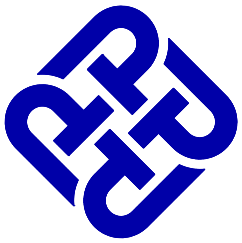

THE HONG KONG POLYTECHNIC UNIVERSITY

Department of Mechanical Engineering

Full-time / Sandwich

Bachelor of Engineering (Honours) Degree

in

Mechanical Engineering

Programme Code: 43478

(4-Year undergraduate degree structure)

Definitive Programme Document

(For 2013 Cohort)

August 2013

TABLE OF CONTENTS

PART A PROGRAMME SCHEME

PART B SYLLABI

GUR Subject

Core Subjects

Elective Subjects

Training Subjects

This Definitive Programme 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. PREAMBLE

The Hong Kong Polytechnic University aspires to be a leading university that excels in professional education, applied research and partnership for the betterment of Hong Kong, the nation and the world. It's the mission of the University (a) To nurture graduates who are critical thinkers, effective communicators, innovative problem solvers, lifelong learners and ethical leaders; (b) To advance knowledge and the frontiers of technology to meet the changing needs of society; and (c) To support a University community in which all members can excel through education and scholarship. Being one of the oldest Departments in the University, the 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 and survive in the 21st century, its economy has to change from being efficiency-based to knowledge-based. The goal of the ME Department is to produce all-rounded graduates who can lead a changing economy. 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.

2. GENERAL INFORMATION

2.1 Programme Title and Programme Code

Bachelor of Engineering (Honours) in Mechanical Engineering (43478)

2.2 Host Department

Department of Mechanical Engineering

2.3 Award Title

Bachelor of Engineering (Honours) in Mechanical Engineering

2.4 Mode of Attendance

Full-time/Sandwich

2.5 Normal and Maximum Periods of Registration

Mode of Study	Normal Duration of Study	Maximum Period of Registration
Full-time	4 Years	8 Years
Sandwich	5 Years	8 Years

2.6 Entrance Requirements

In addition to the general requirements for admission to the honours degree programmes of the University, a candidate has to satisfy one of the following requirements (a), (b), (c), (d), (e) or (f):

(a) For entry with HKDSE Qualification

General Entrance Requirements
4 core subjects and 1 elective subject with:
Level 3: English Language and Chinese Language
Level 2: Mathematics, Liberal Studies and one elective subject

Preferred Subjects
Preferred elective subject(s): Physics, Biology, Chemistry, Combined Science or Information & Communication Technology
Other preferred subject(s): Preferably with any of the extended modules in Mathematics

Flexibilities
1. Alternative Chinese will be accepted as meeting the Chinese Language requirement for those students who fulfill the requirement for taking Alternative Chinese as announced by EDB.
2. Other language subjects will be accepted as elective subjects. The minimum requirement is Grade E.
3. While relevant Applied Learning (ApL) subjects will be accepted as meeting the elective subject requirement, attainment at distinction level in those subjects will be required.
4. Students not meeting the level requirement of the elective subject may be specially considered if they have attained Level 2 in one of the extended modules of Mathematics.

(b) HKALE/HKASLE, GCEALE/GCEASLE and International Baccalaureate (IB)
- Applicants holding A-Level and IB qualifications will be granted credit transfer upon admission;

(c) Diploma or Higher Certificate in Mechanical Engineering or other related disciplines;

(d) Higher Diploma in Mechanical Engineering or other related disciplines;

(e) Associate Degree in Engineering;

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

Suitable holders of a Higher Diploma or Associate Degree in Mechanical Engineering or a related discipline may be considered for advanced standing entry to the senior year curriculum.

3. RATIONALE AND INTENDED LEARNING OUTCOMES (ILOs)

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 special understanding of one of its sub-fields. Thus prepared, our graduates can meet and lead the changing technological challenges of the 21st century.

