DIPLOMA IN MECHATRONICS (T66)

Course Overview

Industry 4.0 is transforming the modern workplace. From the basic tenets of engineering to cutting-edge technology, this course prepares you for the new era of advanced manufacturing where humans, machines, and systems communicate and collaborate safely in real time. You will go through a multi-disciplinary experiential learning at the TP Advanced Manufacturing Centre (TP AMC) and learn to master the application of robotics, automation, 3D printing and data analytics in technological areas such as cyber-physical systems, virtual manufacturing as well as machine vision and pattern recognition.

With increasing consumer demand for personalised products and smart digital services in growth areas such as advanced manufacturing, aerospace, robotics, arti cial intelligence, precision engineering and pharmaceutical manufacturing, the specialised skills you will acquire in these areas will provide you an advantage in virtually any engineering sector!

In your final year, you can select one of these elective clusters:

• Advanced Manufacturing
• Advanced Engineering Skills
• 3D Printing
• Intralogistics & Cybersecurity
• Semiconductor Technology
• Work-Study Degree Programme*

* You can also join the University Pathway Programme, a "through-train" programme that allows you to take university modules in your final year of this course, and get a one-year exemption for selected degree courses at local universities.

To download a copy of our 4-page course brochure, click here.

Watch video

Entry Requirements

To be eligible for consideration for admission, applicants must obtain 26 points or better for the net ELR2B2 aggregate score (i.e. English Language, 2 relevant subjects and best 2 other subjects, including CCA Bonus Points) and meet the minimum entry requirements of this course. CCA cannot be used to meet the minimum entry requirements.

Subject	Grade
English Language (EL1)*	1-7

Mathematics (E or A)	1-6
Any one of the listed subjects^	1-6
Any two other subjects, excluding CCA	
2021 Planned Intake	**50**
Net ELR2B2 aggregate range (2021 JAE)	**13 - 18**

Note: *Applicants should not be suffering from complete colour vision deficiency, uncontrolled epilepsy, profound hearing loss or severe vision impairment.*

* SPM / UEC holders must have a minimum of grade 6 for the Bahasa Inggeris (English Language) subject

^ List of acceptable subjects: Biology, Biotechnology, Chemistry, Combined Science, Computing/Computer Studies, Design & Technology, Electronics/Fundamentals of Electronics, Physics/Engineering Science, Science (Chemistry, Biology), Science (Physics, Biology), Science (Physics, Chemistry)/Physical Science.

See also the minimum entry requirements for:

- ITE Certificate Holders
- International Students

What You'll Learn

YEAR 1

A strong foundation is needed to excel in Engineering, and this is exactly what you will get from the comprehensive first year programme. Learn basic engineering concepts through lab work, applied hands-on learning and educational visits, and gain an awareness of Industry 4.0 via guided visits to our TP Advanced Manufacturing Centre.

TP Fundamentals (TPFun) Subjects			—
Subject Code	**Subject**	**Credit Units**	
⌄ **ECS1005**	**Communication & Information Literacy**	**2**	⌄
	In this subject, you will learn how to conduct research for relevant information and validate information sources. You will also learn to recognise and avoid plagiarism, and follow standard citation and referencing guidelines when presenting information. In the course of learning, you will be required to plan, prepare and present information appropriately in written and oral form. You will also be taught to consider the **M**essage, **A**udience, **P**urpose and **S**trategy (MAPS) when writing and delivering oral presentations.		

ECS1007 — Persuasive Communication — 2

In this subject, you will be taught how to use persuasive language in written documents. You will be required to use information to your advantage to verbally communicate and convince an audience about your idea, product or service. Skills such as persuasive vocabulary, language features, graphical illustrations, tone and style would also be covered.

The **M**essage, **A**udience, **P**urpose and **S**trategy (MAPS) will also be applied when engaging in verbal and written communication.

EGS1002 — Global Studies — 3

This subject provides essential skills and knowledge to prepare you for an overseas experience. You will examine the elements of culture and learn the key principles of cross-cultural communication. In addition, you will gain an appreciation and awareness of the political, economic, technological and social landscape to function effectively in a global environment.

