THE HONG KONG POLYTECHNIC UNIVERSITY

Department of Mechanical Engineering

Full-time

BEng(Hons) Scheme in Mechanical Engineering (43499)

Awards Offered under the Scheme:

BEng(Hons) in Mechanical Engineering
BEng(Hons) in Product Analysis and Engineering Design

(4-Year undergraduate degree structure)

Programme Requirement Document

(For 2020/21 Cohort)

August 2020

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This Programme Requirement Document is subject to review and changes which the programme offering Department can decide to make from time to time. Students will be informed of the changes as and when appropriate.

PART A PROGRAMME SCHEME

1. GENERAL INFORMATION

1.1 Programme Title and Programme Code

Bachelor of Engineering(Honours) Scheme in Mechanical Engineering (BEng Scheme in ME)

- Scheme Code: 43499
- JUPAS Code: JS3741

1.2 Host Department

Department of Mechanical Engineering

1.3 Award Title

There are two awards operating under the BEng Scheme in ME:

- Bachelor of Engineering(Honours) in Mechanical Engineering (BEngME)
- Bachelor of Engineering(Honours) in Product Analysis and Engineering Design (BEngPAED)

Students admitted into the BEng Scheme in ME will study together during the first two years and then complete their preferred award (BEngME or BEngPAED) in the next two years until graduation.

1.4 Mode of Attendance

Full-time

1.5 Normal Duration of Study

Mode of Study	Normal Duration of Study
Full-time	4 Years (2 Years for Senior Year)

1.6 Minimum Entrance Requirements

In addition to the general requirements for admission to the full-time honours degree programmes offered by the University, a candidate needs to satisfy one of the following requirements (a), (b), (c), (d) or (e):

(a) **For entry with Hong Kong Diploma of Secondary Education Examination (HKDSE) Qualification**

The general minimum entrance requirements are as follows:

HKDSE Subjects	Core Subjects				Elective Subjects (including M1/M2)	
	Chinese Language	English Language	Mathematics	Liberal Studies	1st Elective	2nd Elective
Level Requirement	3	3	2	2	3	3

There is no compulsory subject requirement. Preferred elective subjects for the Scheme include: Physics, Biology, Chemistry, Combined Science, Information and Communication Technology, and Extended Modules in Mathematics.

(b) **For entry with A-Level Qualification**

A minimum of grade of E in 3 A-Level subjects OR E in 2 A-Level and 2 AS-Level subjects; and Satisfy the English Language Requirement.

(c) **For entry with International Baccalaureate (IB) Qualification**

A minimum score of 24 with at least grade 4 in 2 Higher Level (HL) subjects; and
Satisfy the English Language Requirement.

(d) **For those with other Qualifications**

A relevant Diploma passed with credit or a relevant Higher Certificate from a recognized institution; or
A relevant Associate Degree / Higher Diploma from a recognized institution.

(e) **Qualifications equivalent to (a), (b), (c) or (d).**

Note 1: Credit transfer may be granted to applicants with A-Level / IB qualification / Higher Diploma / Associate Degree, or the equivalent.

Note 2: Holder of a Higher Diploma or Associate Degree in Mechanical Engineering/ Engineering Design or a related discipline with good academic result at graduation (as determined by PolyU ME) may be considered for the Senior Year curriculum.

2. PREAMBLE

The Hong Kong Polytechnic University (PolyU) aspires to be a leading university that excels in professional education, applied research and partnership with the industry for the betterment of Hong Kong, the nation and the world. It is the mission of the University (a) To pursue impactful research that benefits the world; (b) To nurture critical thinkers, effective communicators, innovative problem solvers and socially responsible global citizens; and (c) To foster a University community in which all members can excel in their aspirations with a strong sense of belonging and pride. Being one of the oldest departments in the University, the Department of Mechanical Engineering (ME Department) follows closely the progress and development of the University, and shares its vision and mission.

In line with the vision of the University, the ME Department aspires to achieve excellence in education and research in the discipline of mechanical engineering with global out-reach and impact. It is also our mission (a) To train future leaders, with creativity, broad vision, global outlook, and professional ethics for industry, academia, government and communities, who have sound knowledge in mechanical engineering with effective communication, analytical, and problem-solving skills; and (b) To create knowledge and technologies through fundamental research and its applications in mechanical engineering, in order to serve the societal needs.

Hong Kong is facing a fast-evolving and increasingly competitive world. In order to maintain economic growth in the face of globalization, its economy has to change from being efficiency-based to knowledge-based. The goal of the ME Department is to produce all-round graduates who can lead a changing society. This goal is accomplished by having forward looking course curricula. Thus, it is one of the objectives of the Department to provide a holistic education which is outcome-based, work-integrated, professionally and globally-oriented, and student centred to strengthen the holistic development of the students.

The ME Department is currently offering the following two full-time undergraduate degree programmes:

- **Bachelor of Engineering(Honours) in Mechanical Engineering (BEngME); and**
- **Bachelor of Engineering(Honours) in Product Analysis and Engineering Design (BEngPAED)**

Students wish to study in either BEngME or BEngPAED will firstly be admitted into the Bachelor of Engineering(Honours) Scheme in Mechanical Engineering (BEng Scheme in ME).

3. RATIONALE, AIMS AND OBJECTIVES

One of the missions of the ME Department is to produce graduates with a good general education, a competent command of the English and Chinese languages, a broad knowledge of mechanical engineering, and a deeper understanding of one of its sub-fields, with an aims to endow our graduates with competence to meet and lead the changing technological challenges of the 21st century.

PolyU aspires to develop all its students as all-round graduates with professional competence, and has identified a set of highly valued graduate attributes as the learning goals for students. While many of these graduate attributes can be developed through the curricular activities of the BEng Scheme in ME, some (including global outlook, interest in local and international affairs, sense of social and national responsibility, cultural appreciation) are primarily addressed through co-curricular activities offered by faculties, departments and various teaching and learning support units of the University. Students are encouraged to make full use of such opportunities to develop these attributes.

3.1 Aims of BEng Scheme in ME

In order to make our two undergraduate programmes (BEngME and BEngPAED) more attractive to the students, ME Department merges them together into the BEng Scheme in ME. Starting from September 2017, students admitted into the BEng Scheme in ME will study together during the first two years and then complete their preferred programme (BEngME or BEngPAED) in the next two years until graduation. After successful completion of their chosen programme, students will be awarded with either Bachelor of Engineering(Honours) in Mechanical Engineering or Bachelor of Engineering(Honours) in Product Analysis and Engineering Design. The structure of the BEng Scheme in ME is illustrated in Figure 3.1.

3.2 Programme Aims and Objective of BEng(Hons) in Mechanical Engineering (BEngME)

Due to rapid development of infra-structure, transportation engineering, clean energy, materials engineering, and building services engineering projects in Hong Kong, mechanical engineering becomes one of the most essential engineering disciplines required by the community. The major knowledge and skills in mechanical engineering: thermodynamics, fluid mechanics, mechanics, materials engineering, dynamics and control, and engineering design, are critical elements for successful completion of these multi-disciplinary projects. Thus, mechanical engineers are playing very important role in building the modern community and certainly of great demand.

The BEngME programme is designed with the following objectives:

1. To provide students with a broad base of knowledge in the fundamentals of mechanical engineering.
2. To help students develop the ability to engage in life-long learning and professional development.
3. To produce graduates that are aware of the global, societal, ethical and professional issues in the practice of engineering.

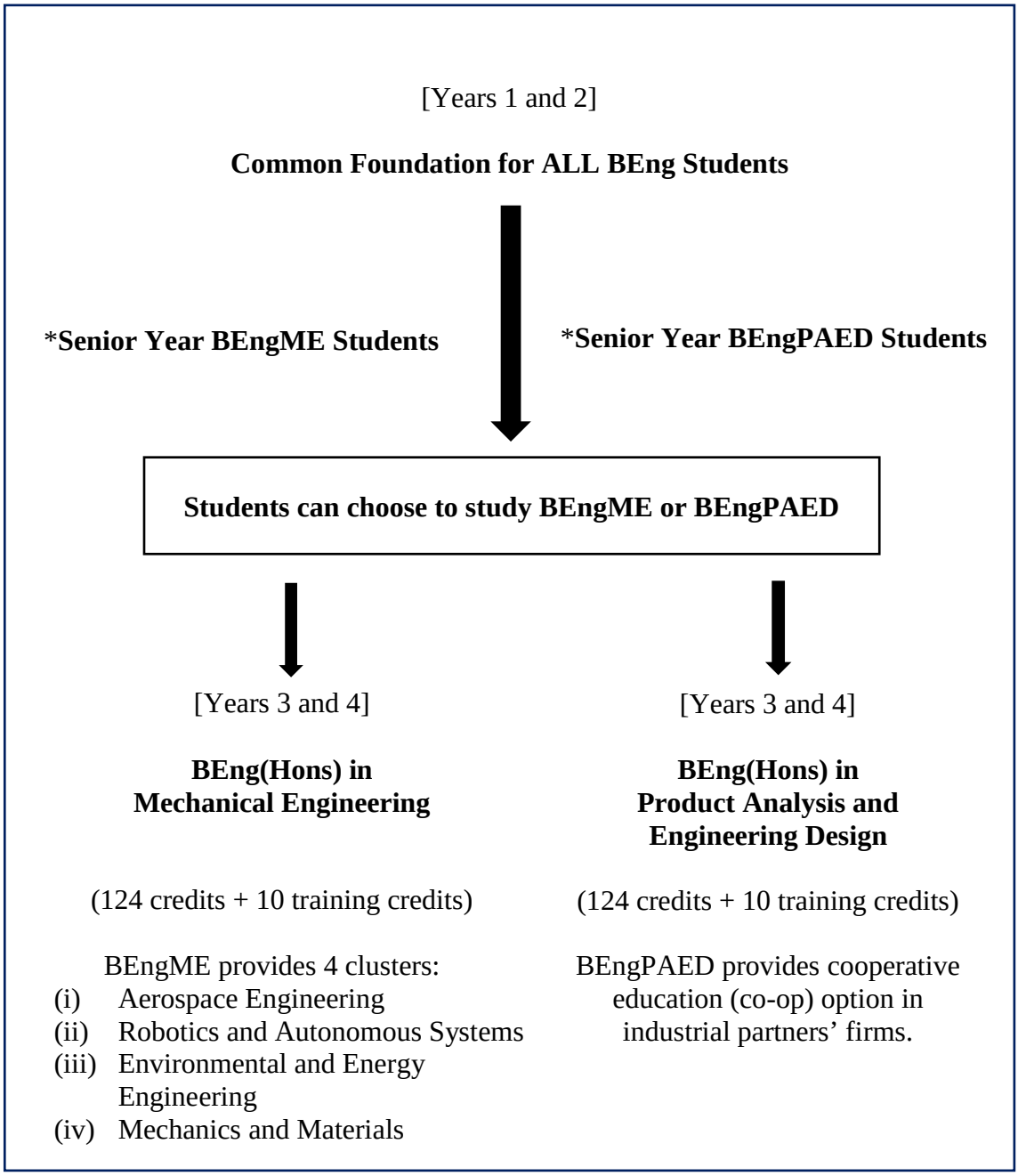
3.3 Programme Aims and Objective of BEng(Hons) in Product Analysis and Engineering Design (BEngPAED)

In order for Hong Kong to sharpen its competitive edge in the export-led international markets, it is of utmost importance for our industries to develop their own brand names as providers of top-quality, trendy and innovative products and engineering systems to *vast* customers worldwide, much like the labels of luxury goods or prestigious service industries excelled in well-developed countries. This pressing need has been transforming the Hong Kong industries from *low-cost* Original Equipment Manufacturers (OEMs), to *high-value-added* Original Design Manufacturers (ODMs), and to the ultimate target of being *creativity-led* and *innovation-driven* Original Brand Manufacturers (OBMs) so as tomaintain their success and even perform better in international market share. In order to achieve this transformation, the Hong Kong industries need a whole new breed of design engineers who can synergize engineering with design and business for the development of innovative products and engineering systems, that provide unprecedented experiences and service quality, across the breadth of engineering and design.

The ME Department identifies it as an excellent opportunity to offer an undergraduate programme that matches the educational needs for nurturing new breed design engineers for the transformation of Hong Kong industries to reach excellence in the innovation-driven business worldwide. The design engineers should be able to integrate fundamental engineering and design knowledge and skills, with a particular emphasis on computer-aided product analysis tools, creativity and engineering design processes, aesthetics and human factors, leverage of existing technologies, enterprise skills and industrial experience necessary to bring new innovations to international markets. With this ultimate goal in mind, the BEngPAED programme is designed with the following objectives:

1. To synergize technology with design and business with an aim to fulfilling the PolyU's strategic development of product design.
2. To provide graduates with excellent integration of knowledge, skills and hands-on experience in developing new products with superior quality including engineering design, industrial design, engineering sciences, simulation and analysis, prototyping and manufacture, management and marketing, via a coherent and well-balanced curriculum developed through collaboration between departments involved.
3. To produce preferred all-round graduates, who have developed all-roundedness knowledge and skills including self-learning, communication, team-playing, management, information search and global outlook, such that they are found immediately useful by the industry, and at the same time, will be able to develop themselves to play important roles in leading the local manufacturers to design and develop high-value-added new products with superior quality, in order to maintain the prosperity of Hong Kong.
4. To help graduates develop the ability to engage in life-long-learning and professional development and to acquire professional recognition from professional bodies including the Hong Kong Institution of Engineers.
5. To produce graduates who are aware of the global, societal, ethical and professional issues in the practice of product design and development.

Figure 3.1 - Structure of Full-time BEng(Hons) Scheme in Mechanical Engineering



*Senior Year Students are admitted directly into either BEng(Hons) in Mechanical Engineering or BEng(Hons) in Product Analysis and Engineering Design.

4. INTENDED LEARNING OUTCOMES (ILOs)

The BEng(Hons) in Mechanical Engineering (BEngME) and BEng(Hons) in Product Analysis and Engineering Design (BEngPAED) programmes offered by the ME Department are designed to produce graduates that are broad-based and knowledgeable in mechanical engineering and design engineering respectively. It is expected that our graduates would accept responsibilities as professionals in academic, industrial and governmental organizations.

4.1 PolyU Institutional Learning Outcomes

It is PolyU's educational mission to nurture competent professionals who are also critical thinkers, effective communicators, innovative problem solvers, lifelong learners, and ethical leaders. The institutional learning outcomes for these attributes are provided as follows:

(a) Competent professional: Graduates should be able to integrate and to apply in-depth discipline knowledge and specialised skills that are fundamental to functioning effectively as an entry-level professional (*professional competence*); understand the global trends and opportunities related to their professions (*global outlook*); and demonstrate entrepreneurial spirit and skills in their work, including the discovery and use of opportunities, and experimentation with novel ideas (*entrepreneurship*).

(b) Critical thinker: Graduates should be able to examine and critique the validity of information, arguments, and different viewpoints, and to reach sound judgments on the basis of credible evidence and logical reasoning.

(c) Effective communicator: Graduates should be able to comprehend and communicate effectively in English, and Chinese where appropriate, orally and in writing, in professional and day-to-day contexts.

(d) Innovative problem solver: Graduates should be able to identify and define problems in both professional and day-to-day contexts, and produce innovative solutions to solve problems.

(e) Lifelong learner: Graduates should be able to recognise the need for continual learning and self-improvement, and be able to plan, manage and evaluate their own learning in pursuit of self-determined goals.

(f) Ethical leader: Graduates should have an understanding of leadership and be prepared to serve as a leader and a team player (*leadership and teamwork*); demonstrate self-leadership and psychosocial competence in pursuing personal and professional development (*intrapersonal competence*); be capable of building and maintaining relationship and resolving conflicts in group work situations (*interpersonal competence*); and demonstrate ethical reasoning in professional and day-to-day contexts (*ethical reasoning*).

(g) Socially responsible global citizen: Graduates should have the capacity for understanding different cultures and social development needs in the local, national and global contexts (*interest in culture and social development*); and accept their responsibilities as professionals and citizens to society, their own nation and the world (s*ocial, national, and global responsibility*).

4.2 Desired Learning Outcomes of The Hong Kong Institution of Engineers (HKIE)

One of the main objectives of our undergraduate degree programmes is to obtain professional accreditation from The Hong Kong Institution of Engineers (HKIE). Thus, the desired learning outcomes achieved by graduates of accredited engineering programmes proposed by HKIE are used as reference for the Department to develop learning outcomes of our academic programmes. Desired learning outcomes proposed by HKIE are presented as below:

(a) an ability to apply knowledge of mathematics, science, and engineering appropriate to the degree discipline;

(b) an ability to design and conduct experiments, as well as to analyze and interpret data;

(c) an ability to design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;

(d) an ability to function on multi-disciplinary teams;

(e) an ability to identify, formulate and solve engineering problems;

(f) an ability to understand professional and ethical responsibility;

(g) an ability to communicate effectively;

(h) an ability to understand the impact of engineering solutions in a global and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public;

(i) an ability to stay abreast of contemporary issues;

(j) an ability to recognize the need for, and to engage in life-long learning;

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline; and

(l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations

4.3 Intended Learning Outcomes of BEngME

To fulfill PolyU's educational mission as well as BEngME's educational objective, the ME programme aims to equip students with the following 12 learning outcomes developed by referring to the desired learning outcomes proposed by HKIE. Each student is expected to achieve these learning outcomes, which are classified into two groups, before graduation:

(A) Professional/academic knowledge and skills (PAK)

(a) an ability to identify, formulate and solve engineering problems;

(b) an ability to apply their knowledge of mathematics, science and engineering;

(c) an ability to design and conduct experiments, as well as to analyze and interpret data;

(d) an ability to design a system, component or process to meet desired needs;

(e) an ability to use the techniques, skills and modern engineering tools, including computational tools necessary for engineering practice;

(f) an ability to work professionally in general mechanical systems, including the design and realization of such systems;

(g) a basic understanding of manufacturing methods.

(B) Professional outlook and workplace skills (POW)

(a) a knowledge of contemporary issues and the broad education necessary to understand the impact of engineering solutions in a global and societal context;
(b) an ability to function professionally in multidisciplinary teams;
(c) an understanding of professional and ethical responsibility;
(d) an ability to communicate effectively;
(e) a recognition of the need for and an ability to engage in life-long learning.

The BEngME programme outcomes that support its three objectives are indicated below:

Programme Intended Learning Outcomes of BEngME	BEngME Programme Objectives		
	1	2	3
PAK (a)	√	√	
PAK (b)	√	√	
PAK (c)	√	√	
PAK (d)	√	√	
PAK (e)	√	√	
PAK (f)	√	√	
PAK (g)	√	√	
POW (a)		√	√
POW (b)		√	
POW (c)		√	√
POW (d)		√	
POW (e)		√	

4.3.1 Relationship of BEngME Intended Learning Outcomes to Institutional Learning Outcomes

Programme Intended Learning Outcomes of BEngME	PolyU's Institutional Learning Outcomes						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
PAK (a)	√	√		√			
PAK (b)	√	√		√			
PAK (c)	√	√		√			
PAK (d)	√	√		√			
PAK (e)	√	√		√			
PAK (f)	√	√		√		√	
PAK (g)	√						
POW (a)	√	√		√		√	√
POW (b)	√					√	
POW (c)	√	√				√	√
POW (d)	√		√				
POW (e)	√				√		

4.3.2 Relationship of BEngME Intended Learning Outcomes to the Desired Learning Outcomes of the Hong Kong Institution of Engineers (HKIE)

Since the development of the BEngME intended learning outcomes is initially referred to the desired learning outcomes proposed by HKIE, thus the HKIE desired learning outcomes can be fully covered.

4.4 Intended Learning Outcomes of BEngPAED

To fulfill PolyU's educational mission as well as BEngPAED's programme objectives, the BEngPAED programme aims to equip students with the following 12 learning outcomes developed by referring to the desired learning outcomes proposed by HKIE. Each student is expected to achieve these learning outcomes, which are classified into two groups, before graduation:

(A) Professional/academic knowledge and skills (PAK)

(a) An ability to evaluate consumers' needs and market situation for a new product, and to identify and formulate a design problem by developing design specifications to achieve the planned goals.

(b) An ability to generate, evaluate and select design concepts with creative design thinking, awareness of business consideration and efficient information search.

(c) An ability to apply knowledge of arts, mathematics, sciences and engineering, via analytical, computational or experimental approaches, to analyze or predict the performance of a design in the life cycle of product development.

(d) An ability to assess the impacts of human factors, materials, manufacturing processes, environmental issues, product safety and quality in the design and development of quality products.

(e) An ability to apply state-of-the-art technology and computer/IT tools related to product development.

(f) An ability to appreciate the concept and trend in industrial design, and to identify market opportunity, and to understand the approach in generating new design concepts to meet the existing as well as potential market needs.

(g) An ability to apply project management technique to ensure successful completion of a product development process.

(B) Professional outlook and workplace skills (POW)

(a) A knowledge of contemporary issues and the broad education necessary to understand the impact of engineering design in a global and societal context.

(b) An ability to function professionally in a multidisciplinary design team as the leader or team member.

(c) An awareness of professional ethics and social responsibilities and the drive to achieve quality.

(d) An ability to communicate effectively and present fluently in English, Chinese and multi-media.

(e) Recognition of the need for and an ability to engage in life-long learning.

The BEngPAED programme outcomes that support its five objectives are indicated below:

Programme Intended Learning Outcomes of BEngPAED	BEngPAED Programme Objectives				
	1	2	3	4	5
PAK (a)	√	√			√
PAK (b)	√	√	√		√
PAK (c)	√	√			
PAK (d)	√	√	√		√
PAK (e)	√	√	√	√	
PAK (f)	√	√			√
PAK (g)		√	√		
POW (a)	√	√	√	√	
POW (b)		√	√		√
POW (c)				√	√
POW (d)		√	√		
POW (e)				√	

4.4.1 Relationship of BEngPAED Intended Learning Outcomes to Institutional Learning Outcomes

Programme Intended Learning Outcomes of BEngPAED	PolyU's Institutional Learning Outcomes						
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
PAK (a)	√	√					
PAK (b)	√	√		√			
PAK (c)		√		√	√		
PAK (d)		√			√	√	√
PAK (e)	√		√		√		
PAK (f)		√		√	√	√	
PAK (g)				√	√		
POW (a)	√	√		√			√
POW (b)			√		√	√	
POW (c)						√	√
POW (d)			√				
POW (e)					√		

4.4.2 Relationship of BEngPAED Intended Learning Outcomes to the Desired Learning Outcomes of the Hong Kong Institution of Engineers (HKIE)

Since the development of the BEngME intended learning outcomes is initially referred to the desired learning outcomes proposed by HKIE, thus the HKIE desired learning outcomes can be fully covered.

4.5 General Approach to Teaching, Learning and Assessment

To accomplish the intended learning outcomes of the programme, students are expected to achieve specific learning outcomes for each subject outlined in Part B. These learning outcomes are spelt out explicitly in the syllabus of each subject. They provide a motivation and a target for students who may use this information to formulate their study plan before the teaching. The students may also use the information to conduct a self-assessment after the teaching.

Generally speaking, a one-credit subject is allocated with a contact time of one hour per week. Hence, a typical PolyU subject offered by the Department normally requires 3 hours per week of class attendance. There are 13 weeks in each semester leading to a total of 39 hours of contact time for a three-credit subject. The structuring of those 39 contact hours varies from subject to subject, and the details are given in the syllabi.

The Department uses a wide variety of teaching methods, in a number of different settings including formal lectures, invited lectures by guest speakers, seminars, laboratory work, practical work, project work, case studies and student project presentations. In most of the classroom activities, the staff member will begin with a formal lecture that is designed to give students an overview of the topic on hand, which may also require their engagement through questioning or interactive hand-outs. Some of these hand-outs form a part of the assignments where the students are required to work after the class. The students are frequently required to contribute through presentations, through working on case studies and mini-projects, through experimental studies by laboratory classes. In many of these teaching/learning activities, students are asked to participate in small groups. These different teaching and learning approaches will be assessed with appropriate methods. In case of group activity, both the overall performance of the group as well as the individual effort/contribution of each team member will be assessed.

The prime purpose of assessment is to enable students to demonstrate that they have met the aims and objectives of the academic programme: in particular, they have fulfilled the requirement of each subject and have, at the end of their study, achieved the standard appropriate to the award.

Assessment also fulfils two major functions. It is used to evaluate whether the specific student-learning-outcomes of a subject have been achieved by the students, and distinguish their performance in achieving them.

Assessment will also serve as prompt and useful feedback to students. Students will be informed of their performance in the assessment so that they are aware of their progress and attainment to facilitate teaching and learning. Students' performance in a subject will be judged by continuous assessment, or final examination and continuous assessment as deemed appropriate. Where both methods are used, the weighting of each in the overall subject grade will be clearly stated in the relevant subject syllabi. Continuous assessment may include tests, assignments, project reports and oral presentations, laboratory work and other forms of classroom participation. As assessment should be a matter of judgment, the subject lecturer will have the discretion to assign a final grade which is considered to reflect more appropriately the overall performance of the student in a subject.

4.6 Alignment of Teaching, Learning and Assessment Methods with Programme Outcomes

There are compulsory and elective subjects offered in the programme. The details for each individual subject are contained in the respective syllabus listed in Part B. These explain how the objectives, teaching/learning activities, and eventually student learning outcomes, can be matched together so that they are constructively aligned in the context of these subjects. Typical teaching methods include lectures, tutorials, laboratory work, case studies which are supplemented by mini-projects, and presentations by individual students.

The major forms of assessment used in the programme are written examinations (open or closed book) and continuous assessment. In assessing students' academic performance and attainment of teaching and learning outcomes, much emphasis is placed on their ability to analyze, synthesize, integrate and apply what they have learnt in the course of their studies.

Details of the alignment of teaching, learning and assessment methods with programme outcomes are shown in Section 5.4 and the individual subject syllabus.

5 PROGRAMME STRUCTURE, CURRICULUM AND STUDY PATTERN

5.1 General Structure and Curriculum of BEngME and BEngPAED

The number of credits required for graduation is 124 academic credits and 10 Industrial Centre Practical Training credits. Futhermore, the students are required to fulfill the Work-Integrated Education (WIE).

The 124 academic credits consist of 30 mandatory credits of General University Requirements (GUR) and 94 credits of Discipline-Specific Requirements (DSR). Students who do not have Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics), or the equivalent qualifications, additional credits on "AP10001 Introduction to Physics" should be taken.

Details of GUR and DSR of BEngME and BEngPAED are shown in the following tables:

Table 5.1.1: General University Requirements (GUR) for both BEngME and BEngPAED

Table 5.1.2: Discipline-Specific Requirements (DSR) for BEngME

Table 5.1.3: Discipline-Specific Requirements (DSR) for BEngPAED

Table 5.1.1 - General University Requirements (GUR) for both BEngME and BEngPAED

Areas	Credits
Language & Communication Requirements (LCR)	9
▪ English	(6)
▪ Chinese	(3)
Cluster Areas Requirements (CAR)	12
▪ 3 credits from each of the following 4 cluster areas	
o Human Nature, Relations and Development	(3)
o Community, Organisation and Globalisation	(3)
o History, Cultures and World Views	(3)
o Science, Technology and Environment	(3)
and of which	
▪ A minimum of 3 credits on subjects designated as "China-related"	
Other Requirements	9
▪ Leadership and Intra-personal Development	(3)
▪ Service-Learning	(3)
▪ Freshman Seminar	(3)
▪ Healthy Lifestyle (non-credit bearing)	(Nil)
Total GUR credits	**30**

Table 5.1.2 - Discipline-Specific Requirements (DSR) for BEngME

Subject Code	Subject Title	Credits
AF3625	Engineering Economics	3
AMA1110	Basic Mathematics I – Calculus and Probability & Statistics	3
AMA1120	Basic Mathematics II– Calculus and Linear Algebra	3
AMA2111	Mathematics I	3
AMA2112	Mathematics II	3
AP10005 (i)	Physics I	3
AP10006	Physics II	3
CLC3241P (ii)	Professional Communication in Chinese	2
EE2901S	Basic Electricity and Electronics	3
ELC3531	Professional Communication in English for Engineering Students	2
ENG2001 (iii)	Fundamentals of Materials Science and Engineering/ Chemistry/Biology	3
ENG2002	Computer Programming	3
ENG2003	Information Technology	3
ENG3003	Engineering Management	3
ENG3004	Society and the Engineer	3
ME22003	Visualization and Communication in Design Engineering	3
ME23001	Engineering Mechanics	3
ME31001	Dynamics and Vibrations	3
ME31002	Linear Systems and Control	3
ME32001	Manufacturing Fundamentals	3
ME32002	Engineering Design Fundamentals	3
ME33001	Mechanics of Materials	3
ME34002	Engineering Thermodynamics	3
ME34004	Fluid Mechanics	3
ME46002	Numerical Methods for Engineers	3
ME49001	Final Year Capstone Project	6
Elective Subject I / II / III / IV / V (iv) (Students are required to complete five subjects from a pool of elective subjects as listed in Table 5.1.2(a))		15
IC2105	Engineering Communication and Fundamentals	4 (training credits)
IC348	Appreciation of Manufacturing Processes	3 (training credits)
IC382	Multidisciplinary Manufacturing Project	3 (training credits)
Total number of DSR credits		**94 + 10 training credits**

Notes:

(i) Students who do not have Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics), or the equivalent qualifications, additional credits on "AP10001 Introduction to Physics" should be taken before studying "AP10005 Physics I".

(ii) Non-Chinese speakers and those students whose Chinese standards are at junior secondary level or below will by default be exempted from the Discipline-Specific Requirement - Chinese and Cluster Area Requirement - Chinese Reading and Writing requirements. However, this group of students would still be required to take one Chinese LCR subject to fulfil their Chinese LCR.

(iii) Students must choose <u>one</u> subject from the list of subjects below:

Engineering Materials:	(a) ENG2001 Fundamentals of Materials Science and Engineering
Biology#:	(b) ABCT1101 Introductory Life Science
	(c) ABCT1303 Biotechnology and Human Health
	(d) BME11101 Bionic Human and the Future of Being Human
Chemistry#:	(e) ABCT1301 Chemistry and Modern Living
	(f) ABCT1314 Chemistry and Sustainable Development

#<u>Double fulfilment of DSR and CAR</u>

Students choosing any one subject in the "Biology" and "Chemistry" areas will have the subject double-counted towards the fulfilment of both the Discipline-Specific Requirement (DSR) and CAR-D (Science, Technology and Environment). They are required to choose any 3-credit subject (except for Level-0 subjects and training subjects (including clinical/field training)) to make up for the total credit requirement.

(iv) Elective Subjects^

Students are required to study five elective subjects. They may choose any five elective subjects from Table 5.1.2(a). These elective subjects are classified into the following four clusters in accordance to their cluster:

(a) Aerospace Engineering (AE)
(b) Robotics and Autonomous Systems (RAS)
(c) Environmental and Energy Engineering (EE)
(d) Mechanics and Materials (MM)

A list of elective subjects is shown in Table 5.1.2(a).

Table 5.1.2(a) - Elective Subjects for BEngME

Elective Subjects ^		Specialism Clusters			
		AE	RAS	EE	MM
ENG4001	Project Management	√	√	√	√
ME41001	Automatic Control Systems		√		
ME41003	Principles of Sound and Vibration			√	
ME41005	Noise Control Engineering			√	
ME41006	Perceptual Robotics		√		
ME42001	Artificial Intelligence in Products		√		
ME42004	Development of Green Products				√
ME42005	CAD/CAE Technologies for Product Development		√		√
ME42011	Fundamentals of Robotics		√		
ME43001	Advanced Materials for Design and Technology				√
ME43003	Product Testing Technology				√
ME44001	Air Conditioning for Indoor Thermal and Environmental Quality			√	
ME44002	Engine Technology		√	√	
ME44003	Combustion and Pollution Control			√	
ME44004	Heat and Mass Transfer	√		√	
ME44007	Fluids Engineering			√	
ME45001	Aerodynamics	√			
ME45002	Aircraft Systems	√	√		
ME45006	Aircraft Structure and Engineering Composites	√			√
ME47005	Aircraft Performance and Flight Management	√	√		
ME47007	Aircraft and Spacecraft Propulsion	√			

^ The elective subjects are updated from time to time to ensure the best development of the programme and to ensure the best career for our students. Since there is minimum planned class size for each subject, the Department has the discretion to cease the offering of subjects which fail to enroll students up to the minimum class size.

Table 5.1.3 - Discipline-Specific Requirements (DSR) for BEngPAED

Subject Code	Subject Title	Credits
AF3625	Engineering Economics	3
AMA1110	Basic Mathematics I – Calculus and Probability & Statistics	3
AMA1120	Basic Mathematics II– Calculus and Linear Algebra	3
AMA2111	Mathematics I	3
AP10005 (i)	Physics I	3
AP10006	Physics II	3
CLC3241P (ii)	Professional Communication in Chinese	2
EE2901S	Basic Electricity and Electronics	3
ELC3531	Professional Communication in English for Engineering Students	2
ENG2001(iii)	Fundamentals of Materials Science and Engineering/ Chemistry/Biology	3
ENG2002	Computer Programming	3
ENG2003	Information Technology	3
ENG3004	Society and the Engineer	3
ENG4001	Project Management	3
ME22003	Visualization and Communication in Design Engineering	3
ME23001	Engineering Mechanics	3
ME31003	System Dynamics	3
ME32001	Manufacturing Fundamentals	3
ME32002	Engineering Design Fundamentals	3
ME32101(iv)	Engineering Design for the Community	3
ME33001	Mechanics of Materials	3
ME34003	Thermofluid Mechanics	3
ME41004	Mechatronics and Control	3
ME42005	CAD/CAE Technologies for Product Development	3
ME42007	Design for Product Safety and Reliability	3
ME42011	Fundamentals of Robotics	3
ME46003	Numerical Fluid Mechanics and Heat Transfer	3
ME49003	Capstone Project	6
SD348	Introduction to Industrial Design	3
SD3401	Designing for Humanities	3
PAED Elective Subject (as listed in Table 5.1.3(a))		3
IC2105	Engineering Communication and Fundamentals	4 (training credits)
IC348	Appreciation of Manufacturing Processes	3 (training credits)
IC382	Multidisciplinary Manufacturing Project	3 (training credits)
Total number of DSR credits		**94 + 10 training credits**

Notes:

(i) Students who do not have Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics), or the equivalent qualifications, additional credits on "AP10001 Introduction to Physics" should be taken before studying "AP10005 Physics I".

(ii) Non-Chinese speakers and those students whose Chinese standards are at junior secondary level or below will by default be exempted from the Discipline-Specific Requirement - Chinese and Cluster Area Requirement - Chinese Reading and Writing requirements. However, this group of students would still be required to take one Chinese LCR subject to fulfil their Chinese LCR.

(iii) Students must choose <u>one</u> subject from the list of subjects below:

Engineering Materials:	(a)	ENG2001 Fundamentals of Materials Science and Engineering
Biology#:	(b)	ABCT1101 Introductory Life Science
	(c)	ABCT1303 Biotechnology and Human Health
	(d)	BME11101 Bionic Human and the Future of Being Human
Chemistry#:	(e)	ABCT1301 Chemistry and Modern Living
	(f)	ABCT1314 Chemistry and Sustainable Development

#<u>Double fulfilment of DSR and CAR</u>

Students choosing any one subject in the "Biology" and "Chemistry" areas will have the subject double-counted towards the fulfilment of both the Discipline-Specific Requirement (DSR) and CAR-D (Science, Technology and Environment). They are required to choose any 3-credit subject (except for Level-0 subjects and training subjects (including clinical/field training)) to make up for the total credit requirement.

(iv) Upon passing it, students will fulfill the requirements of both DSR and SL. However, credits will not be counted twice, you need to take a free elective subject to make up the total credit requirement of the award.

Table 5.1.3(a) - Elective Subjects for BEngPAED

Elective Subject ^	
ISE376	Entrepreneurship and Innovation
ISE430	New Product Planning and Development
ISE457	Business Process Management
ME42001	Artificial Intelligence in Products
ME42004	Development of Green Products
ME43003	Product Testing Technology

^ The elective subjects are updated from time to time to ensure the best development of the programme and to ensure the best career for our students. Since there is minimum planned class size for each subject, the Department has the discretion to cease the offering of subjects which fail to enroll students up to the minimum class size.

5.2 Normal Study Pattern of BEngME and BEngPAED

This section outlines the normal 4-year study patterns for BEngME and BEngPAED. They are only indicative and by no means mandatory; students may take slightly different plans provided that the credit requirements of the intended award are fulfilled within the maximum period of registration. Each subject carries 3 credits, unless specified otherwise.

Table 5.2.1: BEngME Normal Progression Pattern for students with Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent.

Table 5.2.2: BEngME Normal Progression Pattern for students without Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent.

Table 5.2.3: BEngPAED Normal Progression Pattern for students with Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent.

Table 5.2.4: BEngPAED Normal Progression Pattern for students without Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent.

Table 5.2.1 - BEngME Normal Progression Pattern for students with Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent

(Total credits required for graduation: 124 academic credits + 10 IC training credits)

Year 1 (Common with PAED) (33 academic credits + 4 training credits)			
Semester 1 (15 + 2 training credits)		**Semester 2** (18 + 2 training credits)	
AMA1110	Basic Mathematics I	AMA1120	Basic Mathematics II
AP10005	Physics I	AP10006	Physics II
CAR I ^^		APSS1L01	Tomorrow's Leaders
ENG1003	Freshman Seminars for Engineering	CAR II ^^	
LCR I	English Language Subject	ENG2003	Information Technology
		LCR II	English Language Subject
Healthy Lifestyle (non-credit bearing) ^^			
IC2105 Engineering Communication and Fundamentals (4 training credits)			
Year 2 (Common with PAED) (33 academic credits + 3 training credits)			
Semester 1 (15 + 3 training credits)		**Semester 2** (18 credits)	
AMA2111	Mathematics I	CAR III ^^	
ENG2001	Fundamentals of Materials Science and Engineering/Chemistry/Biology	CAR IV ^^	
ENG2002	Computer Programming	EE2901S	Basic Electricity and Electronics
ME22003	Visualization and Communication in Design Engineering	LCR III	Chinese Language Subject
ME23001	Engineering Mechanics	ME32002	Engineering Design Fundamentals
IC348	Appreciation of Manufacturing Processes (3 training credits)	ME33001	Mechanics of Materials
Year 3 (30 academic credits + 3 training credits)			
Semester 1 (15 + 1.5 training credits)		**Semester 2** (15 + 1.5 training credits)	
AF3625	Engineering Economics	ME31002	Linear Systems and Control
AMA2112	Mathematics II	ME32001	Manufacturing Fundamentals
ENG3003	Engineering Management	ME34004	Fluid Mechanics
ME31001	Dynamics and Vibrations	ME46002	Numerical Methods for Engineers
ME34002	Engineering Thermodynamics	Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^	
IC382 Multidisciplinary Manufacturing Project (3 training credits)			
Year 4 (28 academic credits)			
Semester 1 (13 credits)		**Semester 2** (15 credits)	
CLC3241P	Professional Communication in Chinese (2 credits)	ENG3004	Society and the Engineer
ELC3531	Professional Communication in English for Engineering Students (2 credits)	Elective Subject III	
Elective Subject I		Elective Subject IV	
Elective Subject II		Elective Subject V	
ME49001 Final Year Capstone Project (6 academic credits)			

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

Table 5.2.2 - BEngME Normal Progression Pattern for students <u>without</u> Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent

(Total credits required for graduation: 127 academic credits + 10 IC training credits)

Year 1 (Common with PAED) (33 academic credits + 4 training credits)	
Semester 1 (15 + 2 training credits)	**Semester 2** (18 + 2 training credits)
AMA1110 Basic Mathematics I	AMA1120 Basic Mathematics II
AP10001 Introduction to Physics	AP10005 Physics I
CAR I ^^	APSS1L01 Tomorrow's Leaders
ENG1003 Freshman Seminars for Engineering	CAR II ^^
LCR I English Language Subject	ENG2003 Information Technology
	LCR II English Language Subject
Healthy Lifestyle (non-credit bearing) ^^	
IC2105 Engineering Communication and Fundamentals (4 training credits)	
Year 2 (Common with PAED) (36 academic credits + 3 training credits)	
Semester 1 (18 + 3 training credits)	**Semester 2 (**18 credits)
AMA2111 Mathematics I	CAR III ^^
AP10006 Physics II	CAR IV ^^
ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology	EE2901S Basic Electricity and Electronics
ENG2002 Computer Programming	LCR III Chinese Language Subject
ME22003 Visualization and communication in Design Engineering	ME32002 Engineering Design Fundamentals
ME23001 Engineering Mechanics	ME33001 Mechanics of Materials
IC348 Appreciation of Manufacturing Processes (3 training credits)	
Year 3 (30 academic credits + 3 training credits)	
Semester 1 (15 + 1.5 training credits)	**Semester 2** (15 + 1.5 training credits)
AF3625 Engineering Economics	ME31002 Linear Systems and Control
AMA2112 Mathematics II	ME32001 Manufacturing Fundamentals
ENG3003 Engineering Management	ME34004 Fluid Mechanics
ME31001 Dynamics and Vibrations	ME46002 Numerical Methods for Engineers
ME34002 Engineering Thermodynamics	Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^
IC382 Multidisciplinary Manufacturing Project (3 training credits)	
Year 4 (28 academic credits)	
Semester 1 (13 credits)	**Semester 2** (15 credits)
CLC3241P Professional Communication in Chinese (2 credits)	ENG3004 Society and the Engineer
ELC3531 Professional Communication in English for Engineering Students (2 credits)	Elective Subject III
Elective Subject I	Elective Subject IV
Elective Subject II	Elective Subject V
ME49001 Final Year Capstone Project (6 academic credits)	

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

Table 5.2.3 - BEngPAED Normal Progression Pattern for students with Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent

(Total credits required for graduation: 124 academic credits + 10 IC training credits)

Year 1 (Common with ME) (33 academic credits + 4 training credits)			
Semester 1 (15 + 2 training credits)		**Semester 2** (18 + 2 training credits)	
AMA1110	Basic Mathematics I	AMA1120	Basic Mathematics II
AP10005	Physics I	AP10006	Physics II
CAR I ^^		APSS1L01	Tomorrow's Leaders
ENG1003	Freshman Seminars for Engineering	CAR II ^^	
LCR I	English Language Subject	ENG2003	Information Technology
		LCR II	English Language Subject
Healthy Lifestyle (non-credit bearing) ^^			
IC2105 Engineering Communication and Fundamentals (4 training credits)			
Year 2 (Common with ME) (33 academic credits + 3 training credits)			
Semester 1 (15 + 3 training credits)		**Semester 2** (18 credits)	
AMA2111	Mathematics I	CAR III ^^	
ENG2001	Fundamentals of Materials Science and Engineering/Chemistry/Biology	CAR IV ^^	
ENG2002	Computer Programming	EE2901S	Basic Electricity and Electronics
ME22003	Visualization and Communication in Design Engineering	LCR III	Chinese Language Subject
ME23001	Engineering Mechanics	ME32002	Engineering Design Fundamentals
IC348	Appreciation of Manufacturing Processes (3 training credits)	ME33001	Mechanics of Materials
Year 3 (30 academic credits + 3 training credits)			
Semester 1 (15 + 1.5 training credits)		**Semester 2** (15 + 1.5 training credits)	
AF3625	Engineering Economics	ME34003	Thermofluid Mechanics
ME31003	System Dynamics	ME41004	Mechatronics and Control
ME32001	Manufacturing Fundamentals	ME42005	CAD/CAE Technologies for Product Development
ME32101	Engineering Design for Community*	SD3401	Designing for Humanities
SD348	Introduction to Industrial Design	Free Elective Subject@	
IC382 Multidisciplinary Manufacturing Project (3 training credits)			
Year 4 (28 academic credits)			
Semester 1 (13 credits)		**Semester 2** (15 credits)	
CLC3241P	Professional Communication in Chinese (2 credits)	ME42007	Design for Product Safety and Reliability
ELC3531	Professional Communication in English for Engineering Students (2 credits)	ME42011	Fundamentals of Robotics
ENG3004	Society and the Engineer	ME46003	Numerical Fluid Mechanics and Heat Transfer
ENG4001	Project Management	PAED Elective Subject	
ME49003 Capstone Project (6 academic credits)			

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

* *Double fulfillment subject. Upon passing it, students will fulfill the requirements of both DSR and SL.*

@ *"Free electives" under the 4-year undergraduate degree programmes refers to any subjects (including CAR subjects) offered by the University, unless otherwise specified. Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfill free elective requirement for graduation purpose. Students are encouraged to select subject under PAED elective subject pool.*

Table 5.2.4 - BEngPAED Normal Progression Pattern for students <u>without</u> Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent

(Total credits required for graduation: 127 academic credits + 10 IC training credits)

Year 1 (Common with ME) (33 academic credits + 4 training credits)			
Semester 1 (15 + 2 training credits)		**Semester 2** (18 + 2 training credits)	
AMA1110	Basic Mathematics I	AMA1120	Basic Mathematics II
AP10001	Introduction to Physics	AP10005	Physics I
CAR I ^^		APSS1L01	Tomorrow's Leaders
ENG1003	Freshman Seminars for Engineering	CAR II ^^	
LCR I	English Language Subject	ENG2003	Information Technology
		LCR II	English Language Subject
Healthy Lifestyle (non-credit bearing) ^^			
IC2105 Engineering Communication and Fundamentals (4 training credits)			
Year 2 (Common with ME) (36 academic credits + 3 training credits)			
Semester 1 (18 + 3 training credits)		**Semester 2** (18 credits)	
AMA2111	Mathematics I	CAR III ^^	
AP10006	Physics II	CAR IV ^^	
ENG2001	Fundamentals of Materials Science and Engineering/Chemistry/Biology	EE2901S	Basic Electricity and Electronics
ENG2002	Computer Programming	LCR III	Chinese Language Subject
ME22003	Visualization and communication in Design Engineering	ME32002	Engineering Design Fundamentals
ME23001	Engineering Mechanics	ME33001	Mechanics of Materials
IC348	Appreciation of Manufacturing Processes (3 training credits)		
Year 3 (30 academic credits + 3 training credits)			
Semester 1 (15 + 1.5 training credits)		**Semester 2** (15 + 1.5 training credits)	
AF3625	Engineering Economics	ME34003	Thermofluid Mechanics
ME31003	System Dynamics	ME41004	Mechatronics and Control
ME32001	Manufacturing Fundamentals	ME42005	CAD/CAE Technologies for Product Development
ME32101	Engineering Design for Community*	SD3401	Designing for Humanities
SD348	Introduction to Industrial Design	Free Elective Subject@	
IC382 Multidisciplinary Manufacturing Project (3 training credits)			
Year 4 (28 academic credits)			
Semester 1 (13 credits)		**Semester 2** (15 credits)	
CLC3241P	Professional Communication in Chinese (2 credits)	ME42007	Design for Product Safety and Reliability
ELC3531	Professional Communication in English for Engineering Students (2 credits)	ME42011	Fundamentals of Robotics
ENG3004	Society and the Engineer	ME46003	Numerical Fluid Mechanics and Heat Transfer
ENG4001	Project Management	PAED Elective Subject	
ME49003 Capstone Project (6 academic credits)			

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

* *Double fulfillment subject. Upon passing it, students will fulfill the requirements of both DSR and SL.*

@ *"Free electives" under the 4-year undergraduate degree programmes refers to any subjects (including CAR subjects) offered by the University, unless otherwise specified. Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfill free elective requirement for graduation purpose. Students are encouraged to select subject under PAED elective subject pool.*

5.3 Work-Integrated Education (WIE)

In accordance with the University's policies, all full-time UGC-funded undergraduates should fulfill the mandatory requirement of Work-integrated Education (WIE). WIE is a work-based, structured and measurable learning experience in an industrial context which is relevant to the students' areas of studies. A student is required to spend at least 2 weeks on WIE before graduation. WIE is aimed at providing value-added education leading to the development of all-round students with professional competence.