3.1 Programme Objectives and Outcomes

The BEng(Hons) in Mechanical Engineering (BEME) programme offered by the ME Department is designed to produce graduates that are broad-based and knowledgeable in the fundamentals of mechanical engineering. We expect our graduates to accept responsibilities as professionals in industrial and government organizations.

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 this programme, 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.

3.2 Intended Learning Outcomes (ILOs)

The BEME 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.

The BEME programme aims to equip students with 12 learning outcomes. Each student is expected to achieve these 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 BEME programme outcomes that support its three objectives are indicated below:

		Programme Outcomes											
		PAK a	PAK b	PAK c	PAK d	PAK e	PAK f	PAK g	POW a	POW b	POW c	POW d	POW e
Programme Objectives	1	X	X	X	X	X	X	X	X	X		X	
	2	X	X	X	X	X	X	X	X	X	X	X	X
	3								X		X		

3.3 General Approach to Teaching, Learning and Assessment

To accomplish the ILOs 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 14 weeks in each semester leading to a total of 42 hours of contact time for a three-credit subject. The structuring of those 42 contact hours varies from subject to subject, and the details are given in the syllabuses.

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 syllabuses. 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.

3.4 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 within 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 4.5 and the individual subject syllabus.

4. PROGRAMME STRUCTURE

4.1 General Structure

The number of credits required for graduation is 125 academic credits and 10 Industrial Centre Practical Training credits. In addition, students are required to take a non-credit bearing training subject, ME29001 Continuous Professional Development, that requires students to take part in at least 4 industrial visits organized by the Department during the period of their studies. Students in the sandwich mode of attendance will have an industrial training attachment of about 45 weeks after they have successfully completed the first 6 semesters of study. In addition, the students are required to fulfill the Work-Integrated Education (WIE).

The 125 academic credits consist of 30 mandatory credits of General University Requirements (GUR) and 95 credits of Discipline-Specific Requirements (DSR). Details of GUR and DSR are shown in Table 4.1 and Table 4.2 respectively. For further information on the GUR, please refer to section 5.5.

For students without HKDSE Physics, and/or without HKDSE Mathematics Module I or II, additional credits on “Foundation Physics” and/or “Foundation Mathematics” should be taken. Details can be found in section 4.1.1.

Table 4.1: General University Requirements (GUR)

Areas	Credits
Language & Communication Requirements (LCR)	9
▪ English	(6)
▪ Chinese	(3)
Cluster-Area 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 4.2: Discipline-specific Requirements (DSR)

Subjects		Credits	Subjects		Credits
I) Faculty Common Subjects		41	II) Award Core Subjects		39
AF3625	Engineering Economics	(3)	ABCT1700 *	Introduction to Chemistry	(3)
AMA1101	Calculus I	(4)	EE2901S	Basic Electricity and Electronics	(3)
AMA1103 AMA1104	Introductory Linear Algebra; or Introductory Probability	(2)	ME22001	Engineering Design Fundamentals	(3)
AMA2111	Mathematics I	(3)	ME23001	Engineering Mechanics	(3)
AMA2112	Mathematics II	(3)	ME31001	Dynamics and Vibrations	(3)
AP10004	Physics Experiments	(1)	ME31002	Linear Systems and Control	(3)
AP10005	Physics I	(3)	ME32001	Manufacturing Fundamentals	(3)
AP10006	Physics II	(3)	ME33001	Mechanics of Materials	(3)
ENG2001	Fundamentals of Materials Science and Engineering/ Chemistry/Biology	(3)	ME34002	Engineering Thermodynamics	(3)
ENG2002	Computer Programming	(3)	ME34004	Fluid Mechanics	(3)
ENG2003	Information Technology	(3)	ME36001	Numerical Methods for Engineers	(3)
ENG3003	Engineering Management	(3)	ME49001	Final Year Capstone Project	(6)
ENG3004	Society and the Engineer	(3)			
CBS3241P @	Professional Communication in Chinese	(2)			
ELC3521	Professional Communication in English	(2)			
III) Electives Students are required to complete five elective subjects from the subject pool listed in section 4.3.					15
IV) Training Subjects					10
IC2105	Engineering Communication and Fundamentals				(4)
IC348	Appreciation of Manufacturing Processes				(3)
IC349	Integrated Manufacturing Project				(3)
ME29001	Continuous Professional Development				(Nil)
Total DSR credits			95 + 10 training credits		