EIN1001 — Innovation & Entrepreneurship — 2

The Innovation & Entrepreneurship subject is designed for learners from all disciplines to embrace innovation in either their specialised fields or beyond. You will first learn the Design Thinking framework, where you will develop problem statements and ideate solutions. Next, you will discover the tools for prototyping and innovation, such as 3D printing and laser cutting, at TP's Makerspace+ facility. Finally, you will acquire commercial awareness through the LEAN Startup framework of idea crystallisation, prototype building, customer testing and validation, refinement of business model canvas, and crowdfunding or crowdsourcing avenues.

GCC1001 — Current Issues & Critical Thinking — 2

This subject presents you with a panoramic view of current local and global issues, which may have long term implications for Singapore. You will learn to apply critical thinking tools to examine current issues, support your views with relevant research and up-to-date data, articulate an informed opinion and mature as civic-minded individuals.

LEA1011 — Leadership: Essential Attributes & Practice 1 — 1

LEAP 1, 2 and 3 are three fundamental subjects that seek to cultivate in you, the attitude, skills and knowledge for the development of your leadership competencies. This character-based leadership programme enables you to develop your life-skills through establishing personal core values, which will become the foundation for your leadership credibility and influence.

	LSW1002	**Sports & Wellness**	**2**	

This subject will help you develop both the physical and technical skills in your chosen sports or fitness activities. Through a structured curriculum that facilitates group participation, practice sessions and mini competitions, you will learn to build lifelong skills such as resilience, leadership, communication and teamwork. Physical activity sessions will be supplemented by health-related topics to provide you with a holistic approach to healthy living.

	MCR1001	**Career Readiness 1**	**1**	

This Career Readiness programme comprises three core subjects - Personal Management, Career Preparation and Career Management. It seeks to help you understand your career interests, values, personality and skills for career success It also equips you with the necessary skills for seeking success. It also equips you with the necessary skills for seeking and securing jobs, and to develop professional work ethics.

Core Subjects —

	Subject Code	Subject	Credit Units	
	EEE1001	**Circuit Analysis**	**6**	

This subject provides a good foundation in DC and AC network analysis. You will learn the basic principles of electric circuitry and how to apply circuit theorems to analyse DC and AC networks.

	ESE1006	**Computer Programming for Problem Solving**	**4**	

This subject covers the process of decomposing a problem into a sequence of smaller abstractions. The abstractions are implemented in software in a structured top-down approach. Software implementation includes the process of designing, writing, testing, and debugging program code.

	EEE1003	**Digital Fundamentals 1**	**5**	

This subject provides basic knowledge of digital electronics and circuits. Topics include number systems, operations and codes, logic gates, Boolean algebra and logic simplification, combinational logic, functional blocks, latches and flip-flops.

	EEE1004	**Digital Fundamentals 2**	**5**	

This subject builds upon the fundamentals of digital electronics acquired in Digital Fundamentals 1. It introduces the digital concepts of the various building blocks in a computer's digital system. You will acquire the theoretical and practical knowledge of registers, counters, memory devices, and conversions between digital and analogue signals and integrated circuit technologies. Digital troubleshooting techniques are also explored in the laboratory work.

⌃	**EEE1002**	**Electronic Devices & Circuits**	**6**	⌃

This subject covers the theory and practical knowledge of electronic devices such as diodes, bipolar junction transistors, field effect transistors and their applications. It also focuses on the fundamentals of operational amplifiers and their applications, and the rudiments of circuit troubleshooting and testing.

⌃	**EED1001**	**Electronic Prototyping**	**3**	⌃

This subject introduces you to the use of hand tools and standard laboratory equipment for the construction and testing of electronic prototypes. You will also learn to identify basic electronic components for project work and how to use them to build electronic devices.

⌃	**EMA1003**	**Engineering Mathematics 1**	**4**	⌃

This subject teaches pre-calculus techniques required for an engineering course. It trains you in engineering problem-solving approaches using the appropriate mathematical tools. Topics such as simultaneous equations, matrices, trigonometric, exponential and logarithmic functions, complex numbers and vectors will be covered.