Mandatory WIE activities are credit-bearing, but they are not included in the 124 academic credits required for graduation. The WIE components will not be counted towards GPA calculation except as stipulated below. For the completion of every two weeks of WIE activities, one credit will be earned. The WIE activities can be fulfilled by at least one of the following:

(a) Integration into the Final Year Capstone Project (ME49001)/Capstone Project (ME49003), which is industrially/commercially based. However, it is most important that the Final Year Capstone Project and WIE activities should be assessed separately. It is equally important that the WIE activities of students working in the same project team should be assessed individually as they can vary from student to student. In addition, the duration of the WIE activities is not necessarily the same as that of the Final Year Capstone Project. In these cases, the credit value of the project incorporating the WIE component will be counted in full towards the GPA calculation.

(b) Perform during a summer placement in industrial/commercial sector.

(c) Conduct in firm proposed by students with the prior approval of the WIE coordinator.

Detailed guidelines for students on WIE are available on the ME website (www.polyu.edu.hk/me).

5.3.1 Cooperative Education Option of BEngPAED

The ME Department provides a cooperative education (co-op) option to BEngPAED students so as to help them learn and master the major BEngPAED knowledge more effectively through real-world experiential learning in professional setting. Co-op is a structured method of combining lecture-based education with practical work experience. It essentially falls under the umbrella of WIE but it is distinct in its own right for the involvement of a partnership between industry and ME Department. The co-op option is facilitated through combining summer intern right before the commencement of Year 4 BEngPAED study with ME49003 Capstone Project. Having paired up with an industrial partner, a co-op student is expected to be engaged in an remunerated full-time position and perform the same tasks as a training/entry-level professional in co-op industrial partner's establishment to gain practical experience. In addition he/she is required to conduct a solo project during co-op period for the fulfillment of ME49003 under joint supervision of an academic staff from ME Department and a supervisor assigned by the co-op industrial partner. He/She will be assessed with respect to the same ME49003 intended learning outcomes for the six academic credits of the subject.

The co-op option promotes early professional development of BEngPAED students. It allows students to take on increasing levels of design engineering responsibility and to use their job knowledge and learning in campus to make contributions to the establishments in which they work. Through such experience, the students can keep abreast of the latest trends of industrial innovations required by the customers worldwide. As such the normal 4-year study patterns for BEngPAED with co-op option are structured and outlined in Tables 5.3.1 and 5.3.2 below.

Table 5.3.1 BEngPAED Normal Progression Pattern on Cooperative Education (Co-op) option for students with Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent
(Total credits required for graduation: 124 academic credits + 10 IC training credits)

Year 1 (Common with ME) (33 academic credits + 4 training credits)	
Semester 1 (15 + 2 training credits)	**Semester 2** (18 + 2 training credits)
AMA1110 Basic Mathematics I	AMA1120 Basic Mathematics II
AP10005 Physics I	AP10006 Physics II
CAR I ^^	APSS1L01 Tomorrow's Leaders
ENG1003 Freshman Seminars for Engineering	CAR II ^^
LCR I English Language Subject	ENG2003 Information Technology
	LCR II English Language Subject
Healthy Lifestyle (non-credit bearing) ^^	
IC2105 Engineering Communication and Fundamentals (4 training credits)	
Year 2 (Common with ME) (33 academic credits + 3 training credits)	
Semester 1 (15 + 3 training credits)	**Semester 2** (18 credits)
AMA2111 Mathematics I	CAR III ^^
ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology	CAR IV ^^
ENG2002 Computer Programming	EE2901S Basic Electricity and Electronics
ME22003 Visualization and Communication in Design Engineering	LCR III Chinese Language Subject
ME23001 Engineering Mechanics	ME32002 Engineering Design Fundamentals
IC348 Appreciation of Manufacturing Processes (3 training credits)	ME33001 Mechanics of Materials
Year 3 (38 academic credits + 3 training credits)	
Semester 1 (18 + 1.5 training credits)	**Semester 2** (17 + 1.5 training credits)
AF3625 Engineering Economics	CLC3241P Professional Communication in Chinese (2 credits)
ENG3004 Society and the Engineer	ME34003 Thermofluid Mechanics
ME31003 System Dynamics	ME41004 Mechatronics and Control
ME32001 Manufacturing Fundamentals	ME42005 CAD/CAE Technologies for Product Development
ME32101 Engineering Design for Community*	SD3401 Designing for Humanities
SD348 Introduction to Industrial Design	Free Elective Subject@
IC382 Multidisciplinary Manufacturing Project (3 training credits)	
Summer Term (3 credits)	
ME49003 Capstone Project (connected to FT summer intern in Year 3 at an industrial firm)	
Year 4 (20 academic credits)	
Semester 1 (3 credits)	**Semester 2** (17 credits)
ME49003 Capstone Project (Connected to FT summer intern in Year 3 at an industrial firm)	ELC3531 Professional Communication in English for Engineering Students (2 credits)
	ENG4001 Project Management
	ME42007 Design for Product Safety and Reliability
	ME42011 Fundamentals of Robotics
	ME46003 Numerical Fluid Mechanics and Heat Transfer
	PAED Elective Subject

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

* *Double fulfillment subject. Upon passing it, students will fulfill the requirements of both DSR and SL.*

@ *"Free electives" under the 4-year undergraduae degree programmes refers to any subjects (including CAR subjects) offered by the University, unless otherwise specified. Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfill free elective requirement for graduation purpose. Students are encouraged to select subject under PAED elective subject pool.*

Table 5.3.2 BEngPAED Normal Progression Pattern on Cooperative Education (Co-op) option for students <u>without</u> Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics) or equivalent
(Total credits required for graduation: 127 academic credits + 10 IC training credits)

Year 1 (Common with ME) (33 academic credits + 4 training credits)	
Semester 1 (15 + 2 training credits)	**Semester 2** (18 + 2 training credits)
AMA1110 Basic Mathematics I	AMA1120 Basic Mathematics II
AP10001 Introduction to Physics	AP10005 Physics I
CAR I ^^	APSS1L01 Tomorrow's Leaders
ENG1003 Freshman Seminars for Engineering	CAR II ^^
LCR I English Language Subject	ENG2003 Information Technology
	LCR II English Language Subject
Healthy Lifestyle (non-credit bearing) ^^	
IC2105 Engineering Communication and Fundamentals (4 training credits)	
Year 2 (Common with ME) (36 academic credits + 3 training credits)	
Semester 1 (18 + 3 training credits)	**Semester 2** (18 credits)
AMA2111 Mathematics I	CAR III ^^
AP10006 Physics II	CAR IV ^^
ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology	EE2901S Basic Electricity and Electronics
ENG2002 Computer Programming	LCR III Chinese Language Subject
ME22003 Visualization and communication in Design Engineering	ME32002 Engineering Design Fundamentals
ME23001 Engineering Mechanics	ME33001 Mechanics of Materials
IC348 Appreciation of Manufacturing Processes (3 training credits)	
Year 3 (38 academic credits + 3 training credits)	
Semester 1 (18 + 1.5 training credits)	**Semester 2** (17 + 1.5 training credits)
AF3625 Engineering Economics	CLC3241P Professional Communication in Chinese (2 credits)
ENG3004 Society and the Engineer	ME34003 Thermofluid Mechanics
ME31003 System Dynamics	ME41004 Mechatronics and Control
ME32001 Manufacturing Fundamentals	ME42005 CAD/CAE Technologies for Product Development
ME32101 Engineering Design for Community*	SD3401 Designing for Humanities
SD348 Introduction to Industrial Design	Free Elective Subject@
IC382 Multidisciplinary Manufacturing Project (3 training credits)	
Summer Term (3 credits)	
ME49003 Capstone Project (Connected to FT summer intern in Year 3 at an industrial firm)	
Year 4 (20 academic credits)	
Semester 1 (3 credits)	**Semester 2** (17 credits)
ME49003 Capstone Project (Connected to FT summer intern in Year 3 at an industrial firm)	ELC3531 Professional Communication in English for Engineering Students (2 credits)
	ENG4001 Project Management
	ME42007 Design for Product Safety and Reliability
	ME42011 Fundamentals of Robotics
	ME46003 Numerical Fluid Mechanics and Heat Transfer
	PAED Elective Subject

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

* *Double fulfillment subject. Upon passing it, students will fulfill the requirements of both DSR and SL.*

@ *"Free electives" under the 4-year undergraduate degree programmes refers to any subjects (including CAR subjects) offered by the University, unless otherwise specified. Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfill free elective requirement for graduation purpose. Students are encouraged to select subject under PAED elective subject pool.*

5.4 Curriculum Mapping with Programme Learning Outcomes

An analysis of the curriculum in terms of the coverage of the programme learning outcomes of BEngME and BEngPAED, respectively (as shown in Sections 3.2 and 3.3, respectively), is presented in Tables 5.4.1 (a, b and c) and 5.4.2 (a, b and c). The tables indicate the subjects of Discipline-Specific requirements (DSR), elective and training natures that we **Teach (T)** students, give students **Practice (P)** and **Measure (M)** achievement of the Intended Learning Outcomes (ILOs). In summary, the curriculum address two programme learning outcomes which students are expected to achieve (A) professional/academic knowledge and skills (PAK), and (B) professional outlook and workplace skills (POW). There are seven items for PAK and five items for POW. The technical elective subjects are updated continually to meet the need of the ever-evolving industrial communities in Hong Kong and the South China region. Essentially, they cover most of the programme learning outcomes with variations of themes from subject to subject. The subject learning outcomes to be achieved by every subject of the programme are listed in the syllabi as shown in Part B of this document.

Table 5.4.1(a) - Curriculum Map for DSR Subjects with ILOs of BEngME

Subject Code	Intended Learning Outcomes (ILOs) of BEngME											
	PAK							POW				
	a	b	c	d	e	f	g	a	b	c	d	e
AF3625								TP	TP		TP	
AMA1110	TP	TP										
AMA1120	TP	TP										
AMA2111	TP	TP										
AMA2112	TP	TP										
AP10005		TP										
AP10006		TP										
CLC3241P											TPM	
EE2901S	TP	TP	TP									
ELC3531											TPM	
ENG2001	TP	TP	TP									
ENG2002	TP				TP			TP				T
ENG2003	TP			TP	TP			TP				
ENG3003							TPM	TPM	TPM	TPM		
ENG3004								TPM	TPM	TPM	TP	TPM
ME22003		TP		TP	TP						TP	
ME23001	TP	TP	TP				TP				TP	
ME31001	TPM	TP	TPM	TP		TP						
ME31002	TP	TP	TPM	TPM	TPM	TPM						
ME32001				TP	TP	TP	TPM		TP	TPM	TPM	
ME32002				TPM	TPM		TPM			TP	TP	
ME33001	TPM	TPM	TPM		TP	TP						
ME34002	TP	TPM	TPM			TPM					TP	
ME34004	TPM	TPM	TP		TPM	TPM						
ME46002	TP	TPM			TPM			TPM			TP	TPM
ME49001	TPM	TPM	TP	TPM	TP	TP	TP	TPM	TPM	TP	TPM	TPM

Table 5.4.1(b) - Curriculum Map for Elective Subjects with ILOs of BEngME

Subject Code	Intended Learning Outcomes (ILOs) of BEngME											
	PAK							POW				
	a	b	c	d	e	f	g	a	b	c	d	e
ENG4001		TP			TP				TP	TP	TP	
ME41001	TP	TP			TP						P	
ME41003	TP	TP		TP							P	
ME41005	TP	TP		TP	TP						P	
ME41006	TP	TP	TP	TP	TP			TP				
ME42001		TP		TP	TP	TP					P	TP
ME42004		TP		TP				TP	TP		P	TP
ME42005		TP		TP	TP	TP						
ME42011	TP	TP	TP		TP			TP				T
ME43001	TP	TP			TP		TP	TP				
ME43003			TP		TP	TP	TP			TP		
ME44001		TP		TP		TP			TP	TP		
ME44002	TP	TP	TP			TP		TP				
ME44003	TP	TP						TP		TP		T
ME44004	TP	TP	TP					TP				TP
ME44007	TP	TP	TP		TP							
ME45001	TP	TP			TP			TP				
ME45002		TP	TP		TP					TP		T
ME45006	TP	TP			TP		TP		TP			T
ME47005	TP	TP		TP				TP				
ME47007	TP	TP	TP	TP								

Table 5.4.1(c) - Curriculum Map for Training subjects with ILOs of BEngME

Subject Code	Intended Learning Outcomes (ILOs) of BEngME											
	PAK							POW				
	a	b	c	d	e	f	g	a	b	c	d	e
IC2105		TP			TP	TP	TP					
IC348				TP	TP	TP	TPM					
IC382				TPM	P	TPM	P		TPM	TPM	P	
WIE								P	P	P	P	P

Table 5.4.2(a) - Curriculum Map for DSR Subjects with ILOs for BEngPAED

Subject Code	Intended Learning Outcomes (ILOs) of BEngPAED											
	PAK							POW				
	a	b	c	d	e	f	g	a	b	c	d	e
AF3625								TP	TP		TP	
AMA1110	TP	TP										
AMA1120	TP	TP										
AMA2111	TP	TP										
AP10005		TP										
AP10006		TP										
CLC3241P											TPM	
EE2901S			TP		TP							TP
ELC3531											TPM	
ENG2001	TP	TP	TP									
ENG2002	TP				TP			TP				T
ENG2003	TP			TP	TP			TP				
ENG3004								TPM	TPM	TPM	TP	TPM
ENG4001				TP	TP		TPM		TPM	TPM	TPM	
ME22003		TP		TP	TP						TP	
ME23001	TP	TP	TP				TP				TP	
ME31003	TPM		TPM	TP	TP							
ME32001				TPM	TP	TP	TPM		TP	TP		
ME32002				TPM	TP	TPM	TPM			TP	TP	
ME32101		TP		TP	TP	TP	TP				TP	
ME33001	TP		TPM	TPM								
ME34003			TP	TP					TPM	TPM		TP
ME41004			TPM		TPM			TPM			TP	TP
ME42005		TPM	TP		TPM	TP	TP					TPM
ME42007	TPM			TPM		TP	TP	TPM		TPM		
ME42011			TPM		TPM			TPM				TPM
ME46003		TPM	TPM		TPM			TP				
ME49003	TPM	TPM	TP	TP	TP	TPM	TP	TP	TPM	TP	TPM	TPM
SD348	TPM	TPM	TP			TPM						TP
SD3401	TP			TP		TPM				TP		

Table 5.4.2(b) - Curriculum Map for Elective Subjects with ILOs for BEngPAED

Subject Code	Intended Learning Outcomes (ILOs) of BEngPAED											
	PAK							POW				
	a	b	c	d	e	f	g	a	b	c	d	e
ISE376	TP	TP		TP		TP			TP			TP
ISE430	TP	TP		TP		TP			TP			TP
ISE457	TP	TP		TP		TP			TP			TP
ME42001	TP		TP		TP			TP		TP		TP
ME42004	TP		TP		TP			TP		TP		TP
ME43003	TP		TP		TP			TP		TP		TP

Table 5.4.2(c) - Curriculum Map for Training Subjects with ILOs for BEngPAED

Subject Code	Intended Learning Outcomes (ILOs) of BEngPAED											
	PAK							POW				
	a	b	c	d	e	f	g	a	b	c	d	e
IC2105		TP			TP	TP	TP					
IC348				TPM	TP	TP	TP					
IC382				TP	TP	TPM	TPM		TPM	TP		
WIE								P	P	P	P	P

5.5 Curriculum Design for Senior Year Intakes of BEngME and BEngPAED

5.5.1 Credit Requirements for Graduation

Normally 64 (plus 6 IC training credits)*

* Since students may be required to meet specific requirements at admission, the credits required for graduation will vary according to the academic background of students.

5.5.2 Work-Integrated Education (WIE)

In accordance with the University's policies, all full-time UGC-funded undergraduates should fulfill the mandatory requirement of Work-integrated Education (WIE). WIE is a work-based, structured and measurable learning experience in an industrial context which is relevant to the students' areas of studies. A student is required to spend at least 2 weeks on WIE before graduation.

For details, please refer to Section 5.3.

5.5.3 General University Requirements (GUR) for BEngME and BEngPAED Senior Year Intakes

Areas	Credits
Cluster Areas Requirements (CAR) ■ 6 credits from any **two** of the following 4 cluster areas ○ Human Nature, Relations and Development ○ Community, Organization and Globalization ○ History, Cultures and World Views ○ Science, Technology and Environment and of which ■ Students need to fulfill the English and Chinese reading and writing requirements and 3 credits of China Studies requirement (CSR). ■ Students may apply for a waiver if they have fulfilled the English and Chinese reading and writing requirements and/or CSR requirement in their previous studies.	6
Service-Learning	3
Language and Communication Requirements (LCR) **	-
Total GUR credits	**9**
** This is normally not required. Only those students not meeting the equivalent standard of the Undergraduate Degree LCR (based on their previous studies in AD/HD programmes and their academic performance) will be required to take degree LCR subjects on top of the normal curriculum requirement.	

5.5.4 Discipline-Specific Requirements (DSR) for BEngME Senior Year Intakes

Subject Code	Subject Title	Credits
AMA2112	Mathematics II	3
CLC3241P	Professional Communication in Chinese	2
ELC3531	Professional Communication in English for Engineering Students	2
ENG3003	Engineering Management	3
ENG3004	Society and the Engineer	3
ME31001	Dynamics and Vibrations	3
ME31002	Linear Systems and Control	3
ME32001	Manufacturing Fundamentals	3
ME33001	Mechanics of Materials	3
ME34002	Engineering Thermodynamics	3
ME34004	Fluid Mechanics	3
ME46002	Numerical Methods for Engineers	3
ME49001	Final Year Capstone Project	6
Elective Subject I / II / III / IV / V (Students are required to complete five subjects from a pool of elective subjects as listed in Table 5.1.2(a))		15

Subject Code	Subject Title	Credits
IC348	Appreciation of Manufacturing Processes	3 (training credits)
IC382	Multidisciplinary Manufacturing Project	3 (training credits)
Total number of DSR credits		**55 + 6 training credits**

5.5.5 Discipline-Specific Requirements (DSR) for BEngPAED Senior Year Intakes

Subject Code	Subject Title	Credits
CLC3241P	Professional Communication in Chinese	2
ELC3531	Professional Communication in English for Engineering Students	2
ENG3004	Society and the Engineer	3
ENG4001	Project Management	3
ME31003	System Dynamics	3
ME32001	Manufacturing Fundamentals	3
ME32101	Engineering Design for Community	3
ME33001	Mechanics of Materials	3
ME34003	Thermofluid Mechanics	3
ME41004	Mechatronics and Control	3
ME42005	CAD/CAE Technologies for Product Development	3
ME42007	Design for Product Safety and Reliability	3
ME42011	Fundamentals of Robotics	3
ME46003	Numerical Fluid Mechanics and Heat Transfer	3
ME49003	Capstone Project	6
SD348	Introduction to Industrial Design	3
SD3401	Designing for Humanities	3
PAED Elective Subject (as listed in Table 5.1.3(a))		3
IC348	Appreciation of Manufacturing Processes	3 (training credits)
IC382	Multidisciplinary Manufacturing Project	3 (training credits)
Total number of DSR credits		**55 + 6 training credits**

Notes:

(i) Upon passing it, students will fulfill the requirements of both DSR and SL. However, credits will not be counted twice, you need to take a free elective subject to make up the total credit requirement of the award.

5.6 Normal Study Pattern of Senior-Year Intakes

Table 5.6.1, 5.6.2(a) and 5.6.2(b) outline the normal 2-year study patterns for BEngME and BEngPAED Senior Year Intakes respectively.

Table 5.6.1 - Normal Progression Pattern for BEngME Senior Year

(Total credits required for graduation: 64 academic credits + 6 IC training credits)

Year 1 (33 academic credits + 6 training credits)	
Semester 1 (18 + 3 training credits)	**Semester 2** (15 + 1.5 training credits)
AMA2112 Mathematics II	CAR II ^^
CAR I ^^	ME31002 Linear Systems and Control
ME31001 Dynamics and Vibrations	ME32001 Manufacturing Fundamentals
ME33001 Mechanics of Materials	ME34004 Fluid Mechanics
ME34002 Engineering Thermodynamics	ME46002 Numerical Methods for Engineers
Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^	IC382 Multidisciplinary Manufacturing Project (1.5 training credits)
IC348 Appreciation of Manufacturing Processes (3 training credits)	
Summer Term (1.5 training credits)	
IC382 Multidisciplinary Manufacturing Project (1.5 training credits)	
Year 2 (31 academic credits)	
Semester 1 (16 credits)	**Semester 2** (15 credits)
CLC3241P Professional Communication in Chinese (2 credits)	ENG3004 Society and the Engineer
ELC3531 Professional Communication in English for Engineering Students (2 credits)	Elective Subject III
ENG3003 Engineering Management	Elective Subject IV
Elective Subject I	Elective Subject V
Elective Subject II	
ME49001 Final Year Capstone Project (6 credits)	

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

Table 5.6.2(a) - Normal Progression Pattern for BEngPAED Senior Year

(Total credits required for graduation: 64 academic credits + 6 IC training credits)

Year 1 (30 academic credits + 6 training credits)	
Semester 1 (15 + 3 training credits)	**Semester 2** (15 + 1.5 training credits)
ME31003 System Dynamics	ME34003 Thermofluid Mechanics
ME32001 Manufacturing Fundamentals	ME41004 Mechatronics and Control
ME33001 Mechanics of Materials	ME42005 CAD/CAE Technologies for Product Development
ME32101 Engineering Design for Community*	SD3401 Designing for Humanities
SD348 Introduction to Industrial Design	Free Elective Subject[@]
IC348 Appreciation of Manufacturing Processes (3 training credits)	IC382 Multidisciplinary Manufacturing Project (1.5 training credits)
Summer Term (1.5 training credits)	
IC382 Multidisciplinary Manufacturing Project (1.5 training credits)	
Year 2 (34 academic credits)	
Semester 1 (16 credits)	**Semester 2** (18 credits)
CAR I [^^]	CAR II [^^]
CLC3241P Professional Communication in Chinese (2 credits)	ME42007 Design for Product Safety and Reliability
ELC3531 Professional Communication in English for Engineering Students (2 credits)	ME42011 Fundamentals of Robotics
ENG3004 Society and the Engineer	ME46003 Numerical Fluid Mechanics and Heat Transfer
ENG4001 Project Management	PAED Elective
ME49003 Capstone Project (6 credits)	

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

* *Double fulfillment subject. Upon passing it, students will fulfill the requirements of both DSR and SL.*

@ *"Free electives" under the 4-year undergraduate degree programmes refers to any subjects (including CAR subjects) offered by the University, unless otherwise specified. Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfill free elective requirement for graduation purpose. Students are encouraged to select subject under PAED elective subject pool.*

Table 5.6.2(b) – Normal Progression Pattern on Cooperative Education (Co-op) option for BEngPAED Senior Year

(Total credits required for graduation: 64 academic credits + 6 IC training credits)

<table>
<tr><th colspan="2">Year 1 (38 academic credits + 4.5 training credits)</th></tr>
<tr><td>Semester 1 (18 + 3 training credits)</td><td>Semester 2 (17 + 1.5 training credits)</td></tr>
<tr><td>ENG3004 Society and the Engineer</td><td>CLC3241P Professional Communication in Chinese (2 credits)</td></tr>
<tr><td>ME31003 System Dynamics</td><td>ME34003 Thermofluid Mechanics</td></tr>
<tr><td>ME32001 Manufacturing Fundamentals</td><td>ME41004 Mechatronics and Control</td></tr>
<tr><td>ME33001 Mechanics of Materials</td><td>ME42005 CAD/CAE Technologies for Product Development</td></tr>
<tr><td>ME32101 Engineering Design for Community*</td><td>SD3401 Designing for Humanities</td></tr>
<tr><td>SD348 Introduction to Industrial Design</td><td>Free Elective Subject[@]</td></tr>
<tr><td>IC348 Appreciation of Manufacturing Processes (3 training credits)</td><td>IC382 Multidisciplinary Manufacturing Project (1.5 training credits)</td></tr>
<tr><td colspan="2">Summer Term (3 credits)</td></tr>
<tr><td colspan="2">ME49003 Capstone Project (Connected to FT summer intern in Year 1 at an industrial firm)</td></tr>
<tr><th colspan="2">Year 2 (26 academic credits + 1.5 training credits)</th></tr>
<tr><td>Semester 1 (3 credits)</td><td>Semester 2 (17 credits +1.5 training credits)</td></tr>
<tr><td rowspan="6">ME49003 Capstone Project
(Connected to FT summer intern in Year 1 at an industrial firm)</td><td>ELC3531 Professional Communication in English for Engineering Students (2 credits)</td></tr>
<tr><td>ENG4001 Project Management</td></tr>
<tr><td>ME42007 Design for Product Safety and Reliability</td></tr>
<tr><td>ME42011 Fundamentals of Robotics</td></tr>
<tr><td>ME46003 Numerical Fluid Mechanics and Heat Transfer</td></tr>
<tr><td>PAED Elective</td></tr>
<tr><td>IC382 Multidisciplinary Manufacturing Project (1.5 training credits)</td></tr>
<tr><td colspan="2">Summer Term (6 credits)</td></tr>
<tr><td colspan="2">CAR I [^^]</td></tr>
<tr><td colspan="2">CAR II [^^]</td></tr>
</table>

^^ *The study pattern for these GUR subjects is indicative only. Students may take the subjects according to their own study plan.*

* *Double fulfillment subject. Upon passing it, students will fulfill the requirements of both DSR and SL.*

@ *"Free electives" under the 4-year undergraduate degree programmes refers to any subjects (including CAR subjects) offered by the University, unless otherwise specified. Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfill free elective requirement for graduation purpose. Students are encouraged to select subject under PAED elective subject pool.*

6. ACADEMIC REGULATIONS AND ASSESSMENT

The academic regulations described below are based on the information known as of August 2020. They are subject to review and changes from time to time. Students will be informed of the changes as and when appropriate. Important information relating to students' study is also published in the Student Handbook (website: https://www.polyu.edu.hk/ar/web/en/for-polyu-students/student-handbook/index.html).

6.1 Subject Registration and Withdrawal

In addition to programme registration, students need to register for the subjects at specified periods prior to the commencement of the semester. An add/drop period will also be scheduled for each semester/term. Students may apply for withdrawal of their registration on a subject after the add/drop period if they have a genuine need to do so. The application should be made to the relevant programme offering department and will require the approval of both the subject teacher and the host department Programme Leader concerned (or an alternate academic staff authorised by the programme offering Department). Applications submitted after the commencement of the examination period will not be considered. For approved applications of subject withdrawal, the tuition fee paid for the subject will be forfeited and the withdrawal status of the subject will be shown in the assessment result notification and transcript of studies, but will not be counted in the calculation of the GPA.

The pre-requisite requirements of a subject must have been fulfilled before a student registers for that subject. However, the subject offering department has the discretion to waive the pre-requisite requirements of a subject, if deemed appropriate. If the pre-requisite subject concerned forms part of the requirements for award, the subject has to be passed in order to satisfy the graduation requirements for the programme concerned, despite the waiving of the pre-requisite.

Subject to the maximum study load of 21 credits per semester and the availability of study places, students are allowed to take additional subjects on top of the prescribed credit requirement for award before they become eligible for graduation. Students will be allowed to take additional subjects for broadening purpose, after they fulfil the graduation requirements and for the following semester. However, they will still be subject to the maximum study load of 21 credits per semester and the availability of places in the subjects concerned, and their enrolment will be arranged as subject-based students only and be subject to the rules on 'Admission of Subject-based Students', except that graduates from UGC-funded programmes will not be restricted to taking only subjects from a self-financed programme.

6.2 Study Load

For students following the progression pattern specified for their programme, they have to take the number of credits and subjects, as specified in the Programme Requirement Document, for each semester. Students cannot drop those subjects assigned by the department unless prior approval has been given by the department.

The normal study load is 15 credits in a semester for full-time study. The maximum study load to be taken by a student in a semester is 21 credits, unless exceptional approval is given by the Head of the programme offering Department (or his/her delegates). For such cases, students should be reminded that the study load approved should not be taken as grounds for academic appeal.

To help improve the academic performance of students on academic probation, these students will be required to take a reduced study load in the following semester (Summer Term excluded). The maximum number of credits to be taken by the students varies according to the policies of individual Departments and will be subject to the approval of the authorities concerned.

Students are not allowed to take zero subject in any semester, including the mandatory summer term as required by some programmes, unless they have obtained prior approval from the programme offering Department; otherwise they will be classified as having unofficially withdrawn from their programme. Students who have been approved for zero subject enrolment (i.e. taking zero subject in a semester) are allowed to retain their student status and continue using campus facilities and library facilities. Any semester in which the students are allowed to take zero subject will nevertheless be counted towards the total period of registration (or maximum period of registration for students admitted in or before 2019/20).

Students who have obtained approval to pace their studies and students on programmes without any specified progression pattern who wish to take more than the normal load of 15 credits in a semester should seek advice from the Department concerned before the selection of subjects.

6.3 Subject Exemption

Students may be exempted from taking any specified subjects, including mandatory General University Requirements (GUR) subjects, if they have successfully completed similar subjects previously in another programme or have demonstrated the level of proficiency/ability to the satisfaction of the subject offering department. If students are exempted from taking a specified subject, the credits associated with the exempted subject will not be counted towards meeting the award requirements. It will therefore be necessary for the students to consult the programme offering department and take another subject in order to satisfy the credit requirement for the award.

6.4 Credit Transfer

Students may be given credits for recognised previous studies including mandatory General University Requirements (GUR) subjects; and the credits will be counted towards meeting the requirements for award. Transferred credits may not normally be counted towards more than one degree. The granting of credit transfer is a matter of academic judgment.

Credit transfer may be done with or without the grade being carried over; the former should normally be used when the credits were gained from PolyU. Credit transfer with the grade being carried over may be granted for subjects taken from outside the University, if deemed appropriate, and with due consideration to the academic equivalence of the subjects concerned and the comparability of the grading systems adopted by the University and the other approved institutions. Subject credit transfer is normally decided by the subject offering Department. However, for applications which are submitted by students who have completed an approved student exchange programme, the decision will be made by the programme offering Department in consultation with the subject offering Departments.

The validity period of credits previously earned, is 8 years after the year of attainment. Normally, not more than 50% of the credit requirement for award may be transferable from approved institutions outside the University. For transfer of credits from programmes offered by PolyU, normally not more than 67% of the credit requirement for award can be transferred. In cases where both types of credits are being transferred (i.e. from programmes offered by PolyU and

from approved institutions outside the University), not more than 50% of the credit requirement for award may be transferred.

All credit transfers approved will take effect only in the semester for which they are approved. A student who applies for transfer of credits during the re-enrolment or the add/drop period of a particular semester will only be eligible for graduation at the end of that semester, even if the granting of credit transfer will immediately enable the student to satisfy the credit requirement for the award.

Regarding credit transfer for GUR subjects, the Programme Host Department is the approval authority at the time of admission to determine the number of GUR credits which an Advanced Standing student will be required to complete for the award concerned. Programme Host Departments should make reference to the mapping lists of GUR subjects, compiled by the Committee on General University Requirements (CoGUR), on the eligibility of the subjects which can qualify as GUR subjects. Applications for credit transfer of GUR subjects after admission will be considered, on a case-by-case basis, by the Subject Offering Department or Office of General University Requirements (OGUR)/Office of Service Learning (OSL), in consultation with the relevant Sub-committee(s) under CoGUR, as appropriate.

For credit transfer of retaken subjects, the grade attained in the last attempt should be taken in the case of credit transfer with grade being carried over. Students applying for credit transfer for a subject taken in other institutions are required to declare that the subject grade used for claiming credit transfer was attained in the last attempt of the subject in their previous studies. If a student fails in the last attempt of a retaken subject, no credit transfer should be granted, despite the fact that the student may have attained a pass grade for the subject in the earlier attempts.

Students should not be granted credit transfer for a subject which they have attempted and failed in their current study unless the subject was taken by the student as an exchange-out student in his current programme.

For students admitted to an Articulation Degree or Senior Year curriculum, irrespective of the entry qualifications they held when applying for admission to the programmes, are required to complete at least 60 credits to be eligible for award.

6.5 Deferment of Study

Students may apply for deferment of study if they have a genuine need to do so such as illness or posting to work outside Hong Kong. Approval from the Department offering the programme is required. The deferment period will not be counted towards the total period of registration (or maximum period of registration for students admitted in or before 2019/20).

Application for deferment of study from students who have not yet completed the first year of a full-time programme will only be considered in exceptional circumstances.

Where the period of deferment of study begins during a stage for which fees have been paid, no refund of such fees will be made.

Students who have been approved for deferment are not entitled to enjoy any campus facilities during the deferment period.

6.6 Recording of Disciplinary Actions in Students' Records

With effect from Semester One of 2015/16, disciplinary actions against students' misconducts will be recorded in students' records.

Students who are found guilty of academic dishonesty or non-compliance with examination regulations will be subject to the penalty of having the subject result concerned disqualified and be given a failure grade with a remark denoting 'Disqualification of result due to academic dishonesty/non-compliance with examination regulations'. The remark will be shown in the students' record as well as the assessment result notification and transcript of studies, until their leaving the University.

Students who have committed disciplinary offences (covering both academic and non-academic related matters) will be put on 'disciplinary probation'. The status of 'disciplinary probation' will be shown in the students' record as well as the assessment result notification, transcript of studies and testimonial during the probation period, until their leaving the University. The disciplinary probation is normally one year unless otherwise decided by the Student Discipline Committee.

The University reserves the right to withhold the issuance of any certificate of study to a student/graduand who has unsettled matters with the University, or subject to disciplinary action.

6.7 General Assessment Regulations

Students progress by credit accumulation, i.e. credits earned by passing individual subjects can be accumulated and counted towards the final award.

A 'level' in a programme indicates the intellectual demand placed upon students and may characterise each subject with respect to its recommended sequencing within that programme. Upper level subjects should normally build on lower level subjects. Pre-requisite requirements, if any, must therefore be spelt out on a subject basis.

A 'subject' is defined as a discrete section of the programme which is assigned a separate assessment. A list of subjects, together with their level and weightings, shall be published in the Programme Requirement Document.

The language of assessment for all programmes/subjects shall be English, unless approval is given for it to be otherwise. Such approval shall normally be granted at the stage of validation.

6.8 Principles of Assessment

Assessment of learning and assessment for learning are both important for assuring the quality of student learning. Assessment of learning is to evaluate whether students have achieved the intended learning outcomes of the subjects that they have taken and have attained the overall learning outcomes of the academic programme at the end of their study at a standard appropriate to the award. Appropriate methods of assessment that align with the intended learning outcomes should be designed for this purpose. The assessment methods will also enable the teacher to differentiate students' different levels of performance within the subject. Assessment for learning is to engage students in productive learning activities through purposefully designed assessment tasks.

Assessment will also serve as feedback to students. The assessment criteria and standards should be made explicit to students before the start of the assessment to facilitate student learning, and

feedback provided should link to the criteria and standards. Timely feedback should be provided to students so that they are aware of their progress and attainment for the purpose of improvement.

The ultimate authority in the University for the confirmation of academic decisions is the Senate, but for practical reasons, the Senate has delegated to the Faculty/School Boards the authority to confirm the decisions of Boards of Examiners provided these are made within the framework of the General Assessment Regulations. Recommendations from Board of Examiners which fall outside these Regulations shall be ratified by the Academic Regulations Committee (ARC) and reported to the Senate.

6.9 Assessment Methods

Students' performance in a subject can be assessed by continuous assessment and/or examinations, at the discretion of the individual subject offering department. Where both continuous assessment and examinations are used, the weighting of each in the overall subject grade shall be clearly stated in the Programme Requirement Document. The subject offering Department can decide whether students are required to pass both the continuous assessment and examination components, or either component only, in order to obtain a subject pass, but this requirement (to pass both, or either, components) shall be specified in the Programme Requirement Document. Learning outcome should be assessed by continuous assessment and/or examination appropriately, in line with the outcome-based approach.

Continuous assessment may include tests, assignments, projects, laboratory work, field exercises, presentations and other forms of classroom participation. Continuous assessment assignments which involve group work should nevertheless include some individual components therein. The contribution made by each student in continuous assessment involving a group effort shall be determined and assessed separately, and this can result in different grades being awarded to students in the same group.

Assessment methods and parameters of subjects shall be determined by the subject offering department.

At the beginning of each semester, the subject lecturer should inform students the details of the methods of assessments to be used, within the assessment framework as specified in the Programme Requirement Document.

6.10 Progression/Academic Probation/Deregistration

The Board of Examiners shall, at the end of each semester (except for the Summer Term unless there are students who are eligible to graduate after completion of Summer Term subjects or the Summer Term is mandatory for the programme), determine whether each student is:

(i) eligible for progression towards an award; or

(ii) eligible for an award; or

(iii) required to be de-registered from the programme.

When a student has a Grade Point Average (GPA) lower than 1.70, he will be put on academic probation in the following semester. If a student is able to pull his GPA up to 1.70 or above at the end of the semester, the status of “academic probation” will be lifted. The status of “academic probation” will be reflected in the examination result notification but not in the transcript of studies.

A student will have "progressing" status unless he falls within any one of the following categories which shall be regarded as grounds for deregistration from the programme:

(i) the student has exceeded the maximum period of registration for that programme as specified in the Programme Requirement Document (applicable to students admitted in or before 2019/20); or

(ii) the student has reached the final year of the normal period of registration for that programme, as specified in the Programme Requirement Document, unless approval has been given for extension (applicable to students admitted in or after 2020/21); or

(iii) the student has reached the maximum number of retakes allowed for a failed compulsory subject; or

(iv) the student's GPA is lower than 1.70 for two consecutive semesters and his Semester GPA in the second semester is also lower than 1.70; or

(v) the student's GPA is lower than 1.70 for three consecutive semesters.

When a student falls within any of the categories as stipulated above, except for category (ii) with approval for extension, the Board of Examiners shall de-register the student from the programme without exception.

A student may be deregistered from the programme enrolled before the time frame specified in the above conditions (iv) or (v) if his academic performance is poor to the extent that the Board of Examiners deems that his chance of attaining a GPA of 1.70 at the end of the programme is slim or impossible.

The progression of students to the following academic year will not be affected by the GPA obtained in the Summer Term, unless Summer Term study is mandatory for all students of the programme and constitutes a requirement for graduation, and is so specified in the Programme Requirement Document.

If the student is not satisfied with the de-registration decision of the Board of Examiners, he can lodge an appeal. All such appeal cases will be referred directly to Academic Appeals Committee (AAC) for final decision. Views of Faculties/Schools/Departments will be sought and made available to AAC for reference.

6.11 Retaking of Subjects

Students may only retake a subject which they have failed (i.e. Grade F or S or U). Retaking of subjects is with the condition that the maximum study load of 21 credits per semester is not exceeded.

The number of retakes of a subject should be restricted to two, i.e. a maximum of three attempts for each subject is allowed. The retake count for students admitted in or before 2019/20 will be reset to "0" in 2020/21 when the revised regulations come into effect.

In cases where a student takes another subject to replace a failed elective subject, the fail grade will be taken into account in the calculation of the GPA, despite the passing of the replacement subject. Likewise, students who fail in a Cluster Area Requirement (CAR) subject may need to

take another subject from the same Cluster Area in order to fulfill this part of the GUR, since the original CAR subject may not be offered, in such cases, the F grade of the first CAR subject will be taken into account in the calculation of the GPA, despite the passing of the second CAR subject. (Note 1)

Students need to submit a request to the Faculty/School Board for the second retake of a failed subject.

Students who have failed a compulsory subject after two retakes and have been de-registered can submit an appeal to the Academic Appeals Committee (AAC) for a third chance of retaking the subject. In case AAC does not approve further retakes of a failed compulsory subject or the taking of an equivalent subject with special approval from the Faculty, the student concerned would be de-registered and the decision of the AAC shall be final within the University.