Remarks:

@ Non-Chinese speakers or those whose Chinese standards are at junior secondary level or below will be exempted from the Discipline-Specific Chinese Language requirement. Students of this category can take a replacement subject of any level to make up for credit requirement.

***** Students who have obtained level 3 or above in Chemistry in HKDSE will be exempted from ABCT1700, however, they are required to take a replacement subject ABCT1741 General Chemistry I.

4.1.1 Additional Subjects Requirement

I. Physics

Additional subjects requirement for students **who do not have Level 2 or above in HKDSE Physics or Combined Science with Physics as one of the components**:

AP00002 Foundation Physics I (3 credits)
AP00003 Foundation Physics II (3 credits)

II. Mathematics

Students **who do not have Level 2 or above in HKDSE Mathematics Extended Module I or II are required to take ALL of the following subjects:**

AMA1100 Basic Mathematics - an introduction to Algebra and Differential Calculus (2 credits)
AMA1103 Introductory Linear Algebra (2 credits)
AMA1104 Introductory Probability (2 credits)
AMA1102 Calculus IA (4 credits) (to replace AMA1101 Calculus I)

4.2 Normal Study Pattern

This section outlines the normal 4-year study pattern for the programme. The three LCR subjects and the four CAR subjects are required for fulfilling the Language & Communication Requirements and the Cluster Area Requirements, respectively.

Year 1 (34 Credits)	
Semester I (18 Credits)	**Semester II (16 Credits)**
AMA1101 Calculus I (4)	AMA1103 Introductory Linear Algebra OR AMA1104 Introductory Probability (2)
AP10005 Physics I (3)	AP10006 Physics II (3)
CAR I # (3)	CAR II # (3)
LCR I # English Language Subject I (3)	ENG2003 Information Technology (3)
Leadership and Intra-Personal Development # (3)	LCR II # English Language Subject II (3)
Healthy Lifestyle # (0)	
AP10004 Physics Experiments (1)	
ENG1003 # Freshman Seminars for Engineering (3)	
IC2105 Engineering Communication and Fundamentals + (4 training credits)	

Year 2 (30 Credits)	
Semester I (15 Credits)	**Semester II (15 Credits)**
ABCT1700 Introduction to Chemistry (3)	CAR III # (3)
AF3625 Engineering Economics (3)	EE2901S Basic Electricity and Electronics (3)
AMA2111 Mathematics I (3)	ENG2001 Fundamentals of Materials Science and Engineering/ Chemistry/Biology (3)
ENG2002 Computer Programming (3)	LCR III # Chinese Language Subject (3)
ME22001 Engineering Design Fundamentals (3)	ME23001 Engineering Mechanics (3)
IC348 Appreciation of Manufacturing Processes + (3 training credits)	
Year 3 (30 Credits)	
Semester I (15 Credits)	**Semester II (15 Credits)**
AMA2112 Mathematics II (3)	CAR IV # (3)
ME31001 Dynamics and Vibrations (3)	ME31002 Linear Systems and Control (3)
ME32001 Manufacturing Fundamentals (3)	ME34004 Fluid Mechanics (3)
ME33001 Mechanics of Materials (3)	ME36001 Numerical Methods for Engineers (3)
ME34002 Engineering Thermodynamics (3)	Service-Learning # (3)
IC349 Integrated Manufacturing Project + (3 training credits)	
Year 4 (31 Credits)	
Semester I (16 Credits)	**Semester II (15 Credits)**
CBS3241P Professional Communication in Chinese (2)	ENG3003 Engineering Management (3)
ELC3521 Professional Communication in English (2)	Elective Subject III @
ENG3004 Society and the Engineer (3)	Elective Subject IV @
Elective Subject I @	Elective Subject V @
Elective Subject II @	
ME49001 Final Year Capstone Project (6)	

Remarks:

General University Requirements (GUR) subjects. The study pattern for GUR subjects (with the exception of Freshman Seminars) is indicative only. Students may take those subjects at their own schedule.