⌃	**EMA1002**	**Engineering Mathematics 2**	**4**	⌃

This subject introduces the basic concepts of calculus and statistical method to test a hypothesis. Basic concepts in calculus include limits, derivatives and integrals. Applications of the derivative and integrals in engineering will be discussed. Basic statistical method in hypothesis testing includes normal distribution, confidence interval of population mean and procedure to test hypothesis for a claim made about a population mean.

⌃	**ESC1004**	**Engineering Physics**	**3**	⌃

This subject covers a spectrum of fundamental physics laws and concepts applicable to the scope of engineering physics. It covers a few core areas including Mechanics, Energy, Thermal Physics, Electromagnetism, Waves & Optics and Materials. This subject provides a foundation for a further in depth study of the various engineering disciplines.

Apply your knowledge and skills in electronics, mechanics and computer technologies from Year 1 to develop smart devices and automated systems. You will also acquire new in-demand skills in data visualisation and analytics, as well as additive printing, and will be exposed to key job roles by taking up operational roles in Advanced Manufacturing as relevant core diploma subjects.

TP Fundamentals (TPFun) Subjects —

Subject Code	Subject	Credit Units
ECS1006	**Workplace Communication**	2
	In this subject, you will be taught how to conduct effective meetings while applying team communication strategies and the skills for documenting meeting notes. You will be required to write clear emails, using the appropriate format, language, tone and style for an audience. You will also be taught to communicate appropriately in and for an organisation when using various platforms. In all aspects, the principles of applying **M**essage, **A**udience, **P**urpose and **S**trategy (MAPS) will be covered.	
EGS1003	**Managing Diversity at Work***	3
	This subject explores the concepts of identity, diversity and inclusion at the workplace. It examines the relationship between identity and diversity, the benefits and challenges of diversity and the strategies that promote inclusion and inspire collaboration in a diverse workplace. Examples of the elements of diversity covered in this subject include nationality, generation, ethnicity and gender. A one week residential stay is mandatory for this subject.	
EGS1004	**Global Citizenship & Community Development***	3
	Students will examine the meaning and responsibilities of being a Global Citizen, in order to contribute towards a more equitable and sustainable world. In addition, students will learn how sustainable solutions can support community development, and, execute and critique a community action plan that addresses the needs of a specific community/ cause.	
EGS1005	**Expressions of Culture***	3
	This subject provides a platform for an understanding of culture and heritage through modes of expression. Students will be introduced to global and local cultures via everyday objects, places and human behaviour seen through time and space. Students will explore issues and challenges in culture and heritage sustainability in community, national and global contexts.	

⌃	**LEA1012**	**Leadership: Essential Attributes & Practice 2**	**1**	⌃
		LEAP 1, 2 and 3 are three fundamental subjects that seek to cultivate in you, the attitude, skills and knowledge for the development of your leadership competencies. This character-based leadership programme enables you to develop your life-skills through establishing personal core values, which will become the foundation for your leadership credibility and influence.		
⌃	**MCR1002**	**Career Readiness 2**	**1**	⌃
		This Career Readiness programme comprises three core subjects – Personal Management, Career Preparation and Career Management. It seeks to help you understand your career interests, values, personality and skills for career success. It also equips you with the necessary skills for seeking and securing jobs, and to develop professional work ethics.		
⌃	**TGL1001**	**Guided Learning**	**3**	⌃
		The subject introduces students to the concepts and process of self-directed learning in a chosen area of inquiry. The process focusses on four stages: planning, performing, monitoring and reflecting. Students get to plan their individual learning project, refine and execute the learning plan, as well as monitor and reflect on their learning progress and project. The learning will be captured and showcased through a curated portfolio. The self-directed learning project will broaden and/or deepen a student's knowledge and skills.		

* Students must choose to take either one of these three subjects or TGL1001 Guided Learning.