Note 1: In these circumstances when students do not have a choice to retake a failed subject, such as when the failed subject has been phased out, a 'tie-subject' arrangement can be made with the approval of the Faculty/School Board. Under the arrangement, another appropriate subject can be taken as equivalent to the subject which is not offered. Upon passing the equivalent subject, the fail grade of the original subject will be replaced by the latest grade of the retake subject and the failure grade of the original subject will not be taken into account in the calculation of the GPA.

6.12 Exceptional Circumstances

Absence from an assessment component

If a student is unable to complete all the assessment components of a subject, due to illness or other circumstances which are beyond his control and considered by the subject offering Department as legitimate, the Department will determine whether the student will have to complete a late assessment and, if so, by what means. This late assessment shall take place at the earliest opportunity, and normally before the commencement of the following academic year (except that for Summer Term, which may take place within 3 weeks after the finalisation of Summer Term results). If the late assessment cannot be completed before the commencement of the following academic year, the Faculty/School Board Chairman shall decide on an appropriate time for completion of the late assessment.

The student concerned is required to submit his application for late assessment in writing to the Head of Department offering the subject, within five working days from the date of the examination, together with any supporting documents. Approval of applications for late assessment and the means for such late assessments shall be given by the Head of Department offering the subject or the subject teacher concerned, in consultation with the Programme Leader.

Aegrotat award

If a student is unable to complete the requirements of the programme in question for the award due to very serious illness, or other very special circumstances which are beyond his control, and considered by the Board of Examiners as legitimate, the Faculty/School Board will determine whether the student will be granted an aegrotat award. Aegrotat award will be granted under very exceptional circumstances.

A student who has been offered an aegrotat award shall have the right to opt either to accept such an award, or request to be assessed on another occasion to be stipulated by the Board of Examiners; the student's exercise of this option shall be irrevocable.

The acceptance of an aegrotat award by a student shall disqualify him from any subsequent assessment for the same award.

An aegrotat award shall normally not be classified, and the award parchment shall not state that it is an aegrotat award. However, the Board of Examiners may determine whether the award should be classified, provided that they have adequate information on the students' academic performance.

6.13 Grading

Assessment grades shall be awarded on a criterion-referenced basis. A student's overall performance in a subject shall be graded as follows from 2020/21 onwards.

Subject Grade	Short Description	Elaboration on Subject Grading Description
A+ A A-	Excellent	Demonstrates excellent achievement of intended subject learning outcomes by being able to skillfully use concepts and solve complex problems. Shows evidence of innovative and critical thinking in unfamiliar situations, and is able to express the synthesis or application of ideas in a logical and comprehensive manner.
B+ B B-	Good	Demonstrates good achievement of intended subject learning outcomes by being able to use appropriate concepts and solve problems. Shows the ability to analyse issues critically and make well-grounded judgements in familiar or standard situations, and is able to express the synthesis or application of ideas in a logical and comprehensive manner.
C+ C C-	Satisfactory	Demonstrates satisfactory achievement of intended subject learning outcomes by being able to solve relatively simple problems. Shows some capacity for analysis and making judgements in a variety of familiar and standard situations, and is able to express the synthesis or application of ideas in a manner that is generally logical but fragmented.
D+ D	Pass	Demonstrates marginal achievement of intended subject learning outcomes by being able to solve relatively simple problems. Can make basic comparisons, connections and judgments and express the ideas learnt in the subject, though there are frequent breakdowns in logic and clarity.
F	Fail	Demonstrates inadequate achievement of intended subject learning outcomes through a lack of knowledge and/or understanding of the subject matter. Evidence of analysis is often irrelevant or incomplete.

"F" is a subject failure grade, whilst all others ("D" to "A+") are subject passing grades. No credit will be earned if a subject is failed.

Indicative descriptors for modifier grades

Main Grade (solid)	The student generally performed at this level, indicating mastery of the subject intended learning outcomes at this level.
+ (exemplary)	The student consistently performed at this level and exceeded the expectations of this level in some regards, but not enough to claim mastery at the next level.
- (marginal)	The student basically performed at this level, but the performance was inconsistent or fell slightly short in some regards.

Note: The above indicative descriptors for modifier grades are not applicable to the pass grades D and D+

A numeral grade point is assigned to each subject grade. The grade points assigned to subject grades attained by students from 2020/21 are as follows:

Grade	***Grade Point for grades attained from 2020/21***
A+	4.3
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
D+	1.3
D	1.0
F	0.0

The grade points assigned to subject grades attained by students before 2020/21 are as follows:

Grade	***Grade Point for grades attained before 2020/21***
A+	4.5
A	4.0
B+	3.5
B	3.0
C+	2.5
C	2.0
D+	1.5
D	1.0
F	0.0

At the end of each semester/term, a Grade Point Average (GPA) will be computed, as follows, and based on the grade point of all the subjects:

$$GPA = \frac{\sum_{n} \text{Subject Grade Point} \times \text{Subject Credit Value}}{\sum_{n} \text{Subject Credit Value}}$$

where n = number of all subjects (inclusive of failed subjects) taken by the student up to and including the latest semester/term. For subjects which have been retaken, only the grade point obtained in the final attempt will be included in the GPA calculation

In addition, the following subjects will be excluded from the GPA calculation:

(i) Exempted subjects

(ii) Ungraded subjects

(iii) Incomplete subjects

(iv) Subjects for which credit transfer has been approved, but without any grade assigned

(v) Subjects from which a student has been allowed to withdraw (i.e. those with the grade "W")

Subject which has been given an "S" code, i.e. absent from all assessment components, will be included in the GPA calculation and will be counted as "zero" grade point. GPA is thus the unweighted cumulative average calculated for a student, for all relevant subjects taken from the start of the programme to a particular point of time. GPA is an indicator of overall performance, and ranges from 0.00 to 4.30 from 2020/21.

Different Types of GPA

GPA will be calculated for each Semester including the Summer Term. This Semester GPA will be used to determine students' eligibility to progress to the next Semester alongside with the 'cumulative GPA'. However, the Semester GPA calculated for the Summer Term will not be used for this purpose, unless the Summer Term study is mandatory for all students of the programme concerned and constitutes part of the graduation requirements.

The GPA calculated after the second Semester of the students' study is therefore a "cumulative" GPA of all the subjects taken so far by students, and without applying any level weighting.

Along with the "cumulative" GPA, a weighted GPA will also be calculated, to give an indication to the Board of Examiners on the award classification which a student will likely get if he makes steady progress on his academic studies. Weighted GPA will be computed as follows:

$$\text{Weighted GPA} = \frac{\sum_{n} \text{Subject Grade Point} \times \text{Subject Credit Value} \times W_i}{\sum_{n} \text{Subject Credit Value} \times W_i}$$

where W_i = weighting to be assigned according to the level of the subject

n = number of all subjects counted in GPA calculation, except any subjects passed after the graduation requirement has been met.

For calculating the weighted GPA (and award GPA) to determine the Honours classification of students who satisfy the graduation requirements of Bachelor's degree awards, a University-wide standard weighting will be applied to all subjects of the same level, with a weighting of 2 for Level 1 and 2 subjects, a weighting of 3 for Level 3, 4 and 5 subjects. Although the Industrial Centre training credits are counted in the GPA calculation, they are excluded from the calculation of weighted GPA and award GPA. Same as for GPA, Weighted GPA ranges from 0.00 to 4.30 from 2020/21.

When a student has satisfied the requirements for award, an award GPA will be calculated to determine his award classification. GUR subjects will be included in the calculation of award GPA for all programmes.

For students taking the Major/Minor study route, a separate GPA will be calculated for their Major and Minor programmes. The Major GPA will be used to determine his award classification, which will be so reflected on the award parchment. The Minor GPA can be used as a reference for Board of Examiners to moderate the award classification for the Major, as explained further in Section 8.

6.14 University Graduation Requirements

To be eligible for a Bachelor's Degree award under the 4-year full-time undergraduate curriculum, a student must:

1. Complete successfully the requisite number of credits as defined in Section 5.
2. Earn a cumulative GPA of 1.70 or above at graduation.
3. Complete successfully the mandatory Work-Integrated Education (WIE) component.
4. Satisfy the residential requirement for at least one-third of the normal credit requirement for the award unless the professional bodies concerned stipulate otherwise.
5. Satisfy any other requirements as specified in the Programme Requirement Document.
6. Satisfy the following GUR requirements:

(a) Language and Communication Requirements	9 credits
(b) Freshman Seminar	3 credits
(c) Leadership and Intra-Personal Development	3 credits
(d) Service-Learning	3 credits
(e) Cluster Areas Requirement (CAR)	12 credits
(f) China Studies Requirement	(3 of the 12 CAR credits)
(g) Healthy Lifestyle	Non-credit bearing
	Total = 30 credits

(a) Language and Communication Requirements (LCR)

English

All undergraduate students must successfully complete two 3-credit English language subjects as stipulated by the University, according to their English language proficiency level (Table A). These subjects are designed to suit students' different levels of English language proficiency at entry, as determined by their HKDSE score or the English Language Centre

(ELC) entry assessment (when no HKDSE score is available, e.g. in the case of non-local students).

Table A - English LCR subjects (each 3 credits)

English language competence level/ Subject	ELC1011 Practical English for University Studies	ELC1012/ELC1013 English for University Studies	Any LCR Proficient level elective subject in English (Table B)
HKDSE Level 4 and above or equivalent	---	Subject 1	Subject 2
HKDSE Level 3 or equivalent	Subject 1	Subject 2	---

Table B - Proficient level elective subjects for DSE Level 4 students and above (or equivalent) (each 3 credits)

LCR Proficient level elective subjects	ELC2011 Advanced English Reading and Writing Skills
	ELC2012 Persuasive Communication
	ELC2013 English in Literature and Film
	ELC2014 Advanced English for University Studies

Chinese

All undergraduate students must successfully complete one 3-credit Chinese language subject as stipulated by the University, according to their Chinese language proficiency level. All Chinese-speaking students will be required to take the same Chinese LCR subject.

Cantonese will be used as the Medium of Instruction (Mol) of a certain proportion of Chinese LCR subject (Table C). Students taking the Cantonese version of the subjects will be offered a 39 hour non-credit bearing e-Learning course in Putonghua (optional).

Table C - Chinese LCR subjects (each 3 credits)

Subject Code	Subject Title	Mol
CLC1104C	University Chinese	Cantonese
CLC1104P	University Chinese	Putonghua

For non-Chinese speaking students or students whose Chinese standards are at junior secondary level or below:

Depending on students' Chinese Language Centre entry assessment result, one subject from Table D will be re-assigned to students as Chinese LCR. Students are also exempted from the Chinese Reading and Writing Requirements of CAR.

Table D - Chinese LCR Subjects for non-Chinese speakers or students whose Chinese standards are at junior secondary level or below

Subject Code	Subject Title
CLC1151	Chinese I (for non-Chinese speaking students)
CLC1152	Chinese II (for non-Chinese speaking students)
CLC2151	Chinese III (for non-Chinese speaking students)
CLC2154	Chinese IV (for non-Chinese speaking students)
CLC2152	Chinese Literature - Linguistics and Cultural Perspectives (for non-Chinese speaking students)

For the updated information, please refer to the website of Office of General University Requirement (OGUR): https://www.polyu.edu.hk/ogur.

Writing Requirement

In additional to the LCR in English and Chinese explained above, all students must also, among the Cluster Areas Requirement (CAR) subjects they take (see Section (e) below), pass one subject that includes the requirement for a substantial piece of writing in English and one subject with the requirement for a substantial piece of writing in Chinese.

Reading Requirement

All students must, among the CAR subjects they take, pass one subject that includes the requirement for the reading of an extensive text in English and one subject with the requirement for the reading of an extensive text in Chinese.

A list of approved CAR subjects for meeting the Writing Requirement (with a "W" designation) and for meeting the Reading Requirement (with an "R" designation) is shown at: https://www.polyu.edu.hk/ogur/GURSubjects/.

Non-Chinese speakers and those students whose Chinese standards are at junior secondary level or below will by default be exempted from the DSR – Chinese and CAR – Chinese Reading and Writing requirement. However, this group of students would still be required to take one Chinese LCR subject to fulfil their Chinese LCR.

Note: In addition to the LCR in General Education Requirements, students also have to complete 4 credits of discipline-specific language requirements (2credits in English and 2 credits in Chinese) as specified in the curriculum requirements of their Major.

(b) Freshman Seminar

All students must successfully complete, normally in their first year of study, one 3-credit Freshman Seminar offered by their chosen Broad Discipline. The purpose is to (1) introduce students to their chosen discipline and enthuse them about their major study, (2) cultivate students' creativity, problem-solving ability and global outlook, (3) give students an exposure to the concepts of, and an understanding of, entrepreneurship, and (4) engage

students, in their first year of study, in desirable forms of university learning that emphasises self-regulation, autonomous learning and deep understanding.

A list of Freshman Seminars offered by the Broad Disciplines can be found at: https://www.polyu.edu.hk/ogur/GURSubjects/.

(c) Leadership and Intra-Personal Development

All students must successfully complete one 3-credit subject in the area of Leadership and Intra-Personal Development, which is designed to enable students to (1) understand and integrate theories, research and concepts on the qualities (particularly intra-personal and interpersonal qualities) of effective leaders in the Chinese context, (2) develop greater self-awareness and a better understanding of oneself, (3) acquire interpersonal skills essential for functioning as an effective leader, (4) develop self-reflection skills in their learning, and (5) recognise the importance of the active pursuit of knowledge on an intra-personal and interpersonal level and its relationship to leadership qualities.

A list of designated subjects for meeting the leadership and intra-personal development requirement is available at: https://www.polyu.edu.hk/ogur/GURSubjects/.

(d) Service-Learning

All students must successfully complete one 3-credit subject designated to meet the service-learning requirement, in which they are required to (1) participate in substantial community service or civic engagement activities that will benefit the service users or the community at large in a meaningful way, (2) apply the knowledge and skills acquired from their Major or other learning experiences at the University to the community service activities, and (3) reflect on their service learning experience in order to link theory with practice for the development of a stronger sense of ethical, social and national responsibility.

A list of designated subjects for meeting the service-learning requirement is available at: https://www.polyu.edu.hk/ogur/GURSubjects/.

(e) Cluster Areas Requirement (CAR)

To expand students' intellectual capacity beyond their disciplinary domain and to enable them to tackle professional and global issues from a multidisciplinary perspective, students are required to successfully complete at least one 3-credit subject in each of the following four Cluster Areas:

- Human Nature, Relations and Development
- Community, Organisation and Globalisation
- History, Culture and World Views
- Science, Technology and Environment

A list of CAR subjects under each of the four Cluster Areas is available at: https://www.polyu.edu.hk/ogur/GURSubjects/.

(f) China Studies Requirement

Of the 12 credits of CAR described in (e) above, students are required to successfully complete a minimum of 3 credits on CAR subjects designated as "China-related". The

purpose is to enable students to gain an increased understanding of China (e.g. its history, culture and society, as well as emerging issues or challenges).

A list of approved CAR subjects for meeting the China Studies Requirement is available at: https://www.polyu.edu.hk/ogur/GURSubjects/.

(g) Healthy Lifestyle

Healthy lifestyle is the platform for all-round development. Students are required to successfully complete a non-credit-bearing programme in healthy lifestyle.

With effect from the 2015/16 intake cohort, students will be required to complete the following components: (i) sports training/participation, (ii) e-learning modules, and (iii) lectures/talks. The syllabus covers physical health, mental health, social health, spiritual health, values and priorities on health behavior with reference to competing priorities in life, reflection on healthy living and plans for self-improvement or maintenance of health behavior. Details of the programme can be found at: https://www.polyu.edu.hk/ogur/GURSubjects/

Students in Articulation Degree Programmes and Senior Year intakes to the 4-year Undergraduate degree programmes are not required to take the Health Lifestyle Programme. Advanced Standing students are required to take HLS (except for those who are HD/AD holders who follow the Senior Year/Articulation Degree programme GUR curriculum).

A student is required to graduate as soon as he satisfies the graduation requirements. The student concerned is required to apply for graduation, in the semester in which he is able to fulfil all his graduation requirements, and after the add/drop period for that semester has ended.

Students are allowed to take more elective subjects beyond GUR and DSR until the total number of credits reaches 150 without incurring a higher tuition rate. Subject to the maximum study load of 21 credits per semester and the availability of study places, students are allowed to take additional subjects on top of the prescribed credit requirement for award before they become eligible for graduation.

The awards will be classified based upon the Award GPA. Any subject passed after the graduation requirement has been met or subject taken on top of the prescribed credit requirements for award shall not be taken into account in the grade point calculation for award classification. However, if a student attempts more elective subjects (or optional subjects) than the requirement for graduation in or before the semester in which he becomes eligible for award, the elective subjects (or optional subjects) with higher grade/contribution shall be included in the grade point calculation (i.e. the excessive subjects with lower grade/contribution, including failed subjects, will be excluded except for students who have indicated inclusion of specific free electives for fulfilment of award requirements).

The following are guidelines for Boards of Examiners' reference in determining award classifications:

Honours Degrees	**Guidelines**
1st	The student's performance/attainment is outstanding and identifies him as exceptionally able in the field covered by the programme in question.
2:i	The student has reached a standard of performance/ attainment which is more than satisfactory but less than outstanding.
2:ii	The student has reached a standard of performance/ attainment judged to be satisfactory, and clearly higher than the 'essential minimum' required for graduation.
3rd	The student has attained the 'essential minimum' required for graduation at a standard ranging from just adequate to just satisfactory.

Under exceptional circumstances, a student who has completed an Honours degree programme, but has not attained Honours standard, may be awarded a Pass-without-Honours degree. A Pass-without-Honours degree award will be recommended, when the student has demonstrated a level of final attainment which is below the 'essential minimum' required for graduation with Honours from the programme in question, but when he has nonetheless covered the prescribed work of the programme in an adequate fashion, while failing to show sufficient evidence of the intellectual calibre expected of Honours degree graduates. For example, if a student in an Honours degree programme has a Grade Point Average (GPA) of 1.70 or more, but his Weighted GPA is less than 1.70, he may be considered for a Pass-without-Honours classification. A Pass-without-Honours is an unclassified award, but the award parchment will not include this specification.

Students who have committed academic dishonesty or non-compliance with examination regulations will be subject to the penalty of the lowering of award classification by one level. For undergraduate students who should be awarded a Third class Honours degree, they will be downgraded to a Pass-without-Honours. The minimum of downgraded overall result will be kept at a Pass.

The following are the award GPA ranges for determining award classifications:

Honours classification	***Award GPA***
1st	3.60 – 4.30
2:i	3.00 – 3.59
2:ii	2.40 – 2.99
3rd	1.70 – 2.39

Decisions by the Boards of Examiners on award classifications to be granted to each student on completion of the programme shall be ratified by the Faculty/School Board (of Examiners). For cases the decisions of which do not conform to the above indicative GPA range, they should be referred, by the Faculty/School Board (of Examiners), to the APRC for ratification.

7. SCHEME/PROGRAMME OPERATION AND MANAGEMENT

7.1 Departmental Undergraduate Programme Committee

The Departmental Undergraduate Programme Committee will exercise the overall academic and operational responsibility for the Scheme/Programme.

7.2 Programme Executive Group

The day-to-day operation of the Scheme/Programme will be carried out by the Programme Executive Group, which consists of the Scheme/Programme Leader and Deputy Scheme/Programme Leader. The Group will report the operation back to the Departmental Undergraduate Programme Committee.

7.3 Student-Staff Consultative Committee

The Student-Staff Consultative Committee consists of Student Representatives together with the Scheme/Programme Leader. The Committee is normally chaired by the Scheme/Programme Leader and meets at least twice a year. Issues to be kept under consideration include: student workload, teaching methods, balance between subject areas, training matter and other areas of mutual concern.

7.4 Academic Advising

There are two components in the academic advising system at PolyU - Department-based Academic Advising (primarily for matters related to major programme and career) and Institutional level Academic Advising by the Student Affairs Office (SAO) (primarily for matters related to GUR).

Academic advising at PolyU aims to help students to make informed and intelligent academic decisions/choices about their study at PolyU that suit their intellectual, professional and personal goals. It is instrumental to promoting student success, and plays a vital role in enhancing students' overall learning experience at PolyU. The specific objectives are:

- To provide accurate information about academic regulations and studies;
- To help students formulate study plans;
- To connect students to resources and support;
- To strengthen the connection between students and their home departments;
- To explore students' interests so that they can set suitable academic, professional, and personal goals.

Every student will be assigned an Academic Advisor from the ME Department. The main responsibilities of the academic advisor will include:

- Building rapport with students;
- Being accessible, available and responsive to students;
- Helping students formulate and refine their academic, professional, and personal goals;
- Helping students to develop an appropriate study plan;

- Alerting students to academic regulations and requirements, particularly those relating to one’s Major;
- Providing early identification of students with special learning needs or signs of learning problems and making necessary referrals;
- Contacting with students regularly and have at least one face-to-face meeting (individually or in small groups) during the academic year. Students are expected to consult the advisors before subject registration.

8. MINOR AND DOUBLE MAJOR

The 4-year undergraduate degree framework allows students to work for a single discipline Major, a Major plus a Minor (unless the Major is so designed as to preclude the possibility of a further Minor study) or Double Majors.

8.1 Minor Study

Minor study will be a free choice by students and not mandatory. Each student can be applied to take not more than one Minor. This option will not be applicable to students who are admitted to the advanced stage of the programme. Students who opt for Minor study will be subject to the following regulations.

(i) A Minor programme will comprise a collection of subjects totaling 18 credits, with at least 50% of the subjects (9 credits) at Level 3 or above.

(ii) Students must apply to and obtain approval from the Minor-offering Department, at the start of second year of study.

(iii) Subject to approval by the Minor-offering Department, students may count up to 6 credits from their Major/GUR subjects [including Language Communication Requirement (LCR) subjects at proficiency level] towards their chosen Minor. Nevertheless, students must take at least 6 credits from their chosen Minor programme in order to satisfy the residential requirement of their chosen Minor. In addition, to be eligible for the Major and Minor awards, the total number of credits taken by the students for their Major-Minor studies must not be lower than the credit requirement of the single discipline Major programme.

(iv) Only students with a GPA of 2.5 or above can be considered for Minor study enrolment. The Minor-offering Department can also set a quota and additional requirements for enrolment on their Minors.

(v) Departments have the discretion to allow students who fail to obtain a GPA of 2.5 or above after enrolment, to stay on the Minor programme for a longer while in order to pull up their GPA to the required level.

(vi) Students must complete their approved Minor as part of their graduation requirements. Students who wish to withdraw from a Minor need to obtain approval from the Minor-offering Department, before the end of the add/drop period of the last Semester of study.

(vii) Students are required to obtain a GPA of at least 1.70 to satisfy the requirement for graduation with a Major plus a Minor.

(viii) Since students are expected to complete their approved Minor as part of their graduation requirements, students taking the Major/Minor route will be considered for an award of both the Major and Minor simultaneously, and not separately.

(ix) Students graduating with a Major plus a Minor will receive one award parchment, which will list the title of the Major programme only. The honours classification will be based on the Major GPA, and reflected accordingly on the parchment. The award title of the Minor programme will not be reflected on the parchment. It will be recorded in the Transcript of Studies.

(x) There is no guarantee that a clash-free timetable can be provided for all students who pursue Minor study.

8.2 Double Majors

Double Majors will provide an opportunity for the more capable students, who are interested in expanding their study beyond a single degree, to take a Second Major study. Students who opt for a double Major study will be subject to the following regulations:

(i) Completion of Double Majors requires more than the normative study period of 4/5 years and extra credits on self-financed basis (therefore require higher tuition fee). The total credit requirements of a Double Major will depend on the degree of commonality between the 2 Majors, but should be more than 120 in all instances. Apart from the 30 credits of GUR subjects, up to 1/3 of the Discipline-Specific Requirements (DSR) of the First Major which are common to the Second Major can be double-counted towards the Second Major.

(ii) Students who wish to take a Second Major must obtain approval from the host Department of the First Major.

(iii) Only students with a GPA of 3.0 or above can be considered for admission to a Second Major, while Departments offering the Second Major can stipulate a higher GPA requirement if deemed appropriate.

(iv) Students will be put on academic probation if they fail to obtain a GPA of 1.70 or above.

(v) Students who wish to withdraw from a Second Major must obtain approval from the Department offering the Second Major, before the end of the add/drop period of the last Semester of study.

(vi) Students will not be allowed to drop the First Major and continue with the Second Major only. This is to avoid students using the Double Major mechanism to gain a “backdoor” entry to a “popular” and oversubscribed Major programme.

(vii) Students are required to obtain an overall GPA of at least 1.70, in order to satisfy the requirement for graduation with Double Majors. They will not be allowed to graduate with one of the 2 Majors.

(viii) Two award parchments will be issued for the Double Majors (one for each Major programme). The honours classification of the two Major awards need not be identical.

PART B SYLLABI

GUR Subject

Subject Description Form

Subject Code	ENG1003
Subject Title	Freshman Seminar for Engineering
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	The objectives of this subject are to: (1) Introduce students to the engineering broad discipline and enthuse them about their major study (2) Cultivate students' creativity and problem-solving ability, and global outlook (3) Introduce students to the concept of entrepreneurship (4) Engage the students in desirable forms of learning at university that emphasizes self-regulation, autonomous learning and deep understanding
Intended Learning Outcomes	Upon completion of the subject, students will: (a) Be able to demonstrate an understanding and an enthusiasm about the engineering broad discipline and their major study (b) Develop their problem-solving ability and global outlook (c) Be able to demonstrate an understanding of entrepreneurship (d) Be able to research for information, formulate a project plan, and manage a project with initiative (e) Be able to demonstrate an understanding of academic integrity.
Subject Synopsis/ Indicative Syllabus	***1. Online Tutorial on Academic Integrity (4 hours*)*** Students will be required to complete successfully an Online *Tutorial on Academic Integrity* on or before week 5 of the first semester. The students will understand the importance of academic integrity by completing the Online Tutorial. ***2. Seminars (12 hours*)*** There will be seminars given by various speakers on various topics to introduce to students the engineering broad discipline, to enthuse them about their major study, to arouse students' interests in engineering and to cultivate their understanding of and sense of belonging to the discipline and the engineering profession, and to cultivate students' global outlook. The formats of the seminars may be, but not limited to, Departmental Seminars, and Renowned Speaker Seminar. ***3. Freshman Project (45 hours*)*** There will be practical workshops, presentation and demonstration sessions for the Freshman Project. The freshman project aims at developing students' creativity, problem-solving skills, research for information, and project management abilities through practical and hands-on tasks at a level commensurate with their first-year engineering backgrounds. Students will work in small groups under the guidance of teachers/instructors to design and implement an engineering solution to some given problems.

	4. Entrepreneurship Project (45 hours*) The entrepreneurship project is designed to develop students' appreciation and understanding about entrepreneurship and the commercialization process by attending lectures, workshops and tutorials. In the course of the Entrepreneurship Project, students will identify technology opportunities and learn the skills of preparing a simple business plan. (* Note: hours indicate total student workload)
Teaching/Learning Methodology	***Online Tutorial on Academic Integrity*** The *Online Tutorial on Academic Integrity (OTAI)* is developed by the University to help the students understand the importance of academic integrity. By going through the Online Tutorial, students will be aware of the importance of upholding academic integrity during University study. They will also learn good practices by which to stay clear of dishonest behaviors and academic plagiarism. Completing the OTAI is a completion requirement of Freshman Seminar. For successful completion of the OTAI, the students need to attempt the pre-test in the Tutorial, read all four modules in the Tutorial, obtain at least 75% in the post-test in the Tutorial and sign the Honour Declaration before the completion deadline. Students who fail to complete the OTAI before the completion deadline will fail the Freshman Seminar for Engineering. ***Seminars*** The seminars (such as renowned speaker seminars and departmental seminars) are designed to arouse students' interest about engineering. The delivery mode will be *interactive* and *engaging*. Students will be motivated to search for information and do background reading. They will be encouraged to raise questions and discuss with the presenters. Assessment tasks (quizzes) will be designed to measure students' learning outcomes as well as to encourage participation and interaction. ***Freshman Project*** For the Freshman Project, students will work collaboratively with their group members to design and implement an engineering solution to a given problem under the guidance of instructors. There will be close staff-students and students-students *interaction.* Students will be given opportunities to develop creativity, problem-solving skills, research for information and project management abilities. Assessment tasks will consist of demonstration, presentation, reports, and reflective essay writings. These are designed to evaluate individual student's performance and achievement of the relevant intended learning outcomes as well as to encourage active participation. Appropriate pedagogies will also be used to promote the "Learning to Learn" ability of students. ***Entrepreneurship Project*** There will be lectures, workshops, and tutorials. A general overview of the concepts required to conduct the project will be provided to students through lectures. They will then work in small groups in a workshop to appreciate the essential elements in the development of a business plan and subsequently to produce a simple business plan and to present it to fellow classmates. Assessment will focus towards students' understanding about entrepreneurship, innovation and creativity.

Assessment Methods in Alignment with Intended Learning Outcomes

Students' performance in this subject will be assessed by using a letter-grading system in accordance with the University's convention from grade F (failure) to A+. The relative weights of the different assessment components are as follows:

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
Online Tutorial on Academic Integrity	0%					✓
Seminars Quizzes	10%	✓	✓			
Freshman Project Project demonstration, presentation, report and reflective essay writing	45%		✓		✓	
Entrepreneurship Project Business plan	45%			✓	✓	
Total	100 %					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Quizzes (online or paper-based) can measure the students' *understanding* about the engineering discipline. Through reflective essays, students can reflect on their appreciation and understanding about the *engineering* discipline. Through project demonstration, presentation and project reports, students can demonstrate their *creativity and problem-solving skills abilities*. They can also demonstrate their *ability to research for information, formulate a project plan*, and *manage a project with initiative*. Through business plan, students can demonstrate their understanding about *entrepreneurship.*

Pass Conditions

In order to pass this subject, students must obtain a Grade D or above for total marks comprising the Seminars, Freshman Project and Entrepreneurship Project as described here AND successfully complete the Online Tutorial on Academic Integrity (OTAI) on or before week 5 of semester 1 as described in the previous section.

Student Study Effort Expected	Class contact:	
	▪ Introduction and Seminars (such as Departmental Seminars, Renowned Speaker Seminar)	6 hours
	▪ Freshman project: 3 hours per week for 5 weeks	15 hours
	▪ Entrepreneurship project: 3 hours per week for 5 weeks	15 hours
	▪ Other student study effort: 4 hours for Online Tutorial on Academic Integrity; 6 hours for seminars quizzes preparation; 60 hours for Freshman project and Entrepreneurship project: background information search, project work preparation, meeting and	70 Hours

	discussion, presentation and demonstration, and report writing.	
	▪ Total student study effort	106 Hours
Reading and References List	H. Scott Fogler and Steven E. LeBlanc, *Strategies for creative problem solving*, Upper Saddle River, N.J. : Prentice Hall, 2008 N.J. Smith (ed), *Engineering project management*, Oxford, UK; Malden, MA: Blackwell, 2008 Gene Moriaty, *The engineering project: its nature, ethics, and promise*, University Park, Pa.: Pennsylvania State University Press, 2008. K. Allen, *Entrepreneurship for scientists and engineers*, Upper Saddle River, N.J. : Prentice Hall, 2010. The Hong Kong Institution of Engineers, "Engineering Our City", Youtube clip ref. no. nYMmI6vlVeQ HKIE Corporate Video, Youtube clip ref. no. lNMVl8MuNEY	

(revised) June 2020

Core Subjects

Subject Description Form

Subject Code	AF3625
Subject Title	Engineering Economics
Credit Value	3
Level	3
Exclusion	AF2618
Objectives	This subject aims to equip students with 1. The fundamental concepts of micro- and macroeconomics related to the engineering industry; 2. The fundamental understanding of finance and costing for engineering operations, budgetary planning and control.
Intended Subject Learning Outcomes	**Upon successful completion of this subject, students will be able to:** 1. Understand how the relevant economic factors shape the environment within which an engineering company operates; 2. Evaluate the financial condition of a company based on the financial statements; 3. Apply the basic cost accounting techniques in the planning and control of engineering and production activities.
Subject Synopsis/ Indicative Syllabus	Economic Environment of a Firm **Microeconomic Factors** Scarcity, choice and opportunity cost; Demand, supply and price; Profit-maximizing behavior of the firm; Organization of industry: perfect competition and monopoly **Macroeconomic Factors** International trade and globalization Accounting and Engineering Economics Financial statements; Financial ratio analysis; Return on investment; Composition of cost; Cost-volume-profit analysis; Accounting profit versus economic profit Fundamentals of Budgetary Planning and Control Principle types of budgets for production and service operations; Approaches to budgeting and the budgeting process; Investment and source of finance; Cost of capital; Evaluation of investment alternatives
Teaching/ Learning Methodology	The two-hour lecture each week focuses on the introduction and explanation of key concepts of Engineering Economics. The one-hour tutorial provides students with directed studies to enhance their self-learning capacities. Individual and group activities including discussions and presentations are conducted to facilitate students' understanding and application of the concepts they have learned to tackling real-life problems in Engineering Economics.

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific Assessment Methods/Tasks</th><th rowspan="2">% Weighting</th><th colspan="3">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th></tr>
<tr><td>Continuous Assessment</td><td>50%</td><td></td><td></td><td></td></tr>
<tr><td>1. In-class activities</td><td>15%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Written assignments</td><td>15%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Test</td><td>20%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Final Examination</td><td>50%</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="3"></td></tr>
</table>
To pass this subject, students are required to obtain Grade D or above in <u>both</u> the Continuous Assessment and Examination components.
</td></tr>
<tr><td>Student Study Effort Required</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>26 Hours</td></tr>
<tr><td>• Tutorial</td><td>13 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Study and self-learning</td><td>48 Hours</td></tr>
<tr><td>• Presentation preparation and written assignments</td><td>18 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>
Recommended Textbooks

1. Parkin and Bade, Foundations of Microeconomics, 8th ed., Pearson, 2018.
2. Sullivan, Wicks and Koelling, Engineering Economy, 16th ed., Pearson, 2014.

References

1. Drury, Colin, Management and Cost Accounting, 10th ed., Cengage Learning, 2018.
2. Robert H. Frank, The Economic Naturalist: Why Economics Explain Almost Everything?, Basic Books, 2007.
</td></tr>
<tr><td>Last Updated</td><td>July 2019</td></tr>
<tr><td>Prepared by</td><td>School of Accounting and Finance</td></tr>
</table>

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA1110</td></tr>
<tr><td>Subject Title</td><td>Basic Mathematics I – Calculus and Probability & Statistics</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>1</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td></tr>
<tr><td>Objectives</td><td>This subject aims to introduce students to the basic concepts and applications of elementary calculus and statistics. Emphasis will be on the understanding of fundamental concepts and the use of mathematical techniques in handling practical problems in science and engineering.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) apply analytical reasoning to solve problems in science and engineering;
(b) make use of the knowledge of mathematical/statistical techniques and adapt known solutions to various situations;
(c) apply mathematical modeling in problem solving;
(d) demonstrate abilities of logical and analytical thinking.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td><u>Elementary calculus</u>: Limit and continuity, derivatives and their geometric meaning, rules of differentiation including chain rule, Leibniz's rule and L'Hopital's rule, exponential and logarithmic functions, trigonometric functions and their inverses, hyperbolic and inverse hyperbolic functions, applications of differential calculus.

<u>Elementary Probability and Statistics</u>: Descriptive statistics, random variables, probability and probability distributions, binomial, Poisson and normal distributions, applications.

Population and random samples. Sampling distributions related to sample mean, sample proportions, and sample variances. Concepts of a point estimator and a confidence interval. Point and interval estimates of a mean and the difference between two means.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and elementary techniques of differential and integral calculus and elementary statistics will be taught in lectures. These will be further enhanced in tutorials through practical problem solving.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1.Assignments and mid-term tests</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
</table>
</td></tr>
</table>

	Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester. Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering. Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: *The subject focuses on understanding of basic concepts and application of techniques in differential/integral calculus, elementary statistics. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.*	
Student Study Effort Expected	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Homework and self-study	81 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	Chung, K.C. *A Short Course in Calculus and Matrices*, McGraw Hill 2013 Hung, K.F., Kwan, Wilson, Pong, T.Y. *Foundation Mathematics & Statistics*, McGraw Hill 2013 Larson, R., Edwards, B. *Single Variable Calculus*, Brooks/Cole 2012 Walpole, R.E., Myers, R.H., Myers, S.L. Ye, K. *Probability and Statistics for Engineers and Scientists*, Prentice Hall, 2012	

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA1120</td></tr>
<tr><td>Subject Title</td><td>Basic Mathematics II –Calculus and Linear algebra</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>1</td></tr>
<tr><td>Pre-requisite</td><td>Basic Mathematics I – Calculus and Probability & Statistics (AMA1110)</td></tr>
<tr><td>Objectives</td><td>This subject aims to introduce students to the basic concepts and applications of elementary calculus and statistics. Emphasis will be on the understanding of fundamental concepts and the use of mathematical techniques in handling practical problems in science and engineering.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:
(a) apply analytical reasoning to solve problems in science and engineering;
(b) make use of the knowledge of mathematical/statistical techniques and adapt known solutions to various situations;
(c) apply mathematical modeling in problem solving;
(d) demonstrate abilities of logical and analytical thinking.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Elementary calculus: Mean Value Theorem with applications to optimization and curve sketching. Definite and indefinite integrals, fundamental theorem of calculus, methods of integration (integration by substitution, integration by parts, integration of rational functions using partial fractions and integration of trigonometric and hyperbolic functions), reduction formulas, applications to geometry and physics. Improper Integrals.

Linear algebra: Basic properties of matrices and determinants, linear systems, Gaussian elimination, inverse of a square matrix, Cramer’s rule, vectors in 2-space or in 3-space, applications to geometry.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and elementary techniques of differential and integral calculus and linear algebra will be taught in lectures. These will be further enhanced in tutorials through practical problem solving.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1.Assignments and tests</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
</table>

Continuous Assessment comprises of assignments and tests. An examination is held at the end of the semester.</td></tr>
</table>

	Questions used in assignments, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering. Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: *The subject focuses on understanding of basic concepts and application of techniques in differential/integral calculus, elementary statistics and elementary linear algebra. As such, an assessment method based mainly on examinations/tests is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.*	
Student Study Effort Expected	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Homework and self-study	81 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	Chung, K.C. *A Short Course in Calculus and Matrices*, McGraw Hill 2013 Hung, K.F., Kwan, Wilson, Pong, T.Y. *Foundation Mathematics & Statistics*, McGraw Hill 2013 Larson, R., Edwards, B. *Single Variable Calculus*, Brooks/Cole 2012 Larson, R. *Elementary Linear Algebra*, Brooks/Cole 2013	

Subject Description Form

Subject Code	AMA2111
Subject Title	Mathematics I
Credit Value	3
Level	2
Pre-requisite	Calculus and Linear Algebra (AMA1007) or Calculus I (AMA1101) or Calculus IA (AMA1102) or Basic Mathematics II – Calculus and Linear Algebra (AMA1120) or Calculus for Engineers (AMA1130) or Foundation Mathematics for Accounting and Finance (AMA1500)
Exclusion	Intermediate Calculus and Linear Algebra (AMA2007) Introduction to Differential Equations (AMA2008) Mathematics for Engineers (AMA2308) Engineering Mathematics (AMA2380) Applied Mathematics I (AMA2511) Mathematics for Scientists and Engineers (AMA2882) Engineering Mathematics (AMA290)
Objectives	This subject aims to introduce students to the basic principles and techniques of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply mathematical reasoning to analyze essential features of different problems in science and engineering; 2. extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations; 3. develop and extrapolate the mathematical concepts in synthesizing and solving new problems 4. demonstrate abilities of logical and analytical thinking; 5. search for useful information in the process of problem solving.
Subject Synopsis/ Indicative Syllabus	1. <u>Algebra of complex numbers</u> Complex numbers, geometric representation, complex exponential functions, n-th roots of a complex number. 2. <u>Linear algebra</u> Systems of linear equations, vector spaces, inner product and orthogonality, eigenvalues and eigenvectors, applications. 3. <u>Ordinary differential equations</u> ODE of first and second order, linear systems, Laplace transforms, Convolution theorem, applications to mechanical vibrations and simple circuits.

<table>
<tr><td></td><td>4. <u>Differential calculus of functions of several variables</u>

Partial derivatives, total differential, chain rule, Taylor's expansion, maxima and minima, directional derivatives, Lagrange multipliers, implicit differentiation, applications.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The subject will be delivered mainly through lectures and tutorials. The lectures aim to provide the students with an integrated knowledge required for the understanding and application of mathematical concepts and techniques. Tutorials will mainly be used to develop students' problem solving ability.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>1.Homework, quizzes and mid-term test</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="5"></td></tr>
</table>

Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester.

Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The subject focuses on understanding of basic concepts and application of techniques in engineering mathematics. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>26 Hours</td></tr>
<tr><td>• Tutorial</td><td>13 Hours</td></tr>
<tr><td>• Mid-term test and examination</td><td></td></tr>
<tr><td>Other student study effort</td><td></td></tr>
<tr><td>• Assignments and Self study</td><td>78 Hours</td></tr>
<tr><td>Total student study effort:</td><td>117 Hours</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>1. C.K. Chan, C.W. Chan and K.F. Hung, Basic Engineering Mathematics, McGraw-Hill, 2015.

2. Anton, H. Elementary Linear Algebra (11th edition). Wiley, 2014.</td></tr>
</table>

	3. Kreyszig, E. (2011). *Advanced Engineering Mathematics*, 10th ed. Wiley. 4. James, G. (2015). *Modern Engineering Mathematics*, 5th ed. Pearson Education Limited 5. Thomas, G. B., Weir, M. D. & Hass, J. R. *Thomas' Calculus*, 14th ed. Pearson Education 2017

Subject Description Form

Subject Code	AMA2112
Subject Title	Mathematics II
Credit Value	3
Level	2
Pre-requisite	Mathematics I (AMA2111)
Exclusion	Intermediate Calculus and Linear Algebra (AMA2007) Introduction to Differential Equations (AMA2008)
Objectives	This subject is a continuation of AMA2111. It aims to introduce students to the basic principles and techniques of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply mathematical reasoning to analyze essential features of different problems in science and engineering; 2. extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations; 3. develop and extrapolate the mathematical concepts in synthesizing and solving new problems 4. demonstrate abilities of logical and analytical thinking; 5. search for useful information in the process of problem solving.
Subject Synopsis/ Indicative Syllabus	1. <u>Multiple integrals</u> Double and triple integrals, change of variables, applications to problems in geometry and mechanics. 2. <u>Vector calculus</u> Vector and scalar fields, the del operator, line and surface integrals, the theorems of Green, Gauss and Stokes, applications to electromagnetic theory and fluid mechanics. 3. <u>Series expansion</u> Infinite series, Taylor's expansion, Fourier series expansion of a periodic function. 4. <u>Partial differential equations</u> Formulation of PDE of mathematical physics, separation of variables, initial-boundary value problems, introduction to Fourier transforms.