@ Students are required to select five subjects from a pool of elective subjects as shown in section 4.3. Elective subjects are of 3 credits except ENG3002 "Multidisciplinary Project" which is of 6 credits.

\+ Industrial Centre Training subjects

Teaching department abbreviations

ABCT	Applied Biology and Chemical Technology
AF	School of Accounting and Finance
AMA	Applied Mathematics
AP	Applied Physics
CBS	Chinese and Bilingual Studies
EE	Electrical Engineering
ELC	English Language Centre
ENG	Engineering Faculty
IC	Industrial Centre

4.3 Elective Subjects

Students are required to study five elective subjects. They may choose five elective subjects from the following list. Most of the elective subjects are classified into the following three technical streams:

- Aviation and Aeronautical Engineering (AA)
- Design and Manufacturing (DM)
- Environmental and Energy Engineering (EE)

Students completing four elective subjects from any one of the above specialism streams are considered to have completed a stream of study in that specialism.

Elective Subjects ^		**Specialism Stream**		
		EE	**AA**	**DM**
ME41001	Automatic Control System			X
ME41002	Noise Abatement and Control	X		
ME41003	Principles of Sound and Vibration	X		
ME42001	Artificial Intelligence in Products			X
ME42002	Design for Packaging and No-assembly			X
ME42003	Design for Six Sigma			X
ME42004	Development of Green Products			X
ME43001	Advanced Materials for Design and Technology			X
ME43002	Nano- and Micro-Technology Applications to Product Development			X
ME43003	Product Testing Technology			X
ME43004	Fundamentals of Nanoscience and Nanotechnology			X
ME44001	Air Conditioning for Indoor Thermal and Environmental Quality	X		
ME44002	Engine Technology	X		
ME44003	Combustion and Pollution Control	X		
ME44004	Heat and Mass Transfer	X	X	
ME44005	Renewable Energy I: Alternative Fuels	X		
ME44006	Renewable Energy II: Solar and Wind Power	X		
ME45001	Aerodynamics		X	
ME45002	Aircraft Systems		X	
ME45003	Aviation Systems		X	

Elective Subjects ^		Specialism Stream		
		EE	AA	DM
ME45004	Aircraft Maintenance Engineering		X	
ME45005	Flight Mechanics and Airplane Performance		X	
ME45006	Aircraft Structure and Engineering Composites		X	
ME45007	Avionics Systems		X	
ME49002	Environmental Noise	X		
ENG3002	Multidisciplinary Project			
ENG4001	Project Management			
Relevant Level 5 subjects offered to MSc degree *				

Remarks:

^ 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.

* For students opted for fast track combined BEng(Hons)/MSc Mechanical Engineering programme. Details are elaborated in section 8.

4.4 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 125 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. For sandwiched students who are placed in a company for 11 months, 45 weeks, say, they will earn 22 credits. The WIE activities can be fulfilled by at least one of the following:

- Integration into the Final Year Capstone Project, 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.

- Perform during a summer placement in industrial/commercial sector.

- Integrated into the sandwich training in the industrial/commercial sector. The duration of the WIE activities is not necessarily the same as that of the sandwich training.

- Conduct in a form proposed by students with the prior approval of the WIE coordinator.

Detailed guidelines for students on WIE are available on the ME website.

