Subject Description Form

Subject Code	AAE2101/IC2105
Subject Title	Engineering Communication and Fundamentals
Credit Value	4 Training Credits
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject offers a wide spectrum of fundamental engineering practice that are essential for a professional engineer. This subject includes Engineering Drawing and CAD, Safety, Basic Mechatronic Practice, Mechanism Design Practice and Scientific Computing Languages that aims at providing fundamental and necessary technical skills to all year 1 students interested in engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) Describe the principles and conventional representation of engineering drawings according to engineering standards and be able to use it as a medium in technical communication and documentation with CAD application, modelling and practice with application in engineering; b) Interpret basic occupational health and industrial safety requirements for engineering practice; c) Explain common testing requirements; d) Apply scientific computing software for computing in science and engineering including visualization and programming. Upon completion of Stream A of the subject, student will be also able to: e) Design and implement simple mechatronic systems with programmable controller, software, actuation devices, sensing devices and mechanism; and Upon completion of Stream B of the subject, student will be also able to: f) Design and fabricate simple mechanism assembly with standard components, fast prototyping processes and tolerance practices

Subject Description Form

Subject Synopsis/ Indicative Syllabus	1 (TM2009) Industrial Safety 1.1 Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures. 1.2 Safety Law: F&IU Ordinance and principal regulations, OSH Ordinance and principal regulations. 1.3 Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling. 1.4 Safety Technology: Mechanical lifting, fire prevention, dangerous substances and chemical safety, machinery hazards and guarding, electrical safety, first aid, job safety analysis, fault tree analysis, and personal protective equipment. **One of the following as decided by hosting programme** Stream A 2a (TM3014) Basic Scientific Computing with MATLAB 2.1 Overview of scientific computing with MATLAB; interactive calculations, variables, vectors, matrices and string; mathematical operations, polynomial operation, data analysis and curve fitting, file I/O functions. Basic 2D and 3D plots. 2.2 M-file programming & debugging; scripts, functions, logic operations, flow control, introduction to the graphical user interface. 3a (TM8059) Engineering Drawing and CAD 3.1 Fundamentals of Engineering Drawing: Principles of engineering drawing, dimensioning and tolerances; types of drawings, such as part drawing and assembly drawing; conventional representation of common machine elements and parts; wiring diagram and wiring table for electrical installation; system block diagram for the electrical system; architectural wiring diagram. 3.2 Introduction to CAD Features of the 2D CAD system; 2D drawings techniques, such as basic object construction, annotation, dimensioning; setup of 2D plotting; general concepts on 3D computer modelling; parametric feature-based solid modelling; construction and detailing of solid features; concepts of assembly modelling; virtual validation and simulation, generation of 2D drawings from 3D parts and assemblies; data exchange; techniques for export files for different processes (e.g. 3D printing, laser machining, VR) 4a (TM1116) Electronic Product Safety Test and Practice 4.1 Use of basic electronic test instruments, current and voltage measurements, waveform measurement, power supply and signal sources;

Subject Description Form

	4.2 Electronic product safety standards; electronic product test methods, such as high voltage isolation test, insulation resistance test, continuity test, leakage current measurement, electrostatic discharge (ESD) test etc. 5a (TM0510) Basic Mechatronic Practice 5.1 Definitions of mechatronics; mechatronic system design approach; key elements of a mechatronic system, such as sensor and actuator, mechanical drives, digital control, signal conditioning, and human-machine interfaces. 5.2 Introduction of design and operation of typical mechatronic systems, such as robotic arms, elevator systems, mobile robots, manufacturing and logistic system; 5.3 Design of mechatronic system using programmable controllers and development software such as PLC and Microcontroller system; use of simulation software packages to support system prototyping. Stream B 2b (TM3302) Python for Engineers and Scientists 2.1 Fundamental of Python Basic data type; variable and identifiers; constant, statement and expression, control structure and logic, string, tuple and list, set; object oriented concepts; interactive calculations and mathematical operations. 2.2 Problems solving with Python Functions and Python packages to solve engineering problem (i.e. plot displacement diagram). 2.3 Human Machine Interface (HMI) Application development with data manipulation, visualisation and HMI by using data and graphics packages such as data processing, data plotting, visualisation, exploratory data analysis and graphic user interface. 3b (TM8060) Computer Aided Design Fundamental 3.1 General concepts on CAD Parametric feature-based solid modeling; construction and detailing of solid features; solid model modification and its limitations. 3.2 Assembly modelling Bottom-up and top-down approaches for the generation of parts, subassemblies, and final assembly; mechanism design and its simulation methods. 3.3 Generation of engineering drawing