<table>
<tr><td>Teaching/Learning Methodology</td><td>The subject will be delivered mainly through lectures and tutorials. The lectures aim to provide the students with an integrated knowledge required for the understanding and application of mathematical concepts and techniques. Tutorials will mainly be used to develop students' problem solving ability.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>1. Assignments, quizzes and mid-term test</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="5"></td></tr>
</table>
Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester.
Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering.
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
The subject focuses on understanding of basic concepts and application of techniques in engineering mathematics. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>26 Hours</td></tr>
<tr><td>• Tutorial</td><td>13 Hours</td></tr>
<tr><td>• Mid-term test and examination</td><td></td></tr>
<tr><td>Other student study effort</td><td></td></tr>
<tr><td>• Assignments and Self study</td><td>78 Hours</td></tr>
<tr><td>Total student study effort:</td><td>117 Hours</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>

C.K. Chan, C.W. Chan and K.F. Hung, Basic Engineering Mathematics, McGraw-Hill, 2015.
Anton, H. Elementary Linear Algebra (11th edition). Wiley, 2014.
Kreyszig, E. (2011). Advanced Engineering Mathematics, 10th ed. Wiley.
James, G. (2015). Modern Engineering Mathematics, 5th ed. Pearson Education Limited

</td></tr>
</table>

	5. Thomas, G. B., Weir, M. D. & Hass, J. R. *Thomas' Calculus*, 14th ed. Pearson Education 2017

Subject Description Form

Subject Code	AP10001
Subject Title	Introduction to Physics
Credit Value	3
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This is a subject designed for students with no background in physics studies. Fundamental concepts in major topics of physics (mechanics, heat, wave and electromagnetism) will be discussed. The aim of this subject is to equip students with some basic physics knowledge, and to appreciate its applications in various branches of science and technology.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) solve simple problems in kinematics Newton's law and Energy; (b) solve problems in heat capacity and latent heat; (c) explain phenomena related to the wave character of light; (d) apply the superposition of waves; (e) understand electrostatic field and potential; (f) solve problems on interaction between current and magnetic field; and (g) describe and demonstrate the phenomenon of electromagnetism.
Subject Synopsis/ Indicative Syllabus	**Mechanics**: scalars and vectors; kinematics and dynamics; Newton's laws; momentum, impulse, work and energy; conservation of momentum and conservation of energy. **Thermal physics**: heat and internal energy; heat capacity; conduction, convection and radiation; latent heat. **Waves**: nature of waves; wave motion; reflection and refraction; image formation by mirrors and lenses; superposition of waves; standing waves; diffraction and interference; electromagnetic spectrum; sound waves. **Electromagnetism**: charges; Coulomb's law; electric field and potential; current and resistance; Ohm's law; magnetic field; magnetic force on moving charges and current-carrying conductors; Faraday's law and Lenz's law.
Teaching/Learning Methodology	**Lecture**: Fundamentals in mechanics, waves and electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Students are free to request help. Homework problem sets will be given. **Student-centered Tutorial**: Students will work on a set of problems in tutorials. Students are encouraged to solve problems and to use their own knowledge to verify

their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.

e-learning: In order to enhance the effectiveness of teaching and learning processes, electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework and notices etc.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
		a	b	c	d	e	f	g
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓	✓	✓
Total	100							

Continuous assessment:
The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
• Self-study	81 h
Total student study effort	120 h

Reading List and References

John D. Cutnell & Kenneth W. Johnson, **Introduction to Physics**, 9th edition, 2013, John Wiley & Sons.

Hewitt, **Conceptual Physics**, 11th edition, 2010, Benjamin Cummings.

Subject Description Form

Subject Code	AP10005
Subject Title	Physics I
Credit Value	3
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This course provides a broad foundation in mechanics and thermal physics to those students who are going to study science, engineering, or related programmes.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) solve simple problems in single-particle mechanics using calculus and vectors; (b) solve problems in mechanics of many-particle systems using calculus and vectors; (c) understand simple harmonic motion and solve simple problems; (d) solve problems related to acoustic standing waves; (e) calculate changes in frequency received due to Doppler's effect; (f) apply ideal gas laws to solve problems; (g) apply the first law of thermodynamics to simple processes; and (h) solve simple problems related to the cyclic processes.
Subject Synopsis/ Indicative Syllabus	**Mechanics**: calculus-based kinematics, dynamics and Newton's laws; calculus-based Newtonian mechanics, involving the application of impulse, momentum, work and energy, etc.; conservation law; gravitational force; systems of particles; collisions; rigid body rotation; angular momentum; oscillations and simple harmonic motion; pendulum; statics; longitudinal and transverse waves; travelling wave and standing wave; Doppler effect; sound waves and beats. **Thermal physics**: conduction, convection and radiation; black body radiation; ideal gas and kinetic theory; work, heat and internal energy; first law of thermodynamics; entropy and the second law of thermodynamics; Carnot cycle; heat engine and refrigerators.
Teaching/Learning Methodology	**Lecture**: Fundamentals in mechanics, waves and electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Students are free to request help. Homework problem sets will be given. **Student-centered Tutorial**: Students will work on a set of problems in tutorials. Students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience. **e-learning**: In order to enhance the effectiveness of teaching and learning processes, electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework and notices etc.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
		a	b	c	d	e	f	g	h
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓	✓	✓	✓
Total	100								

Continuous assessment:
The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students' study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
• Self-study	81 h
Total student study effort:	120 h

Reading List and References

John W. Jewett and Raymond A. Serway, "Physics for Scientists and Engineers", 2014, 9th edition, Brooks/Cole Cengage Learning.

Hafez A. Radi, John O. Rasmussen, "Principles of physics: for scientists and engineers", 2013, Springer.

W. Bauer and G.D. Westfall, "University Physics with Modern Physics", 2011, McGraw-Hill.

Subject Description Form

Subject Code	AP10006
Subject Title	Physics II
Credit Value	3
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with fundamental knowledge in physics focusing on the topics of waves and electromagnetism. This course prepares students to study science, engineering or related programmes.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) apply simple laws in optics to explain image formation; (b) understand phenomena related to the wave character of light; (c) solve problems in electrostatics; (d) solve problems on interaction between current and magnetic field; (e) apply electromagnetic induction to various phenomena; and (f) solve problems in simple circuits.
Subject Synopsis/ Indicative Syllabus	**Waves and optics**: nature of light, reflection and refraction; Snell's law; image formation by mirrors and lenses; compound lens; microscope and telescope; superposition of waves; Huygen's principle; interference and diffraction; diffraction grating; Rayleigh's criterion and optical resolution; polarization. **Electromagnetism**: charge and Field; Coulomb's law and Gauss' law; electrostatic field and potential difference; capacitors and dielectric; current and resistance; Ohm's law; electromotive force, potential difference; Lorentz force; magnetic force on moving charges and current; Hall effect; Biot-Savart law and Ampere's law; Faraday's law and Lenz's law; induction; transformers; AC circuits and applications.
Teaching/Learning Methodology	**Lecture**: The fundamentals in optics and electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Students are free to request help. Homework problem sets will be given. **Student-centered Tutorial**: Students will work on a set of problems in tutorials. Students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience. **e-learning**: In order to enhance the effectiveness of teaching and learning processes, electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework

<table>
<tr><td></td><td>and notices etc.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
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(Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td></td></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Total</td><td>100</td><td colspan="7"></td></tr>
</table>
Continuous assessment:
The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students' study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.
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<table>
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<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>81 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
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</td></tr>
<tr><td>Reading List and References</td><td>John W. Jewett and Raymond A. Serway, "Physics for Scientists and Engineers", 2014, 9th edition, Brooks/Cole Cengage Learning.

Hafez A. Radi, John O. Rasmussen, "Principles of physics: for scientists and engineers", 2013, Springer.

W. Bauer and G.D. Westfall, "University Physics with Modern Physics", 2011, McGraw-Hill.</td></tr>
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The Hong Kong Polytechnic University

Subject Description Form

Subject Code	CLC3241P (2019-20 onward) CBS3241P (2018-19 and before)
Subject Title	Professional Communication in Chinese
Credit Value	2
Level	3
Pre-requisite / Co-requisite	Chinese LCR subjects
Objectives	This subject aims to develop the language competence for professional communication in Chinese required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals and reports.
Intended Learning Outcomes	Upon completion of the subject, and in relation to effective communication with a variety of intended readers/audiences in Chinese, students will be able to a. plan, organise and produce professionally acceptable project proposals and reports with appropriate text structures and language for different intended readers b. plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences c. adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences
Subject Synopsis/ Indicative Syllabus	1. Project proposals and reports in Chinese • Planning and organising project proposals and reports • Explaining the background, rationale, objectives, scope and significance of a project • Referring to the literature to substantiate project proposals • Describing the methods of study • Describing and discussing project results, including anticipated results and results of pilot study • Presenting the budget, schedule and/or method of evaluation • Writing executive summaries./abstracts 2. Oral presentations of projects • Selecting content for audience-focused presentations

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- Choosing language and style appropriate to the intended audience
- Using appropriate transitions and maintaining coherence in team presentations
- Using effective verbal and non-verbal interactive strategies

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<tr><td>Teaching/Learning Methodology</td><td>

<u>Learning and teaching approach</u>

The subject is designed to develop the students' Chinese language skills, both oral and written, that students need to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects.

The study approach is primarily seminar-based. Seminar activities include instructor input as well as individual and group work, involving drafting and evaluating texts, mini-presentations, discussions and simulations.

The learning and teaching activities in the subject will focus on a course-long project which will engage students in proposing and reporting on an engineering-related project to different intended readers/audiences. During the course, students will be involved in:
- planning and researching the project
- writing project-related documents such as project proposals and reports
- giving oral presentations to intended stakeholders of the project

The study plan outlining the allocation of contact hours is attached.

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<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>

<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td></td><td></td><td></td></tr>
<tr><td>1. Project proposal in Chinese</td><td>60%</td><td>✓</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Oral presentation of project proposal</td><td>40%</td><td></td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The assessments will arise from the course-long engineering-related project.

- Students will be assessed on written documents and oral presentations targeted at different intended readers/audiences. This facilitates assessment of students' ability to select content and use language and style appropriate to the purposes and intended readers/audiences.

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	• Students will collaborate in groups in planning, researching, discussing and giving oral presentations on the project. The written proposals will be individual work to ensure that students will be rigorously engaged in the application of language skills for the entire document.	
Student Study Effort Expected	Class contact:	
	▪ Seminars	26 Hrs.
	Other student study effort:	
	▪ Researching, planning, writing, and preparing the project	44 Hrs.
	Total student study effort	70 Hrs.
Reading List and References	a) 路德慶 主編 (1982)《寫作教程》，華東師範大學出版社。 b) 司有和 (1984) 《科技寫作簡明教程》，安徽教育出版社。 c) 葉聖陶 呂叔湘 朱德熙 林燾 (1992) 《文章講評》 語文出版社。 d) 邢福義 汪國勝 主編 (2003)《現代漢語》，華中師範大學出版社。 e) 于成鯤主編（2003）《現代應用文》，復旦大學出版社。	

Subject Description Form

Subject Code	EE2901S
Subject Title	Basic Electricity and Electronics
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the fundamental principles for operating basic electric devices, circuits, and machines applicable to ME students. 2. To introduce the appropriate techniques for analyzing basic electric devices, circuits, and machines. 3. To introduce the appropriate skills and tools for experimenting basic electric devices, circuits, and/or machines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Describe the fundamental principles for operating basic electric devices, circuits, and machines. 2. Apply the appropriate techniques for analyzing basic electric devices, circuits, and machines. 3. Use the appropriate skills and tools for conducting relevant hands-on/simulated experiments and reporting the findings.
Subject Synopsis/ Indicative Syllabus	**DC Electric Circuits** ***Fundamentals*** — How electricity works. Electromechanical analogies. Common Prefixes. Atoms and atomic structure. Basic electric quantities: charge, potential, current, voltage, power, and energy. Resistance, Ohm's law, and resistors. Resistors in series and in parallel. Sign convention. Practical, ideal, independent, and dependent voltage and current sources. Voltage and current dividers. Use of basic test meters: voltmeters, ammeters, ohmmeters, and multimeters. ***Analysis*** — Lumped circuit elements. Network description: branch, node, loop, and mesh. Kirchhoff's voltage and current laws. Tellegen's theorem. Mesh-current and node-voltage methods. Thévenin's and Norton's theorems. Loading effect and maximum power transfer. **AC Electric Circuits** ***Fundamentals*** — The war of the currents. AC versus DC. Time-dependent, periodic, and sinusoidal signals. Sinusoidal sources. Worldwide mains electricity. Peak, average, and root-mean-square values. Inductors and capacitors. Sinusoidal steady-state analysis by time-domain method. Complex number. Euler's identity. Phasors and phasor diagrams. Impedance and admittance. Sinusoidal steady-state analysis by phasor–impedance method. ***Power*** — Power, energy, and electricity bill. Instantaneous and average powers. Power in resistive, inductive, capacitive, and complex loads. Complex power and power factor. Power generation, transmission, and distribution. Three-phase power basics. Single (split)-phase three-wire source. Star (wye)-connected three-phase four-wire source. Star–star and star–delta source–load connections. Star–delta transformations.

Semiconductor Devices and Circuits

Diodes — Semiconductor basics: intrinsic and extrinsic semiconductors, electrons and holes, doping, donors and acceptors, n-type and p-type semiconductors. P–N junction diodes: basic structure, symbol, depletion region, barrier potential, forward bias, reverse bias, ideal current–voltage characteristics, ON and OFF states, ideal diode equation, breakdown characteristics, Zener diodes. Diode circuits: ideal and practical diode assumptions, analysis of basic and specific diode circuits.

Transistors — Bipolar junction transistors (BJTs): transistor basics, basic structures, symbols, BJTs as electric switches and amplifiers, modes of operation, input and output characteristics. BJT circuits: DC equivalent circuits, DC analysis, load line, Q-point, DC biasing schemes.

Electric Machines

Electromagnets and Transformers — Basic principles of electromagnetics: Ørsted's, Ampère's, Faraday's, and Lenz's laws. Magnetomotive force. Magnetic flux. Reluctance. Inductance. Magnetic field energy. Electromagnetic analogies. Electromagnetic structure analysis by magnetic equivalent circuit method. Self- and mutual inductances. Dot conversion. Step-up, step-down, and impedance transformers.

DC Machines — Electric machine basics: DC versus AC machines, motors versus generators. DC machines: basic operations, physical structures, configurations, equations of currents, voltages, speed and torque, steady-state analysis.

Laboratory Experiments *(Two of the following)*:

1. EE2901S-E01: DC Circuit Analysis.
2. EE2901S-E02: Diode Circuit Analysis.
3. EE2901S-E03: Electromagnet and Transformer Analysis.

Teaching/Learning Methodology

Teaching/Learning Methodology	Outcome		
	1	2	3
Lecture	✓	✓	
In-class Practice	✓	✓	
Assignment	✓	✓	
Laboratory			✓

Lecture: Students are introduced to the knowledge of the subject and the comprehension is strengthened with interactive Q&A (outcomes 1 and 2).

In-class Practice: Students apply what they have learnt in solving the problems in the class (outcomes 1 and 2).

Assignment: Students further test and develop their understanding and comprehension of the knowledge by after-class exercises (outcomes 1 and 2).

Laboratory: Students acquire hands-on/simulated experience in using electric devices and test equipment in circuits, apply what they have learnt in the class to experimentally validate the theoretical investigations, and develop the experimental log and report writing skill (outcome 3).

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended learning outcomes to be assessed		
		1	2	3

	Continuous Assessment	50%	✓	✓	✓
	Examination	50%	✓	✓	
	Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.5 × Continuous Assessment + 0.5 × End of Subject Examination

Continuous Assessment covers all intended learning outcomes 1 to 3, while examination involves intended learning outcomes 1 & 2.

Continuous Assessment (50%) contains Assignment (16%), Test (18%), and Laboratory (16%), aiming to provide timely feedbacks to students on various topics of syllabus, including their assignment works, laboratory skills, use of appropriate electric devices & test equipment in circuits, data analysis of experimental results, etc.

Examination (50%) is in form of a three-hour, closed-book, end-of-subject written examination, aiming to assess students' overall understanding and ability of applying the fundamental principles and analysis techniques.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture	30 Hrs.
	▪ In-class Practice	3 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Self-study	41 Hrs.
	▪ Assignment	12 Hrs.
	▪ Laboratory log & report writing	8 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Textbooks:

1. Giorgio Rizzoni and James Kearns, *Principles and Applications of Electrical Engineering*, 6th Edition, Boston: McGraw-Hill Higher Education (2018).
2. Donald A. Neamen, *Microelectronics: Circuit Analysis and Design*, 4th Edition, Boston: McGraw-Hill Higher Education (2010).

Reference books:

1. W. H. Hayt, J. E. Kemmerly, and S. M. Durbin, *Engineering Circuit Analysis*, 8th Edition, New York: McGraw-Hill (2012).
2. A. H. Robbins and W. C. Miller, *Circuit Analysis: Theory and Practice*, 5th Edition, Thomson Learning (2013).
3. R. A. DeCarlo and P. M. Lin, *Linear Circuit Analysis*, 2nd Edition, Oxford University Press (2001).

June 2020

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	ELC3531
Subject Title	Professional Communication in English for Engineering Students
Credit Value	2
Level	3
Pre-requisite / Co-requisite	English LCR subjects
Objectives	This subject aims to develop the language competence for professional communication in English required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals.
Intended Learning Outcomes	Upon completion of the subject, and in relation to effective communication with a variety of intended readers/audiences in English, students will be able to: a. plan, organise and produce professionally acceptable project proposals with appropriate text structures and language for different intended readers b. plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences c. adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences
Subject Synopsis / Indicative Syllabus	1. Project proposal in English • Planning and organising a project proposal • Explaining the background, rationale, objectives, scope and significance of a project • Referring to the current situation or existing literature to substantiate a project proposal • Describing the methods of study • Describing and discussing anticipated project results and (if applicable) results of a pilot study • Presenting the budget, schedule and (if applicable) method of evaluation • Writing an executive summary 2. Oral presentation of project proposal in English • Selecting content for an audience-focused presentation • Choosing language and style appropriate to the intended audience • Using appropriate transitions and maintaining coherence in a team presentation • Using effective verbal and non-verbal interactive strategies
Teaching/Learning Methodology	The subject is designed to develop the English language skills, both oral and written, that students need to use to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects.

The study approach is primarily seminar-based. Seminar activities include instructor input as well as individual and group work, involving drafting and evaluating texts, mini-presentations, discussions and simulations.

The learning and teaching activities in the subject will focus on a course-long project which will engage students in proposing and reporting on an engineering-related project to different intended readers/audiences. During the course, students will be involved in:

- planning and researching the project
- writing project-related documents such as project proposals
- giving oral presentations to intended stakeholders of the project

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c			
1. Project proposal in English	40%	✓		✓			
2. Oral presentation of project proposal in English	60%		✓	✓			
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The assessments will arise from a course-long engineering-related project. Students will collaborate in groups in planning, researching, discussing and giving oral presentations on the project. They will be assessed on written documents and oral presentations targeted at different intended readers/audiences. This facilitates assessment of students' ability to select content and use language and style appropriate to the purposes and intended readers/audiences.

Assessment type	Intended readers/audience	Timing
1. Project proposal in English Each team writes a proposal of 2000-2500 words; and each member writes a report of 200-250 words explaining his/her contribution to the project	Mainly engineering experts	Week 8
2. Oral presentation of project proposal in English Each team delivers a speech (30 minutes for a team of four), simulating a presentation of the final proposal	Mainly non-experts	Weeks 12-13

Student Study	Class contact:	

Effort Expected	Seminars	26 Hrs.
	Other student study effort:	
	Researching, planning and writing the project Rehearsing the presentation	52 Hrs.
	Total student study effort:	78 Hrs.
Reading List and References	1. D. F. Beer, Ed., *Writing and Speaking in the Technology Professions: A practical guide*, 2nd ed. Hoboken, NJ: Wiley, 2003. 2. R. Johnson-Sheehan, *Writing Proposals*, 2nd ed. New York: Pearson/Longman, 2008. 3. S. Kuiper, *Contemporary Business Report Writing*, 4th ed. Mason, OH: South-Western, 2009. 4. M. H. Markel, *Practical Strategies for Technical Communication*. New York: Bedford/St. Martin's, 2016. 5. D. C. Reep, *Technical Writing: Principles, strategies, and readings*, 8th ed. Boston: Pearson/Longman, 2011. 6. E. D. Zanders and L. Macleod, *Presentation Skills for Scientists: A practical guide*, 2nd ed. Cambridge: Cambridge University Press, 2018.	

Subject Description Form

Subject Code	ENG2001
Subject Title	Fundamentals of Materials Science and Engineering
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	1. To realize the impact of the development of engineering materials on human civilization; 2. To enable students to establish a broad knowledge base on the structure and properties of materials for solving engineering problems. 3. To enable students to understand the applications and selection of engineering materials based on the consideration of properties, cost, ease of manufacture, environmental issues and their in service performance.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. comprehend the importance of materials in engineering and society; b. explain the properties and behaviour of materials using fundamental knowledge of materials science. c. apply the knowledge of materials science to analyze and solve basic engineering problems related to stress, strain and fracture of materials; d. select appropriate materials for various engineering applications taking into consideration of issues in cost, quality and environmental concerns.
Subject Synopsis/ Indicative Syllabus	1. <u>Introduction</u> Historical perspective; Evolution of engineering materials; Materials science and engineering; Classification of materials 2. <u>Atomic Structure and Structures of Materials</u> Atomic structure; Bonding forces and energies; Primary interatomic bonds and secondary bonding; Crystalline and non-crystalline materials; Phase diagram and microstructure of alloys 3. <u>Electrical and Optical Properties of Materials</u> Conductors and insulators; Semi-conductor materials; N-type and P-type semiconductors; P/N junction; Light interactions with materials; Light emitting diode (LED) and photovoltaics; Light propagation in optical fibers; Liquid crystal; Photoelasticity

4. Mechanical Properties of Materials
   Concept of stress and strain; Stress-strain behaviour; Elastic and plastic properties of materials; Concepts of dislocations and strengthening mechanisms; Tensile properties; Elastic recovery after plastic deformation; Hardness; Stress concentration; Impact energy, Fracture toughness; Design and safety factors

5. Introduction to Failure Analysis and Prevention
   Fundamentals of fracture: ductile, brittle, fatigue and creep; Corrosion; Nondestructive testing; Techniques for failure analysis and prevention

6. Selection of Engineering Materials
   Characteristics of metallic, polymeric, ceramic, electronic and composite materials; Economic, environmental and recycling issues

Teaching/Learning Methodology

The subject will be delivered mainly through lectures but tutorials, case studies and laboratory work will substantially supplement which. Practical problems and case studies of material applications will be raised as a focal point for discussion in tutorial classes, also laboratory sessions will be used to illustrate and assimilate some fundamental principles of materials science. The subject emphasizes on developing students' problem solving skills.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d		
1. Assignments	15%	√	√	√	√		
2. Test	20%		√	√	√		
3. Laboratory report	5%		√	√			
3. Examination	60%		√	√	√		
Total	100 %						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The assignments are designed to reflect students' understanding of the subject and to assist them in self-monitoring of their progress.

The laboratory report is designed to assess the capability of students in analyzing and reporting experimental data relates to learning outcome (b).

The test and examination are for determining students' understanding of key concepts as well as for assessing their achievement of the learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lectures, tutorials, practical	39Hrs.
	Other student study effort:	
	▪ Guided reading, assignments and reports	37Hrs.
	▪ Self-study and preparation for test and examination	47Hrs.
	Total student study effort	123Hrs.
Reading List and References	1. William D. Callister, Jr., David G. Rethwisch, *Fundamentals of materials science and engineering*, 4th edition, *E-Text* John Wiley & Sons; ISBN: 978-1-118-53126-6 2. William D. Callister, Jr., David G. Rethwisch, *Materials Science and Engineering*, 8th edition, *E-Text* John Wiley & Sons; ISBN: 978-1-118-37325-5 3. Materials World (Magazine of the Institute of Materials, Minerals and Mining)	

Revised (April 2014)

Subject Description Form

Subject Code	ENG2002
Subject Title	Computer Programming
Credit Value	3
Level	2
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	(i) To introduce the fundamental concepts of computer programming (ii) To equip students with sound skills in C/C++ programming language (iii) To equip students with techniques for developing structured and object-oriented computer programs (iv) To demonstrate the techniques for implementing engineering applications using computer programs.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Familiarize themselves with at least one C/C++ programming environment. 2. Be proficient in using the basic constructs of C/C++ to develop a computer program. 3. Develop a structured and documented computer program. 4. Understand the fundamentals of object-oriented programming and be able to apply it in computer program development. 5. Apply computer programming techniques to solve practical engineering problems.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction to programming - Components of a computer; Programming environment; Process of application development. 2. Bolts and Nuts of C/C++ - Preprocessor; Program code; Functions; Comments; Variables and constants; Expressions and statements; Operators. 3. Program Flow Control - Branching and looping; Function parameters passing; Return values; Local and global variables; Scope of variables. 4. Program Design and Debugging - Structured program design; Debugging a program. Case study: Using the Visual C++ debugger. 5. Basic Object Oriented Programming - Objects and classes; Private versus public; Implementing class methods; Constructors and destructors. 6. Pointer and Array - Stack and Free store; Create and delete objects in the free store; Pointer arithmetic; Passing function arguments by pointer; Returning values by pointer; Array of objects; Array and pointer; Array of pointers; Pointer of array; Character array; Command-line processing. 7. Stream I/O - Input and output as streams; File I/O using streams.

Teaching/Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures, supplemented with short quizzes	2,3,4	Students are introduced to the knowledge of computer programming through explanation and illustrative examples. Comprehension of the knowledge is strengthened with short quizzes. Students will be able to monitor the skills of using C/C++ and apply the techniques of developing structured object-oriented applications.
Laboratories/tutorials where problems are given to students for them to solve	1,2,3,4	Students apply what they have learnt in lectures and solve problems in exercises. The purpose is to ensure students have captured the important points. Tutors will aid the lecturer in helping the students finishing the exercises, and interactive Q&A will take place.
Assignment, tests and final examination	1,2,3,4,5	By doing assignment, students will develop a firm understanding and comprehension of the knowledge taught. They will analyse given C/C++ applications and apply knowledge to solve problems. They will have to design solutions by evaluating different alternatives. To enhance the students' problem solving skill in a given programming environment, open-book programming tests are arranged regularly. To assure students' understanding of fundamental concepts, a closed-book final examination is arranged.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
1. In-class exercises	10	✓	✓	✓	✓	
2. Short-quizzes	10		✓	✓	✓	
3. Programming tests	30	✓	✓	✓	✓	✓
4. Assignment	20	✓	✓	✓	✓	✓
5. Final examination	30	✓	✓	✓	✓	✓
Total	100 %					

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The short-quizzes are for assessing the understanding of fundamental concepts. The in-class exercises are conducted to help students familiarized with the programming language and skills. The programming tests are for assessing the ability of students on solving computer problems through programming within a specified period. Through doing assignment, students will be able to experience how to solve computer problems and design solutions by using a systematic approach. The final examination is for assessing the students' ability on using the programming language and analysing computer programs.	
Student Study Effort Expected	**Class contact:**	39 Hours
	▪ Lectures, Tests and Quizzes	26 Hours
	▪ Laboratory/Tutorial	13 Hours
	Other student study effort:	69 Hours
	▪ Self-studying	57 Hours
	▪ Homework	12 Hours
	Total student study effort	108 Hours
Reading List and References	**Reference Books:** 1. S. Rao, *Sams Teach Yourself C++ in One Hour a Day*, 8th ed. Indianapolis, IN: Sams, 2017. 2. P. Deitel and H. Deitel*, C++ How to Program : Introducing the New C++14 Standard*, 10th ed. Boston, MA: Pearson, 2017. 3. R. Cadenhead and J Liberty, *Sams Teach Yourself C++ in 24 hours,* 6th ed. Indianapolis, IN: Sams, 2017.	

(revised) July 2018

Subject Description Form

Subject Code	ENG2003
Subject Title	Information Technology
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	To provide the foundation knowledge in internet applications, computer networks, and database management that is essential to modern information system design
Intended Subject Learning Outcomes	Upon completion of the subject, students will be able to: Category A: Professional/academic knowledge and skills 1. Understand the functions and features of modern computing systems. 2. Understand the client-server architecture and be able to set up multiple internet applications. 3. Understand the principles of computer networks and be able to set up simple computer networks. 4. Understand the basic structure of a database system and be able to set up a simple database system. Category B: Attributes for all-roundedness 1. Solve problems using systematic approaches.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction to computers Introduction to information technology using Internet of Things as a real life example. Introduction to modern computing systems. 2. Computer Networks Introduction to computer networks (Client-Server Architecture). Study different internet applications (HTTP/FTP/DNS). Explain basic concepts on packet routing (Data Encapsulation/IP Addressing/Functions of Routers). Introduction to basic network security measures. 3. Introduction to data processing and information systems Database systems – architecture, relational database concept, structural query language (SQL), database management systems, Web and database linking, database application development. Introduction to Information systems. Workflow management. Case study: Database design, implementation and management.
Teaching/Learning Methodology	There will be a mix of lectures, tutorials, and laboratory sessions/workshops to facilitate effective learning. Students will be given case studies to understand and practice the usage of modern information systems.

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th></tr>
<tr><th>A1</th><th>A2</th><th>A3</th><th>A4</th><th>B1</th></tr>
<tr><td>1. Quizzes (in tutorials)</td><td>3%</td><td>√</td><td>√</td><td>√</td><td></td><td>√</td></tr>
<tr><td>2. Quizzes (in lectures)</td><td>14%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Workshops</td><td>14%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Mid-term Test</td><td>11%</td><td>√</td><td>√</td><td>√</td><td></td><td>√</td></tr>
<tr><td>5. Assignment</td><td>8%</td><td></td><td></td><td></td><td>√</td><td>√</td></tr>
<tr><td>6. Examination</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The assessment methods include an end-of-subject 2-hour written examination (total 50%) and other assessment methods (total 50%), including quizzes, a mid-term test, workshops, and an assignment, which cover intended subject learning outcomes A1, A2, A3, A4, and B1.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lectures (18), tutorials (6), and workshops (15)</td><td>39 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Workshops preparation (6/workshop)</td><td>30 Hours</td></tr>
<tr><td>• Self study (3/week)</td><td>39 Hours</td></tr>
<tr><td>Total student study effort</td><td>108 Hours</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>

1. B. Williams and S. Sawyer, *Using Information Technology: A Practical Introduction to Computers and Communications*, 11th ed., McGraw-Hill, 2014.
2. J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach*, 7th ed., Pearson, 2016.
3. D. E. Comer, *Computer Networks and Internets*, 6th ed., Pearson, 2015.
4. B. A. Forouzan, *TCP/IP Protocol Suite*, 4th ed., Tmh, 2010.
5. W. Stalling, *Data and Computer Communications*, 10th ed., Pearson, 2013.
6. S. Morris and C. Coronel, *Database Systems: Design, Implementation, and Management*, 11th Edition, Course Technology, 2014.
7. M. Mannino, *Database Design, Application Development, & Administration*. 6th ed., Chicago Business Press, 2014.

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(revised) July 2018

Subject Description Form

Subject Code	ENG3003
Subject Title	Engineering Management
Credit Value	3
Level	3
Pre-requisite/Co-requisite/Exclusion	Nil
Objectives	This subject provides students with: 1. A practical introduction to management and a comprehensive guide to the tools and techniques used in managing people and other resources. 2. Opportunities to trace the historical development and describe the functions of management, from planning, and decision making to organizing, staffing, leading, motivating, and controlling. It also includes a discussion on engineering ethics. 3. Opportunities to explore the core business strategy, technology, and innovation, and examine how these functions intertwine to play a central role in structural design, as well as supporting an organization's overall success.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. perform tasks in an organization related to organizing, planning, leading and controlling project and process activities; b. select appropriate management techniques for improving organizational structures, work procedures, and quality performance of operational tasks; c. analyze the factors that affect changes in the work environment, and be aware of the approaches in implementing change in an organization; d. be aware of the imperatives of ethical and business behaviors in engineering organizations in a fast-changing business environment.
Subject Synopsis/Indicative Syllabus	1. <u>Introduction</u> General management concepts in organizations; Functions and types of industrial organizations; Organizational structures; Corporate objectives, strategy, and policy 2. <u>Industrial Management</u> Roles of managers: Process of management, leadership, planning, organizing, motivating, and control of social and engineering activities; Quality management: Related tools and techniques

3. Project Management

Project scope and objectives; Network analysis; Tools that support engineering operations and task scheduling

4. Management of Change

Change leadership; Organizational change; Phases of planned change; Stress management; Factors that affect the execution of change

5. Effects of Environmental Factors

The effects of extraneous factors on the operations of engineering organizations, such as ethics and corporate social responsibilities issues

Teaching/Learning Methodology

A mixture of lectures, tutorial exercises, and case studies are used to deliver various topics in this subject. Some topics are covered by problem-based format whenever applicable in enhancing the learning objectives. Other topics are covered by directed study so as to develop students' "life-long learning" ability.

The case studies, largely based on real experience, are designed to integrate the topics covered in the subject and to illustrate the ways various techniques are inter-related and applied in real life situations.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d		
1. Coursework • Group learning activities (10%) • Presentation (individual) (30%)	40%	✓	✓	✓	✓		
2. Final examination	60%	✓	✓	✓	✓		
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The coursework of this subject involves students working in groups to study cases that reflect the realities of management situations in an engineering setting. Through such exercises, students' ability to apply and synthesize acquired knowledge can be assessed on the basis of their performance in group discussion, oral presentations, and the quality of their written reports on these case studies. A written final examination is also designed to assess the intended learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lectures and review	27 Hrs.
	▪ Tutorials and presentations	12 Hrs.
	Other student study effort:	
	▪ Research and preparation	30 Hrs.
	▪ Report writing	10 Hrs.
	▪ Preparation for oral presentation and examination	37 Hrs.
	Total student study effort	116 Hrs.
Reading List and References	1. John R. Schermerhorn, Jr., 2013, Introduction to Management, 12th Ed., John Wiley 2. Robbins, S P, DeCenzo, D A, and Coulter, M, 2013, Fundamentals of Management Essential Concepts and Applications, 8th Ed., Pearson 3. Morse, L C and Babcock, D L, 2010, Managing Engineering and Technology: an Introduction to Management for Engineers, 5th Ed., Prentice Hall 4. White, M A and Bruton, G D, 2011, The Management of Technology and Innovation: A Strategic Approach, 2nd Ed., South-Western Cengage Learning	

(revised) July 2015

Subject Description Form

Subject Code	ENG3004
Subject Title	Society and the Engineer
Credit Value	3
Level	3
Pre-requisite/Co-requisite/Exclusion	Nil
Objectives	This subject is designed for engineering students as a complementary subject on the role of the professional engineer in practice and their responsibilities toward the profession, colleagues, employers, clients, and the public. The objectives of the subject are to enable students to 1. appreciate the historical context of modern technology and the nature of the process whereby technology develops and the relationship between technology and the environment, as well as the implied social costs and benefits; 2. understand the social, political, legal, and economic responsibilities and accountability of the engineering profession and the organizational activities of professional engineering institutions; 3. be aware of the short-term and long-term effects related to safety and health, and the environmental impacts of technology; 4. observe professional conduct, as well as the legal and other applicable constraints, related to various engineering issues; and 5. develop a strong vision to optimize their contribution to sustainable development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. identify and evaluate the effects of technology as it applies to the social, cultural, economic, legal, health, safety, and environmental dimensions of society; b. explain the importance of local and international professional training, professional conduct and ethics, and responsibilities in various engineering disciplines, particularly the Washington Accord; c. evaluate and estimate, in a team setting, the impact of contemporary issues, planned projects, and unforeseen technological advances related to engineers; effectively communicate and present the findings to laymen and peers.
Subject Synopsis/ Indicative Syllabus	1. <u>Impact of Technology on Society</u> Historical cases and trends of technological innovation explored through their impact on social and cultural developments of civilization and their commonalities.

	2. Environmental Protection and Related Issues Roles of the engineer in energy conservation, ecological balance, and sustainable development. 3. Global Outlook for Hong Kong's Economy and Industries Support organizations, policies and their impacts on industrial and economic development in Greater China, the Pacific Rim, and the world. 4. Regulatory Organizations and Compliance Discussion of engineer's responsibilities within different regulatory frameworks and environments; Examples from various entities such as the Labor Department and the Occupational Health and Safety Council; Legal dimensions to engineering such as liability, contract law, and industrial legislation. 5. Professional Institutions Local and overseas professional institutions; Washington Accord and the qualifications and criteria of professional engineers. 6. Professional Ethics Prevention of bribery and corruption; The work of the Independent Commission Against Corruption (ICAC); Social responsibilities of engineers.
Teaching/Learning Methodology	Class comprises short lectures to provide essential knowledge and information on the relationships between society and the engineer under a range of dimensions. Other methods include discussions, case studies, and seminars to develop students' in-depth analysis of the relationships. Each student will submit two assignments based on their weekly learning activities, which will be part of the subject's evaluation. The assignments will deal with important issues of social, cultural, economic, legal, health, safety, and environmental dimensions of society. Students are assembled into groups; throughout the course, they will work on engineering cases by completing the following learning activities: 1. Case analysis where students explore the relationships between society and the engineering issues of a project under specific dimensions; 2. Construction and assembly of a case portfolio which includes i. Presentation slides ii. Feedback critiques iii. Weekly summary reports iv. A report on Sustainable Development v. Individual Reflections 3. Final oral presentation

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Continuous assessment	70%			
• Group weekly learning activities	(20%)	✓	✓	✓
• Individual Assignments (2)	(20%)	✓	✓	
• Individual final presentation	(15%)	✓	✓	
• Individual reflection statement	(5%)	✓	✓	
• Group project and SD reports	(10%)	✓	✓	✓
2. Examination	30%	✓	✓	
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The coursework requires students to work in groups to study cases from the perspectives of the eight dimensions in an engineering setting. Based on these exercises, students' ability to apply and synthesize acquired knowledge can be assessed through their performance during groups' discussion, oral presentations, and the quality of their portfolio reports on the case studies.

The closed-book examination is used to assess students' critical thinking and problem-solving skills when working on their own.

Student Study Effort Expected

Class contact:	
▪ Lectures and review	27 Hrs.
▪ Presentation	12 Hrs.
Other student study efforts:	
▪ Research and preparation	55 Hrs.
▪ Report and Assignments writing	25 Hrs.
Total student study effort	119 Hrs.

Reading List and References	**Reference Books & Articles:** 1. Education for Sustainable Development - An Expert Review of Processes and Learning, UNESCO, 2011 2. Poel, Ibo van de, and Lambèr M. M. Royakkers. Ethics, Technology, and Engineering : an Introduction. Wiley-Blackwell, 2011 3. Engineering-Issues, Challenges and Opportunities for Development, USECO, 2010 4. Engineering for Sustainable Development: Guiding Principles, Royal Academy of Engineering, 2005 5. Securing the future: delivering UK sustainable development strategy, 2005 6. Johnston, F S, Gostelow, J P, and King, W J, 2000, *Engineering and Society Challenges of Professional Practice*, Upper Saddle River, N.J.: Prentice Hall 7. Hjorth, L, Eichler, B, and Khan, A, 2003, *Technology and Society A Bridge to the 21st Century*, Upper Saddle River, N.J.:Prentice Hall 8. The Council for Sustainable Development in Hong Kong, http://www.enb.gov.hk/en/susdev/council/ 9. Poverty alleviation: the role of the engineer, http://publications.arup.com/publications/p/poverty_alleviation_the_role_of_the_engineer **Reading materials:** Engineering journals: - Engineers by The Hong Kong Institution of Engineers - Engineering and Technology by The Institution of Engineers and Technology Magazines: Time, Far East Economic Review Current newspapers: South China Morning Post, China Daily, Ming Pao Daily

(revised) July 2019

Subject Description Form

Subject Code	ENG4001
Subject Title	Project Management
Credit Value	3
Level	4
Pre-requisite/Co-requisite/Exclusion	Nil
Objectives	This subject provides students with knowledge in: 1. project management tools in business organizations, taking into account the time-cost relationships, resources, processes, risks, the project life cycle, organization, and management principles; 2. project management methodologies and their application; 3. choosing project variables for effective project management; and 4. various developments of project management.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. demonstrate good understanding of definition of a project, the characteristics and project life cycle; b. identify appropriate project variables and practices that are applicable to engineering projects; c. perform project planning, cost/resources estimation, evaluate and monitor of project progress; and d. propose project management solutions, taking into consideration the project objectives and constraints.
Subject Synopsis/ Indicative Syllabus	1. <u>Project Overview, Management Principles, and the Systems Approach</u> Characteristics of projects and project management. Management principles. Project organization. Team development. Systems concepts and principles. Conflict management. 2. <u>Project Methodologies and Planning Techniques</u> Constraints: time, cost, and technical performance. Work breakdown structure. Management of scope. Scheduling tools: Gantt charts, network analysis techniques, time-phased networks, CPA, PERT, and resource smoothing. 3. <u>Cost Estimation and Cost Control for Projects</u> Types of estimates. Budgeting project costs. Experience curve. Cost schedules and forecasts. Cost control systems. 4. <u>Evaluation and Control of Projects</u> Earned value measurement system. Managing project risks. Status reporting. Project closeout and termination.

Teaching/Learning Methodology

A mixture of lectures, tutorial exercises, case studies, and laboratory work are used to deliver the various topics in this subject. Some material is covered using a problem-based format where this advances the learning objectives. Other material is covered through directed study to enhance the students' "learning to learn" ability. Some case studies are from best practices of projects, based on a literature review. They are used to integrate the topics and demonstrate to students how the various techniques are interrelated and applied in real-life situations.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Tutorial exercises/ written report	10%		✓	✓	
2. Oral presentation	10%		✓	✓	
3. End Term Test	15%	✓	✓	✓	
4. Written examination	65%	✓	✓	✓	✓
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Continuous assessment (1), (2), and (3): Test, written reports, oral presentation, and tutorial exercises are used to assess students' understanding and application of the knowledge that they have learnt relative to learning outcomes (a), (b) and (c).

Written examination: questions are designed to assess learning outcomes (a), (b), (c), and (d).

Student Study Effort Expected

Class contact:	
▪ Lectures 3 hours/week for 9 weeks	27 Hrs.
▪ Tutorials / Case studies 3 hours/week for 4 weeks	12 Hrs.
	39 Hrs.
Other student study effort:	
▪ Preparation for assignments, short tests, and the written examination	79 Hrs.
Total student study effort	118 Hrs.

Reading List and References	1. Meredith JR and Mantel SJ, 2010, *Project Management: a Managerial Approach*, Wiley, Hoboken NJ 2. Kerzner, H 2009, *Project Management: a Systems Approach to Planning, Scheduling, and Controlling*, John Wiley, New York 3. Smith, NJ (ed.) 2008, *Engineering Project Management*, Blackwell, Oxford

(Revised) August 2019

Subject Description Form

Subject Code	ME22003
Subject Title	Visualization and Communication in Design Engineering
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enhance the students' three-dimensional visualization skills and equip them with range of visual communication tools; and 2. To provide students with fundamental understanding of the engineering design process.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate the qualities of a well-designed product and have awareness of the need of specific disciplinary knowledge to develop functional products that meet customer's and manufacturer's need; b. Communicate engineering design details with confidence using range of visualization and communication tools including hand-sketching, CAD geometric models, mechanism simulations, engineering drawings and physical prototypes; c. Work in a team to modify or improve an existing consumer product; and d. Apply project management techniques in meeting planned schedule.
Subject Synopsis/ Indicative Syllabus	***Appreciation of Design Engineering*** – Characteristics of good design, customer's perspective, manufacturer's perspective, role of materials, investigation of manufacturing methods, skills of a design engineer, examples of successful design. ***Creativity and Design process*** – What is design? Basic introduction to engineering design process, creativity in design, Visual thinking (brainstorming, concept mapping) and its relationship with design innovation, applications of computer in design. ***Visualization and Communication techniques for Design Engineering*** – hand-sketching, 3-D solid modelling, assembly modeling and simulation, engineering drawings, prototyping (virtual prototypes, 3-D printing, physical prototypes). ***Working in a Team Environment*** – Multi-disciplinary project team: its importance in modern industry/community. Functions of design project team: team roles, design logbook, project scheduling, review and assessment of design stages, project outcome communication including interim report, oral presentation, final report and prototype presentation.