4.5 Curriculum Mapping

Section 3 outlines the objectives and intended learning outcomes of the programme. It also presents the general philosophy in teaching, learning and assessment adopted by the Department. In Section 4.1, we detailed the structure of the programme describing a range of subjects which individual students are expected to study. This enables the students to develop generic skills by achieving the learning outcomes of each subject and by taking part in the work-integrated education (see section 4.4). An analysis of the curriculum in terms of the coverage of the programme outcomes (see section 3.2) is presented in Table 4.3. In summary, the programme outcomes address two areas expecting students 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. Table 4.3 displays a curriculum map in which all subjects are mapped with appropriate PAKs and POWs. 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 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 syllabuses shown in Part B.

Table 4.3: Curriculum Map for All Subjects

SUBJECT CODE	PROGRAMME OUTCOMES											
	PAK a	PAK b	PAK c	PAK d	PAK e	PAK f	PAK g	POW a	POW b	POW c	POW d	POW e
ABCT1700		√	√								√	
AF3625	√	√			√			√	√		√	√
AMA1101	√	√			√						√	√
AMA1103/ AMA1104	√	√			√						√	√
AMA2111	√	√			√						√	√
AMA2112	√	√			√						√	√
AP10004			√									
AP10005	√	√										
AP10006	√	√										
CBS3241P											√	
EE2901S	√	√	√	√	√			√	√			√
ELC3521											√	
ENG2001	√	√	√				√	√			√	√
ENG2002	√	√	√		√			√				
ENG2003	√	√	√		√			√				
ENG3003	√	√			√			√	√	√	√	√
ENG3004								√	√	√	√	√
ME22001	√			√				√	√	√	√	√
ME23001	√	√				√					√	√
ME31001	√	√	√	√								

SUBJECT CODE	PROGRAMME OUTCOMES											
	PAK a	PAK b	PAK c	PAK d	PAK e	PAK f	PAK g	POW a	POW b	POW c	POW d	POW e
ME31002	√	√	√	√								
ME32001				√	√	√	√		√		√	
ME33001	√	√	√	√		√			√		√	√
ME34002	√	√	√					√			√	
ME34004	√	√	√									
ME36001	√	√			√							
ME49001	√	√	√	√	√	√	√	√	√	√	√	√
Technical Electives	√	√	√	√	√	√	√	√	√	√	√	√
IC2105	√	√	√		√	√	√					
IC348				√	√	√	√					
IC349				√	√	√	√		√		√	
ME29001								√		√		
WIE								√	√	√	√	√

Remarks: GUR subjects are not included in this table

5. GENERAL ASSESSMENT REGULATIONS (GAR)

The General Assessment Regulations adopted in the BEME Programme is in line with the prevailing GAR of the University governing all full-time 4-year undergraduate degree programmes. Some regulations are extracted and presented in the following sections.

5.1 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), determine whether each student is:

(i) eligible for progression towards an award; or
(ii) eligible for an award; or
(iii) required to be deregistered from the programme.

When a student has a Grade Point Average (GPA) lower than 2.0, he will be put on academic probation in the following semester. If a student is able to pull his GPA up to 2.0 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 the following categories, either of which may 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 Definitive Programme Document; or

(ii) the student's GPA is lower than 2.0 for two consecutive semesters and his Semester GPA in the second semester is also lower than 2.0; or
(iii) the student's GPA is lower than 2.0 for three consecutive semesters.

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 Definite Programme Document.

A student may be deregistered from the programme enrolled before the time frame specified in the above conditions (ii) or (iii) if his academic performance is poor to the extent that the Board of Examiners considers that there is not much of a chance for him to attain a GPA of 2.0 at the end of the programme.

Where there are good reasons, the Board of Examiners has the discretion to recommend allowing students who fall into categories as stated in the above conditions (ii) or (iii) to stay on the programme, and these recommendations should be presented to the relevant Faculty/School Board for final decision.

Under the current procedures, a student can appeal against the decisions of Boards of Examiners to deregister him. If such an appeal is upheld by the Department/School concerned, the recommendation (to reverse the previous decision to deregister the student) should also be presented to the relevant Faculty/School Board for final decision.