Core Subjects	—

	Subject Code	Subject	Credit Units	
⌃	**ESE1008**	**Data Visualisation & Analytics**	**3**	⌃
		This subject covers the data analytics lifecycle, including gathering, cleaning, processing and visualising of data. Exploratory data analysis methods, descriptive and predictive analytics, and the presentation of insights, will also be covered.		
⌃	**EDR1003**	**Engineering Drawing**	**4**	⌃
		Engineering drawing is essential for communicating engineering design. This subject will introduce you to the understanding and preparation of two-dimensional mechanical engineering drawings with the use of both manual and Computer Aided Design/ Drafting (CAD) software. CAD modelling is also taught. You will also learn general methods of dimensioning according to international and local standards.		

	EMA2003	**Engineering Mathematics 3**	4	

This subject introduces Ordinary Differential Equations (ODE). In particular, it focuses on the formulation of engineering problems into first and second order differential equations. Some techniques in solving ODE and the applications of ODE will be discussed, including the use of Laplace Transforms and the calculation of Fourier series.

	EED2011	**Integrated Project**	3	

This subject covers the basic principles in the development of product design through hands-on experience. The project will involve the use of mechanical hardware, electronics, software and data visualisation to demonstrate solutions to real world problems in advanced manufacturing.

	EME2004	**Introduction to Smart Automation**	4	

This subject provides the fundamentals of automation in a manufacturing environment. Four main topics are covered, namely: pneumatics, electro-pneumatics, programmable logic controllers and an introduction to advanced manufacturing. Essential knowledge of the working principles and applications of automation equipment are covered, followed by an overview of how to automate production processes to achieve quality and high productivity. You will also be introduced to the concept of smart automation and the key concepts of advanced manufacturing.

	EME2007	**Machining Technology**	4	

The subject introduces the various manufacturing processes including computer-controlled processes and you get hands-on practice with conventional and Computer Numerical Control (CNC) machines. You will also learn about Computer-Aided Design and Manufacturing (CAD/CAM) system. Safety aspects are emphasised throughout the workshop sessions. You will acquire the fundamental knowledge and skills in designing for the manufacturing sectors such as the tool and die industry.

	EME2008	**Principles of Dynamics**	5	

The application of dynamic systems theory can be seen everywhere in our daily lives, from vehicles moving on the road to planes flying in the air. In this subject, you will learn learn the fundamental principles of dynamics and apply them to the analyses of bodies in motion. The objective is to present the foundation and applications of dynamics. The main topics covered include Newton's laws of motion, the principle of work and energy, the principle of impulse and momentum, and the motion of projectiles.

	EMF3005	**Robotics & Automation**	4	

This subject covers factory automation systems which are the foundation for advanced manufacturing systems. It provides

Subject Code	**Subject**	**Credit Units**

the essential concepts and background on industrial automation, robotics and their applications, as well as their integration into a complete manufacturing system. You will also learn the working principles and applications of automation equipment and how to automate production processes to achieve quality and high productivity. Both hardware and software links between the main factory automation components are introduced.

∧	**EME1002**	**Statics & Strength of Materials**	**4**	∧
		This subject consists of two principal areas: Fundamentals statics and strength of materials. Fundamental statics provides an introduction to the basic concepts in simple statics, while strength of materials introduces the methodology for designing members subjected to various loading conditions.		

YEAR 3

Choose an elective in emerging fields in advanced manufacturing, or a "through-train" work-study degree programme! Deepen your specialisation via cross-school elective subjects and on-the-job training in the TP Advanced Manufacturing Centre as part of your Major Project. With this practice-based approach, you will get a head-start when working in relevant companies in the Advanced Manufacturing sector.

TP Fundamentals (TPFun) Subjects   —

	Subject Code	Subject	Credit Units	
∧	**ESI3001**	**Student Internship Programme**	**12**	∧
		This structured programme is designed to link your learning with the real work environment. You will be placed in organisation(s) with opportunities to apply the concepts and skills acquired in the course of your study. Besides reinforcing technical concepts and mastering of skills in areas that you have been trained, the practical training will enable you to build important skills such as problem-solving, communication, teamwork, and to cultivate good attitude and a strong work ethic.		
∧	**LEA1013**	**Leadership: Essential Attributes & Practice 3**	**1**	∧
		LEAP 1, 2 and 3 are three fundamental subjects that seek to cultivate in you, the attitude, skills and knowledge for the development of your leadership competencies. This character-based leadership programme enables you to develop your life-skills through establishing personal core values, which will become the foundation for your leadership credibility and influence.		
∧	**MCR1003**	**Career Readiness 3**	**1**	∧
		This Career Readiness programme comprises three core subjects – Personal Management, Career Preparation and Career Management. It seeks to help you understand your career interests, values, personality and skills for career success. It also equips you with the necessary skills for seeking and securing jobs, and to develop professional work ethics.		