Teaching/ Learning Methodology

This introductory course aims at arousing students' interest in design engineering and related skills important for engineering design. It also aims at developing interest and curiosity in all relevant subsequent subjects. Students are learnt to appreciate the qualities of well-designed products through direct interaction with the products. The importance of design visualization and communication will be experienced with in-class group/individual activities. Design communication tools including hand- sketching, CAD geometric modeling, mechanism simulation, engineering drawings, and 3D printing will be introduced with the use of real product examples. The focus of software introduction is not mere training but education in fundamentals to equip the students with sound skills for lifelong career.

The intended learning outcomes of the subject are mainly achieved through a group design improvement project. Students will work in groups of 4-5 members. All the learning activities, including CAD skill development are centered around a product given to each student group. Students begin the learning by studying the function, design features, materials, manufacturing methods, technology, etc. of the product. They then develop visualization techniques by sketching the product. The product is then dissected to learn about the internal mechanisms, take part measurements and develop CAD geometric models. The geometric model is used for assembly and mechanism visualization, basic design analysis and use creativity techniques to make a simple design improvement to improve the product function/cost reduction/improve its aesthetic qualities, etc. The details of the final design are then presented using different visualization and communication techniques such as photo rendering, 3-D printed physical models, hand crafted models, and 2-D engineering drawings. Final outcome will be presented orally and through a written technical report.

Following is the suggested study plan:

Week 1	Introduction of the subject and the mini team-project
Week 2	Appreciation of design engineering; Introduction to solid modelling: Part modelling
Week 3	Creativity and design process; Introduction to solid modelling: Assembly modelling and 2-D Engineering documentation
Week 4	Practice and consultation: (for weeks 1, 2 & 3 including planning of the mini team- project)
Week 5	Solid Modelling with mechanism
Week 6	Surface Modelling and sheet metal modelling
Week 7	Practice and consultation: (for weeks 5 & 6 including checking milestones of the mini team-project)
Week 8	Basic simulation of mechanism motion
Week 9	Basic Structural/static analysis
Week 10	3-D printing and Solid Modelling with photo rendering
Week 11-13	Practice and consultation: (to complete and present the mini team-project)

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Individual assignments	30%	√	√		
2. Group assignments	20%	√	√	√	
3. Oral communication: Group oral presentation	20%	√	√	√	
4. Written communication: Group technical report (with peer evaluation)	30%	√	√	√	√
Total	100 %				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment: 1.0 x Continuous Assessment

Written examination is not suitable for this course since a specific set of knowledge is not the intended learning outcome. Focus is more on the skill development, critical thinking and creativity improvement. Individual assessment of students can be achieved through individual assignments, oral presentation and peer evaluation. Project assessment consists of an oral presentation and a written report. The assessment is performed by a panel of assessors that includes guest assessors from the industry. Project assessment is mainly based on the performance of the whole project group to encourage team spirit. Intra-group peer evaluation is performed to elicit the individual contribution for project activities.

Student Study Effort Expected

Class contact:	**Time**
▪ Lectures	15 Hrs.
▪ Small group activities/Workshops/Consultations	24 Hrs.
Other student study effort:	**Time**
▪ CAD and sketching skills development	40 Hrs.
▪ Independent study and homework	20 Hrs.
▪ Project	20 Hrs.
Total student study effort	**119 Hrs.**

Reading List and References	1. D.K. Lieu and S. Sorby, Visualization, Modeling, and Graphics for engineering Design, CENGAGE Learning, Latest Edition. 2. M.N. Horenstein, Design Concepts for Engineers, Prentice Hall, latest edition. 3. T. Taura, Creative design engineering : introduction to an interdisciplinary approach, Academic Press, Latest Edition.

Modified July 2017

Subject Description Form

Subject Code	ME23001
Subject Title	Engineering Mechanics
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AP10005 Physics I
Objectives	To provide students the fundamental mechanics concepts of equilibrium and motion for rigid structural systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the fundamental knowledge of mechanics to solve for forces and moments in simple systems. b. Distinguish the basic differences between diverse engineering systems and select the suitable design in achieving the engineering purposes. c. Employ engineering mechanics to solve the problems encountered in assignments and projects. d. Collaborate with peers in experiments and projects and present effectively the results of experiment or project.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Mechanics*** **-** Basic concepts of mechanics; Scalar and vectors: Vector algebra and vector components; Position, unit of force vectors; Two and three-dimensional force systems; Moment of a force about a point; Moment of a force about a line. ***Statics*** **-** Equilibrium of a particle and the associated free-body diagrams; Equilibrium of a rigid body and the associated free-body diagram; Two and three force members equilibrium in three dimensions; Simple trusses: the method of joints; the method of sections; zero-force members; Internal forces developed in structural members; Shear and moment equations and diagrams in structural members; Relations between distributed load, shear and moment; Theory of dry friction; Systems with friction; Wedges; Belt friction; Rolling resistance. ***Equivalent Systems*** **-** Determination of the resultant concurrent forces; Equivalent force/couple systems; Centre of gravity and centroid: by composite parts, by integration; Resultant of a general distributed force system; Moment of inertia of areas; Parallel-axis theorem for an area; Radius of gyration of an area; Calculation of moments of areas: by composite areas, by integration; Product of inertia for an area; Principles of virtual work. ***Dynamics*** **-** Kinematics and kinetics of particles; rectilinear motion; plane curvilinear motion; relative motion; equation of motion.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to the topics as described in the section subject synopsis (Outcomes a, b and c).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a, b and c).

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes c and d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Tutorial	√	√	√	
Experiment/Projects			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignment	20%	√	√	√	√
2. Test	20%	√	√	√	
3. Examination	60%	√	√	√	
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.60 \times$ End of Subject Examination + $0.40 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, assignments and laboratory/project reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/Laboratory/Projects	6 Hrs.
Other student study effort:	
▪ Course work	23 Hrs.
▪ Self-study	43 Hrs.
Total student study effort	105 Hrs.

Reading List and References	1. R.C. Hibbeler, Engineering Mechanics – Statics, Prentice Hall, latest edition. 2. A. Pytel, J. Kiusalaas, Engineering Mechanics – Statics, Stamford, CT: Cengage Learning, latest edition.

Revised June 2020

Subject Description Form

Subject Code	ME31001
Subject Title	Dynamics and Vibrations
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME23001 Engineering Mechanics
Objectives	To teach students basic concepts of rigid body planar motion and mechanical vibration.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve planar motion problems in rigid body dynamics by applying knowledge of dynamic analyses and mathematics. b. Formulate and solve vibration problems in single DOF mechanical systems by applying knowledge of vibration theory and mathematics. c. Analyse and interpret data obtained from experiments in dynamics and vibrations. d. Present effectively in completing written reports of laboratory work.
Subject Synopsis/ Indicative Syllabus	***Dynamics*** **-** *Plane kinematics of rigid bodies*, rotation, absolute motion, relative velocity, instantaneous centre of zero velocity, relative acceleration, motion relative to rotating axes. *Plane kinetics of rigid bodies*, force, mass and acceleration, general equation of motion, applications, e.g., four-bar linkage and slider-crank mechanisms, gear trains, work and energy, impulse, momentum, impulse-momentum equations, impact and applications and whirling of rotating shafts. ***Vibration of a Single-degree-of-freedom System*** **-** Free vibration of particles, equation of motion, damping effects, forced vibration of particles, vibration of rigid bodies, energy methods, computer simulations of the free and forced vibration response of a single-degree-of-freedom system. **Laboratory Experiment** There is one 2-hour laboratory session. Typical Experiments: 1. Gear train experiment 2. Forced vibration 3. Whirling of shaft

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for understanding dynamics and single-degree-freedom vibration systems. Theories and examples will be presented to cover the syllabus on kinematics and kinetics of rigid bodies; equation of motions, work and energy, impulse and momentum, and one DOF vibrations. (Outcomes a and b)

Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skills of solving different engineering problems using the knowledge of dynamics and single-degree-freedom vibration systems. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a and b)

Experiments will provide students with experience on gear train systems, forced vibration systems and whirling of shafts. These experiments are designed to train students how to apply theories to practical applications, how to analyze and present experimental data. (Outcomes c and d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		
Laboratory			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Class test	30%	√	√		
2. Homework	15%	√	√		
3. Laboratory	5%			√	√
4. Examination	50%	√	√		
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability to apply the concepts. It is supplemented by the tests, assignments and laboratory report which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected	Class contact:	
	▪ Lecture	31 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Reading and review	45 Hrs.
	▪ Homework assignment	22 Hrs.
	▪ Laboratory report	6 Hrs.
	Total student study effort	112 Hrs.
Reading List and References	1. F.P. Beer and E.R. Johnson, Vector Mechanics for Engineers: Dynamics, McGraw-Hill, latest edition. 2. J.L. Meriam and L.G. Kraige, Engineering Mechanics, John Wiley, latest edition. 3. S. Graham Kelly, Fundamentals of Mechanical Vibrations, McGraw Hill, latest edition. 4. W.T. Thomson, Theory of Vibration with Applications, Prentice Hall, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME31002
Subject Title	Linear Systems and Control
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31001 Dynamics and Vibrations
Objectives	To teach students time and frequency responses of dynamic systems to different inputs and the feedback control of such systems using PID controllers
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Model physical elements in dynamic systems and find the transfer function of a system comprising mechanical and other physical components. b. Predict the output response of a first- or second-order system both in time and frequency domains subject to typical input signals. c. Complete a given task in linear system control, such as an assignment or a project, by applying concepts in dynamics and control systems. d. Analyze and interpret the data obtained from a control experiment. e. Design a first-order and second-order system with suitable parameters and/or PID controller that will be stable and has the required system performance.
Subject Synopsis/ Indicative Syllabus	***Dynamic Responses of First-Order and Second-Order Systems*** **-** Mathematical modelling of system elements, interconnection of elements in systems by differential equations, parameters of first-order and second-order systems, system response analysis due to step, ramp and impulse inputs using Laplace transform, simulation of dynamic systems using Matlab. ***Frequency Response of First-Order and Second-Order Systems*** **-** Harmonic response, Bode diagrams, frequency domain specifications, frequency response applications. ***Introduction to Feedback Control*** **-** Analysis of open-loop and closed-loop systems, transfer functions and block diagrams, time-domain specifications, system stability analysis, time-domain analysis of control systems. ***Feedback Control Systems*** **-** Automatic controllers, basic P, PD, PID controllers, Routh-Hurwitz stability criterion, numerical computations for the frequency-domain analysis of dynamical systems. **Laboratory Experiment** There are two 2-hour laboratory sessions. Typical Experiments: 1. Digital simulation of feedback control systems 2. DC servomechanism 3. Water level control

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for understanding and analyzing feedback control systems. (Outcomes a, b, c and e)

Tutorials aim at enhancing analytical skills of students. Examples on system modeling, transient and frequency response of dynamic systems, and performance and stability of control systems will be involved. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a, b, c and e)

Experiments will provide students with hands-on experience on the instrumentation and measurement of physical variables such as motor speed and water level, and their control. It also trains students in the analysis and presentation of experimental data. (Outcome d)

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√		√
Tutorial	√	√	√		√
Experiment				√	

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Class test	25%	√	√	√		√
2. Homework	15%	√	√	√		√
3. Laboratory report	10%				√	
4. Examination	50%	√	√	√		√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Assignments, laboratory reports, and tests are adopted in continuous assessment on students' timely feedback to and on-going understanding of the course. Students' overall understanding of the course and ability in applying the delivered knowledge are further assessed through a formal examination.

Student Study Effort Expected	Class contact:	
	▪ Lecture	31 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Self-study	45 Hrs.
	▪ Homework assignment	20 Hrs.
	▪ Laboratory report	8 Hrs.
	Total student study effort	112 Hrs.
Reading List and References	1. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition. 2. N.S. Nise, Control Systems Engineering, John Wiley, latest edition. 3. C.L. Phillips and R.D. Harbor, Feedback Control Systems, Prentice-Hall, latest edition. 4. M.R. Driels, Linear Control Systems Engineering, McGraw-Hill, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME31003
Subject Title	System Dynamics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME23001 Engineering Mechanics
Objectives	To provide students the knowledge in modeling and solving different dynamic systems including plane kinematics and kinetics of rigid bodies through theoretical and mathematical principles.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Construct and analyze the dynamic models of different systems by applying knowledge of physical laws and mathematical techniques. b. Formulate and analyze the translational and rotational motions of mechanical systems by applying knowledge of rigid body dynamics. c. Complete a given task in modeling and analysis of dynamic systems such as an assignment or a project by applying concepts and knowledge in system dynamics, mathematical and simulation tools. d. Present effectively in completing written reports of a given task.
Subject Synopsis/ Indicative Syllabus	***Dynamics*** - *Plane kinematics of rigid bodies*, translation and rotation, relative velocity, instantaneous centre of zero velocity, relative acceleration, motion relative to rotating axes. *Plane kinetics of rigid bodies*, force, mass and acceleration, general equation of motion, applications, e.g., four-bar linkage and slider-crank mechanisms, principles of work, energy, impulse and momentum. ***Modelling of Linear Systems*** **–** Dynamic equations of multi-degrees-of-freedom spring-mass-damper systems, and other systems; introduction to Laplace transform and analysis of vibration systems; block diagram construction and simplification; Transfer functions; Characteristic equations, Zeros and poles; Transient responses of 1^{st} and 2^{nd} order systems.
Teaching/Learning Methodology	Lectures aim at providing students with an integrated knowledge required for understanding and analyzing the dynamics of rigid bodies and systems. (Outcomes a to c) Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skill of modeling dynamic systems and determining their responses. (Outcomes a to c) Assignments aim at providing opportunities for students to apply concepts and knowledge in system dynamics and mathematical tools in solving real-world problems. The project aims at providing opportunities for students to design/enhance a real-life product or system using the knowledge they acquired in the class. (Outcomes a to d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Tutorial	√	√	√	
Task (Assignments, Project)	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Class test	20%	√	√		
2. Assignments	10%	√	√	√	
3. Project	20%			√	√
4. Examination	50%	√	√		
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

The continuous assessment includes three components: closed-book tests (20%), assignments (10%), and a project (20%). The closed-book tests aim at assessing the interim knowledge gained by the student. The assignments aim at assisting the students in preparation for the tests and checking the progress of their study. The project aims at integrating the knowledge through a design project.

The examination will be used to assess the knowledge acquired by the students for understanding and analyzing the problems, critically and individually, related to modeling and analysis of linear dynamic systems.

Student Study Effort Expected

Class contact:	
▪ Lecture	32 Hrs.
▪ Tutorial	7 Hrs.
Other student study effort:	
▪ Reading and review	36 Hrs.
▪ Homework assignment and project	30 Hrs.
Total student study effort	105 Hrs.

Reading List and References	1. F.P. Beer and E.R. Johnson, Mechanics for Engineers: Dynamics, McGraw-Hill, latest edition. 2. J.L. Meriam and L.G. Kraige, Engineering Mechanics, John Wiley, latest edition. 3. N.S. Nise, Control Systems Engineering, Wiley, latest edition. 4. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition.

Revised March 2017

Subject Description Form

Subject Code	ME32001
Subject Title	Manufacturing Fundamentals
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME22001 Engineering Design Fundamentals, or ME32002 Engineering Design Fundamentals, and ME23001 Engineering Mechanics
Objectives	To provide students with the fundamental knowledge of manufacturing processes and to teach students on how to apply manufacturing processes in product design and development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the basic working principles and rationales of common manufacturing processes and the related tooling for product development. b. Select appropriate manufacturing processes for product fabrication at up-front design stage. c. Present the completed mini-project related to manufacturing.
Subject Synopsis/ Indicative Syllabus	***Machining*** **-** The principle, operation, mechanisms and the related machines of boring, drilling, facing, grinding, milling, planning, turning, sawing, ECM and EDM. ***Finishing*** **-** The principles and realization of anodizing, honing, painting, plating and polishing and their related facilities. ***Bulk Plastic Deformation*** **-** The principles, rationales and realization related to facilities of extrusion, forging, rolling, bar drawing, wire drawing processes. ***Sheet Metal Forming*** **-** The principles, design rationales and the process realization of drawing, blanking, bending, punching, shearing and spinning processes. ***Casting*** **-** The operation, realization and principles of die casting, investment casting, permanent mold casting, sand casting, and centrifugal casting. ***Polymer Processing*** **-** The process, principles and the realization of blow molding, casting, compression molding, extrusion, injection molding, and thermoforming. ***Assembly*** **-** Introduction to the process principle of welding (fusion, brazing & soldering, solid state), adhesive bonding and mechanical fastening. Process determination, die and tooling design, plastic deformed components design and product quality for bulk metal forming, sheet metal forming, casting and polymer processing.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge related to conventional and advanced manufacturing processes. (Outcomes a – b).

Tutorials and case studies are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a – c).

Mini-project/study report is used to enhance the understanding and use of the learned knowledge (Outcomes a – c).

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	
Tutorials	√	√	√
Mini-project	√	√	√
Study report	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Test and quizzes	20 %	√	√	
2. Mini-project report	15 %	√	√	√
3. Presentation of the mini-project	15 %	√	√	√
4. Examination	50 %	√	√	
Total	100 %			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.5 \times$ End of Subject Examination + $0.5 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the test, quizzes, mini-project report and presentation which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected

Class contact:	
▪ Lecture and seminar	33 Hrs.
▪ Tutorial	6 Hrs.
Other student study effort:	
▪ Performing mini-projects/study report	20 Hrs.

	▪ Course work	23 Hrs.
	▪ Literature search and private study	22 Hrs.
	Total student study effort	104 Hrs.
Reading List and References	1. S. Kalpakjian, S. Schmid, manufacturing engineering and technology, Prentice Hall, latest edition. 2. B. Benhabib, Manufacturing: Design, Production, Automation and Integration, Marcel Dekker, latest edition. 3. J.Y.H. Fuh, Y.F. Zhang, A.Y.C. Nee, M.W. Fu, Computer-aided injection mold design and manufacture, Marcel Dekker, Inc, latest edition. 4. Jiri Tlusty, Manufacturing processes and equipment, Prentice Hall, latest editon. 5. Robert H. Wagoner, Jean-Loup Chenot, Fundamental of metal forming**,** New York: Wiley, latest editon. 6. MW Fu, Design and development of metal-forming processes and products aided by finite element simulation, Springer, 2017	

Revised August 2017

Subject Description Form

Subject Code	ME32002
Subject Title	Engineering Design Fundamentals
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME22003 Visualization and Communication in Design Engineering
Objectives	To provide students with an extensive knowledge in product design and development process, and professional obligations of an engineer with the use of real world open-ended engineering problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify, formulate and solve engineering design problems and search for design related/needed data, information and knowledge for decision-making and design solution generation in product design and development. b. Explore up-to-date information on product design, materials and manufacturing processes. c. Recognize the design for X, human factors/ergonomics, product safety and reliability, and the professional and ethical responsibilities in product design and development. d. Use different modes of communications effectively to present outcomes of design activities.
Subject Synopsis/ Indicative Syllabus	***Overview of Design Process*** - Design problem formulation, identifying product function and establishing engineering specifications, generating and evaluating design alternatives, detail design, product testing and prototyping, communicating the design outcome: virtual/physical prototypes, engineering drawings, oral and written reports ***Types of Design Problems –*** Selection design, configuration design, variant design, adaptive design, original design, redesign ***Design of Common Mechanical Components –*** Load and stress analysis, material selection, strategies for failure prevention, safety factors, overview and design/selection design of common engineering components (gears, bearings, couplings, belt and train drives, shafts, keys, springs, etc.) ***Design for X –*** Design for manufacture, assembly, tolerance, affordability, safety & reliability, quality, environment, human factors / ergonomics ***Cost Estimation in Design Engineering –*** Time value of money, design to cost, cost and price estimation, break-even economics ***Ethics in Design –*** Professional obligations, codes of ethics

Teaching/Learning Methodology

This subject provides students with the opportunity to develop essential skills required for a professional design engineer and understanding of key concepts through activity-, project-, and problem-based (APPB) learning approach. APPB-learning challenges students to continually hone their interpersonal skills, creative abilities and understanding of the design process. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.

Lectures are used to deliver the fundamental knowledge related to product engineering design and development (Outcomes a – c).

Group/individual design activities and case studies are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a – c).

Group project is used to apply concepts learned to develop design solution/s for real-world open-ended engineering problem and enhance team-working skills, communication skills, project management skills, etc. (Outcomes a – d).

Assessment Methods in Alignment with Intended Learning Outcomes

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Small group activities	√	√	√	√
Project	√	√	√	√
Homework/assignment	√	√	√	√

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Group Project a. Individual concept solutions b. Final group report c. Group oral presentation d. Peer and facilitator evaluation	60 %	√	√	√	√
2. Homework/Assignments	15 %	√	√	√	√
3. Test	25 %	√	√	√	
Total	100 %				

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 1.0 x Continuous Assessment The group project is intended to be carried out by student groups of 3-4 members. The outcome of the group design project is presented orally in group oral presentation and in a detailed design project report. Other than the contribution for group activities each student in the group need to develop individual conceptual designs which will be assessed individually. Peer and facilitator assessments will be used to decide the individual contribution by group members for project activities. Individual homework assignments are used to enhance students' comprehension and assimilation of selected design concepts. Test is adopted for assessment of individual student's overall understanding and the ability of applying engineering design concepts.	
Student Study Effort Required	Class contact:	
	▪ Lectures	24 Hrs.
	▪ Small group activities/ Workshops/ Consultations	15 Hrs.
	Other student study effort:	
	▪ Reading and review	20 Hrs.
	▪ Homework assignment	20 Hrs.
	▪ Project	40 Hrs.
	Total student study effort	119 Hrs.
Reading List and References	1. C.L. Dym and P. Little, Engineering Design – A Project-Based Introduction, Jon Wiley & Sons, latest edition 2. D.G. Ullman, The Mechanical Design Process, McGraw Hill Education, latest edition 3. R.J. Eggert, Engineering design, Prentice Hall, latest edition. 4. B. Hyman, Fundamentals of Engineering Design, Prentice Hall, latest edition. 5. George E. Dieter, Engineering Design, McGraw-Hill International Editions, latest edition. 6. G. Pahl and W. Beitz, Engineering Design-A systematic approach, Springer, latest edition. 7. R.C. Juvinall, Fundamentals of machine component design, John Wiley & sons, latest edition 8. J.A. Collins, Mechanical design of machine elements and machines: a failure prevention perspective, John Wiley & sons, latest edition	

Revised March 2017

Subject Description Form

Subject Code	ME32101/ ME3S01
Subject Title	Engineering Design for the Community
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Fundamental knowledge in Design and Engineering Science
Objectives	The objectives of this subject are to: 1. Introduce to students the concept and practice of service learning. 2. Raise students' awareness of social issues in Hong Kong and educate them on the challenges and needs of underprivileged communities in Hong Kong. 3. Develop a systemic platform to facilitate engineering/design students to apply their knowledge/skills to serve the community. 4. Reinforce the students' problem solving skill through real-life design projects. 5. Enhance students' generic competencies of innovative problems solving, communication and teamwork. 6. Nurture students' sense of social awareness, responsibility and engagement.
Intended Learning Outcomes	Upon the completion of the subject, the students will be able to: 1. Concept and Practice of Service Learning a) Link their service learning activities and experiences with academic content of the subject. b) Demonstrate empathy for people in need and a strong sense of civic responsibility. c) Evaluate people's needs by considering the complex issues in the service setting. d) Understand the role and responsibility both as a professional in their chosen discipline and as a responsible citizen. e) Function effectively in a multi-disciplinary team. 2. Discipline-specific Concepts, Issues and Skills f) Identify and formulate a design problem by developing design specifications to achieve the planned goals.

	g) Apply knowledge of design, mathematics and engineering science to analyze and predict the life-cycle performance of a design. h) Assess the impacts of various factors including, materials, human, environment, safety and reliability of a design.
Subject Synopsis/ Indicative Syllabus	The topics in the course syllabus cover three major areas: 1. Concept and Practice of Service Learning (i) Understand the social responsibility (ii) Proper attitude and behaviours in service delivery (iii) Reflection as a tool for learning (iv) Ethical issues in service learning 2. Discipline-Specific Concepts, Issues and Skills Fundamental knowledge of engineering design for problem solving including: (i) Problem identification and analysis (ii) Develop a design project with the goal to solve the problem (iii) Develop design specifications (iv) Design for ergonomics (v) Application of materials (vi) Use of common engineering components (vii) Design for reliability, safety and environmental-friendly (viii) Proper use of engineering/computational tools to conduct the design project 3. Project-Specific Concepts, Issues and Skills Knowledge about and understanding of an identified target group of the community including: (i) Their human psychology and behavior - Human psychology and behavior focuses on the human factors that affect the elderly daily life operation. It involves their feeling in dealing with common tasks, their sensory and motion, their reaction to different materials. (ii) Social problems related to and social services provided for them (iii) Primary health and social care available (iv) Market situation for the possible preferable product
Teaching/Learning Methodology	The following teaching and learning methodology will be used for the first and second offerings of the subject and then reviewed before it is continued to offer: 1. E-learning of service learning (10 hours)

2. Project-Specific Lectures, Tutorials, Seminars and/or Workshop

- Study the psychology and behavior of the identified target group (1 lecture)
- Understand public information in relation to the problems of the identified target group (1 lecture)

3. Service Learning Project

- Identification of a target group at the beginning, during and at the end of the entire project to complete the following tasks (40 hours):
  (i) Identify the need for a design project
  (ii) Modify the design with input from the identified target group
  (iii)Train the identified target group to use the end product
- Discuss with different professionals related in the field (2 lectures)
- Develop and complete a design project to serve the identified target group in solving their problems which includes the following activities:
  (i) Visits and workshops
  (ii) Literature search and self-study
  (iii) Design team group discussions
  (iv) Consultations and discussions with professionals
  (v) Written report and oral presentation

Examples of organizations that students may work with are:

- The Hong Kong Senior Citizen Association (HKSCA)
- The Hong Kong Government Elderly Commission
- The Institution of Mechanical Engineers, Hong Kong Branch

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods /tasks	% weighting	Intended subject learning outcomes to be assessed							
		a	b	c	d	e	f	g	h
1. E-learning Module and Project-specific seminars and workshops (individual)	20	√	√			√	√	√	
2. Reflective Journal/report (individual)	30	√					√	√	√
3. Final Report (group) • Problem solving skill • Ability to assess	30	√	√	√	√	√	√	√	√

alternative design • Report writing skill • Helping prototype making • Providing service • Oral presentation										
4. Performance in Rendering Service (individual)	20	√	√	√				√		
Total	100 %									

The students are expected to apply their knowledge and skills in performing an engineering design project to provide service to an identified target group, therefore their performance in both the service learning project and the engineering design project will be assessed.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes are shown below:

- In the preliminary report (group report), students will present their understanding of the community need and responsibility in performing the design task, as well as the appropriateness of the direction, goals and specifications of the design project.
- Making use of the reflective journal (individual writing), students are able to further elaborate the objectives of the design task in relation to provide service to an identified target group of the community and to demonstrate empathy for people in need and a strong sense of civic responsibility.
- In addition to those outcomes fulfilled by the preliminary report, students are expected to apply knowledge of design, mathematics and engineering science to analyze and predict the life-cycle performance of their design in the final report (group report). They are also required to consider the impacts of various factors including, materials, human, environment, safety and reliability of a design. In the oral presentation (group presentation), students' ability to explain precisely and concisely on their contribution will be assessed. Due to the time constraint, the technical details including problem formulation and analysis may not be emphasized.
- The students' attitude and performance in the rendering of service, their degree of engagement with the service recipients, their collaboration with other students, and interactions with the service recipients and/or collaborating NGOs are obviously indicators of their ability to communicate effectively with clients and stakeholders, their sense of responsibility, professional ethics and their empathy for people in need.
- Because of the nature of the subject, written examination seems not necessary.

Student Study Effort Expected	Class contact:	
	▪ Lectures and seminars	13 Hrs.
	▪ e-learning of service learning	10 Hrs.
	▪ Workshops	8 Hrs.
	▪ Discussions and consultations	8 Hrs.
	Other student study effort:	
	▪ Visits to the identified target group at different stages of the project	40 Hrs.
	▪ Literature review and marketing survey	9 Hrs.
	▪ Prepare preliminary report, final report, reflective journal and oral presentation, and Participate in prototype fabrication.	30 Hrs.
	▪ Self studying	10 Hrs.
	Total student study effort	**128 Hrs.**
Reading List and References	1. Mandell, B.R. and Schram, B., An introduction to human services: policy and practice, Pearson, latest edition. 2. Schriver, J.M., Human behavior and the social environment: shifting paradigms in essential knowledge for social work practice, Allyn and Bacon, latest edition. 3. Wayne, J.H., The social services: an introduction, F.E. Peacock Publishers, latest edition. 4. Ulrich, K.T., Product design and development, McGraw-Hill, latest edition. 5. Budynas, R.G. and Nisbett, J.K., Shigley's mechanical engineering design, McGraw-Hill, latest edition. 6. Boothroyd, G., Dewhurst, P. and Knight, W.A., Product design for manufacture and assembly, Boca Raton, CRC Press, latest edition. 7. Szalma, J.L. (2009). Individual differences in human-technology interaction: Incorporating variation in human characteristics into human factors and ergonomics research and design. Theoretical Issues in Ergonomics Science, 10(5), 381-397. doi: 10.1080/14639220902893613 8. Wickens, C.D., & Kramer, A. (1985). Engineering Psychology. Annual Review of Psychology, 36(1), 307-348. doi: doi:10.1146/annurev.ps.36.020185.001515	

Revised August 2019

Subject Description Form

Subject Code	ME33001
Subject Title	Mechanics of Materials
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME23001 Engineering Mechanics; and ENG2001Fundamentals of Materials Science and Engineering
Objectives	To introduce the fundamental mechanics knowledge of solid materials under basic loading conditions. And to introduce practical approaches to solve for the stress and strain/deformation of solid materials under external mechanical loadings.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Solve for external forces and moments applied on a structure and determine the distribution of internal forces and moments in the structure by using free body diagrams and the laws of equilibrium. b. Recognize the crucial material and geometrical properties for a structural component under different types of loading, and solve for stress and deformation in a structural component due to axial loading, torsion, and bending acting individually or in combination. c. Evaluate the principal stresses in structural components subjected to a combined state of loading. d. Formulate and solve problems involving tension, compression, torsion or bending for statically indeterminate structural components.
Subject Synopsis/ Indicative Syllabus	***Fundamentals*** **-** Free Body Diagram; Equilibrium of a deformable body; General state of stress; Strain; Mechanical properties of materials. ***Axial Load*** **-** Saint-Venant's Principle; Axial elastic deformation; Principle of superposition; Statically indeterminate axially loaded member; Thermal stress. ***Torsion*** **-** Torsional deformation; Torsional Stress; Angle of twist; Statically indeterminate torque-loaded members. ***Bending*** **-** Equilibrium of beams; Shear force and bending moments; Flexural stresses; Beam deflection; Slope and deflection by method of superposition; Statically indeterminate systems. ***Combined Loading*** **-** Transformation of stresses; Principle stresses and maximum shear stress; Mohr's circle. Thin walled pressure vessels; Cylinders and spheres under internal and external pressures; Compounded cylinder; Stress distribution in beams; Stresses due to combined loads.

Laboratory Experiment
There are two 2-hour laboratory sessions.
Typical Experiments:
1. Torsion test
2. Deflection of beam

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to the topics as described in the section subject synopsis (Outcomes a to d).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a to d).

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes a and d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Tutorial	√	√	√	√
Experiment	√			√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignment	25%	√	√	√	√
2. Laboratory report	5%	√			√
3. Test	10%	√	√	√	√
4. Examination	60%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.60 \times$ End of Subject Examination + $0.40 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort ExpectedExpected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Laboratory	6 Hrs.
	Other student study effort:	
	▪ Course work	23 Hrs.
	▪ Self-study	42 Hrs.
	Total student study effort	104 Hrs.
Reading List and References	1. R.C. Hibbeler, Mechanics of Materials, Pearson Prentice Hall, latest edition. 2. F.P. Beer, E.R. Johnston and Jr. J.T. DeWolf, Mechanics of Materials, McGraw-Hill, latest edition. 3. A.C. Ugural, A.C. and S.K. Fenster, Advanced Strength and Applied Elasticity, Prentice Hall, latest edition.	

Revised August 2014

Subject Description Form

Subject Code	ME34002
Subject Title	Engineering Thermodynamics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AP10005 Physics I, and AMA2111 Mathematics I Exclusion: ME34001 Engineering Thermodynamics
Objectives	To provide fundamental knowledge of steam and gas power cycles and refrigeration cycle, and air-conditioning, combustion and heat transfer processes.
Intended Learning Outcomes	a. Formulate and solve thermodynamic problems relating to steam power, gas power and refrigeration cycles; and air-conditioning, combustion and heat-transfer processes by applying knowledge in engineering thermodynamics, air-conditioning, combustion, heat-transfer and mathematics. b. Complete a given task such as a design project in thermodynamics by applying knowledge acquired in the subject and information obtained through literature search. c. Analyze and interpret data obtained from experiments in engineering thermodynamics, combustion and heat transfer. d. Present effectively in completing written reports of laboratory work and the given task.
Subject Synopsis/ Indicative Syllabus	***Review of Basic Concepts of Thermodynamics*** **-** Thermal properties. Ideal gas. First law of thermodynamics. Non-flow and steady-flow processes. Second law of thermodynamics. ***Second Law of Thermodynamics*** **-** Kelvin-Planck and Clausius statements. Reversible and irreversible processes. Carnot cycle. Thermodynamic temperature scale. Inequality of Clausius. Entropy. The second law for a control mass/control volume. Isentropic efficiency. ***Power and Refrigeration Cycles*** **-** Vapour cycles: Carnot cycle and Rankine cycle. Superheat and reheat. Air standard engine cycles: Otto cycle and Diesel cycle. Gas turbine cycles. Carnot efficiency. Refrigerator and heat pump. Vapor compression cycle. Coefficient of Performance. ***Psychrometry and Air Conditioning*** **-** Psychrometry. Psychrometric chart. Introduction to air conditioning. ***Combustion*** **-** Hydrocarbon fuels. Combustion equations. Stoichiometric air fuel ratio. Lean and rich mixture. ***Review of Fundamental Heat Transfer*** **-** Mechanisms and governing equations of conduction, convection and radiation. ***Convection Heat Transfer*** **-** Forced, free and mixed convection. Hydrodynamic and thermal boundary layers. Use of non-dimensional parameters: Reynolds number;

Nusselt number; Prandtl number; Grashof number and Richardson number. Application of convective heat transfer correlations to solve convective heat transfer problems.

Laboratory Experiment
There are two 2-hour laboratory sessions with the typical experiments:
1. Refrigeration system
2. Diesel engine test-bed
3. Convection heat transfer
4. Combustion

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to thermodynamics and heat transfer (outcomes a and b).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a, b and d).

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (outcomes c and d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		√
Experiment			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Examination	60%	√	√		
2. Tests	20%	√	√		
3. Thermal Design Project	10%	√	√		√
4. Laboratory Work/Reports	10%			√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.6 \times$ End of Subject Examination + $0.4 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts and knowledge. It is supplemented by the tests (usually two), design project (and report) and laboratory work (and reports) which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial / Experiment	6 Hrs.
	Other student study effort:	
	▪ Course work	40 Hrs.
	▪ Self-study and Literature Search	38 Hrs.
	Total student study effort	117 Hrs.
Reading List and References	1. R.E. Sonntag, C. Borgnakke and G.J.V. Wylen, Fundamentals of Thermodynamics, John Wiley and Son, latest edition. 2. T.D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, Pearson, latest edition. 3. K. Wark, and D. Richards, Thermodynamics, McGraw-Hill, latest edition. 4. K.D. Hagen, Heat Transfer with Applications, Prentice Hall, latest edition. 5. F.D. Incropera, and D.P. Dewitt, Introduction to Heat Transfer, Wiley, latest edition.	

Revised July 2018

Subject Description Form

Subject Code	ME34003
Subject Title	Thermofluid Mechanics
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: AP10005 Physics I
Objectives	1. To provide fundamental concepts and knowledge of fluid mechanics, acoustics and heat transfer. 2. To provide fundamental concepts and knowledge of internal and external flow systems, pump and fan systems, heating and cooling systems and their applications to product design.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve fluid-mechanic/heat-transfer/acoustic problems by applying knowledge of thermofluids, heat transfer, acoustics and mathematics. b. Complete a design project of a thermofluid system by applying knowledge acquired in the subject with the aid of computer technology. c. Analyze and interpret data obtained from experiments in fluid mechanics, acoustics and heat transfer. d. Search for updated technology in thermofluid engineering in completing a design project of a thermofluid system. e. Communicate effectively in completing written reports of laboratory work and design project.
Subject Synopsis/ Indicative Syllabus	***Fluid Mechanics –*** Basic concepts. Fluid pressure and manometers. Bernoulli, energy and momentum equations. Pitot tubes. Laminar and turbulent flow in pipes. Moody chart, frictional and minor losses. Design for pipes in parallel and in series. Pump matching in pipe flow system. Parallel flow over flat plates, flow over cylinders and spheres. Dimensional Analysis. Buckingham π theorem. Flow similarity and modeling. ***Flow Generation –*** Conservation of angular momentum and working principles of fluid machinery. Performance characteristics of fans, pumps and blowers and their design selections. Engineering estimates of the working point of the fluid machines in products. ***Heat Transfer –*** Revision: basic heat transfer modes; one-dimensional steady state heat conduction in plane walls and cylinders; electrical analogy method. Thermal insulation. Critical thickness of insulation. Fins. Natural convection over surfaces. Forced convection over flat plates and in pipes. Heat exchangers. Thermal, blackbody and gray body radiations. View factors. Radiative exchange between surfaces in enclosures.

<table>
<tr><td></td><td>Noise – Sound pressure and sound power levels. Point source models. Common noise source mechanisms involving flow and vibration and their sound power laws. Simple noise control design.

Experimental Work
There are two 2-hour laboratory sessions with the following typical experiments:
1. Flow pattern at exit of a hair dryer
2. Heat transfer via a heat sink
3. Natural convection and radiation heat transfer
4. Noise control technique</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>1. The subject intends to lay a solid scientific foundation for the design and analysis of a product in which thermofluid sciences play a crucial role. Systematic lectures are required to achieve such foundation building coupled with assignments (outcomes a, and b).
2. Tutorials are used to illustrate the applications of fundamental knowledge to practical situations (outcomes a, b, and d).
3. Laboratory works are essential for students to have hands-on experience of the thermofluid systems to be learned (outcomes c and e).
4. The design project aims to integrate the thermofluid sciences to engineering design of a thermofluid system, and this design task provides opportunity to apply knowledge of mathematics, thermofluid sciences and acoustics to design a real-life product (outcomes a, b, d and e).

It is intended to make use of these teaching/learning methodologies to achieve the intended subject learning outcomes as indicated in the following table:

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="5">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td></tr>
<tr><td>Lecture</td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Tutorial</td><td>√</td><td>√</td><td></td><td>√</td><td></td></tr>
<tr><td>Experimental Work/Report</td><td></td><td></td><td>√</td><td></td><td>√</td></tr>
<tr><td>Design Project/Report</td><td>√</td><td>√</td><td></td><td>√</td><td>√</td></tr>
</table>
</td></tr>
</table>

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	50%	√	√			
2. Test	25%	√	√			
3. Assignments	7.5%	√			√	
3. Design Project/Report	10%	√	√		√	√
4. Laboratory Work/Report	7.5%			√		√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on their overall understanding and ability in applying the concepts and knowledge of thermofluid mechanics. It is supplemented by homework assignments, design project/report and laboratory works/reports. The mid-term test which covers the first half of the course materials provides useful timely feedback to both lecturer and the students on the topics.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/laboratory	6 Hrs.
Other student study effort:	
▪ Coursework (Assignments, Design Project/ Laboratory Works and Reports)	39 Hrs.
▪ Self Study	39 Hrs.
Total student study effort	117 Hrs.

Reading List and References

1. Cengel Y.A., Turner R. H. and Cimbala J. M., Fundamentals of thermal-fluid sciences. McGraw Hill, latest edition.
2. Holman J. P., Heat Transfer, McGraw Hill, latest edition.
3. Wright T., Fluid machinery: performance, analysis, and design, CRC Press, latest edition.
4. Munson B. R., Young D. F., Okiishi T. H., Huebsch W. W., Fundamentals of Fluid Mechanics, John Wiley, latest edition.
5. Barron, R. F., Industrial Noise Control and Acoustics, Marcel Dekker Inc., latest edition.

Revised July 2014

Subject Description Form

Subject Code	ME34004
Subject Title	Fluid Mechanics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2112 Mathematics II
Objectives	1. To teach fundamental concepts and knowledge of fluid mechanics. 2. To provide fundamental concepts and knowledge of inviscid and viscous flows, low-Reynolds number and high-Reynolds number flows, incompressible and compressible flows, and their applications in mechanical engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve flow problems by applying knowledge of fluid mechanics and mathematics. b. Analyze and interpret data obtained from experiments in fluid mechanics. c. Search for updated technology in fluid mechanics in completing assignments related to fluid systems. d. Communicate effectively in completing written reports of laboratory work and assigned tasks.
Subject Synopsis/ Indicative Syllabus	***Basic Concepts –*** Define fluid and its important properties; viscosity and shear stress; Newton's Law of viscosity; Newtonian and non-Newtonian fluids; compressibility; incompressible and compressible fluids; introduction to shock waves. ***Fluid Statics*** **-** Fluid pressure; Pascal's law and pressure-height relation; forces on submerged surfaces and buoyancy; manometers; stability of unconstrained body in fluid. ***General Description & Equations of Motion of Fluid Flow*** **-** Flow: steady and unsteady, uniform and non-uniform, incompressible and compressible, laminar and turbulent; subsonic and supersonic; shock waves; streamline; Continuity, Euler's, Bernoulli's and Momentum Equations; Pitot and Pitot-static tubes, venture-meter and orifice; force on stationary/moving object caused by a fluid jet. ***Dimensional Analysis*** **-** Principle of dimensional analysis; fundamental dimensions; Buckingham's π theorem; dimensionless groups and their physical significance; similarity and model testing. ***Conservation Equations*** **-** Navier-Stokes equations and Energy equation; exact solutions on solving N-S equations applied to fluid systems: Couette flow and Poiseuille flow; introduction on solving N-S equations by CFD software and numerical simulation models. ***Internal Flow*** **-** Fully developed flow and entrance length in a pipe; Darcy's law; Moody chart; primary (frictional) and minor losses in pipe system; design for pipes in parallel and in series.

	External Flow **-** Viscosity and viscous stress; laminar and turbulent boundary layers over a flat plate; effects of adverse pressure gradient and flow separation; velocity profiles and characteristics of flow over bluff body and streamline body; lift, friction and profile drag; boundary layer theory; boundary layer thicknesses; laminar boundary layer profiles; skin friction coefficient; turbulent boundary layer profiles, power law and laws of walls. **Laboratory Experiment** There are two 2-hour laboratory sessions and the typical Experiments are: 1. Compressible flow nozzle 2. Potential Flow Visualization (Hele-Shaw Experiment) 3. Wind Tunnel Testing of Cylinder and aerofoil 4. Universal velocity Profile 5. Boundary Layer Experiment
Teaching/Learning Methodology	Lectures aim to deliver the fundamental knowledge in relation to fluid mechanics (Outcome a). Tutorials are deployed to illustrate the application of fundamental knowledge to practical situations (Outcomes a and c). Experiments are arranged to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes b, c and d). Assignments are arranged to provide opportunity for students to search information, to analyze fluid systems with knowledge obtained, and to present the completed tasks (Outcomes a, c and d).

