad-based foundation will prepare you for a wide range of careers in numerous industries ranging from energy and power, robotics and even transportation.

In your final year, you have the choice of picking one of eight specialisation options. Whatever your choice of specialisation is, the EE course will open doors to a wide range of exciting careers. You will also get to put your skills and knowledge into practice with a six-month enhanced internship with industry leaders such as ST Engineering, Resorts World Sentosa, Keppel Offshore & Marine, PSA Marine, Surbana Jurong, ABB, Meiden and SP Group. Or you can work on a design project to develop your very own products and patents.

LEVEL 3.1

ELECTRIC TRANSPORTATION OPTION

Electric Vehicle & Charging Systems

This module covers the working principles of electric vehicle (EV), electric motors and controllers, the charger and electrical system, the battery storage and management system. The vehicle charging processes (different modes of charging) and the safety requirements will be introduced. The infrastructure for the charging stations, the impact of EV charging on the power network and the use of EV as energy storage for the power system will be examined.

Fuel Cell Vehicle

This module aims to provide the students with an appreciation on the use of fuel cell in various mode of transportation. The working principles of Proton Exchange Membrane (PEM) fuel cell and electronic system for fuel cell vehicle will be introduced. The module covers the application of fuel cell for fuel cell car/bus, fuel cell forklifts and fuel cell powered airplane (unmanned aerial vehicles).

Mass Transit & Light Rail Systems

This module gives a broad overview of the mass transit systems such as MRT (or subway) and electric light rail system for major cities. The topics include the operation of the electric traction motors, the propulsion system, automatic train control system (ATC), regenerative braking, the auxiliary equipment for the train, the power supply and distribution systems. The students will be introduced to the working principles of high-speed train, such as Japanese bullet train (Shinkansen) and Taiwan high-speed train.

MARINE & OFFSHORE ELECTRICAL SYSTEMS OPTION

Electrical Power & Machinery Systems

This module covers the design and operation of electrical power generation plant and emergency power systems for marine and offshore industries. Topics include the design criteria, construction and selection of generators, excitation methods, automatic voltage regulators, as well as synchronisation of generators for parallel operation and load sharing. The operating principles of low voltage and medium voltage DC and AC machines and drives for marine and offshore applications will also be taught.

Design of Marine Electrical Systems

This module covers the design of electrical distribution network for ships and oil rigs. Students will learn the estimation of load requirements, selection of protective devices, sizing of cables, design of switchboards and bus bar systems. Harmonic filtering, EM disturbances and counter measures, reserve (standby) and alternative power sources, surge protection, batteries systems will be covered in this module.

Instrumentation & Auxiliary Systems

This module covers the fundamentals of instrumentation, method of measurement, process control and their applications in marine and offshore industries. Topics include operating principles of measuring instruments, instrumentation standards, working principles of Supervisory and Data Acquisition (SCADA) system, cathodic protection system, fire and gas detection and alarm systems.

AUDIO-VISUAL TECHNOLOGY OPTION

Audio Video Systems Integration

In this module, students will study the standards, characteristics and specifications of audio video devices such as DVD players, surround sound speaker systems, MP3/MP4 players, HDTV (LCD/Plasma) and
HDMI cables and connectors. Students will learn how to design integrated audio video systems which covers equipment selection, acoustic and sound proofing, speaker selection and placement and also cable selection and wiring. The module will also introduce students to the latest development in the Digital Living Network Alliance (DLNA) software and devices.

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.

Media Transmission System

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.

ENGINEERING PRODUCT DEVELOPMENT OPTION

Integrated Project

Students will work on a group project that integrates knowledge and skills learnt from the core modules of the Engineering Product Development option. Students are required to carry out research, design, implementation, testing and troubleshooting processes from a prototype to a final product or system under supervision.

Applied Analogue Electronics

This module equips the students with practical skills in analogue signal conditioning, current source and motor drive circuits. Students will learn Power Supply Design principles such as voltage regulator with multiple output voltage requirements, switching noise and battery specifications. Through this module, troubleshooting skills are emphasised to undergird students' foundations in analogue circuits design.

Embedded System & Applications

The module covers the hardware and software design for systems containing the PIC microcontroller series, a reduced instruction set processor (RISC). Students will learn to interface the PIC with 7 segment display, LCD, keypad, stepper and servo motor, rotary encoder, relays, real time clock, UART, SPI and I2C communications, analog to digital converter and digital to analog converter. Towards the end of the semester, students will do a mini project and develop a product such as a low cost handheld electronic game.