Core Subjects

Subject Code	Subject	Credit Units
∧ EMP3002	**Major Project**	8 ∧
	In this subject, you will work in teams to integrate and apply your skills and knowledge to implement your projects in a practical work-and-learn environment. Besides research, design, analytics, project management, communication and problem solving skills, the emphasis will also be on innovation, teamwork and self-learning.	

#Students to choose one of these elective clusters

Cluster Elective Subjects

3D Printing Elective Cluster

Subject Code	Subject	Credit Units
∧ EDR3001	**Advanced CAD & Simulation**	4 ∧
	This subject involves the use of advanced computer-aided design (CAD) to design, create and simulate engineering production in a virtual environment. It aims to equip you with in-depth knowledge of the software and its advanced modelling tools. CAD applications include Mechanism, Animation, Simulate and Illustrate.	
∧ EME2012	**CAD & Additive Manufacturing#**	4 ∧
	Additive Manufacturing, also commonly known as 3D Printing, is becoming an important manufacturing technique in advanced manufacturing that complements existing manufacturing processes. In this subject, the main topics covered include principles and development of Additive Manufacturing, design guidelines for Additive Manufacturing (ISO/ASTM 52911-2), design of support structures, generalised process chain, process selection guidelines, pre-processing software, post-processing methods and laser-based powder bed.	

Advanced Engineering Skills Elective Cluster

Subject Code	Subject	Credit Units
EED3014	**Advanced Skills Practices**	8

This subject provides opportunities for you to integrate and apply your knowledge for high level competitions or projects in practical learning situations. The project or skills training can involve substantial work related to either a high level industrial program or an end-user product, as well as advanced training to develop technical abilities to execute specific tasks competitively. It could also involve the development, evaluation of workable designs and implementation of ideas related to an innovative product suitable for manufacturing, or an improvement to existing products or processes. You may be required to work on software, hardware, or a combination of both hardware and software.

Advanced Manufacturing Elective Cluster

Subject Code	Subject	Credit Units
EMF3006	**Machine Vision & Pattern Recognition**	4

This subject covers the fundamentals of machine vision and pattern recognition technologies in advanced manufacturing. It provides the essential knowledge of the key components and technologies used in machine vision systems. An overview of the techniques in data analysis and the derivation of useful hidden patterns in the data are introduced, including the selection, development and application of suitable pattern recognition techniques to solve a given problem. These skills and knowledge will be applied to machine vision systems in a smart manufacturing facility.

Subject Code	Subject	Credit Units
EMF2002	**Smart Manufacturing System**	4

This subject introduces the core elements of a smart manufacturing system where real-time manufacturing data enables flexibility and increases productivity. An introduction to advanced manufacturing and key enabling technologies such as Radio Frequency Identification (RFID) systems, Manufacturing Executions Systems (MES) and Augmented Reality (AR) are used to lay the foundation for understanding the application and benefits of smart manufacturing.

Intralogistics & Cybersecurity Elective Cluster

	Subject Code	Subject	Credit Units	
∧	BLO2010	**Distribution Centre Management**	**4**	∧
		This subject provides an overview of the role of a Distribution Centre (DC) in the supply chain. It also covers the various activities performed within a DC and the significance of these activities on customer service and total logistics costs. It focuses on the major resources to be applied in a DC and explains how they interact with one another in contributing to the DC's effectiveness and efficiency. It will also cover the significance of providing DC services to the Third-Party Logistics industry.		
∧	CCF2C02	**IOT Security**	**4**	∧
		This subject covers the knowledge and skills required to analyse and troubleshoot IoT vulnerabilities and threats. You will use latest technologies to perform risk assessments and recommend mitigation strategies for common security issues in IoT systems.		