Teaching/Learning Methodology	**Learning Outcomes**			
	a	**b**	**c**	**d**
Lectures	√			
Tutorials	√		√	
Laboratory Work		√	√	√
Assignments	√		√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/ tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	50%	√	√		
2. Assignments/ Laboratory Reports	30%	√	√	√	√
3. Test	20%	√	√		
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, assignments (including analyses of fluid systems and problem-solving) and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected

Class contact:	
• Lecture	33 Hrs.
• Tutorial / Laboratory	6 Hrs.
Other student study effort:	
• Assignments	38 Hrs.
• Laboratory Reports	10 Hrs.
• Self-study and information search	30 Hrs.
Total student study effort	**117 Hrs.**

Reading List and References

1. Y.A. Cengel J.M. Cimbala, Fluid Mechanics (Fundamentals and Applications), McGraw-Hill, latest edition.
2. F.M. White, Fluid Mechanics, McGraw-Hill, latest edition.
3. J.F. Douglas, J.M. Gasiorek and J.A. Swaffield, Fluid Mechanics, Pearson, latest edition
4. M.C. Potter, and D.C. Wiggert, Mechanics of Fluids, Prentice-Hall, latest edition.

September 2017

Subject Description Form

Subject Code	ME41004
Subject Title	Mechatronics and Control
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31003 System Dynamics
Objectives	To provide students the knowledge in designing mechatronic systems for product development which integrate mechanical, electrical and control systems engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve problems related to sensors, actuators, and signal conditioning in mechatronic systems, controller design and stability analysis, and performance specifications for mechatronic systems. b. Design and analyze a given task or project in mechatronics system by applying knowledge acquired in the subject and information obtained through literature search. c. Analyze and interpret data obtained from experiments to evaluate the performance and/or stability of mechatronic systems. d. Present effectively in completing written reports of laboratory work and the given task.
Subject Synopsis/ Indicative Syllabus	***Sensors and Actuators*** **-** Instrumentation and measurement principles; frequency response characteristics; sensors for motion and position measurement; force, pressure and acceleration sensors, *etc*; actuators such as direct current motors, stepper motors, piezoelectric actuators, *etc*. ***Signal Conditioning and Transmission*** **-** Concepts and principles; analogue electronics with operational amplifier; conversion between analog and digital signals, multiplexing; data acquisition principles, signal filtering. ***Digital Logic Controller and PLC*** **-** Logic; controller design in mechatronic system integration, combinational and sequential control, minimization of logic equations; ladder logic diagrams; introduction to microcontrollers and programmable logic controllers (PLC). ***Introduction to Feedback Control*** **–** Analysis of open-loop and closed-loop systems; transfer functions and block diagrams, time-domain specifications such as overshoot, settling time, steady-state error etc. ***Feedback Control Systems*** **–** Automatic controllers, basic P, PD, PI, PID controllers, Routh-Hurwitz stability criterion, controller design to satisfy the design specifications.

Laboratory Experiment
There are two laboratory sessions.
Typical Experiments:
1. Displacement Measurement using Linear Variable Differential Transformer (LVDT)
2. Sequential control using programmable logic controller (PLC)
3. DC servomechanism
4. Water level control

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to sensors and actuators, signal conditionings, digital logic controllers, feedback control systems and stability analysis (Outcomes a and b).

Tutorials are used to illustrate the application of fundamental knowledge to practical situation (Outcomes a and b).

Assignments are used to help students in developing a firm understanding in the concepts taught (Outcomes a and b).

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes c and d).

The project is used to help students in enhancing their ability to apply the knowledge in relation to sensors and actuators in designing a real-life system (Outcomes a, b and d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		
Assignments	√	√		
Experiment			√	√
Project	√	√		√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Class Test	15%	√	√		
2. Assignments	10%	√	√		
3. Laboratory Report	10%	√		√	√
4. Project	15%	√	√		√
5. Examination	50%	√	√		
Total	100%				

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.50 x End of Subject Examination + 0.50 x Continuous Assessment. Tests, assignments, laboratory reports, and project are adopted in continuous assessment on students' timely feedback to and on-going understanding of the course. Students' overall understanding of the course and ability in applying the delivered knowledge are further assessed through a formal examination.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Laboratory / Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study	36 Hrs.
	▪ Homework assignment	15 Hrs.
	▪ Laboratory report	6 Hrs.
	▪ Project	9 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Shetty, D. and Kolk, R. A., *Mechatronic System Design*, PWS Publishing Company, latest edition. 2. Alciatore, D. G. and Histand, M. B., *Introduction to Mechatronics and Measurement Systems*, McGraw Hill, latest edition. 3. Bolton, W., *Mechatronics: Electronic Control Systems in Mechanical Engineering*, Prentice Hall, latest edition. 4. Ogata, K., *Modern Control Engineering*, Prentice Hall, latest edition. 5. Gopal, M., *Control Systems Principles and Design*, Tata McGraw-Hill, latest edition. 6. Nise, N.S., *Control Systems Engineering*, John Wiley, latest edition.	

Revised March 2017

Subject Description Form

Subject Code	ME42005
Subject Title	CAD/CAE Technologies for Product Development
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I Exclusion: ME42008 Computer-Aided Technology for Design
Objectives	To provide students with computer-aided design (CAD) and computer-aided engineering (CAE) technologies and the ability in using CAD and CAE software for product design and development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Use CAD and CAE technologies to support product design activities, including geometry modeling, design solution modeling, analysis and evaluation, in different design process of the whole product design and development cycle. b. Understand data exchange standards and practices between CAD and CAE models and systems and their interoperability and associativity. c. Use CAD and CAE commercial software systems for product design and development in terms of geometry modeling, kinetics simulation, design solution analysis and evaluation. d. Optimize design solutions with the aid of CAD and CAE technologies.
Subject Synopsis/ Indicative Syllabus	***Computer-aided Design*** - Geometric Models of Products • Wireframe model • Surface model • Solid Model - Geometry modeling technologies • Curve Modeling • Surface Modeling • Solid Modeling - Product kinetics modeling and simulation ***Design Analysis and Evaluation*** - Finite Element Modeling and Analysis • Basic concept of finite element method • Modeling techniques • Mesh types • Boundary constraints • Material and Properties • Symmetry in modeling and analysis - Mechanical and thermal stress analyses - Dynamic response - Product optimization in terms of product size, shape and material - Non-linear stress analysis

CAD/CAE Integration

- Data exchange standards: STL, STEP and IGES
- Interoperability and associativity between CAD and CAE
- Model defect and repairing

Case Studies

- CAD case studies
- CAE case studies
- CAD and CAE integration

Teaching/Learning Methodology

Lectures will be given to explain the theories behind CAD and CAE and their applications. (Outcomes b, c and d)

Tutorials will be used to teach the students on how to conduct product design, analysis and evaluation using state-of-the-art CAD and CAE software commercial software systems. Students will be given various assignments to learn how to represent and model the products from geometry perspective, how evaluate and analyze the design solutions from thermal, mechanical and physical perspectives and how to optimize the design solutions in terms of product size, shape and material. (Outcomes a, c and d)

A mini-project will be given to students so that they will go through all the design phases in using computer-aided technologies to achieve design objectives. (Outcomes a to d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture		√	√	√
Tutorial	√		√	√
Case study			√	
Mini-project	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Class test	20%	√	√	√	√
2. Written/computer assignment	10%	√	√	√	√
3. Case study	10%			√	
4. Mini-project report/presentation	10%	√	√	√	√
5. Examination	50%	√		√	√
Total	100%				

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.50 × End of Subject Examination + 0.50 × Continuous Assessment	
	Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, written and computer assignments which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written reports on various case studies and mini-project are used to assess the students' knowledge in the application of state-of-the-art CAD/CAE software to facilitate the product design and analysis process. Mini-project report and presentation assess the students' ability to assimilate the learnt knowledge for solving a more realistic, open-ended design problem systematically.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Tutorial	3 Hrs.
	▪ Guided study of CAD/CAE	6 Hrs.
	Other student study effort:	
	▪ Performing CAD/CAE in design (tutorial problems)	20 Hrs.
	▪ Performing modeling of design problems (case studies and mini-project)	24 Hrs.
	▪ Literature search and private study	23 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. Michael E. Mortenson, Geometric Modeling, John Wiley & Sons, latest edition. 2. Kunwoo Lee, Principles of CAD/CAM/CAE System, Addison-Wesley Longman, latest edition. 3. Vince Adams and Abraham Askenazi, Building Better Products with Finite Element Analysis, Onword Press, latest edition. 4. J.Y.H. Fuh, Y.F. Zhang, A.Y.C. Nee, M.W. Fu, Computer-aided injection mold design and manufacture, Marcel Dekker, Inc, latest edition.	

Revised June 2019

Subject Description Form

Subject Code	ME42007
Subject Title	Design for Product Safety and Reliability
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME22002 Integrated Product Development Fundamentals or ME32002 Engineering Design Fundamentals
Objectives	To provide students an overview of the product liability and legal aspects in launching of new consumer products and develop their understanding of the management strategy in achieving product safety.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify problems related to liability, safety and reliability for an existing product design and apply their knowledge in reliability engineering to devise a technically and economically feasible solution. b. Apply knowledge of mathematics and engineering sciences via analytical and computational approaches to assess the risks of a product design and development project, and to assess the impacts of various key elements in achieving product safety. c. Develop systematically a safer and more reliable design for an existing product via a group project and present in a professional manner their ideas using multimedia and written reports.
Subject Synopsis/ Indicative Syllabus	***Product Reliability*** **–** Definition of product reliability, reliability programme plan, reliability requirements, parameters, modeling, prediction, test requirement, and design for reliability. ***Product Liability*** **-** Meaning of product liability. Definition of defective product. Product liability in Hong Kong. Product liability law in Hong Kong. Product liability law in other Jurisdictions. ***The Management of Design Risks*** **-** Management strategy in product safety. Reducing product design risks through design reviewing systems. Personal and environmental risk identification of the whole product life from manufacturing to end of services disposal. ***Product Safety Standards*** **-** The consumer Product Safety Acts. The safety standards used in different countries such as Underwriters Laboratories Inc. (UL) in USA, British Standards in United Kingdom and International Electro-technical Commission (IEC) in Europe. Overview of the application and testing procedures in obtaining product safety markings for new products. Planning, implementation and control in product test and assurance.

	Product Risk Identification Methods **-** Fault Tree Analysis (FTA). Failure Mode and Effect Analysis(FMEA). Hazard and Operability Study (HAZOP) and Hazard Analysis Critical Control Point (HACCP). The use of quantitative and statistical methods in assessing product risks and design optimisation. ***Product Risk Management*** **-** Product Risk transfer through insurance and contract conditions.
Teaching/Learning Methodology	1. Lectures give coverage and exposure and arouse interest. (Outcomes a to c) 2. Group discussions and tutorials help students consolidate lecture materials. (Outcomes a to c) 3. Assignments, through which students learn to compile, assimilate, assess and analyze. (Outcomes a to c) 4. Through thematic projects students would keep abreast of current product liability law and strategies for management of design risks. The presentation of reports allows students develop communication skills. (Outcomes a to c)

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	√
Tutorial	√	√	√
Assignment	√	√	√
Project	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Group project	15%	√	√	√
2. Individual report	25%	√	√	√
3. Class presentation	10%	√		
4. Examination	50%	√	√	√
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 x End of Subject Examination + 0.50 x Continuous Assessment.

1. For continuous assessment evaluation, each student is required to submit a minimum of three reports. One of these reports is group-based and the other two are individual assignments. Besides assessing all the written assignments, students will be required to present the group and/or individual projects in class.

<table>
<tr><td></td><td colspan="2">Class presentation and participation in discussions will be assessed.

2. To achieve the intended learning outcomes, it is considered that more emphasis on formative assessment would be appropriate as students' performance will be improved via written and verbal feedback.

3. Marked assignments provide feedback and reinforcement on learning key concepts and outcomes.

4. Through presentations/discussions, students will learn how to:
i. Work effectively with diverse group of people;
ii. Persuasively explain in both oral and written form their product safety concepts;
iii. Tackle diverse and unstructured questions;
iv. Tell thoughts, feelings, ideas so that others may understand;
v. Supports and leads others in discussion.

5. The examination will be used to assess the knowledge acquired by the students to deal with product design risks in a strategic manner. It provides a reference of standards with which the learning outcomes are measured.</td></tr>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture and seminar</td><td>33 Hrs.</td></tr>
<tr><td>▪ Tutorial and group discussion</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Performing group project</td><td>25 Hrs.</td></tr>
<tr><td>▪ Conducting case study and assignment</td><td>23 Hrs.</td></tr>
<tr><td>▪ Literature search and private study</td><td>18 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>105 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. Abbot, Howard: Safer by design: a guide to the management and law of designing for product safety, Gower, latest edition.
2. Hammer, Willie: Product Safety management and engineering, American Society for Safety Engineers, latest edition.
3. The Law Reform Commission of Hong Kong: Report on Civil Liability for Unsafe Products, latest edition.</td></tr>
</table>

Revised July 2018

Subject Description Form

Subject Code	ME42011
Subject Title	Fundamentals of Robotics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear systems and control; or ME41004 Mechatronics and Control
Objectives	1. To provide students with the concepts and techniques for the design, modeling, analysis of robot manipulators. 2. To provide students with the fundamental knowledge of machine vision for robot guidance and automation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify different types of robots and their applications in the industry. b. Construct the kinematics and dynamics equations of robot manipulators for motion analysis. c. Apply trajectory planning algorithms to generate the path for robot manipulators. d. Apply different machine vision and image processing algorithms to automate robot manipulators.
Subject Synopsis/ Indicative Syllabus	***Robot Manipulators*** **-** degrees of freedom, coordinate frame and homogeneous transformation, Denavit-Hartenberg (DH) convention, forward and inverse kinematics, Jacobian matrix, singularity, Lagrange's equation kinetic and potential energy, trajectory planning and obstacle avoidance. ***Computer Vision*** **-** Image formation, acquisition, histogram, edge and line detections, image enhancement, filtering, object recognition, stereo vision, camera modeling and calibration. **Laboratory Work** There is at least 1 2-hour laboratory session or an equivalent project. Typical Experiments are: 1. Object manipulation through a robot manipulator. 2. Programming and control of gantry robot. 3. Path planning of mobile robots for collision avoidance.

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for understanding and analyzing different robots, including system modeling, trajectory planning and image processing (Outcomes a to d)

Tutorials aim at enhancing students' analytical and problem solving skills on robotics. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to d)

The project/experiments aims to have hand-on experience to automation of a robot system with vision or other functions. (Outcomes a to d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
1. Lectures	√	√	√	√
2. Tutorials		√	√	√
3. Homework assignments		√	√	√
4. Project or experiments	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	50%	√	√	√	√
2. Class Test	20%	√	√	√	√
3. Coursework including Project/Experimental Work	30%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

1. The assessment is comprised of 50% continuous assessment and 50% examination.
2. The continuous assessment consists of three components: homework assignments, test, and experiments/projects. They are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.
3. The examination is used to assess the knowledge acquired by the students for understanding and analyse the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Laboratory	6 Hrs.
	Other student study effort:	
	▪ Reading and review	36 Hrs.
	▪ Coursework (assignments, project)	40 Hrs.
	Total student study effort	115 Hrs.
Reading List and References	1. S. B. Niku, Introduction to robotics : analysis, control, applications, Wiley, latest edition. 2. M. W. Spong S. Hutchinson, and M. Vidyasagar, Robot Modeling and Control, Wiley, latest edition. 3. C. Bishop, Pattern Recognition and Machine Learning, Springer, latest edition. 4. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall, latest edition.	

Revised March 2017

Subject Description Form

Subject Code	ME46002
Subject Title	Numerical Methods for Engineers
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I
Objectives	To teach students numerical methods of solving typical engineering problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate simple engineering problems with knowledge in engineering mathematics. b. Solve non-linear equations, simultaneous linear algebraic equations, eigenvalue problems, using numerical methods. c. Perform numerical differentiation and integration and analyze the errors. d. Apply curve fitting to experimental data. e. Use MATLAB or other numerical software tools to compute the solutions of engineering problems using the appropriate numerical methods.
Subject Synopsis/ Indicative Syllabus	***Introduction to Mathematical Modelling and Computational Methods –*** Importance of computational modelling in engineering. Data representation and errors. Applications of commercial software packages such as MATLAB. Functions and plotting using MATLAB. ***Computer Solution of Non-linear Equations*** - Bracketing Methods. Bisection Method. Open Methods. Newton-Raphson Method. Secant Method. Convergence of methods. Determination of multiple roots. Engineering applications. ***Simultaneous Linear Equations*** - Solving simultaneous linear equations by Matrix Inversion. Cramer's Rule. Gauss Elimination. Gauss-Jordan Elimination. LU decomposition method. Engineering applications and choice of methods. ***Eigenvalue Problems*** - Standard and General Eigenvalues Problems. Methods of solving Eigenvalue problems. Applications in vibrations and Modal Analysis. ***Curve Fitting and Interpolation*** - Collocation-Polynomial Fit. Lagrange Interpolation. Newton's Divided-Difference Interpolating Polynomials. Interpolation using splines. Least-Squares Regression. ***Numerical Differentiation and Integration*** - Taylor's series expansion. Finite differences for the first derivative and the second derivative. High-accuracy differentiation formulas. Trapezoidal rule. Simpson's rule. High-order Newton-Cotes formulas. Applications of numerical differentiation and integration in heat transfer, solid mechanics and fluid flow problems.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to numerical methods. (Outcomes a - d)

Tutorials will be conducted in small groups to facilitate discussions. (Outcomes a - d)

Computational workshops provide hands-on experience in using software to solve numerical problems. (Outcomes b - e)

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	
Tutorial	√	√	√	√	
Computational workshop		√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Test	20%	√	√	√	√	
2. Assignment	30%	√	√	√	√	√
3. Examination	50%		√	√		
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Tests will be conducted to assess students' learning on numerical methods.

Assignments will be used to assess students' learning on using numerical methods in solving engineering problems and using computational software in solving such problems.

Examination will be conducted to assess students' learning on numerical methods.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	4 Hrs.
	▪ Computational Workshop	2 Hrs.
	Other student study effort:	
	▪ Performing assignment	40 Hrs.
	▪ Applying computational software	12 Hrs.
	▪ Private study	25 Hrs.
	Total student study effort	116 Hrs.
Reading List and References	1. S.C. Chapra and R.R. Canale, Numerical Methods for Engineers, McGraw-Hill, latest edition. 2. S.S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice-Hall, latest edition. 3. S.C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill, latest edition. 4. D.M. Etter, Engineering Problem Solving with Matlab, Prentice-Hall, latest edition.	

Revised August 2018

Subject Description Form

Subject Code	ME46003
Subject Title	Numerical Fluid Mechanics and Heat Transfer
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ENG2002 Computer Programming, and ME34003 Thermofluid Mechanics
Objectives	To equip students with numerical methods and computational techniques in analyzing fluid dynamics and heat transfer problems which are usually encountered in the design of thermofluid systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand and apply numerical differentiation method, and analyze the stability and errors involved. b. Apply knowledge of thermofluid science/engineering to formulate numerical equations for solving steady-state/transient fluid mechanics or heat transfer problems, and apply appropriate mathematics methods for their evaluation. c. Apply knowledge of mathematics and thermofluid science/engineering via computational approaches to analyze and predict the performance of thermofluid systems/products.
Subject Synopsis/ Indicative Syllabus	***Introduction to Numerical Methods for Product Analysis*** – Mathematical modeling for fluid mechanics and heat transfer systems. Numerical approximations of scientific equations. Direct and iterative methods for solving simultaneous equations. Stability and major errors involved in numerical methods. ***Numerical Differentiation*** – Finite-differences for the first derivative and the second derivative. Finite-differences for partial differentiation. High-accuracy differentiation formulas. ***Finite-Difference Methods in Solving Heat Transfer Problems*** – Governing equations for heat transfer. Boundary conditions in heat conduction and heat convection. Steady-state and transient heat transfer problems. Dimensionless differential equations. Discretization. Explicit scheme finite-difference. Implicit scheme finite-difference. Direct and iterative mathematics methods. Analysis on solution stability and estimation of errors.

Finite-Difference Methods in Solving Fluid Dynamics Problems – Classification of partial differential equations for fluid dynamics. Navier-Stokes equations. Grid types. Explicit and implicit scheme finite-difference formulations. Introduction to turbulence and its modeling.

Introduction to computational approach – Introduction to commercial CFD software and their applications to solve fluid mechanics problems.

Teaching/Learning Methodology

1. The lectures are aimed at providing students with necessary background knowledge in related mathematical principles and computational approaches for analysis of thermofluid problems. (Outcomes a to c)

2. The tutorials and in-class exercises are aimed at enhancing the students' skills in effectively using numerical and computational approaches to solve thermofluid problems. Thus, some tutorial classes will be held in the Computational Laboratory. (Outcomes a to c)

3. The homework assignments are to get students engaged with learning activities continuously and to provide them with self-assessment opportunities on their progress of learning. (Outcomes a to c)

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	√
Tutorials/In-class exercises	√	√	√
Homework assignments	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Homework assignments/ In-class exercises	30%	√	√	√
2. Test	20%	√	√	√
3. End-of-semester Examination	50%	√	√	√
Total	100%	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.5 × Continuous Assessment + 0.5 × Examination. 1. Homework assignments and in-class exercises are aimed at evaluating students' progress in study, and assisting them in fulfilling the respective subject learning outcomes. Homework assignments and in-class exercises should include analyses of thermofluid systems, case-study of problems encountered in thermofluid design, and applications of computational technique (including CFD software) to solve thermofluid problems. 2. Test and end-of-semester examination will be used to assess the degree of achieving the subject learning outcomes by individual student. Their understanding of numerical methods and ability to apply them to critically analyze thermofluid problems will be evaluated.	
Student Study Effort Expected	Class contact:	**Time**
	▪ Lectures	26 Hrs.
	▪ Tutorials/In-class Exercises	13 Hrs.
	Other student study effort:	**Time**
	▪ Performing assignments including computational work	50 Hrs.
	▪ Self-study	31 Hrs.
	Total student study effort	120 Hrs.
Reading List and References	1. S.C. Chapra and R.R. Canale, Numerical Methods for Engineers, McGraw-Hill, latest edition 2. S.S. Rao, applied Numerical Methods for Engineers and Scientists, Prentice-Hall, latest edition 3. A. Cengel Yunus, and J. Ghajar Afshin, Heat and Mass Transfer-Fundamentals and Applications, 4th edition in SI units, McGraw-Hill, 2011. 4. H. K. Versteeg and W. Malalasekera, An Introduction to Computational Fluid Dynamics, 2nd edition, Pearson Prentice Hall 2007.	

Developed in March 2017

Subject Description Form

Subject Code	ME49001
Subject Title	Final Year Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31001 Dynamics and Vibrations; ME31002 Linear Systems and Control; ME32001 Manufacturing Fundamentals; ME33001 Mechanics of Materials; ME34002 Engineering Thermodynamics; and ME34004 Fluid Mechanics
Objectives	To provide students with an opportunity of integrating and applying knowledge from different disciplines of mechanical engineering to conduct an engineering project that is open-ended and requires team collaboration for its completion.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate the problem and suggest a practical solution to solve an open-ended real-world engineering problem. b. Utilize knowledge from different disciplines of engineering to solve problems encountered in conducting the team project. c. Design, plan and carry out scientific and engineering experiments (physical tests and/or computer numerical simulations) to prove the feasibility of their designed solutions. d. Design the test apparatus, rigs, assemblies or systems as required by the project. e. Apply appropriate engineering tool (analytical, experimental, and/or computational) for carrying out tasks in the development and implementation of a designed solution. f. Work in a professional manner and comply with all applicable standards and regulations in conducting the project. g. Select and employ the appropriate manufacturing methods in the production and fabrication of components and assemblies required by the project. h. Evaluate the potential impact of their designed solution on performance, safety, cost and environment. i. Participate and lead in a multi-functional team. j. Take into account of safety, legal, environmental protection considerations in an engineering project. k. Communicate their project work to sponsors (if any), supervisors, other peer teams, and even non-technical audience and articulate the results and findings with scientific and logical arguments. l. Conduct literature search including patents, books, archived publications and product catalogues, and to perform the state-of-the-art and benchmark studies.

Subject Synopsis/ Indicative Syllabus

A project group consisting normally of three students will be expected to complete a substantial project of a major mechanical engineering task. The task can be an analytical study, an experimental investigation, a design project or a numerical simulation aimed at solving an engineering problem. The students are expected to go through the following stages of work:

- Problem identification
- Literature review
- Methodology of study
- Project execution
- Report writing
- Project presentation

Teaching/Learning Methodology

The subject is taught through guided studies. The students are given the project title, objectives and description. The students are guided by the project supervisor to go through the different stages of the project as shown in the Subject Synopsis/Indicative Syllabus. (Outcomes a – l)

Teaching/Learning Methodology	Outcomes											
	a	b	c	d	e	f	g	h	i	j	k	l
Guided study	√	√	√	√	√	√	√	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)											
		a	b	c	d	e	f	g	h	i	j	k	l
1. Continuous monitoring	15%	√	√	√	√	√	√	√	√	√	√	√	√
2. Interim report	10%	√	√	√	√	√	√	√	√	√	√	√	√
3. Final report	50%	√	√	√	√	√	√	√	√	√	√	√	√
4. Oral examination	25%	√	√	√	√	√	√	√	√	√	√	√	√
Total	100%												

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment: 1.0 × Continuous Assessment

1. Performance of each student should be assessed individually together with the team's overall performance by the supervisor, an independent assessor, the peers and an examination panel consisting of at least three academic staff.

2. The continuous monitoring of a project group as a whole and that of each group member on an individual basis are conducted by the supervisor. The interim

report is assessed by the independent assessor. The final report is assessed by both the supervisor and the independent assessor. As part of the assessment process, each group member is required to specify his/her own contribution in completing the project when compared to his/her team mates (peer assessment). In case of an industrial-based project, comments will be invited from the industrial supervisor but he/she will not be required to perform the formal assessment.

3. The supervisor monitors and assesses the overall and individual progresses through regular meetings. The interim report should be submitted to the independent assessor at around week 8 of the first semester. The final report submitted before the end-of-year examination is assessed by both the supervisor and the independent assessor. Due consideration of each student's individual contribution and performance will be taken into account.
4. During the oral examination, every group member is required to present the project especially on his/her significant contribution to the whole project, and respond to the questions addressed to him/her by the examination panel. Marks for oral examination are awarded to individual student by taking into account the group's overall performance.
5. The assessment system is summarized as shown in the following table:

Assessor	**Assessment Component (% of the total)**				
	Continuous Monitoring (15)	**Interim Report (10)**	**Final Report (25)**	**Final Report (25)**	**Oral Examination (25)**
Supervisor	√		√		
Independent Assessor		√		√	
Examination Panel					√

Student Study Effort Expected	Class contact:	
	▪ Guided study	26 Hrs.
	Other student study effort:	
	▪ Conducting project	154 Hrs.
	▪ Literature search and private study	72 Hrs.
	Total student study effort	252 Hrs.
Reading List and References	To be advised by supervisor	

Revised June 2019

Subject Description Form

Subject Code	ME49003
Subject Title	Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31003 System Dynamics; ISE386 Integrated Design for Manufacture or ME32001 Manufacturing Fundamentals; ME33001 Mechanics of Materials; ME34003 Thermofluid Mechanics; and ME41004 Mechatronics and Control
Objectives	To provide students an opportunity to utilize and integrate their knowledge of engineering, design and marketing in completing a real-life product design engineering project.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate a design problem addressing certain market needs and to develop design specifications with due consideration of industrial design. b. Generate alternative design concepts, and then evaluate each of these concepts by considering the impacts of various important factors including human factors, materials used, manufacturing processes, quality and environmental issues, health and safety on product design and development. c. Apply arts, mathematics, information technology and engineering sciences via analytical, computational and experimental approaches to realize a selected design concept. d. Work effectively and make contributions independently in a multi-disciplinary design project team, and apply project management technique to ensure successful competition of the design project. e. Understand the importance of life-long learning and perform literature search to upkeep with the state-of-the-art product design technology. f. Present a design project via oral presentation and written report.
Subject Synopsis/ Indicative Syllabus	***In-depth Study of Substantial Design Tasks*** **-** Marketing survey; Alternative conceptual design; Engineering design and analysis; Product safety and reliability; Product testing techniques; Prototyping and development technologies. ***Areas of Design Project*** **-** Toys; Home appliances; Electronic and electrical appliances; Bio-medical equipment; Plastic and metallic products; Green products; Health products; Computer-aided technology for product development; Products for specialists. ***Knowledge and Skills Required for Performing Design Project*** **-** Problem identification; Literature review; Methodology for data analysis; Engineering design and analysis; Design concept generation; Safety and risk analysis; Prototyping technology; Project management; Report writing and presentation skill.

Teaching/Learning Methodology

Normal Study Pattern

1. Guidance will be given to students during the whole design project. (Outcomes a to d)
2. Regular group discussions with the supervisor (and the industrial supervisor for an industrial-based project) to ensure the correct direction and focus of the project. (Outcomes a to e)
3. The interim report aims at ensuring the proper progress of the project.
4. The final report aims at examining the completeness, quality, workability, practicability and engineering content of the product being designed and developed.
5. Prototype and/or computer-aided simulation will be conducted to show the functionality and safety of the product being designed and developed. (Outcomes a to f)
6. Oral examination will be conducted to examine the presentation skill, ability to provide prompt response to a question and understanding of the whole design project.

Cooperative Education (Co-Op) Study Pattern

1. Guidance will be given to students during the whole design project. (Outcomes a to d)
2. Regular meetings with the academic/industrial supervisor to ensure the correct direction and focus of the project. (Outcomes a to e)
3. The interim report aims at ensuring the proper progress of the project.
4. The final report aims at examining the completeness, quality, workability, practicability and engineering content of the product being designed and developed.
5. Prototype and/or computer-aided simulation will be conducted to show the functionality and safety of the product being designed and developed. (Outcomes a to f)
6. Oral examination will be conducted to examine the presentation skill, ability to provide prompt response to a question and understanding of the whole design project.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Tutorial	√	√	√	√		
Group Discussion	√	√	√	√	√	
Project	√	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Continuous monitoring	15%	√	√	√	√	√	
2. Interim report	10%	√	√	√			√
3. Final report	50%	√	√	√	√	√	√
4. Oral presentation	25%	√	√	√	√	√	√
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

1.0 x Continuous Assessment.

	Normal Study Pattern 1. Performance of each student should be assessed individually together with the team's overall performance by the supervisor, an independent assessor, the peers and an examination panel consisting of at least three academic staff. The following criteria should normally be used for performance assessment: i. Innovative approaches in generating alternative design concepts to meet market need; ii. Functionality, workability, practicability and engineering content of the final design; iii. General attitude, initiative and effectiveness in making progress; iv. Engineering design and analysis, and work accomplishment; v. Quality of the interim and the final report; vi. Performance during the oral examination. 2. The continuous monitoring of a project group as a whole and that of each group member on an individual basis are conducted by the supervisor. The interim report is assessed by the independent assessor. The final report is assessed by both the supervisor and the independent assessor. As part of the assessment process, each group member is required to specify his/her own contribution in completing the project when compared to his/her team mates (peer assessment). In case of an industrial-based project, comments will be invited from the industrial supervisor but he/she will not be required to perform the formal assessment. 3. The supervisor monitors and assesses the overall and individual progresses through regular meetings. The interim report should be submitted to the independent assessor around week 8 of the first semester. The final report submitted before the end-of-year examination is assessed by both the supervisor and the independent assessor. Deal consideration of each student's individual contribution and performance will be taken into account. 4. During the oral examination, every group member is required to present the project especially on his/her significant contribution to the whole project, and respond to the questions addressed to him/her by the examination panel. Marks for oral examination are awarded to individual student by taking into account the group's overall performance. Co-Op Study Pattern 1. Performance of each student should be assessed individually by the academic supervisor, the industrial supervisor from the collaboration company, an independent assessor and an examination panel consisting of at least three academic staff. The following criteria should normally be used for performance assessment: i. Innovative approaches in generating alternative design concepts to meet customer and/or market need agreed by academic and industrial supervisors; ii. Functionality, workability, practicability and engineering content of the final design; iii. General attitude, initiative and effectiveness in making progress; iv. Engineering design and analysis, and work accomplishment; v. Quality of the interim and the final report; vi. Performance during the oral examination.

2. The continuous monitoring of student is conducted by the academic supervisor and industrial supervisor. The interim report is assessed by the independent assessor. The final report is assessed by the academic supervisor, the industrial supervisor and the independent assessor. As part of the assessment process, student is required to specify his/her own contribution in completing the industrial project in the collaboration company.

3. The supervisors monitor and assesse the overall and individual progresses through regular meetings. The interim report should be submitted to the independent assessor around week 5 of the first semester. The final report submitted before the end of first semester of academic year and is assessed by the academic supervisor, the industrial supervisor, and the independent assessor.

4. During the oral examination, student is required to present the project especially on his/her significant contribution to the whole project, and respond to the questions addressed to him/her by the examination panel.

The assessment system for both normal and co-op study pattern is summarized as shown in the following table:

Assessor	**Assessment Component (% of the total)**				
	Continuous Monitoring (15)	**Interim Report (10)**	**Final Report (25)**	**Final Report (25)**	**Oral Examination (25)**
Supervisor	√		√		
Independent Assessor		√		√	
Examination Panel					√

Student Study Effort Expected	Class contact:	
	▪ Guided study	26 Hrs.
	Other student study effort:	
	▪ Conducting project	154 Hrs.
	▪ Literature search and private study	72 Hrs.
	Total student study effort	252 Hrs.
	Students will be guided to search relevant references by the supervisor.	
Reading List and References	To be advised by supervisor.	

Revised June 2019

Subject Description Form

Subject Code	SD3401
Subject Title	Designing for Humanities
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	There are three sections in the subject: Human Factors in Design, Designing for Disabilities, and the introduction of "Universal Design". 1. To introduce to students the fundamentals of human requirements that are essential to the success of user-related design. Well-designed visuals, products, systems and environments involve the appreciation and thorough consideration of the human aspects of design. Such aspects include the physiological, psychological and sociological factors. 2. Students will devise more appropriate solutions to design problems in the acknowledgement of the people they design for. 3. This subject intensifies at a later stage. It guides students to the appreciation of higher levels and more complex human requirements that relate to the success of user-interface design. 4. The subject addresses particularly the interface issues, which will contribute to future design studies (projects). The issue of designing for special group of users such as the disabled and the ageing populations will be investigated. The "Universal Design" principles will be discussed.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate a design problem addressing to certain market needs and by fully considering impacts of human factors, product safety and environmental issues. b. Fully consider the physiological, psychological, cultural and sociological factors in generating and evaluating alternative design concepts in product design. c. Present a design project via oral presentation and/or written report.
Subject Synopsis/ Indicative Syllabus	***Human Factors in Design*** **-** 1. Understanding people's activities at work, rest & in play. The basic principles of human factors are introduced. The significance and relevance of the subject to design tasks are explained. 2. The appreciation and application of data in the physiological, psychological cultural and sociological aspects of people are presented. This section will start with anthropometry (body measurements). 3. The evaluation of designs for people use: This includes people's abilities and limitations in relation to the tasks & environments, and thereby the designs. Methods of approaching human aspects for design projects are discussed.

	Students are expected to be able to identify user-interface issues, plan and carry out related tests and experiments needed to support design works, and to evaluate the design results. 4. The goal is to enhance *effectiveness, efficiency, comfort and safety* by improving the user/design interface. ***User-related Design and Designing for Disabilities -*** 1. User in normal conditions and environments. 2. User in extreme conditions and environments. 3. Designing for the elderly and the disability. 4. User testing methods: Heuristic evaluation (quick and inexpensive method made in early phases of design to evaluate the most significant usability problems); Pluralistic usability (evaluation performed by user interface specialists, designers and real users). 5. Usability test: A design evaluation in the usability that can be performed during the development of a product or system to reveal problems. This may result in re-design or modification, or for product/system comparison (compared against competitor's design). 6. Universal Design Principles.
Teaching/Learning Methodology	The teaching and learning approaches as stated in Section E are justified as below: 1. The teaching and learning methods include lectures, tutorials, case studies, seminars, and assignment (design exercise). 2. The lectures are aimed at providing students with an integrated knowledge required for understanding and analyzing Human Factors and related issues in Design. 3. The design exercise is aimed at allowing hands-on experience in team-work to appreciate the lectures. The students are required to participate in the mini-project through literature survey, information search, discussions, report writing and presentation of results. Innovative thinking is encouraged. 4. The tutorials are aimed at helping students to go through the exercise smoothly, and to guide the students to solve real-world problems using the knowledge they acquired in the class. 5. Case studies are there to reinforce the lectures and to encourage discussions.
Assessment Methods in Alignment with Intended Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
Design exercise assignment, presentation	90	v	v				
Motivation (participation in team, attendance)	10			v			
Total	100 %						

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: *The assessment methods are justified as below:* 1. The Design Exercise assessment is in an "open-book" format to encourage continuous effort throughout the whole period of assignment. 2. The presentation allows student to learn about and experiencing in presenting one's view, opinion and argument in open critique, by thorough preparation. 3. The grade for motivation encourages students to work postively, energetically, in private and in group. It can be checked also by class-attendance. Minimum condition to consider a grade, would require the student to satisfactorily complete and submit the assignment, and present it as indicated. A pass grade or above will depend on how well the student has achieved in the learning outcomes. In addition, the following points should be taken into consideration: 1. A minimum grade "D" should be obtained in assignment. 2. Assignment may require both "group effort" and "individual effort". 3. Copy right must be strictly respected. If a copy is detected, a zero score will be assigned regardless of whom/which group did the assignment. 4. Attendance of class is very important. If a student anticipates being absent from class for any reason, please notify the course instructor ahead of time. In the event of absence, it is the student's responsibility to catch up on any work missed.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	6 Hrs.
	▪ Tutorial, Seminar	16 Hrs.
	▪ Case Studies and Design Exercise	17 Hrs
	Other student study effort:	
	▪ Research, preparation of design exercise and presentation	41 Hrs.
	Total student study effort	80 Hrs.
Reading List and References	1. Barbacetto, G. *Design interface: How man and machine communicate.* Arcadia Edizioni, 1992. 2. Chan, L. H.. *Successful aging: from the perspective of Hong Kong elderly: a qualitative approach.* Hong Kong: School of Nursing, The Hong Kong Polytechnic University. 2003. 3. Cox, K., Walker, D. User interface design. New York: Prentice Hall, 1993. 4. Dul, J. et al. *Ergonomics for beginners - A quick reference guide.* London: Taylor & Francis,.1993 5. Fernandes, T. Global Interface Design: A guide to Designing International User Interfaces. Boston: AP Professional, 1995. 6. Gary, D. et al. *Designing and using assistive technology: The human perspective.* London: Paul H. Brookes, 1998. 7. Grandjean, E. Fitting the task to the man. London: Taylor & Francis, 1998. 8. Green, W. S., Jordon, P. W. *Human factors in product design: Current practice and future trends.* London: Taylor and Francis. 1999. 9. Karwowski, W., Soares, M. M., Stanton, N. A. *Human factors and ergonomics in consumer product design.* Boca Raton: Taylor & Francis Group. 2011.	

10. Kroemer, K. Ergonomics: How to design for ease and efficiency. Englewood Cliffs, N.J.: Prentice Hall, 1994.
11. Kroemer, K. Fitting the task to the human: A textbook of occupational ergonomics. London: Taylor & Francis, 1997.
12. Law, Kenneth Wing-kin (ed.). *Aging, gender and family in Singapore, Hong Kong and China.* Taipei: Programme for Southeast Asian Area Studies Academia Sinica. 2001.
13. Laurel, B. (ed.). *Design research: methods and perspectives*. Cambridge, Mass.: MIT Press. 2003.
14. Monk, A. *Improving your human computer interface*. New York: Prentice Hall, 1993.
15. Norman, D. A. *The invisible computer*. Cambridge MA: MIT Press, 1998.
16. Norman, D. *The design of everyday things*. New York: Doubleday,1990.
17. Philips, D. R; Yeh, A. (ed.). *Environment and ageing: environmental policy, planning and design for elderly people in Hong Kong*. Hong Kong: Centre of Urban Planning and Environmental Management, University of Hong Kong. 1999.
18. Prikl, J. *Guidelines and strategies for designing transgenerational products: a resource manual for industrial design professionals*. Syracuse, NJ: Syracuse University. 1998.
19. Sanders, M. *Human factors in engineering and design*. New York : McGraw-Hill, 1993.
20. Schifferstein, H. N. J., Hekkert, P. *Product experience*. San Diego, CA: Elsevier. 2008.
21. Siu, K. W. M. (ed.). *New era of product design: Theory and practice*. Beijing: Beijing Institute of Technology Press, 2009.
22. Tilley, A. *The Measure of man and woman: Human factors in design*. New York: Whitney Library, 1993.
23. *Trans-generational design: Products for an aging population*. New York: Van Nostrand Reinhold, 1994.

Websites:

http://www.baddesigns.com/ *(Examples of bad Human Factors in design)*
http://gemma.apple.com/ngs/lpp/adrpub/docs/dev/techsupport/insidemac/HIGuidelines/HIGuidelines-251.html *(Human Factors Society)*
http://www.usernomics.com/hf.html *(Human factors & ergonomics)*
http://www.iat.unc.edu/guides/irg-05.html *(User interface design: Bibliography)*

Subject Description Form

Subject Code	SD348
Subject Title	Introduction to Industrial Design
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject gives an introduction to the field of industrial design as a creative discipline, a discipline which synthesises knowledge from fields as diverse as arts, sciences and engineering. Industrial design is known for its capacity to innovate and to add value to products and services. Industrial designers solve problems centred on user needs with the intent to improve the quality of people's lives. The design process incorporates unique problem solving methods and creativity process. Industrial design intends to work with technological and ecological parameters in an appropriate way. The development and use of state of the art tools and technologies puts industrial design in a significant position socially and economically. The subject aims to equip students with knowledge and experience of industrial design to appreciate the profession, relate to its practitioners in different work situations, employ the design process appropriately for problem identification, solving and innovation, and to realise the importance of a user centred approach to the creation of new products and services. The subject is project-oriented that the students are expected to learn through a design project. The subject does not include any engineering skill, such as software application. The students are expected to apply the technological and engineering knowledge, skills and experience obtained from other subjects to tackle the project.
Intended Learning Outcomes	Upon completion of the subject, students will be able to basic knowledge to: a. Appreciate the industrial/product design profession, relate to its practitioners in different work situations. b. Employ the design process appropriately for problem solving and innovation. c. Realise the importance of a user centered approach to the creation of new products and services. d. Apply visualisation skill in project presentation. e. Understand objectives of industrial/product design, and apply knowledge and experience in other related subjects and future career.
Subject Synopsis/ Indicative Syllabus	The field of industrial design is introduced through a series of lectures featuring a review of milestones of design achievements internationally and locally. The relationships between design, culture and society are highlighted through a look at topics like cultural identity in product design, user centred design, employment of technologies, and design and sustainability.

Further lectures and seminars cover two major parts of industrial design and its professional practice:

1. The essentially theoretical foundation of the industrial design process and methodology covering topics such as:
   - Design and culture
   - Form, aesthetics and semantics
   - Human factors and ergonomics in design
   - Research and problem identification
   - Design requirements and design brief
   - Design development and specifications
   - Design evaluation and concept selection

2. The essentially practical aspects of the industrial design process covering topics such as:
   - Design visualisation, presentation and communication
   - Product prototyping and user testing
   - Manufacturer and marketing relations

Teaching/Learning Methodology

Emphasis in the practical learning activities is placed on students' creativity in relation to designing. Students explore different approaches to problems and experience methods of problem solving with the designer's tools.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
1. Design project: Understanding design process	10	✓	✓	✓	✓	✓	
2. Design project: investigation and application in design	30		✓	✓		✓	
3. Design project: development of design ideas	45	✓	✓	✓	✓	✓	
4. Design project: presentation of design ideas	15				✓	✓	
Total	100 %						

Project and continuous assessment approaches are adopted in the subject.