Intelligent Motion Control

This module provides students with a comprehensive understanding of the architecture of a motion control system, including motion controllers, drives, actuators and sensors. Students will learn to design and implement closed loop motion control systems to achieve required motion profiles, involving control in speed, position and acceleration. They will learn about coordinated motion control by linking distributed motion controllers using different communication protocols. Customisation of a motion control solution to cater for different applications will also be explored in the context of integrating motion system with other relevant systems, such as vision, speech and HMI.

SOLAR TECHNOLOGY OPTION

Building Energy Studies

This module will train students in the field of energy studies using building modelling and simulation software which are increasingly being required by the industry when new buildings are designed or existing buildings are being retrofitted. Energy modelling will allow building owners and designers to better understand and predict the energy consumption patterns in their buildings before they are built and commissioned. Students will also learn the various parameters building designers have to consider including meeting the requirements from the local standards and codes.

COMMON MODULE:

Power Engineering, Electric Transportation, and Marine & Offshore Electrical Systems Options

Control & Automation

This module examines the characteristics and designs of the industrial automation process. Two main areas will be covered - continuous feedback control and discrete sequential control. Topics in continuous feedback control include system concept and applications, process characteristics, control strategies, system performance, design of controllers/compensators, and modern digital control systems. Topics in discrete sequential control include system concept and applications, and design tools.

COMMON MODULE:

Electronics, Power Engineering, and Marine & Offshore Electrical Systems Options

Power Electronics

This module deals mainly with the applications of power semiconductor devices for the control and conversion of electric power. The objective is to provide students with a broad understanding of the various power conversion circuits and their industrial applications. The principles of operation and analysis of power conversion circuits such as AC to DC converters, DC to DC converters, DC to AC converters, and AC power controllers are studied in detail together with their applications.

COMMON MODULE:

Electronics and Solar Technology Options

Photovoltaic & Cell Fabrication Technology

This module provides students with fundamental knowledge on the operation principles and behaviour of solar cells and modules including spectral response effect of temperature, parasitic resistance and cell efficiency. Students learn about PV cells interconnection, module fabrication and circuit design. This module also provides hands-on training for students in the NP cleanroom as well as the opportunity to learn how to fabricate solar cells in the laboratory.

COMMON MODULE:
Engineering Management Option

E-Commerce Technology & Applications

This module begins with a brief history of the Internet and e-commerce, and goes on to cover the planning aspects of setting up an e-commerce site and the factors that attract surfers to return to it. Technical ecommerce topics include Hypertext Markup Language (HTML), VBScript, Structured Query Language (SQL), Active Server Pages (ASP .NET) and mobile Web applications (.NET Mobile). These technologies allow an e-commerce site to be data-driven - a dynamic site that provides relevant and up-to-date information with powerful search capability.

COMMON MODULE:
Audio-visual Technology and Electronics Options

Electronic System Design

In this module, students will learn how to design a basic electronic system in the control of electrical equipment and drive systems. The practical considerations will be emphasised through design examples and case studies. The topics covered include the selection of a wide range of electronic devices such as passive and active discrete devices, and op amps for specific applications and the interpretation of manufacturers' datasheets. There will be hands-on laboratory work and the introduction of software design aids to carry out the electronic design tasks.

COMMON MODULE:
Engineering Management and Power Engineering Options

Power System Economics & Energy Market

This module aims to equip students with a basic understanding of the economic principles underlying the introduction of competition in the electricity industry. Students will explore the structure, operation and regulations of Singapore's electricity market, which was introduced to promote the efficient supply of competitively priced electricity and open up the wholesale and retail market for full competition.

COMMON MODULE:
Engineering Management, Power Engineering and Solar Technology Options

Power Distribution & Protection

In this module, students will gain a basic knowledge of high voltage and low voltage distribution systems, related equipment and protection devices. Topics include fault calculation, principles of operation of switching devices, switchboards, transformers and cables, and the economic aspects of power distribution systems. Laboratory sessions include the testing of protection devices, operation of electrical equipment, and familiarisation with the safety requirements and precautions to be taken in the operation and maintenance of electrical apparatus.

COMMON MODULE:
Engineering Management, Power Engineering, Solar Technology and Marine & Offshore Electrical Systems Options

Design & Operation of Photovoltaic Systems

This module takes students through the design process of photovoltaic (PV) system and operation, identifying appropriate PV applications in power systems and undertaking simple PV system design. Topics include concept of PV standalone and on-grid systems, sizing of cables and batteries, lightning protection, power protection and power quality issues.