Semiconductor Technology Elective Cluster

	Subject Code	Subject	Credit Units	
∧	EMI3005	**Cleanroom Equipment & Technology**	**4**	∧
		This subject introduces contamination control in a cleanroom and the factors to control the environment. It includes wafer plant facilities, process equipment and vacuum technology. Practical training includes appreciating the environment in the cleanroom, identifying the various components of a deionised water purification plant and operating vacuum pumps and systems.		
∧	EMI2008	**IC Process Integration**	**4**	∧
		This subject covers the basic concepts of IC, IC fabrication and IC wafer fabrication, as well as producing process flow, conceptual mask layouts and test structures for CMOS process. It also covers the basic concepts of process in-line monitoring and characterisation of basic solid state devices.		

Work-Study Degree Programme Elective Cluster —

	Subject Code	Subject	Credit Units	
^	EME3006	**Engineering Statics**	**5**	^
		This course aims to provide you with the important fundamentals in engineering mechanics. The statics component in engineering mechanics focuses on finding and analysing the governing mechanical characteristics of structural elements and bodies in equilibrium. As this subject is offered together with Singapore Institute of Technology (SIT), please refer to the SIT Work-Study Degree Programme page for more information.		
^	EMF3007	**Computer-Aided Design & Manufacturing**	**5**	^
		You will learn how to employ solid modelling software to generate 3D models and 2D technical drawings, and be acquainted with forming processes, machine methods, production planning and costing. You will also gain an understanding of fundamental orthographic principles, engineering fits & limit dimensions, geometric dimensions & tolerances, as well as surface texture. As this subject is offered together with Singapore Institute of Technology (SIT), please refer to the SIT Work-Study Degree Programme page for more information.		
^	ESE3011	**Programming**	**5**	^
		This module introduces you to computer programming using the "C" programming language. You will learn how to analyse programming problems, and also have hands-on exposure in designing, implementing, testing and debugging programs that use different data types. As this subject is offered together with Singapore Institute of Technology (SIT), please refer to the SIT Work-Study Degree Programme page for more information.		

Special Electives

Students can opt to take Special Electives when offered. These optional subjects aim to stretch the students' potential to enable them to meet their aspirations. They are taken in addition to the diploma cluster elective subjects.

Special Electives —

	Subject Code	Subject	Credit Units	
^	EED3009	**Special Project 1**	**2**	^
		The focus of this subject is on the application of students' existing domain knowledge to develop a deliverable. The subject will introduce new skills and knowledge specific to the project, as and when required.		

EED3010	**Special Project 2**	2	^

This subject provides opportunities for students to apply the acquired knowledge and skills, along with their fundamental and in-depth knowledge from different subjects to designing, developing, and implementing a well-engineered project solution.

EED3011	**Higher Engineering Skills 1**	2	^

Higher Engineering Skills 1 and 2 aim to impart some special design and hands-on skills that allow you to acquire knowledge and skills that are not normally incorporated into a diploma programme. These Special Elective subjects will equip you with the skills and knowledge to participate in competitions and enable you to tackle real challenges.

EED3012	**Higher Engineering Skills 2**	2	^

Higher Engineering Skills 1 and 2 aim to impart some special design and hands-on skills that allow you to acquire knowledge and skills that are not normally incorporated into a diploma programme. These Special Elective subjects will equip you with the skills and knowledge to participate in competitions and enable you to tackle real challenges.

EMA3001	**Higher Engineering Mathematics**	4	^

The subject introduces mathematical concepts and techniques used in advanced engineering courses. You will learn topics in calculus such as limits and continuity, infinite series, improper integrals, multiple integrals, higher order differential equations, 2D and 3D analytic geometry, and partial differentiation.

GRADUATION REQUIREMENTS

Cumulative Grade Point Average	min 1.0
TP Fundamentals Subjects	36 credit units
Diploma Core Subjects	83 credit units
Diploma Cluster Elective Subjects	min 7 credit units
Total Credit Units Completed	min 126 credit units