Student Study Effort Required

Class contact:	
▪ Lectures and seminars	26 Hrs.

	▪ Tutorials and exercises	13 Hrs.
	Other student study effort:	
	▪ Research and design	31 Hrs.
	▪ Preparation of presentation	10 Hrs.
	Total student study effort	80 Hrs.
Reading List and References	1. *Design Issues. The MIT Press. (Journal)* 2. *Design Management Journal. The Design Management Institute. (Journal)* 3. *Design Studies. Elsevier Science. (Journal)* 4. *International Journal of Design (Journal)* 5. *The Design Journal (Journal)* 6. *Forest, D. (Ed.) (2014). The art of things: Product design since 1945. New York: Abbeville Press Publishers.* 7. *Fung, A., Lo, A., & Rao, M. N. (2005). Creative tools. Hong Kong: School of Design, The Hong Kong Polytechnic University.* 8. *Graedel, T. E. (2003). Industrial ecology (2nd ed.). Upper Saddle River, NJ: Prentice Hall.* 9. *Jordan, P. W. (1997). Putting the pleasure into products. IEE Review, Nov. 1997, 249-252.* 10. *Koos, E. (2014). Sketching product design presentation. Amsterdam, The Netherlands: BIS.* 11. *Leung, T. P. (Ed.) (2004). Hong Kong: Better by design. Hong Kong: The Hong Kong Polytechnic University.* 12. *Mackenzie, D. (1997). Green design: Design for the environment (2nd ed.). London: Laurence King.* 13. *Monika, H. (2013). Branding and product design: An integrated perspective. Surrey, England: Gower Publishing Limited.* 14. *Norman, D. A. (1998). The invisible computer: Why good products can fail, the personal computer is so complex and information appliances are the solution. Cambridge, Mass., London: The MIT Press.* 15. *Norman, D. A. (1998). The design of everyday things. London: The MIT Press.* 16. *Richard, M. (2016). The fundamentals of product design (2nd ed.). London: Fairchild Books.* 17. *Rodgers, P. (2011). Product design. London: Laurence King.* 18. *Roqueta, H. (2002). Product design. London: Te Neues.* 19. *Rowe, P. G. (1987). Design thinking. Cambridge, Mass.: The MIT Press.* 20. *Siu, K. W. M. (Ed.) (2009). New era of product design: Theory and practice (Chinese ed.) Beijing: Beijing Institute of Technology Press. 邵健偉 編著（2009）：《產品設計新紀元：理論與實踐》。北京：北京理工大學出版社。* 21. *Stanton, N. (Ed.) (1998). Human factors in consumer products. London: Taylor & Francis.* 22. *Ulrich, K. T. (2004). Product design and development (3rd ed.). New York, NY: McGraw-Hill/Irwin.* 23. *Wang, S. Z. (1995). A history of modern design 1864-1996. Guangzhou: Xin Shi Ji Chu Ban She.* 24. *Whiteley, N. (1993). Design for society. London: Reaktion Books.*

Intended Blank

Elective Subjects

Subject Description Form

Subject Code	ISE376
Subject Title	Entrepreneurship and Innovation
Credit Value	3
Level	3
Pre-requisite/Co-requisite/Exclusion	Nil
Objectives	The objectives of the subject are to enable the students to 1. gain an overview of the concept of entrepreneurship and entrepreneurship strategies; 2. develop an awareness of the sources/processes of innovation; 3. develop the ability to analyze innovative business.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. understand entrepreneurship strategies in which innovation is an important part of business and corporate strategy; b. recognize various types of innovations and their processes; c. apply the techniques involved in assessing corporate ventures; d. evaluate the management of innovative business development or processes from a strategic and contemporary viewpoint.
Subject Synopsis/ Indicative Syllabus	Entrepreneurship and Industry Analysis 1. <u>Overview of Entrepreneurship</u> This provides the fundamental concept of entrepreneurship and relevant issues. 2. <u>Understanding Industry Context and Entrepreneurship Strategies</u> This details the approaches to justify the industry context. This introduces the various strategies involved in the business development process. Innovation and Business Development 3. <u>Introduction of Innovation Types</u> Innovation styles and approaches are discussed. 4. <u>Implementation of Innovation</u> This discusses the approaches to integrate innovation in entrepreneurship.
Teaching/Learning Methodology	The teaching/learning approach combines lectures, cases, and in-class activities. Each session includes a number of readings (required/optional) pertaining to the theme of the session.

<table>
<tr><td></td><td>Lectures: Lectures are conducted to give students an overview of the fundamental concepts and theories.

Case studies are given to students to facilitate the application of learned knowledge and interactive knowledge sharing.

In-class activities include seminars by industrialists and projects involving hands-on experience on the subject.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1. Ind. Assessments, in-class activities and Test(s)</td><td>50 %</td><td>✓</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. Project</td><td>30 %</td><td></td><td></td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>3. Reflection</td><td>20 %</td><td></td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
</table>
The various forms of assessments/assignments allow students not only to understand the learned topics but also to reflect on the topics.

• Assessment methods 1: Assignments and tests are used to assess students' understanding of the basic concepts of the subject, students are also required to participate in in-class activities and

• Assessment methods 2 & 3: Project and individual reflections are used to assess the students' ability in applying learned knowledge, that is, the techniques in assessing corporate ventures and the management of innovative entrepreneurship.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact</td><td></td></tr>
<tr><td>▪ Lectures / Test(s)
3 hours/week x 6 weeks</td><td>18 Hrs.</td></tr>
<tr><td>▪ Case studies/Workshops/Guided project/ Reflection 3 hours x 7 weeks</td><td>21 Hrs.</td></tr>
<tr><td>Other student study efforts</td><td></td></tr>
<tr><td>▪ Individual reading and assignments</td><td>42 Hrs.</td></tr>
<tr><td>▪ Project</td><td>42 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>123 Hrs.</td></tr>
</table>
</td></tr>
</table>

Reading List and References	1. Dorf, R C & Byers, T H 2008, *Technology Ventures: From Idea to Enterprise*, 2nd edn, McGraw Hill 2. Hisrich, R D, Peters, M P, & Shepherd, D A. 2008, *Entrepreneurship*, 7th edn, McGraw Hill 3. Gerry, G & Bock, A 2009, *Inventing Entrepreneurs: Technology Innovators and their Entrepreneurial Journey*, Prentice Hall 4. Drucker, F P 1985, *Innovation and Entrepreneurship*, New York: Harper Business

Subject Description Form

Subject Code	ISE430
Subject Title	New Product Planning and Development
Credit Value	3
Level	4
Pre-requisite/Co-requisite/Exclusion	Exclusion: MM484 Managing New Product Development
Objectives	This subject will enable students to 1. understand the new product development process and strategic features of new product development; 2. develop strategic thinking and planning abilities throughout the early product design stage; 3. understand various techniques for new product planning.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. appreciate the generation of product concepts that satisfy the needs of customers; b. explore and analyze market needs and appreciate their direct relationship with new products; c. identify new product opportunities; d. introduce financial, environmental, social, and cultural considerations with regard to design decisions.
Subject Synopsis/ Indicative Syllabus	1. <u>Introduction to New Product Planning and Development</u> New product planning and development process, Types of new products, Drivers of new product development, Success and failure factors, New product development strategy, Analysis of business and completion environments for new product development 2. <u>Issues of Strategic Planning for New Products</u> Modular product design, Product architecture, Product family design, Product line design, Product Portfolio planning, Customized products versus mass products, Technology roadmapping 3. <u>Customer Needs and Value</u> Acquisition, organization and analysis of customer needs, Customer value and its measurement

4. Segmentation, Targeting, and Positioning

Market and benefit segmentation and its techniques, Product positioning, Perceptual mapping, Value mapping

5. Opportunity Specification and Justification

Needs analysis, Ethnography, Scenario analysis, Product innovation charter

6. Defining Design Specification

Conjoint analysis, QFD-based techniques

7. Concept Test

Concept statements, Considerations, Formats

8. Sales Forecasting and Financial Analysis

Sales forecasting models, Choice modeling, Pricing techniques for new products, Examples of financial plans

Teaching/Learning Methodology

Teaching and learning activities include lectures, tutorials, case studies, a group project, and a laboratory exercise. The lectures are aimed at providing students with the basic understanding of new product development process, as well as common techniques and methods used in new product planning. In tutorial classes, small group discussions are facilitated for students to enhance their understanding of the subject matter. Through a number of minor exercises in tutorial classes, students not only have better understanding of the subject matter, but teachers are also allowed to monitor their learning progress. All the case studies are related to real-life successful and failed cases of new product development. Through the case studies, students can appreciate various issues and factors leading to the success and failure of new product development. Laboratory exercises provide students with hands-on experience on the segmentation and generation of perceptual maps.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d		
1. Case studies	25%	✓	✓	✓	✓		
2. Assignments	45%	✓	✓	✓			
3. Test	30%	✓	✓	✓	✓		
Total	100%						

	The case studies are aimed at assessing all the ILOs of students. The assignments of this subject contain in-class assignments and take-home assignments which are used to assess the ILOs a, b and c of students. A test is normally conducted by the end of the semester and is aimed at assessing all the ILOs of students.	
Student Study Effort Expected	Class contact:	
	▪ Lectures	24 Hrs.
	▪ Tutorials	11 Hrs.
	▪ Laboratory exercise	2 Hrs.
	▪ Test	2 Hrs.
	Other student study effort:	
	▪ Case studies	25 Hrs.
	▪ Preparation for test	28 Hrs.
	▪ Take-home assignments	30 Hrs.
	Total student study effort	122 Hrs.
Reading List and References	1. Crawford, C.M., and Di Benedetto, C.A., *New Products Management*, McGraw Hill 2. Glen, L. 1993, *Design and Marketing of New Products*, Prentice Hall 3. Lilien, G.L. and Rangaswamy, A. 2003, *Marketing Engineering – Computer Assisted Marketing Analysis and Planning*, Prentice Hall 4. Baxter, M. 1995, *Product Design – Practical Methods for Systematic Development of New Products*, Chapman & Hall 5. Ulrich, K.T. and Eppinger, S.D., *Product Design and Development*, McGraw-Hill 6. *Design Management Journal*, Design Management Institute Press 7. *The Journal of Product Innovation Management*, Elsevier Science Inc.	

Subject Description Form

Subject Code	ISE457
Subject Title	Business Process Management
Credit Value	3
Level	4
Pre-requisite/Co-requisite/Exclusion	Nil
Objectives	This subject aims at enabling students to 1. appraise the importance of structuring and measuring business processes in an organization; 2. identify and build business processes for various business applications; 3. apply appropriate measures to assess, report and improve the performance of business processes.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. describe the basic concept of business process management; b. assess the organizational implications of functional and process-centric management; c. illustrate the process of designing and developing a Business Process Management Solution; d. configure and manage a business process management system with knowledge of the scope and limitations of such tools; e. develop an overall understanding of team building and governance of processes in an organization.
Subject Synopsis/ Indicative Syllabus	1. <u>Introduction to Business Process Management</u> Definition of business process management; Process and workflow life cycle; Transformation of a functional enterprise to a process-centric enterprise; Business value and risk of process automation. 2. <u>Business Process Management Solution Development</u> Business process management solution architectures; Business process analysis; BPM Process Development; BPM reporting and monitoring. BPM and application integration; BPM and Robotic Process Automation; Configuration of business process management solutions; BPM software vendor products; and Evaluation and selection.

<table>
<tr><td></td><td>3. <u>Technology for Business Process Management</u>

Process Modeling Standards - Business Process Modeling Notation (BPMN); Process repository and Business rules systems.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>A mix of lectures, laboratories, tutorial exercises, and projects is used to deliver the various topics in this subject. Practical problems and case studies are raised as a focal point for discussion in tutorial classes. Laboratory session(s) are also used to illustrate and assimilate some fundamental principles of business process management, some of which are covered in a problem-based format and exercises to enhance the learning objectives. Others are covered through directed study in order to enhance the students' ability of "learning to learn." The subject stresses creative thinking, and problem solving approach. Local and overseas case studies are also included to reinforce understanding and enhance practicality.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td></td></tr>
<tr><td>1. Assignment</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>2. Forum discussions</td><td>10%</td><td>✓</td><td>✓</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>2. Tests</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>3. Project</td><td>30%</td><td></td><td></td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
</table>
The coursework consists of assignments with individual and group components, usually up to two individual tests. All assessment components require students to apply concepts delivered in lectures to real life cases. The assignments require students to conduct background research on BPM and identify, among others, potential applications and benefits. Short quizzes are also used to test student's understanding of the taught concepts and ability to apply BPM to stated situations. As they work in groups, students must tackle a project by identifying the problem structure, representing the processes, presenting and simulating the process flow, as well as identifying innovations and potential improvements in the current design.</td></tr>
<tr><td>Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td></td><td>▪ Lecture (In-person & Online)</td><td>21 Hrs.</td></tr>
<tr><td></td><td>▪ Tutorial/Case Study/Guest presentation(s)</td><td>9 Hrs.</td></tr>
<tr><td></td><td>▪ Online Bulletin Board</td><td>6 Hrs.</td></tr>
</table>

	▪ Laboratory	3 Hrs.
	Other student study effort:	
	▪ Tackling of assignments and preparation for tests	35 Hrs.
	▪ Background research and project	40 Hrs.
	Total student study effort	114 Hrs.
Reading List and References	Reference Books 1. Burton, R 2001, B*usiness Process Management: Profiting from Process*, Sams, Indianapolis 2. Smith, H and Fingar, P 2006, *Business Process Management*: *The Third Wave*, Megan Kiffer Press, Tampa Journal 3. Bradford X 2005, *Business Process Management Journal*, England: MCB University Press	

Subject Description Form

Subject Code	ME41001
Subject Title	Automatic Control Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear Systems and Control
Objectives	To provide students with the fundamental knowledge of controller design for automatic control systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve problems relating to modeling of linear mechanical systems, analysis of system relative stabilities; determining specifications for open- or closed-loop control systems and designing controllers or compensators for mechanical systems. b. Complete a given task such as a project in system modeling or controller design by applying knowledge acquired in the subject and information obtained through literature search. c. Analyze and interpret data obtained from experiments in system modeling, stability analysis or frequency-domain analysis of mechanical systems. d. Present effectively in completing written reports of laboratory work and the given task.
Subject Synopsis/ Indicative Syllabus	***Time Domain Controller Design*** **-** Multi-mode controllers; Optimum controller settings; Ratio, cascade and feedforward control. ***Frequency Domain Compensator Design*** **-** Nyquist criterion; Phase and gain margins; Multiple design constraints; Characteristics of lead, lag and lag-lead elements; Compensator design via Bode plots. ***State-Space Representation of Dynamic Systems*** **-** State variables of a dynamic system; State differential equations; State-space form equations from transfer functions; Canonical forms and decoupled systems; Relationship between eigenvalues and system poles. ***Control System Analysis Using State Variable Method*** **-** Direct numerical solution of state equation; Solution using state transition matrix; System stability; Controllability and observability. ***Control System Design Using State Variable Method*** **-** State variable feedback; Direct calculation of gains by comparison with characteristic equation; Pole placement via control canonical form of state equations; Pole placement via Ackermann's formula. **Laboratory Experiment**

There are two 2-hour laboratory sessions.

Typical Experiments:
1. Twin-rotor control
2. Inverted pendulum control
3. DC servo control

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for understanding controller or compensator design, analyzing and designing state-space control systems (Outcomes a and b).

Tutorials aim at enhancing the analytical skills of the students. Examples on time-domain controller design, frequency domain compensator design, state-space system representation, analysis and controller design are used to illustrate the application of integrated knowledge to solve real-world problems (Outcomes a and b).

Experiments will provide the students with experience on the use of simulation tools for the computer-aided analysis and controller design of typical state-space dynamic systems. It also trains students in the measurement and instrumentation, the analysis and presentation of experimental data (Outcomes c and d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		
Experiment			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Examination	50%	√	√		
2. Test	25%	√	√		
3. Assignment	15%	√	√		
4. Laboratory report	10%			√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected	Class contact:	
	▪ Lecture	31 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Course work	26 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	110 Hrs.
Reading List and References	1. M. Gopal, Control Systems, Principles and Design, McGraw-Hill, latest edition. 2. N.S. Nise, Control Systems Engineering, Wiley, latest edition. 3. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME41003
Subject Title	Principles of Sound and Vibration
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics
Objectives	To provide students with the fundamental knowledge of generation and measurement of sound and vibration and the sound propagation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the physics of the vibration of simple structure and sound propagation in the acoustic medium, in duct and in room. b. Formulate and solve the sound and vibration problem relating to vibration of string, beam and plate, sound radiation from the source, sound reflection and transmission through a junction and a flat interface of acoustic media by applying knowledge in noise mitigation method. c. Understand the mechanisms of basic measurement devices for sound and vibration, analyze and interpret the measured data from the experiments of noise and vibration.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Sound*** **-** Fluid compressibility, wave equation, sound pressure level and sound power, addition of sounds of different frequencies, octave bands and one-third octave bands, conservation of acoustic energy flux at the absence of a mean flow. ***Vibration of Continuous Systems*** **-** Vibration of string, rod, beams and plates; energy transmission through structures, natural modes, free and forced vibrations. ***Sources of Sound*** **-** Radiation of sound by pistons (1D, 2D), impedance, radiation efficiency, monopole and dipole, critical frequency, sound radiation by 2D structures. ***Sound Propagation*** **-** Single travelling wave and properties of standing wave, reflection of sound at pipe junctions and at interface of two media. ***Sound and Vibration Measurement*** **-** Measuring systems, microphones, sound level meters, background noise, measurement of sound intensity, reverberation time and absorption coefficient; accelerometers, calibration and mounting of accelerometers; shakers, hammers, force transducers and amplifiers; damping measurement, experimental modal analysis. **Laboratory Measurement** 1. Sound propagation in anechoic chamber 2. Impedance tube measurement 3. Experimental modal analysis of a vibrating beam 4. Traffic noise measurement

Teaching/Learning Methodology

Lectures are aimed at providing students with the knowledge of acoustics and vibration. (Outcomes a to c).

Tutorials are aimed at enhancing students' skills necessary for analyzing the physics of sound and vibration system (Outcomes a and b).

Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems (Outcomes b and c).

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	√
Tutorial	√	√	
Experiment		√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Class test	20%	√	√	√
2. Homework	20%	√	√	√
3. Laboratory report	10%		√	√
4. Examination	50%	√	√	√
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Examination is used to assess students on the overall understanding and the ability of applying the knowledge. It is supplemented by tests, assignments and laboratory reports which provide timely feedbacks to both lecturers and students.

Student Study Effort Expected

Class contact:	
▪ Lecture	32 Hrs.
▪ Tutorial/Laboratory	7 Hrs.
Other student study effort:	
▪ Reading and review	43 Hrs.
▪ Homework assignment	10 Hrs.
▪ Laboratory report	10 Hrs.
Total student study effort	102 Hrs.

Reading List and References	1. L.E. Kinsler, et al., Fundamentals of Acoustics, Wiley, latest edition. 2. M.P. Norton, Fundamentals of Noise and Vibration Analysis for Engineers, Cambridge University Press, latest edition. 3. H. Benaroya, Mechanical Vibration: Analysis, Uncertainties and Control, Prentice-Hall, latest edition. 4. A.P. Dowling and J.E. Ffowcs Williams, Sound and Sources of Sound, Chichester: E. Horwood, latest edition. 5. L.L. Beranek, Noise and Vibration Control Engineering: Principles and Applications, Wiley, latest edition.

Revised July 2014

Subject Description Form

Subject Code	ME41005
Subject Title	Noise Control Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics; and ME34004 Fluid Mechanics
Objectives	To provide students with fundamental concepts and knowledge of acoustic noise and control, including sound generation mechanism, noise abatement technology and applications
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the sound generation mechanisms and the method to analyze the type of noise source. b. Understand the simple sound fields and identify the noise sources and their respective mitigation measures. c. Understand the importance and usage of the noise assessment criteria for typical problems such as duct and room noise applications. d. Apply the state-of-the-art noise abatement technology and design elementary reactive and absorptive noise control device, analyze and interpret its performance from measurement. Understand basic principles in structural noise and aero-acoustic noise.
Subject Synopsis/ Indicative Syllabus	***Noise Characteristics and its modeling –*** Sound and noise characterization, sound measure in time frequency domain, elementary noise source, modelling of acoustic waves, and various types of sound source models. Overview of control strategy for different frequency ranges. ***Sound Reflection and Absorption –*** Sound propagation in different acoustic media, typical sound propagation phenomena and characterization, duct acoustics, sound reflection by expansion chamber, Helmholtz resonator, sound absorbing materials and absorbers, design of reactive silencers, acoustic enclosures etc. ***Flow-induced Noise and Control –*** Von Karman vortices, turbulence noise, cavitations, jet noise, fan noise etc. ***Structure-induced Noise and Control –*** Basic sound radiation phenomena, vibration isolation and absorption, sound transmission and mass law. ***Environmental Noise and Control –*** Basic concepts of sound propagation outdoors, absorption of sound in air; attenuation of sound over ground, temperature gradient etc. Noise reduction by sound barriers, Maekawa formula. Train noise, etc. ***Room Acoustic Control –*** Basic concepts of room acoustics, direct and diffuse sound

field, reverberation time, Sabin formula, prediction of internal sound field and noise mitigation measures.

Laboratory Experiment
There is one 1-hour laboratory session.
Typical experiment:
1. Helmholz resonator
2. Expansion chamber

Teaching/Learning Methodology

Lectures are aimed at providing students with the knowledge of acoustics and noise control for achieving the subject outcomes. (Outcomes a to d)

Tutorials are aimed at enhancing students' skills necessary for analyzing and designing the noise control method. (Outcomes a, b and d)

Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems, to develop the students' interest and curiosity in the design of noise control method. (Outcomes b to d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Tutorial	√	√		√
Experiment		√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Homework	30%	√	√		√
2. Lab report	10%		√	√	√
3. Examination	60%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:
0.60 × End of Subject Examination + 0.40 × Continuous Assessment

Examination is applied to assess students on understanding and the ability to apply the concepts. It is supplemented by the homework and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Laboratory	6 Hrs.
	Other student study effort:	
	▪ Reading and review	44 Hrs.
	▪ Homework assignment	12 Hrs.
	▪ Laboratory report	10 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. A.D. Pierce, Acoustics: an Introduction to its Physical Principles and Applications, Acoustical Society of America, Woodbury, N.Y., latest edition. 2. A.P. Dowling and J.E. Ffowcs Williams, Sound and Sources of Sound, Chichester: E. Horwood, latest edition. 3. L.L. Beranek, Noise and Vibration Control Engineering: Principles and Applications, Wiley, latest edition. 4. D.A. Bies and C.H. Hansen, Engineering Noise Control: Theory and Practice, E & FN Spon, latest edition.	

Developed Jan. 2018

Subject Description Form

Subject Code	ME41006
Subject Title	Perceptual Robotics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear Systems and Control
Objectives	The subject aims to equip students with knowledge of: 1. Artificial robot perception 2. Perception-guided control 3. Adaptive robot behaviour 4. Perception-aided algorithms
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) Able to mathematically model the different perceptual modalities used for robotic systems; b) Able to design perception-guided motion controls for mechanical robots c) Able to use perceptual feedback to implement adaptive robot behaviours d) Able to design perception-aided methods for learning properties about the environment e) Able to conduct experiments with perceptual and robotic systems
Subject Synopsis/ Indicative Syllabus	**Artificial robot perception.** Vision sensors (monocular perception and RGB-D sensors), thermal imaging (models and principles), touch (force and tactile imaging), proximity (different ranging methodologies), audio sensing. **Perception-guided control.** Sensor-motion coordination problem, derivation of sensorimotor models (analytical and computational), formulation of sensor servoing controls (vision-based, thermal-based, touch-based, proximity-based). **Adaptive robot behaviour.** Braitenberg machines, reactive motion paradigms (potential fields, subsumption architecture, etc.), hybrid paradigms, multi-agent systems, robot babbling, bug algorithms, sensor-based navigation. **Perception-aided algorithms.** Iterative closest point (ICP), simultaneous localisation and mapping (SLAM), sensor-based model learning, and image registration. **Practical work.** A robotic platform is assigned to a team of 2-3 students. Each chapter is delivered with a hands-on experimental session where students reinforce their knowledge in the subject.

Teaching/Learning Methodology

1. Lectures aim at providing students with fundamental knowledge required for understanding and analysing different perceptual robotic systems, including its mathematical models, controller design, and algorithms. (Outcomes a to d)
2. Tutorials aim at enhancing students' analytical and problem solving skills on robotics. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to d)
3. The experiments/project aim to provide hands-on experience for developing perceptual robots, and reinforcing the acquired knowledge. (Outcomes a to e)

Teaching/Learning Methodology	Intended Subject Learning Outcomes to be assessed				
	a	b	c	d	e
1. Lecture	√	√	√	√	
2. Tutorial	√	√	√	√	
3. Experiments/Project	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Class test	10%	√	√	√	√	√
2. Coursework: includes assignments, project, experiments, lab report	40%	√	√	√	√	√
3. Final Examination	50%	√	√	√	√	
Total	100 %					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 x End of Subject Examination + 0.50 x Continuous Assessment.

1. The continuous assessment aims at evaluating the progress of the students' study, assisting them in self-monitoring the respective learning outcomes, and applying the knowledge learnt in practical situations.
2. The examination is used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lectures	33 Hrs.
▪ Tutorials / Laboratory	6 Hrs.
Other student study effort:	

	▪ Course work	40 Hrs.
	▪ Self-learning	36 Hrs.
	Total student study effort	115 Hrs.
Reading List and References	1. Lecture Notes, Articles, and Handouts 2. Computer Vision: A Modern Approach, David A. Forsyth and Jean Ponce, latest edition. 3. Introduction to AI Robotics, Robin Murphy, MIT Press Cambridge, MA, USA, latest edition. 4. Principles of Robot Motion: Theory, Algorithms, and Implementations, Howie Choset et al, MIT, latest edition. 5. Vehicles: Experiments in Synthetic Psychology, Valentino Braitenberg, MIT Press Ltd, latest edition. 6. Robotics Modelling, Planning and Control, Bruno Siciliano at al, latest edition.	

Developed in June 2019

Subject Description Form

Subject Code	ME42001
Subject Title	Artificial Intelligence in Products
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear Systems and Control ; or ME41004 Mechatronics and Control
Objectives	To provide students with basic knowledge on Artifical Intelligence (AI) for product design and development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply knowledge of mathematics, expert systems, fuzzy systems and learning models to aid the design and development of intelligent products and systems. b. Understand applications of AI in different fields. c. Work effectively as a member to tackle a multi-disciplinary design project involving the application of AI. d. Appreciate the state-of-the-art applications of AI in products and present a design project via computer programming and written report.
Subject Synopsis/ Indicative Syllabus	***Expert Systems*** **-** Principles of expert systems; Knowledge representations; Inference mechanisms; Graph search algorithms; Rule-based expert systems; Application of expert systems to product design and product data management using Prolog or available software packages. (Delete some topics) ***Fuzzy Inference Systems*** **-** Fuzzy sets and crisp sets; Membership functions; Properties of fuzzy sets; Operations on fuzzy sets; Operations on fuzzy relations; Fuzzy if-then statements; Inference rules; Developing fuzzy inference systems using Matlab or available software packages. ***Learning Models*** **–** Introduction to different learning algorithms and models; Regression; Classification; Supervised learning; Unsupervised learning; Reinforcement learning; Neural Network; Deep learning; Developing learning models using Python or available software packages

Teaching/Learning Methodology

1. The lectures are aimed at providing fundamental knowledge on artifical intelligence for product design and development. (Outcomes a and b)
2. The tutorials/computer labs are aimed at enhancing applicable skills of the students. Examples of machine intelligence and other forms of AI in commercial products will be involved. (Outcomes a and b)
3. The project is aimed at integrating the knowledge that will be applied through a team project on product design and development with intelligence systems. (Outcomes a - d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		
Tutorial	√	√		
Project	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Class Test	10%	√	√		
2. Homework	10%	√	√		
3. Group Project	30%	√	√	√	√
4. Examination	50%	√	√		
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 x End of Subject Examination + 0.50 x Continuous Assessment.

The weighting of 50% on continuous assessment is meant to allow students to consolidate their learning through continuous effort such as assignments and project work. The group project will be assigned to students at early stage of the subject study which enables students to link the knowledge they learnt with the project step by step. Report and the presentation will be major outcomes of the project work that will show how the students are able to design intelligent systems for products. The examination is used to assess the knowledge acquired by the students for understanding artifical intelligence of the products.

Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Tutorial / Computer Labs	9 Hrs.
	Other student study effort:	
	▪ Reading and review	20 Hrs.
	▪ Homework assignment	10 Hrs.
	▪ Project Report	36 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Luger, G.F., and Stubblefield, W.A., Artificial Intelligence and the Design of Expert Systems, The Benjamin/Cummings Publishing Co., latest edition. 2. Clocksin, W. F., Programming in Prolog, Berlin; New York: Springer-Verlag, latest edition. 3. Ross, Timothy J., Fuzzy logic with engineering applications, Chichester; Hoboken, NJ: Wiley, latest edition. 4. Campesato, O., Artificial Intelligence, Machine Learning, and Deep Learning, Mercury Learning & Information, latest edition.	

Revised Jun 2020

Subject Description Form

Subject Code	ME42004
Subject Title	Development of Green Products
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: CEE370 Environmental Science I; or ME22002 Integrated Product Development Fundamentals; or ME32001 Manufacturing Fundamentals; or ME32003 Design and Manufacturing; or ISE386 Integrated Design for Manufacture
Objectives	To enhance students' awareness of environmental issues and provide them with necessary knowledge in green product development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate the environmental impact of product manufacturing, distribution, use and disposal. b. Critically evaluate the environmental impacts of products during their life cycle and suggest appropriate actions to minimize/mitigate the impacts. c. Apply green design concepts in designing/re-designing products to fulfill the needs of green product market. d. Evaluate existing products/processes/technologies in terms of their environmental performance, and present the findings via oral presentation and written report.
Subject Synopsis/ Indicative Syllabus	***Environmental Issues of Concern*** - Depletion and degradation of natural resources, environmental pollution and history of responses to pollution, waste and waste disposal issues, global warming, ozone layer depletion, acid rains, desertification, climate change, consumerism and its effect on global environment , individual and social preference for green living. ***Environmental Impact of Products*** - Life-cycle of a product, environmental impact of products over its life-cycle, environmental impact of packaging, strategies for minimizing environmental impact, drivers for green product design ***Green and Sustainable Product Development Process*** - Concept of green and sustainable product development: product design, planning and innovation for environment, concept of eco-design, eco-labelling and energy-labelling, international environmental management standards. ***Material Selection and Procurement for Green Product Development –*** Material selection for green design: Material selection process steps for green design, material selection methods, and material assessments. Green Procurement: Benefits of green procurement, green procurement process steps, evaluation of suppliers, green procurement programmes.

	Environmental Assessment of Green Products **-** Criteria on the global warming, stratospheric ozone depletion, photochemical ozone formation, acidification, nutrient enrichment, ecotoxicity, human toxicity, resource consumption and working environment. Normalisation and weighting in the environmental assessment of products, life-cycle impact assessment (LCA) of products. ***The Green Future*** **-** Green consumerism, opportunities from green technologies, green taxes and their effect on product development and marketing.
Teaching/Learning Methodology	1. The lectures are aimed at providing students with an integrated knowledge required for understanding the need for a green design approach, developing green products, assessing environmental impact of products and highlighting the opportunities arising from green consumerism. They provide a necessary framework for subsequent self-learning and group-learning activities. (Outcomes a to c) 2. The tutorials are aimed at enhancing the students' skills necessary for analyzing the environmental impact of existing products and packaging solutions using various tools and develop solution strategies to minimize impact. Therefore, students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to c) 3. The mini-project is aimed at enhancing the written and oral communication skills and teamwork spirit of the students. The students are expected to utilize the knowledge acquired in class to analyze the environmental impact of a selected existing product and systematically redesign it to enhance its green attributes in order to strategically place the product in rapidly developing green market. (Outcomes c and d) 4. The assignments and case studies are aimed at providing students with learning opportunities to study the practical implementations of green product and process assessments and developments. (Outcomes a, b and d)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture/Tutorial	√	√	√	
Mini-project report & presentation			√	√
Homework assignments/Case studies	√	√		√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Homework assignments/ Case studies	10%	√	√		√
2. Test	20%	√	√	√	
3. Mini-project report & presentation	20%			√	√
4. Examination	50%	√	√	√	
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment.

1. The continuous assessment will comprise three components: homework assignments & case studies (10%), test (20%) and mini-project report & presentation (20%). The homework assignments and test are aimed at evaluating the progress of students study and assisting them in fulfilling the respective subject learning outcomes. The mini-project and case studies are to assess students learning outcomes while providing them with opportunities to apply their learnt knowledge, enhance written & oral communication skills and team-work spirit.

2. The examination (50%) will be used to assess the knowledge acquired by students independently in understanding and analysing related problems critically and to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/Mini-project discussion & presentation	6 Hrs.
Other student study effort:	
▪ Self study/coursework	43 Hrs.
▪ Mini-project report preparation and presentation	24 Hrs.
Total student study effort	106 Hrs.

Reading List and References

1. Azapagic A., Perdan S., Clift R. and Surrey G., Sustainable Development in Practice, John Wiley & Sons, Ltd., latest edition.
2. Burall P., Product Development and the Environment, The Design Council, latest edition.
3. Fuad-Luke A., EcoDesign: The Sourcebook, Chronicle Books, latest edition.
4. Ottman J.A. Green Marketing, NTC Business Books, latest edition.
5. William McDonough & Michael Braungart, Cradle to Cradle: Remaking the Way We Make Things, latest edition.
6. Ulrich, K.T. and Eppinger, S.D., Product Design and Development, McGraw-Hill, latest edition.

Revised July 2016

Subject Description Form

Subject Code	ME43001
Subject Title	Advanced Materials for Design and Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials Exclusion: ME45006 Aircraft Structure and Engineering Composite
Objectives	To provide advanced knowledge on the design, development, processing, applications and structural evaluations of advanced materials and structures, including smart materials and aircraft and aerospace structures.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the mechanics of composites and smart materials in the product design process. b. Design innovative products/structures by applying knowledge in advanced materials and technology including smart materials and intelligent technology. c. Identify the limitations and constraints by using advanced materials at different environments. d. Consider environmental factors during the product design process.
Subject Synopsis/ Indicative Syllabus	***Advanced Composite Materials*** **-** Design and mechanical performance; Lamination theory; The rule of mixtures; Design for aircraft and aerospace structures; Environmentally-friendly composites; Composite manufacturing process; Recycling advanced composites; Environmental impact. ***Smart Materials and Structures and Integrated Systems*** **-** Shape memory alloy (SMA) sensors and actuators; Hysteresis loop; Constitutive models; Active piezo-electric actuators; PVDF; Magnetostrictive materials; Dynamic control of smart structures; Bio-compatibility; Embedded sensor technology. ***Nano-structural Materials*** **-** Carbon nanotubes and their composite structures; Nanoclay/polymer composites; Superhard particles for wear resistance; Micro-electro-mechanical (MEMs) and Nano-electro-mechanical (NEMs) devices.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to advanced materials. (Outcomes a, b and c)

Tutorials are used to illustrate the application of fundamental knowledge to practical situations. (Outcomes a, b and c)

Project or case study is used to allow students to deepen their knowledge on a specific topic through search of information, analysis of data and report writing. (Outcomes a to d)

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results. (Outcomes a and c)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	
Tutorial	√	√	√	
Project/case study	√	√	√	√
Experiment	√		√	

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Examination	50%	√	√	√	√
2. Assignment	25%	√	√	√	√
3. Project / case study / Presentation	20%	√	√	√	√
4. Laboratory report	5%	√		√	
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written report and oral presentation on a specific project or case study are used to assess the students' knowledge on smart materials.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial/Laboratory	6 Hrs.
	Other student study effort:	
	▪ Assignment	21 Hrs.
	▪ Self-study	40 Hrs.
	Total student study effort	100 Hrs.
Reading List and References	1. Nano-scale materials: from science to technology, S.N. Sahu, R.K. Choudhury, and P. Jena, editors, New York, Nova Science Publishers, latest edition. 2. Smart Materials, edited by Mel Schwartz, CRC Press/Taylor & Francis, latest edition. 3. Progress in Smart Materials and Structures, Peter L. Reece, editor, New York, Nova Science Publishers, latest edition. 4. Smart Structures -Analysis and Design, A. V. Srinivasan and D. M. McFarland, Cambridge University Press, latest edition. 5. Shape Memory Materials, K. Otsuka & C. M. Wayman, Cambridge University Press, latest edition. 6. Zafer Gurdal, Raphael T. Haftka and Prabhat Hajela, Design and Optimization of Laminated Composite Materials, John Wiley & Sons, latest edition. 7. Sergey Edward Lyshevski, MEMS and NEMS: Systems, Devices, and Structures, Boca Raton, Fla.: CRC Press, latest edition. 8. Facing up to the Recycling Challenge, Reinforced Plastics, Elsevier, Monthly Periodocal, latest edition. 9. Principles of Composite Material Mechanics, Ronald F. Gibson, CRC Press, Taylor & Francis Group, latest edition. 10. Materials Science and Engineering an Introduction, William D. Callister, David G. Rethwisch, John Wiley & Sons, latest edition.	

Revised March 2015

Subject Description Form

Subject Code	ME43003
Subject Title	Product Testing Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials
Objectives	To equip students with basic knowledge and universal standards of common product testing and examination technologies.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply knowledge of mathematics, engineering sciences and computing simulation to analyze and test a product design via analytical, experimental and computational approaches. b. Understand and explain the effects of various important factors including materials, manufacturing processes, environmental and health issues, reliability and safety issues on product design and development. c. Work effectively as a member and apply project management technique in the capacity of a team leader to complete a multi-disciplinary product testing project. d. Appreciate the state-of-the-art product testing technologies and present a design project via written report. e. Recognize the need to develop the ability of life-long learning.
Subject Synopsis/ Indicative Syllabus	***Purpose and Classification of Product Testing and Examination*** **-** Damage and degradation of products, environmental attack, crack initiation, aging, fault in manufacturing process; classification of testing and examination methods. ***Destructive Testing*** **-** Tensile and shear strength tests; Drop tests for home appliances and toys; Impact and fracture toughness tests for plastics and metallic materials; Scratch and wear tests of surface coatings; Hardness test; Creep and durability tests for static and dynamic products. ***Non-destructive Testing (NDT)*** **-** Damage detection in products; embedded sensor technology; Wireless sensing technique; Ultrasonic spectroscopy and detection technique; Vibration and acoustic emission technique; Acousto-ultrasonic reproducibility; C-scan of composite products; Thermal wave imaging and full-field NDE; Microwave evaluation; Eddy current and Magnetic flux techniques. ***Product Examination Techniques*** **-** Surface morphology examination using optical technique, scanning electron microscopy (SEM) and atomic force microscopy (AFM); Chemical analysis using EDX and XRF; Structure examination using XRD. ***Standards and Data Handling*** **-** Design for inspection; Testing codes and standards; Data collection and analysis techniques. ***Virtual Testing*** **-** Product drop test simulations using CAE technique.

Teaching/Learning Methodology

1. The lectures are aimed at providing students with an integrated knowledge required for understanding and analyzing product testing technology and methodology. (Outcomes a and b).
2. The tutorials are aimed at enhancing the analytical skills of the students. Examples on the analysis of testing methods and testing results will be involved. So the students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a, b and e).
3. The experiments will provide the students with hands-on experience on the instrumentation and measurement. It also trains students in the analysis and presentation of experimental data. (Outcomes a and b).
4. The mini-project is aimed at enhancing the written and oral communication skills and team-work spirit of the students. The students are expected to apply the knowledge learnt in product testing technologies. The students are required to participate in the mini-project through literature survey, information search, discussions, report writing and presentation of results. Innovative thinking is encouraged. (Outcomes a, b, c, d and e).

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√			
Tutorial	√	√			√
Experiment	√	√			
Mini-project	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Test	20%	√	√			
2. Assignment	10%	√	√			√
3. Project	20%	√	√	√	√	√
4. Examination	50%	√	√			
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 x End of Subject Examination + 0.50 x Continuous Assessment.

	1. The continuous assessment will comprise of four components: one test (20%), assignments (10%), project reports (10%) and oral presentation (10%). The test is aimed at assessing the interim knowledge gained by the student. The assignments are aimed at assisting the students in preparation for the tests and checking the progress of their study. The project report is aimed at assessing the capability of the student in analyzing and reporting experimental data, self-learning and problem-solving skills, and English writing capability. The oral presentation is aimed at assessing the student's communication and presentation skills. 2. The examination will be used to assess the knowledge acquired by the students for understanding and analyzing the product problems related to property testing and defect/motion detecting technologies.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Laboratory / Tutorial	9 Hrs.
	Other student study effort:	
	▪ Reviewing and Reading	26 Hrs.
	▪ Assignment / Laboratory Report	40 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Mechanical Testing, ASM International, ASM Handbook Volume 8, latest edition. 2. Sampling and analysis, Upper Saddle River, N.J.: Prentice Hall, latest edition. 3. Nondestructive testing of materials, Amsterdam; Washington, D.C.: IOS Press; Tokyo: Ohmsa, latest edition. 4. Practical non-destructive testing, Raj Baldev, New Delhi: Narosa Pub. House; Materials Park, Ohio: Distribution in North America only by ASM International, latest edition. 5. Encyclopedia of Materials Characterization, TA418.7.B73, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME44001
Subject Title	Air Conditioning for Indoor Thermal and Environmental Quality
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics or ME34003 Thermofluid Mechanics
Objectives	To provide students with the fundamental knowledge of air conditioning for indoor thermal and environmental quality.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate and understand the concepts and components of air conditioning and refrigeration systems and applications. b. Applied the general knowledge of indoor thermal comfort and environmental health. c. Applied the knowledge of moist air properties and conditioning processes. d. Apply the knowledge of heating and cooling load required for a building. e. Applied the knowledge of refrigeration systems and cycles.
Subject Synopsis/ Indicative Syllabus	***Introduction of Air Conditioning and Refrigeration Systems and Applications*** **-** Basic components of air conditioning and refrigeration systems. The complete air conditioning system. Central mechanical equipment. All-air systems, air-and-water systems, all-water systems. Unitary air conditioners. Heat pumps. Heat recovery systems. Thermal storage. ***Moist Air Properties and Conditioning Processes*** **-** Moist air and standard atmosphere. Fundamental parameters. Adiabatic saturation. Wet bulb temperature and the Psychrometric chart. Space air conditioning- design and off-design conditions. ***Space Heating and Cooling Loads*** **-** Outdoor and Indoor design conditions. Heat transmission in building structures. Infiltration. Heat losses from air ducts. Auxiliary heat sources. Supply air for space heating. Source media for space heating. Heat gain, cooling load and heat extraction rate. Solar radiation. Outside and interior surface heat balance. Zone air heat balance. Implementation of the heat balance method. ***Refrigeration*** **-** Refrigerants. Mechanical vapour-compression refrigeration cycles. Modifications to basic cycles. Reciprocating compressors. Cooling towers. ***Indoor Thermal Comfort*** **-** Physiological considerations. Thermal comfort indices and conditions. Hot and humid, and extreme cold environments. ***Indoor Environmental Health*** **-** Terminology and standards. Health sciences. The basic concerns of indoor air quality (IAQ). Prediction of indoor air quality model. Physical agents. Methods to control contaminants. Gas and particulate removal applications.

Teaching/Learning Methodology

1. The subject intends to equip students with fundamental knowledge of air conditioning for indoor thermal and environmental quality. Systematic lectures are required to achieve such foundation building coupled with assignments (outcomes a, b, c, d and e).
2. Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a, b, c, d and e).