Subject Description Form

	Types of drawings including part drawing and assembly drawing; generation of 2D drawings from 3D parts and assemblies; drawing annotation. 4b (TM1340) Dimensioning and Tolerancing Practice 4.1 Measurement Principles of engineering drawing and orthographic projection; basic concept of dimensioning and tolerancing; introduction to common measuring tools and measurement practices such as steel rule, vernier calipers, micrometer, height gauge, optical projector and CMM. 4.2 Fitting Practice and Assembly Introduction to fasteners; introduction of hand tools and fitting practices such as filing, drilling, sawing, tapping and threading; assembly practice with fasteners and torque wrenches. 5b (TM1325) Fast prototyping for mechanism design 5.1 Fast prototyping technique Overview of mechanism design (i.e. gear, wheel and axle, linkages); basic working principle of 3D printing; pre-processing and post- processing technique (i.e. CAD preparation, support structure and orientation consideration); laser machining & engraving operation techniques with its CAD preparation; basic 3D scanning operation; applications of Arduino for motor control; force and speed measurement; measurement of material properties.
Learning Methodology	The learning and teaching methods include lectures, workshop tutorials, and practical works. The lectures are aimed at providing students with an overall and concrete background knowledge required for understanding key issues in engineering communication, use of standard engineering components and systems, and importance of industrial safety. The workshop tutorials are aimed at enhancing students' in-depth knowledge and ability in applying the knowledge and skills to complete specific tasks. The practical works aim at facilitating students to review the diverse topics covered in this course and perform active learning with research, practice, questioning, and problem solving in a unified activity.

Subject Description Form

Assessment Methods in Alignment with Intended Learning Outcomes

Stream A

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed				
		a	b	c	d	e
Continuous Assessment						
1. Assignment	80.25	✓	✓	✓	✓	✓
2. Test	13		✓		✓	✓
3. In-class learning logs	6.75			✓	✓	
Total	100					

Stream B

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed				
		a	b	c	d	f
Continuous Assessment						
1. Assignment/Project	77.5	✓	✓	✓	✓	✓
2. Test	15		✓		✓	
3. In-class learning logs	7.5					✓
Total	100					

Assessment Methods	Remarks
1. Assignment	Invidual in class hand-on practice assignment is designed to facilitate students to reflect and apply the knowledge periodically throughout the training.
2. Test	Test is designed to facilitate students to review the breadth and depth of their understanding on specific topics.
3. In-class learning logs	In-class learning log is designed to facilitate students to review their learning achievement and critize the outcomes by self-reflection.

Subject Description Form

Student Study Effort Expected	**Class Contact (Stream A)**	**TM8059**	**TM2009**	**TM1116**	**TM0510**	**TM3014**
	▪ Short lecture	11 Hrs.	7 Hrs.	2 Hrs.	6 Hrs.	6 Hrs.
	▪ In-class Assignment/ Hands-on Practice	40 Hrs.	8 Hrs.	4 Hrs.	21 Hrs.	15 Hrs.
	(Stream B)	**TM8060**	**TM2009**	**TM1340**	**TM1325**	**TM3302**
	• Short lecture	7 Hrs.	7 Hrs.	3 Hrs.	7 Hrs.	7 Hrs.
	• In-class Assignment/ Hands-on Practice	23 Hrs.	8 Hrs.	12 Hrs.	23 Hrs.	23 Hrs.
	Other Study Effort					
	▪ Nil					
	Total Study Effort					**120 Hrs.**

Subject Description Form

Reading List and References	**Reference Software List:** 1. AutoCAD from Autodesk Inc. 2. SolidWorks from Dassault Systèmes Solidworks Corp. 3. MATLAB from The Mathworks Inc. 4. Python from Python Software Foundation **Reference Standards and Handbooks:** 1. BS EN ISO 128 – Technical product documentation. General principles of representation 2. Cecil H. Jensen, et al, Engineering Drawing and Design, McGraw-Hill, 2008. 3. IEEE Standard 315 / ANSI Y32.2 / CSA Z99 Graphic Symbols for Electrical and Electronics Diagrams. 4. IEC 61082 Preparation of Documents used in Electrotechnology. **Reference Books:** Training material, manual and articles published by Industrial Centre.