COMMON MODULE:
Engineering Management, Power Engineering, Solar Technology and Marine & Offshore Electrical Systems Options

Engineering Contract & Project Management

This module provides students with an understanding of the various aspects of electrical contracting and management procedures. Upon completion of this module, they will be able to prepare competitive bids for submission of tenders for projects pertaining to electrical services. They will also be able to apply the knowledge gained in project/contract

management. Topics covered include contract arrangements and condition of contracts, cost planning, tendering procedures, specification writing, interim certificates and payments, completion and final payment, as well as variations and their valuation.

COMMON MODULE:

Audio-visual Technology, Electronics, Engineering Management, Engineering Product Development, Power Engineering, Solar Technology and Electric Transportation Options

Electrical Installation Design

Students will learn how to design electrical systems for residential, commercial and industrial installations. Topics include the design of artificial lighting systems, selection of protective devices for various distribution networks, sizing of cables and circuit protective conductors, and estimation of load requirements for large buildings. On completion of the module, students will be able to design electrical distribution systems in compliance with statutory requirements

LEVEL 3.2

6-Month Local/Overseas Internship

Students have the opportunity to apply the skills and knowledge acquired in the classroom in a real-life environment via on-the-job training. This programme allows students to hone skills in the areas of problem-solving, interpersonal communications, project planning and implementation, industrial liaisons and character building. Participating companies will have the opportunity to assess prospective employees and secure the services of these students in advance.

Project Design & Development

Students will work full-time on a group project and have the flexibility to choose from a wide range of topics related to system design and integration, research and development, computer applications or other engineering areas. Students are required to carry out research, design, implementation, testing and troubleshooting processes from a prototype to a final product or system under supervision. Students will also learn to apply project management and scheduling skills to enable them to complete their project in time. They will be required to document their project development process and present their projects at regular intervals.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 3	
Level 3.1 (24 hours per week)	
Common Module	
Project ID: Connecting the Dots (IS Module)	4
ELECTRIC TRANSPORTATION OPTION	
Electric Vehicle & Charging Systems	5
Fuel Cell Vehicle	5
Mass Transit & Light Rail Systems	5
Elective Discipline Module (Electrical Installation Design, Engineering Contract & Project Management, or Control & Automation)	5
MARINE & OFFSHORE ELECTRICAL SYSTEMS OPTION	
Design of Marine Electrical Systems	5

Electrical Power & Machinery Systems	5
Instrumentation & Auxiliary Systems	5
Elective Discipline Module (Power Electronics, Design & Operation of Photovoltaic Systems, or Control & Automation)	5

AUDIO-VISUAL TECHNOLOGY OPTION

Audio Video System Integration	5
Stage Lighting	5
Video Conferencing & Streaming Technology	5
Elective Discipline Module (Electrical Installation Design, Electronic System Design, or Media Transmission System)	5

ELECTRONICS OPTION

Electronic System Design	5
Embedded System Design	5
Power Electronics	5
Elective Discipline Module (Engineering Contract & Project Management, Electrical Installation Design, or Photovoltaic & Cell Fabrication Technology)	5

ENGINEERING MANAGEMENT OPTION

Electrical Installation Design	5
Engineering Contract & Project Management	5
Power System Economics & Energy Market	5
Elective Discipline Module (Power Distribution & Protection, Design & Operation of Photovoltaic Systems, or E-Commerce Technology & Applications)	5

ENGINEERING PRODUCT DEVELOPMENT OPTION

Embedded Systems & Applications	3
Intelligent Motion Control	3
Applied Analogue Electronics	3
Integrated Project	11

POWER ENGINEERING OPTION

Control & Automation	5
Electrical Installation Design	5
Power Distribution & Protection	5
Elective Discipline Module (Engineering Contract & Project Management, Power System Economics & Energy Market, Power Electronics, or Design & Operation of Photovoltaic Systems)	5

SOLAR TECHNOLOGY OPTION	
Building Energy Studies	5
Design & Operation of Photovoltaic Systems	5
Photovoltaic & Cell Fabrication Technology	5
Elective Discipline Module (Electrical Installation Design, Power Distribution & Protection, or Engineering Contract & Project Management)	5
Level 3.2 (22 hours per week)	
6-Month Local/Overseas Internship	22
or	
Project Design & Development	22

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

IS Modules
The School of Interdisciplinary Studies (IS) delivers a broad-based curriculum, which nurtures a new generation of professionals with multidisciplinary skills and an innovative and entrepreneurial spirit to meet the challenges of a knowledge economy. IS offers both prescribed modules and electives to challenge boundaries. Prescribed modules develop students' competencies in core areas such as Communication, Innovation and Enterprise, Culture and Communication, and Personal Mastery and Development, while elective modules provide insights into Arts and Humanities, Business, Design, and Science and Technology.