It is intended to make use of these teaching/learning methodologies to achieve the intended subject learning outcomes as indicated in the following table:

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	√
Tutorial	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Assignment	30%	√	√	√	√	√
2. Test	20%	√	√	√		
3. Examination	50%	√	√	√	√	√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ Examination + $0.50 \times$ Continuous Assessment

1. The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test which covers the first half of the subject material provides useful feedback to both lecturer and students on the learnt topics.

2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Coursework	33 Hrs.
	▪ Self-study/	33 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. ASHRAE Handbooks on HVAC Systems and Equipment, Fundamentals, Refrigeration, and HVAC Applications, latest edition. 2. F.C. McQuiston, J.D. Parker and J.D. Spitler, Heating, Ventilating and Air Conditioning- Analysis and Design, John Wiley & Sons, Inc., latest edition. 3. W.T. Grondzik W.T.; J.S. Reynolds ; B. Stein; A.G. Kwok Mechanical and Electrical Equipment for Buildings, John Wiley & Sons, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME44002
Subject Title	Engine Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics
Objectives	To provide students with the fundamental knowledge of engine technology, and its combustion-related emissions.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand and evaluate physical parameters of engine design and operating characteristics. b. Apply the fundamental knowledge of solving air-standard and real air-fuel engine cycles. c. Apply the fundamental knowledge of thermochemistry and fuels. d. Understand the general principles of engine combustion, emissions controls and standards.
Subject Synopsis/ Indicative Syllabus	***Introduction*** **-** Historical perspective of engines. Engine classifications. Terminology and abbreviations. Engine components. Basic engine cycles. ***Engine Design and Operating Characteristics*** **-** Engine parameters. Indicated work per cycle. Mean effective pressure. Brake torque and power. Dynamometers. Air-fuel and fuel-air ratios. Specific fuel consumption. Fuel efficiencies. Volumetric efficiency. Specific emissions and emission index. Relationships between performance parameters. Engine design and performance data. Noise abatement. ***Engine Cycles*** **-** Air-standard cycles. Otto Cycle. Diesel cycle. Dual cycle. Comparison of Otto, Diesel and Dual cycles. Real air-fuel engine cycles. ***Thermochemistry and Fuels*** **-** Thermochemistry. Gasoline, diesel and alternative fuels. ***Engine Combustion and Emissions*** **-** Spark ignition engine combustion, ignition and burning rate analysis. Compression ignition engine combustion, fuel injection, ignition delay. Engine emissions controls and standards.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to internal combustion engines (outcomes a to d).

Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments (outcomes a to d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Assignment/Tutorial	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignment	30%	√	√	√	√
2. Test	20%	√		√	
3. Examination	50%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ Examination + $0.50 \times$ Continuous Assessment

1. The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students' studies, assisting them in fulfilling the respective intended subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test(s) covers the first half of the subject material and provides useful feedback to both the lecturer and students on the learnt topics.

2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the intended subject learning outcomes.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial	6 Hrs.
Other student study effort:	
▪ Self-study/Coursework	67 Hrs.
Total student study effort	106 Hrs.

Reading List and References	1. C.R. Ferguson and A.T. Kirkpatrick, Internal Combustion Engines, John Wiley & Sons Inc., latest edition 2. W.W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall, latest edition. 3. J.C. Guibet, Fuels and Engines- Technology, Energy and Environment, Vol. 1 & 2, Technip, Paris, latest edition.

Revised July 2014

Subject Description Form

Subject Code	ME44003
Subject Title	Combustion and Pollution Control
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics
Objectives	To provide students with the fundamental knowledge of combustion phenomena, and formation and control of combustion-generated air pollutants.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the fundamental knowledge of thermodynamics and chemical kinetics of combustion. b. Apply the general principles of combustion of fuels. c. Understand the formation mechanisms of combustion-generated air pollutants, and fuel emissions. d. Understand and determine appropriate methods for air pollution measurement and control. e. Determine the air pollutant concentration and dispersion from source(s).
Subject Synopsis/ Indicative Syllabus	***Thermodynamics and Chemical Kinetics of Combustion*** **-** Application of First Law of Thermodynamics. Reactant and product gaseous mixtures. Enthalpy of combustion. Adiabatic flame temperatures. Chemical and partial equilibrium. Global versus elementary reaction rates. Chemical time scales. Preignition kinetics. Global and quasi-global mechanisms. Nitrogen oxide kinetics. ***Combustion of Gaseous and Vaporised Fuels*** **-** Laminar and turbulent premixed flames. Diffusion flames. Mechanisms of flame stabilisation. Explosion limits. Mechanisms of quenching, flammability and ignition. ***Combustion of Liquid Fuels*** **-** Spray formation. Size distribution. Fuel injectors. Spray dynamics. Vaporisation of single droplet. ***Air Pollutants and Their Formation*** **-** Formation of carbon monoxide, nitrogen oxides, unburnt hydrocarbon, soot and particulates. Measurement techniques and quantification of air pollutants. ***Fuels and Emissions*** **-** Gasoline and diesel fuels. LPG, natural gas and biodiesel as alternative fuels. Oxygenated fuels. Effect of sulphur contents on diesel emissions. ***Aftertreatment for Motor Vehicle and Power Plant Emissions*** **-** Two and three way catalysts. Cyclones, precipitators, filters and traps, evaluation of capturing efficiency. Scrubbers for flue gas desulphurisation. NOx reduction. Advanced aftertreatment devices/systems.

	Introduction to Air Pollutant Dispersion **-** Chimneys, inversions and the atmosphere. Air pollutant concentration and dispersion from motor vehicles and chimneys. Street canyon effect.
Teaching/Learning Methodology	Lectures are used to deliver the fundamental knowledge in relation to combustion and pollution control (outcomes a to e). Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments (outcomes a to e). **Teaching/Learning Methodology** — **Outcomes** 1. Lecture: a √ b √ c √ d √ e √ 2. Assignment/Tutorial: a √ b √ c √ d √ e √
Assessment Methods in Alignment with Intended Learning Outcomes	**Specific assessment methods/tasks** — **% weighting** — **Intended subject learning outcomes to be assessed (Please tick as appropriate)** 1. Assignment: 30% — a √ b √ c √ d √ e √ 2. Test: 20% — a √ 3. Examination: 50% — a √ b √ c √ d √ e √ Total: 100% Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.50 × End of Subject Examination + 0.50 × Continuous Assessment 1. The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test(s) covers the first half of the subject material and provides useful feedback to both the lecturer and students on the learnt topics. 2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the intended subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study/coursework	67 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. G.L. Borman and K.W. Ragland, Combustion Engineering, McGraw-Hill, latest edition. 2. R.J. Heinsohn and R.L. Kabel, Sources and Control of Air Pollution, Prentice Hall, latest edition. 3. N.D. Nevers, Air Pollution Control Engineering, McGraw-Hill, latest edition. 4. S.R. Turns, An Introduction to Combustion- Concepts and Applications, McGraw-Hill, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME44004
Subject Title	Heat and Mass Transfer
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics; and ME34004 Fluid Mechanics
Objectives	To provide students with the fundamental knowledge of heat and mass transfer.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the fundamental knowledge of heat transfer mechanisms, namely conduction, convection and radiation. b. Evaluate different types of heat exchangers. c. Apply the numerical techniques in heat transfer applications. d. Apply the fundamental knowledge of mass transfer.
Subject Synopsis/ Indicative Syllabus	***Introduction*** - Conduction, convection and radiation. Fourier's law. Newton's law of cooling. ***Conduction*** - The plane wall. Insulation and thermal resistance. Radial systems. The overall heat transfer coefficient. Critical thickness of insulation. Heat-Source systems. Cylinder with heat sources. Heat transfer from extended surfaces. Unsteady conduction in slab or cylinder, Lumped-heat-capacity method. ***Forced and Free Convection*** - Governing equation for the boundary layer. Fluid and thermal boundary layer. The relation between fluid friction and heat transfer. Flow over a flat plate. Flow across cylinders/tubes and spheres. Heat transfer in laminar tube flow with constant temperature and constant heat flux. Heat transfer coefficients for free convection of plates and cylinders. ***Numerical Simulation*** - General differential equations for heat conduction. Energy balance method. Finite-difference solutions for differential equations of heat conduction. Explicit and implicit methods. Grid shape and size. Gauss-Seidel iteration. Accuracy and stability. ***Heat Exchanger*** - Heat exchanger types. The overall heat transfer coefficient. Heat exchanger analysis: Log mean temperature difference, parallel and counterflow heat exchangers. Heat exchanger analysis: The Effectiveness-NTU Method. ***Radiation*** - Black body and grey body. Absorptivity and emissivity. View factors. Irradiation and radiosity. Radiation exchange between surfaces and its network approach. ***Mass Transfer*** - Basic equations in mass transfer. Analogy between heat and mass transfer. Mass diffusion. Boundary conditions. Steady mass diffusion through a wall.

<table>
<tr><td></td><td>Water vapour migration in buildings. Simultaneous heat and mass transfer.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures are used to deliver the fundamental knowledge in relation to heat transfer and mass transfer (outcomes a to d).

Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments (outcomes a to d).

<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="4">Outcomes</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>Lecture</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Assignment/Tutorial</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
</table></td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td></tr>
<tr><td>1. Assignment</td><td>30%</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Test</td><td>20%</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>3. Examination</td><td>50%</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
</table>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:
0.50 × End of Subject Examination + 0.50 × Continuous Assessment

1. The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective intended subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test(s) covers the first half of the subject material and provides useful feedback to both the lecturer and students on the learnt topics.

2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the intended subject learning outcomes.</td></tr>
</table>

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study/Coursework	67 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. Y.A. Cengel and A.J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications, McGraw-Hill, latest edition. 2. J.P. Holman, Heat Transfer, McGraw Hill, latest edition. 3. F.P. Incropera, D.P. Dewitt, T.L. Bergman and A.S. Lavine, Principles of Heat and Mass Transfer, John Wiley & Sons, Inc., latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME44007
Subject Title	Fluids Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34004 Fluid Mechanics
Objectives	This subject provides students with knowledge to: 1. Apply principle of rotodynamic machinery to centrifugal pump design. 2. Select centrifugal pump system to aid operation of pipe flow system. 3. Understand major parameters of axial-flow fan design and their effects on fan characteristics. 4. Understand the phenomena of crossflow around cylinder(s) and their applications to flow-induced vibration.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply fluid mechanics/dynamics and mathematics to centrifugal/axial-flow pump/fan selection and design. b. Acquire skills and hands-on experience to assess the performance of centrifugal/axial-flow pump/fan at different operation conditions. c. Apply fluid mechanics/dynamics and mathematics to analyze the vibration caused by crossflow around cylinder. d. Conduct a pump/fan design project and produce a design report. e. Search for suitable information related to pump/fan design, and methods to control flow-induced vibration.
Subject Synopsis/ Indicative Syllabus	***Rotodynamic Machinery*** – Construction and characteristics of rotodynamic machinery: pump/fan and turbine, centrifugal pump/fan, axial-flow fan/turbine; application of Euler's equation and Bernoulli's equation. ***Centrifugal Pump*** – Velocity triangles through impeller and volute; losses and efficiency; Net Positive Suction Head (NPSH); impeller design: blade angle and number of blades; problem of cavitation; revision of pipe-flow system; selection of centrifugal pump for pipe flow system; characteristics of pumps in series/parallel; effects of pump speed; Similarity Laws and specific speed. ***Axial-flow Fan*** – Velocity triangles through impeller blade and stationary vane; static pressure and efficiency vs volume discharged; aero-foil lift/drag coefficients and angle of attack; hub/tip ratio; number and solidity of blades (pitch/chord ratio); relation of lift coefficient with blade solidity and flow deflection angle; effects of blade speed; aero-foil blades with losses. ***Crossflow around Cylinder(s)*** – Velocity distribution; effect of Reynolds numbers; flow separations; laminar and turbulent vortex street; vortex shedding; lift and drag; pressure distribution and coefficients; mean and fluctuating forces; effects of freestream turbulence, surface roughness and compressibility of the fluid on flow

field; Prandtl's mixing length model; flow-induced vibration; multi-cylinders system. control of vortex induced vibration.

Laboratory Work:
There are 2 two-hour laboratory sessions:
Typical experiments are:
1. Selection of centrifugal pump for a pipe-flow system.
2. Performance of axial-flow fan at different blade designs.
3. Vortex generation for a crossflow at different Reynolds numbers around a cylinder.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to centrifugal/ axial-flow pump/fan, and crossflow around cylinder(s) (outcomes a and c).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a, b and c).

Design project/case study are used to allow students to develop and enhance their knowledge and skills in design/analysis of centrifugal/axial-flow pump/fan and floe-induced vibration problem (outcomes a, b, c, d and e).

Experimental works are used to relate the concepts to practical applications and students are guided to obtain hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (outcomes b and e).

Teaching/Learning Methodology	**Learning Outcomes**				
	a	**b**	**c**	**d**	**e**
Lectures	√		√		
Tutorials	√	√	√		
Design Project / Case Study	√	√	√	√	√
Experimental Work		√			√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	**% weighting**	**Intended subject learning outcomes to be assessed**				
		a	**b**	**c**	**d**	**e**
1. Examination	50 %	√		√		
2. Test	20 %	√	√	√		
3. Design Project and Report	14 %	√	√		√	√
4. Case Study	8 %			√		√
5. Laboratory Work and Reports	8 %		√	√		√
Total	100 %					

<table>
<tr><td></td><td colspan="2">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:
0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the test, design project, case study and laboratory work which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written reports on design project, case study and laboratory work are used to assess the students' knowledge on these topics and ability on report writing.</td></tr>
<tr><td rowspan="7">On Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>• Lectures</td><td>33 Hrs.</td></tr>
<tr><td>• Laboratory Work/Tutorials</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Assignments: Design Project and Report, Case-study and Report, Laboratory Work and Reports</td><td>48 Hrs.</td></tr>
<tr><td>• Self-study and Literature Search</td><td>30 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>117 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. Darby, R., Chemical Engineering Fluid Mechanics, Marcel Dekker Inc., latest edition.
2. Zdravkovich, M.M., Flow around Circular Cylinders, Oxford University Press, latest edition.
3. Shaw, C.T., Using Computational Fluid Dynamics, Prentice Hall, latest edition.
4. Wallis, R.A., Axial Flow Fans and Ducts, John-Wiley, latest edition.
5. Osborne, W.C., Fans, Pergamon, latest edition.</td></tr>
</table>

August 2017

Subject Description Form

Subject Code	ME45001
Subject Title	Aerodynamics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34004 Fluid Mechanics
Objectives	To equip students with necessary knowledge of flow physics, analytical and numerical techniques for the prediction of forces acting on and performance analysis of aerodynamic bodies.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate and solve problems relating to low-speed flow past two-dimensional airfoils and aerodynamic bodies by applying inviscid and incompressible flow theories. b. Formulate and solve problems relating to downwash and induced drag phenomena for finite wings by applying the techniques derived from laws of vortex motion. c. Formulate and solve problems relating to compressible flow through nozzles/diffusers and supersonic flow past aerodynamic bodies by applying one-dimensional compressible flow equations and knowledge of flow compressibility and wave phenomena in aerodynamics. d. Analyze and interpret data obtained from experiments in incompressible and compressible aerodynamics. e. Present effectively in completing written reports of laboratory work and the given task.
Subject Synopsis/ Indicative Syllabus	***Fundamental Principles and Equations*** **-** Control volume concept for fluid. Continuity equation. Momentum equation. Energy equation. Substantial derivative. Angular velocity, vorticity and strain. Dimensional analysis. ***Inviscid and Incompressible Flow*** **-** Stream function and velocity potential. Potential flow. Laplace's equation and its elementary solutions. ***Incompressible Flow over Two-Dimensional Airfoils*** **-** Airfoil nomenclature and characteristics. The Kutta condition. Circulation and lift. Kelvin's circulation theorem and starting vortex. General thin airfoil theory. Symmetric and cambered airfoils. Aerodynamic Center. Panel method for arbitrary lifting bodies. Viscous airfoil drag. ***Finite Wings*** **-** Downwash and induced drag. Vortex system on finite wing. Law of vortex motion. Prantdl's lifting line theory. Lifting-surface theory and vortex lattice numerical method.

Inviscid and Compressible Flow **-** Definition of compressibility and total conditions. Governing equations. One-dimensional flow: weak waves and plane normal shock waves. Two-dimensional supersonic flow: oblique shock and expansion waves. Flow through nozzles and diffusers.

Compressible Flow over Airfoils **-** Velocity potential equation and its linearized form. Prandtl-Glauert compressibility correction. Critical Mach number. The sound barrier. Supersonic pressure coefficients. Application to supersonic airfoils.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental principles and equations of aerodynamics as well as solution techniques (outcomes a to d).

Tutorials are used to illustrate the application of fundamental principles to practical engineering situations (outcomes a to c).

Projects, in the form of design problems or case studies, are used to allow students to deepen their knowledge on a selected topic through search of information, analysis of data and report writing (outcomes a, b and e).

Experiment(s) on evaluating the effects of configurations of an airfoil on its flow field and aerodynamic characteristics, either in laboratory or numerical setup, is (are) provided for bridging the knowledge of fluid mechanics with current subject. Students are exposed to proper use of knowledge taught and analysis skills on evaluating their experimental results (outcomes a, d and e).

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	
Tutorial	√	√	√		
Project/Laboratory	√	√			√
Experiment	√			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Assignment	20%	√	√	√		
2. Project/Laboratory report	15%		√	√	√	√
3. Test	15%	√	√			
4. Examination	50%	√	√	√		
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

	Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments projects and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Assigned homework and test are designed to enhance the students' learning of fundamental principles in aerodynamics. The projects provide students an opportunity to capitalize on the knowledge they learn for tackling practical aerodynamic problems arising from real practice. Written report and oral presentation on a specific project or case study is used to assess the students' knowledge in contemporary aircraft maintenance engineering.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study	45 Hrs.
	▪ Homework assignment	12 Hrs.
	▪ Project/case study	12 Hrs.
	Total student study effort	108 Hrs.
Reading List and References	1. Anderson Jr., J. D., Fundamentals of Aerodynamics, McGraw-Hill, latest edition. 2. Houghton, E. L., and Carpenter, P. W., Aerodynamics for Engineering Students, Butterworth & Heinemann, latest edition. 3. Bertin, J. J. and Cummings, R. M., Aerodynamics for Engineers, Pearson Prentice-Hall, latest edition. 4. Anderson Jr., J. D., Aircraft Performance and Design, McGraw-Hill, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME45002
Subject Title	Aircraft Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34004 Fluid Mechanics
Objectives	To develop students' fundamental knowledge and basic concepts on components and operating principles of essential mechanical and electrical systems in civil transport aircraft.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate good understanding of the principles of flight control and various systems in civil transport aircraft; and formulate and solve problems relating to aircraft systems. b. Identify the flight control and utility functions to be considered in the design of an aircraft hydraulic system. c. Explain major electrical loads and the characteristics of modern aircraft electrical system. d. Explain the need for cabin and avionics conditioning and outline recent advances in aircraft environmental control system design. e. Explain the design philosophy and objectives of aircraft emergency systems.
Subject Synopsis/ Indicative Syllabus	***Flight Control Systems*** **-** Principles of flight control. Primary and secondary flight controls. Flight phases. ***Power Plant*** **-** Fuel efficiency. Effect of specific thrust. Specific fuel consumption and flight speed. Engine cycle and performance. ***Fuel Systems*** **-** Characteristics of aircraft fuel systems. Fuel system components. Aircraft mass and payload. ***Hydraulic Systems*** **-** Flight control and utility functions. Emergency power sources. Landing-gear system. Braking and anti-skid. ***Electrical systems*** **-** Characteristics of civil aircraft electrical system. Electrical loads. Emergency power generation. ***Pneumatic systems*** **-** Pitot-static systems. Use of engine bleed air**.** Bleed air control. Thrust reversers. ***Environmental Control Systems*** **-** The need for cabin and equipment conditioning. Environmental control system design. Air distribution systems. Cabin pressurization. ***Emergency Systems*** **-** Warning systems. Fire detection and suppression. Emergency oxygen. Explosion suppression. Passenger evacuation.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to various aircraft systems (outcomes a to e).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to e).

Industrial visits and special seminars delivered by invited industrial professionals are used to relate the concepts learnt on class to engineering practices. Students are expected to achieve better understanding of aircraft systems through these activities (outcomes a to e).

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	√
Tutorial	√	√	√	√	√
Industrial field visit and special seminar	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/ tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Examination	50%	√	√	√	√	√
2. Assignment and test	40%	√	√	√	√	√
3. Industrial field visit and visit report, report for special seminars	10%					√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments, closed-book tests, industrial visits and special seminars. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Course work	20 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	104 Hrs.
Reading List and References	1. The Rolls-Royce Book of the Jet Engine, latest edition, Rolls-Royce Ltd, latest edition. 2. SAE Aerospace Information Report 5005, Aerospace – Commercial Aircraft Hydraulic Systems, latest edition. 3. I. Moir amd A.G. Seabridge, Design and Development of Aircraft Systems – An Introduction, First Edition, AIAA Education Series, latest edition.	

Revised July 2014

Subject Description Form

Subject Code	ME45006
Subject Title	Aircraft Structure and Engineering Composites
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials Exclusion: ME43001 Advanced Materials for Design and Technology
Objectives	To provide students fundamental knowledge relevant to the structures and composite materials used in modern aircraft, and broad knowledge of all aspects of the technology related to aircraft structural applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate an understanding of key aspects of aircraft structures. b. Formulate, analyze, design and optimize an aircraft structure subject to a combined loading using stress analysis tools. c. Formulate and solve problems involving compression/tension, bending, torsion and buckling in aircraft structures. d. Understand mechanical behaviors and manufacturing of composites used in aircraft. e. Gain appreciation of the wide design flexibility composites in modern aircraft.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Aircraft Structures and Materials*** – Aircraft structures. Wing, fuselage, tail and landing gear. Aircraft materials. ***Elasticity*** – Equations of equilibrium in a non-uniform stress field. Linear stress-strain relations. Loads Applied on Aircraft Structures – Torsion of wing and fuselage. Bending and Flexural shear of wing and fuselage. Closed single-cell thin-walled fuselage. Transverse shear stress due to transverse force in symmetric sections of fuselage. ***Flexural Shear Flow in Fuselage*** – Flexural shear flow in open thin-walled section. Shear centre in open sections. Closed thin-walled sections and combined flexural and torsional shear flow. ***Failure Criteria*** – Ductile and brittle materials. Fracture mechanics. Stress intensity factor. Fatigue. Failure criteria. ***Elastic Instability*** – Eccentrically loaded beam-column. Elastic buckling of landing gear. Torsional-flexural buckling of thin-walled bars. ***Analysis of Lamina and Laminates in Aircraft*** – Plane stress equations for composite lamina. Off-axis loading. Stacking sequence in laminates. Symmetric laminate under in-plane loading. Effective moduli for symmetric laminates. Laminar stresses.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to aircraft structures and composites (outcomes a to e).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to e).

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	√
Tutorial	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
1. Examination	50%	√	√	√	√	√
2. Assignment and test	50%	√	√	√	√	√
Total	100%					

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments and closed-book tests. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial	6 Hrs.
Other student study effort:	
▪ Course work	20 Hrs.
▪ Self-study	45 Hrs.
Total student study effort	104 Hrs.

Reading List and References

1. C.T. Sun, Mechanics of Aircraft Structures, John Wiley & Sons, latest edition.
2. R.F. Gibson, Principles of Composite Material Mechanics, McGraw-Hill International Editions, latest edition.

Revised March 2015

Subject Description Form

Subject Code	ME47005
Subject Title	Aircraft Performance and Flight Management
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	To teach students the fundamental aerodynamic principles and performance analyses for the management of aircraft flight in atmosphere.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate a good understanding of the aircraft wing aerodynamic forces and their management in cruising flight; b. Define the combinations of aircraft aerodynamic features and propulsion methods for different cruising requirements; c. Describe the relationships between the performance prescriptions and the power and thrust requirements for steady flight; d. Evaluate the aircraft manoeuvre stability for managing flying qualities.
Subject Synopsis/ Indicative Syllabus	***Aircraft Wing Aerodynamics*** – Airfoil lift, drag and moments. Airfoil data. Compressibility correction. Finite wing aerodynamics. Induced drag. High-lift mechanisms. ***Aircraft Performance*** – Concept of drag polar. Propulsion characteristics. Tradeoff between thrust availability and performance efficiency. Thrust and power requirements for cruising flight. Altitude effects. Climb and descent performance. Gliding flight. Takeoff and landing. Level turn, pull-up and pull-down. ***Manoeuvre Management*** – Flying qualities. Elementary concepts of stability and control. Tail surfaces. Pitching moments of airfoil. Static and dynamic stability. Longitudinal and lateral stability. Stalling and spinning. Flight management and guidance computers (FMGC).

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to various aspects of aerodynamic characteristics for aircraft as well as their influence in determining the aircraft performance and manouvre management for atmospheric flight (Outcomes a to d).

Tutorials are used to illustrate the application of fundamental knowledge to practical flight situations (Outcomes c and d).

Experiment on evaluating the effects on aircraft wing profile on aerodynamic force characteristics, either in laboratory or numerical setup, is provided for bridging the knowledge of aerodynamics with flight performance. Students are exposed to proper use of knowledge taught and analysis skills on evaluating their experimental results (Outcomes a and c).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	√
Homework assignments		√	√	√
Test		√	√	
Examination	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Homework assignments	20%	√	√	√	√
2. Experiment	15%		√		
3. Test	15%		√	√	
4. Examination	50%	√	√	√	√
Total	100%				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments projects and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Assigned homework and test are designed to enhance the students' learning of fundamental flight mechanics of an aircraft. The experiment provides students an opportunity to capitalize on the knowledge they learn for tackling practical aircraft flight performance problems. Written report and oral presentation on a specific project or case study is used to assess the students' knowledge in contemporary aeronautical engineering practice.

Student Study Effort Expected	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Tutorials	6 Hrs.
	Other student study effort:	
	▪ Self Study	42 Hrs.
	▪ Homework assignments	12 Hrs.
	▪ Project/Case study	12 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Kermondes, A. C., Mechanics of Flight, Prentice Hall, latest edition. 2. Anderson Jr., J. D., Introduction to Flight, McGraw-Hill, latest edition. 3. Torenbeek, E., and Wittenberg, H., Flight Physics, Springer, latest edition. 4. Hull, D. G., Fundamentals of Airplane Flight Mechanics, Springer, latest edition.	

March 2014

Subject Description Form

Subject Code	ME47007
Subject Title	Aircraft and Spacecraft Propulsion
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics; and ME34004 Fluid Mechanics
Objectives	1. To provide students with the basic knowledge relevant to propulsion systems of aircraft and spacecraft. 2. To provide students with knowledge and applications of thermodynamic cycles in propulsion systems of aircraft and spacecraft and the chemistry and thermodynamics of combustion.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand basic knowledge of modern propulsion systems used in today's aircraft and spacecraft, such as turbojet, turbofan and rocket propulsion. b. Obtain state-of-the-art knowledge in the area of advanced aerodynamics and thermodynamics related to modern propulsion systems in aircraft and spacecraft. c. Apply their knowledge, skills and hand-on experience to the design and analysis of propulsion systems in aircraft and spacecraft. d. Extend their knowledge of mechanical engineering to different situations of engineering context and professional practice in turbomachinery.
Subject Synopsis/ Indicative Syllabus	***Basic Knowledge of Compressible Flows and Thermodynamics*** **-** Conservation laws including continuity equation, momentum equation and energy equation. Brief review of thermodynamics. Isentropic and polytropic processes, stagnation concept. Speed of sound and Mach number. Quasi-one-dimensional flows, including compressible flows with friction and heat and nozzle flows. ***Introduction to Propulsion Systems of Aircraft*** **-** Thrust and drag. Engine stall. Ramjet, turbojet, turbofan, turboprop, turbo-shaft engines, and new types of engines. Engine maintenance. Engine airworthiness. ***Basic Components of Aircraft Gas-turbine Engine*** **-** Inlets. Compressor. Combustion chambers and afterburners. Turbine and nozzles. ***Cycle Analysis and Performance*** **-** Thrust equations. Engine performance parameters. Thermal and propulsion efficiencies. Fuel consumption rate and specific thrust. Basic considerations in the analysis of jet propulsion. Inter-cooling. Reheating. Regeneration. Cycle analysis. Modifications to turbojet engines. Gas turbine design. ***Turbomachinery*** **-** Basics of compressors and turbines. ***Introduction to Propulsion Systems of Spacecraft*** **-** Chemical rockets. Spacecraft propulsion. Electric propulsion. Rocket thrust. High-speed Airbreathing engines. Hypersonic propulsion.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to propulsion systems of aircraft and spacecraft (outcomes a to d).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to d).

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√	√	√
Tutorial	√		√	
Experiment		√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	50%	√	√	√	√
2. Assignments including Tests	30%	√	√	√	√
3. Experiment	20%	√	√	√	√
Total	100%				

Overall Assessment:

0.50 × End of Subject Examination + 0.50 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments, closed-book tests and group experiment. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Continuous assessment will also be used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English so as to fulfill the requirements of being space engineers.

All assigned homework inclusive of any computer problems should be worked independently. It is the students' responsibilities to work out the problems individually and to ask questions on those problems they have difficulty with. Unless stated otherwise, no group submission or copies are permitted. If a copy is detected, a zero score will be assigned.

Student Study Effort Expected

Class contact:	
▪ Lecture	33 Hrs.
▪ Tutorial/Lab.	6 Hrs.
Other student study effort:	
▪ Assignments	36 Hrs.
▪ Self-study	40 Hrs.
Total student study effort	115 Hrs.

Reading List and References

1. S. Farokhi. Aircraft Propulsion, Wiley, latest edition.
2. Hill P. and Peterson C., *Mechanics and Thermodynamics of Propulsion*. Addison Wesley, latest edition.
3. Sutton G. P., Biblarz O., *Rocket Propulsion Elements*, John Wiley & Sons, Inc., latest edition.
4. P. Fortescue, *et al.* Spacecraft Systems Engineering, Wiley, latest edition.

May 2016

Intended Blank

Training Subjects

Subject Description Form

Subject Code	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, Industrial Safety and Electronic Product Safety Test and Practice, Basic Mechatronic Practice and Basic Scientific Computing 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 mechanical, industrial systems and electrical engineering; b) Interpret basic occupational health and industrial safety requirements for engineering practice; c) Explain common electronic product safety tests; d) Design and implement simple mechatronic systems with programmable controller, software, actuation devices, sensing devices and mechanism; and e) Apply scientific computing software for computing in science and engineering including visualization and programming;

Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>(TM8059) Engineering Drawing and CAD</u> 1.1. Fundamentals of Engineering Drawing and CAD Principles of orthographic projection; sectioning; dimensioning; sketching; general tolerances; conventional representation of screw threads and fasteners; types of drawings including part drawing and assembly drawing. Introduction to CAD; features of 2D CAD system (layer; draw; modify; block & attributes; standard library); techniques for the creation of titleblock; setup of 2D plotting; general concepts on 3D computer modeling; parametric feature based solid modeling; construction and detailing of solid features; solid model modification and its limitations; concepts of assembly modeling including bottom up and top down approaches for the generation of parts, subassemblies, and final assembly; virtual validation and simulation, generation of 2D drawings from 3D parts and assemblies; drawing annotation including dimensioning, tolerancing, and part list. 1.2. Electrical Drawing Wiring diagram and wiring table for electronic and electrical installation, functional representation of circuit, system block diagram, electrical and electronic device symbols and layout, architectural wiring diagram with reference to the architectural symbols for electrical drawings in Hong Kong and international standards. 2. <u>(TM2009) Industrial Safety</u> 2.1. Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures. 2.2. Safety Law: F&IU Ordinance and principal regulations, OSH Ordinance and principal regulations. 2.3. Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling. 2.4. 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, personal protective equipment.

	3. (TM1116) Electronic Product Safety Test and Practice 3.1 Use of basic electronic test instruments, current and voltage measurements, waveform measurement, power supply and signal sources; 3.2 Electronic product safety test method; High Voltage Isolation Test, Insulation Resistance Test, Continuity Test, Leakage Current Measurement, Electrostatic Discharge (ESD) Test. 4. (TM0510) Basic Mechatronic Practice 4.1. Definitions of mechatronics; design and operation of typical mechatronic systems; appreciation of measurement system, actuator system, motor drives, mechanical drives, gear train and linkage, pneumatic and hydraulic systems, signal conditioning, and human-machine interfaces. 4.2. Integration of system components using appropriate controller hardware and software such as PLC, PAC, and Microcontroller system; use of simulation software packages for pneumatic and hydraulic circuit design. **One of the followings as decided by hosting programme** 5. (TM3014) Basic Scientific Computing with MATLAB 5.1. Overview to scientific computering; introduction to MATLAB; interactive calculations, random number generators, variables, vectors, matrices and string; mathematical operations, polynomial operation, data analysis and curve fitting, file I/O functions. Basic 2D and 3D plots. 5.2. M-file programming & debugging; scripts, functions, logic operations, flow control, introduction to graphical user interface. 6. (TM3300) Basic Scientific Computing with Python 6.1. Basic data structures and data operations; script programming and debugging; logic operations, flow control and graphical user interfaces. 6.2. Use of functions and popular Python packages, such as Numpy, Panda and Matplotlib. 6.3. Data visualization by using graphics packages; such as basic plotting, formatting, 2D and 3D plots and modifying colormap.

Learning Methodology	The teaching and learning 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.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed				
		a	b	c	d	e
Continuous Assessment						
1. Assignment / Project	Refer to individual Module Description Form	✓	✓	✓	✓	✓
2. Test			✓		✓	✓
3. Report / Logbook				✓	✓	
Total	100					

Assessment Methods	Remarks
1. Assignment / Project	The project 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. Report / Logbook	Report / Logbook is designed to facilitate students to acquire deep understanding on the topics of the training and to present those concepts clearly.

Student Study Effort Expected

Class Contact	**TM8059**	**TM2009**	**TM1116**	**TM0510**	**TM3014 or TM3300**
▪ Mini-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.
Other Study Effort					
▪ Nil					
Total Study Effort					**120 Hrs.**

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. BS8888 Technical Product Specification (TPS) Specification. 2. Cecil H. Jensen, et al, Engineering Drawing and Design, McGraw-Hill, 2008. 3. Warrendale, SAE fastener standards manual, Society of Automotive Engineers, 1997. 4. Timothy H Wentzell, et al, Machine Design, Delmar Learning, 2004. 5. Czernik, Daniel, Gaskets: Design, Selection, and Testing, McGraw-Hill, 1995. 6. Michael M. Khonsari, E. Richard Booser, Applied Tribology: Bearing Design and Lubrication, Wiley-Interscience, 2001. 7. IEEE Standard 315 / ANSI Y32.2 / CSA Z99 Graphic Symbols for Electrical and Electronics Diagrams. 8. IEC 61082 Preparation of Documents used in Electrotechnology. **Reference Books:** Training material, manual and articles published by Industrial Centre.

Subject Description Form

Subject Code	IC348
Subject Title	Appreciation of Manufacturing Processes
Credit Value	3 Training Credits
Level	3
Pre-requisite	IC2105
Objectives	This subject aims at developing students' understanding on: • the principles and operations of common manufacturing processes, and • the properties and application of different materials.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) demonstrate a holistic understanding on the working principle, capability and operation of common manufacturing processes. b) justify appropriate manufacturing processes for specific product requirements. c) select and use various common engineering materials for specific purpose. and d) collaboratively complete an application oriented project through group work and discussions / and discuss current industrial practices and technologies.
Subject Synopsis/ Indicative Syllabus	**Outline Syllabus**: 1) Properties and uses of common materials including ferrous metal, non-ferrous metals, and polymers. 2) Working principles and operation of metal removal processes including turning, milling, CNC machining, and electro-discharge machining. 3) Working principles and operation of common production processes including casting methods for metal parts, and plastic injection moulding. 4) Working principles and operation of arc welding and gas welding. 5) Working principles and operation of common sheet metal parts manufacturing processes including blanking, forming, and turret pressing. 6) Working principles, operation, and comparison of surface-finish processes including electro-plating, and aluminium anodising.

<table>
<tr><td></td><td>7) Application of dimensional and geometrical measuring tools.</td></tr>
<tr><td>Learning Methodology</td><td>Min-lectures aim at providing students an understanding of the principles and application of common manufacturing technologies, properties and selection of common engineering materials.

Hands-on activities will be used for students to appreciate the working principles, capability and operation procedures of common manufacturing processes.

Group product assembly will be used to enable students to apply acquired practical knowledge and skills to produce a functional product, and to facilitate students in performing group collaboration and problem solving skills learning.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Assessment Methods</th><th rowspan="2">Weighting (%)</th><th colspan="4">Intended Learning Outcomes Assessed</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th></tr>
<tr><td>1. Individual Assignments</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>2. Product Assembly</td><td>10</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>3. Individual Report</td><td>30</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td></td><td></td><td></td><td></td></tr>
</table>
The Individual Assignments are aimed at assessing student’s practical ability in using various processes to produce the components for the product.

The Product Assembly is aimed at assessing student’s group collaboration, organization, time management and problem solving capability.

The individual Report is aimed at assessing student’s appreciation, understanding, and application of all the processes involved in the product.
</td></tr>
<tr><td>Student Study Effort Required</td><td>
<table>
<tr><td>Class Contact</td><td></td></tr>
<tr><td>Min-lecture /Hands-on Practice/ Product Assembly /Report Writing</td><td>90 Hrs.</td></tr>
<tr><td>Other Study Effort</td><td>0 Hrs.</td></tr>
<tr><td>Total Study Effort</td><td>90 Hrs.</td></tr>
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Reading List and References	Reading Materials published by the Industrial Centre : 1. Marking Out, Measurement, Fitting & Assembly 2. Metal Cutting Processes 1-Turning 3. Metal Cutting Processes 2 - Milling 4. Computer Numerical Control (CNC) 5. Foundry Processing 6. Plastics Technology Practice 7. Sheet Metal Fabrication 8. Welding Practice 9. Photo-Chemical Machining (PCM) 10. Surface Finishing

Subject Description Form

Subject Code	IC382
Subject Title	Multidisciplinary Manufacturing Project
Credit Value	3 Training Credits
Level	3
Pre-requisite	IC348 or IC2114 or IC381
Objectives	The subject provides opportunity for students to work in a multidisciplinary project team to accomplish realistic engineering goals. Through the project, students will apply and integrate the engineering knowledge and practical skills acquired from prior engineering subjects and industrial trainings. Students will also be able to analyse engineering problems from multiple perspectives, and synthesize a solution from ideas contributed by teammates of multiple disciplines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) apply engineering knowledge in carrying out an industrial project starting from problem definition, design, manufacturing, down to assembly, testing and evaluation; b) select and use appropriate technology building blocks, components and manufacturing processes to develop a solution to meet given specifications and constraints; c) Work collaboratively and effectively in a multidisciplinary team to accomplish mutual project goals; and d) Communicate effectively in a multidisciplinary project team.
Contribution of the Subject to the Attainment of Outcomes of EIE Programmes	<u>Category A: Professional/academic knowledge and skills</u> • Design systems, components and processes to meet given specifications and constraints. • Use modern engineering/IT tools appropriate to EIE practice. <u>Category B: Attributes for all-roundedness</u> • Work with others collaboratively in a multi-disciplinary team and have a knowledge of leadership
Subject Synopsis/ Indicative Syllabus	Students will be divided into groups to design and manufacture an engineering product that satisfy an existing demand in IC or a certain customer from the industry. Throughout the project, students will encounter situations that reinforce the following skills: 1) **Project specification**: Identification of client needs and wants; Identification of resource constraints such as time, manpower,

	equipment, budget; Formulation of project plan. 2) **Engineering design**: Selection of design methodology; collaborative design; Make-or-buy decisions; Design prototyping; Testing and simulation. 3) **Product manufacturing:** Material procurement; Component machining; PCB fabrication; Programming; Assembly and fine-tuning. 4) **Project collaboration:** Determination of project stages and milestones; CAD and PDM; Leadership and Collaborative decision making; Tolerances and fits; Project documentations.
Learning Methodology	Students will be divided into groups of 5-8 to design and manufacture an engineering product. Each project group will be formed by students from two or more engineering streams. The project topics will be provided by the subject supervisor team. Topics will be either initiated by supervisors or by commercial clients. All topics shall demand two or more skillsets including Mechanics, Electronics, and IT. Typical topics include: automated production equipment, mobility products, robotic toys, airframe structures, cabin installations, aircraft maintenance tools, jigs and gauges, *etc*. The subject is divided into two stages: • Design Stage During this period, the project team, under the guidance of the supervisors and clients, have to discover, understand and analyze the requirement of the project; and apply their knowledge to design a solution. Furthermore, students are required to search and track down parts and components with suppliers to obtain materials for the following manufacturing stage. • Manufacturing stage During this period, the project team will fabricate, test, and debug the product they designed. The supervisors will guide and monitor the groups on personal commitment, cooperation and coordination among team members. Regular group tutorials in the form of student-centred project meeting will be arranged between project group and respective supervisors.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed			
		a	b	c	d
1. Quality of final product	30	✓	✓		
2. Report	20	✓	✓	✓	✓
3. Presentation and demonstration	20			✓	✓
4. Reflective Journal	30	✓	✓	✓	✓
Total	100				

Group assessment components

Quality of final product will be assessed by the supervisor team during demonstration. The assessment is to determine how well the group's solution meets with client's requirement in terms of completeness and functionality. The assessment also determines how well the group has carried out the manufacturing in terms of accuracy and craftsmanship. This addresses the intended learning outcomes (a) & (b).

Report submitted at the end of project will be summative evidence of how well the group applied knowledge and made decisions collectively. Compulsory report chapters include: Technical description of final design; Justification of technology building blocks used; Critical review on project execution; and Record of internal communications. This addresses the intended learning outcomes (a), (b), (c) & (d).

Individual assessment components

Oral presentation and demonstration in an exhibition booth setting allow individual members to demonstrate their ability in presenting engineering contents clearly and logically. Through Q&A session supervisors can also determine the effectiveness of individual members' effort toward the final product outcomes. This addresses the intended learning outcomes (c) & (d).

Individual reflective journal serves as summative evidence of how well the student has functioned in the group and embrace the multidisciplinary collaboration concept. Compulsory journal contents include: Technical description of design and manufacturing tasks performed; Critical review of technical ideas proposed and adapted; Critical review on personal performance in the project execution and the collaboration experience. This addresses the intended learning outcomes (a), (b), (c) & (d).

Student Study Effort Required	**Class Contact**	
	▪ Project works	78 Hrs.
	▪ Tutorial	12 Hrs.
	Other Study Effort	**0 Hrs.**
	Total Study Effort	**90 Hrs.**
Reading List and References	1. E. Tebeaux and S. Dragga, 'Chapter.9 Proposals and Progress Reports', in *The Essentials of Technical Communication*, 3rd ed., New York: Oxford, 2012 2. J. Abarca et al, 'Teamwork and Working in Teams', in *Introductory Engineering Design: A Projects-Based Approach*, 3rd ed., University of Colorado at Boulder, 2000. 3. J. Tropman, *Effective meetings*. Thousand Oaks, Calif.: Sage Publications, 3rd ED. 2014. 4. P. Harpum, 'Design Management', in *Engineering Project Management*, 3rd ed., N. Smith, Ed. Oxford: Blackwell, 2008, pp. 234-254. 5. Alur, Rajeev. Principles of Cyber-physical Systems. Cambridge, Massachusetts: MIT, 2015. 6. Valvano, Jonathan W. Introduction to ARM Cortex-M Microcontrollers. Fifth ed. , Jonathan W. Valvano, 2017	