5.2 Retaking of Subjects

Students may retake any subject for the purpose of improving their grade without having to seek approval, but they must retake a compulsory subject which they have failed, i.e. obtained an F grade. Retaking of subjects is with the condition that the maximum study load of 21 credits per semester is not exceeded. Students wishing to retake passed subjects will be accorded a lower priority than those who are required to retake (due to failure in a compulsory subject) and can only do so if places are available.

The number of retakes of a subject is not restricted. Only the grade obtained in the final attempt of retaking (even if the retake grade is lower than the original grade for originally passed subject) will be included in the calculation of the Grade Point Average (GPA). If students have passed a subject but failed after retake, credits accumulated for passing the subject in a previous attempt will remain valid for satisfying the credit requirement for award. (The grades obtained in previous attempts will only be reflected in the transcript of studies.)

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.

5.3 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 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/her 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 Lecturer 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.

Other particular circumstances

A student's particular circumstances may influence the procedures for assessment, but not the standard of performance expected in the assessment.

5.4 Grading

Assessment grades shall be awarded on a criterion-referenced basis. A student's overall performance in a subject (including GUR subjects) shall be graded as follows:

Subject Grade	Short Description	Elaboration on Subject Grading Description
A+	Exceptionally Outstanding	The student's work is exceptionally outstanding. It exceeds the intended subject learning outcomes in all regards.

Subject Grade	Short Description	Elaboration on Subject Grading Description
A	Outstanding	The student's work is outstanding. It exceeds the intended subject learning outcomes in nearly all regards.
B+	Very Good	The student's work is very good. It exceeds the intended subject learning outcomes in most regards.
B	Good	The student's work is good. It exceeds the intended subject learning outcomes in some regards.
C+	Wholly Satisfactory	The student's work is wholly satisfactory. It fully meets the intended subject learning outcomes.
C	Satisfactory	The student's work is satisfactory. It largely meets the intended subject learning outcomes.
D+	Barely Satisfactory	The student's work is barely satisfactory. It marginally meets the intended subject learning outcomes.
D	Barely Adequate	The student's work is barely adequate. It meets the intended subject learning outcomes only in some regards.
F	Inadequate	The student's work is inadequate. It fails to meet many of the intended subject learning outcomes.

"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.

A numeral grade point is assigned to each subject grade, as follows:

Grade	Grade Point
A+	4.5
A	4
B+	3.5
B	3
C+	2.5
C	2
D+	1.5
D	1
F	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 assessment, 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 is capped at 4.0.

Different Types of GPA's

GPA's 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. GUR subjects will be included in the calculation of weighted GPA for all programmes.

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 Wi = weighting to be assigned according to the level of the subject
n = number of all subjects counted in GPA calculation, except those exclusions that any subjects passed after the graduation requirement has been met will not be taken into account of in the grade point calculation for award classification

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 and 4 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 is capped at 4.0.

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 7.

5.5 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 4.
2. Earn a cumulative GPA of 2.0 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 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 (Table 5.1). 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).

Students who can demonstrate that they have achieved a level beyond that of the LCR proficient level subjects as listed in Table 5.2 (based on an assessment by ELC) may apply for subject exemption or credit transfer of the LCR subject or subjects concerned.

Table 5.1: Framework of English LCR subjects

HKDSE	Subject 1	Subject 2
Level 5 or equivalent	Advanced English for University Studies (AEUS) 3 credits	Any LCR proficient level subject in English (see Table 5.2) 3 credits
Level 4 or equivalent	English for University Studies (EUS) 3 credits	Advanced English for University Studies (AEUS) 3 credits
Level 3 or equivalent	Practical English for University Studies (PEUS) 3 credits	English for University Studies (EUS) 3 credits

Table 5.2: LCR Proficient level subjects in English

For students entering with HKDSE Level 5, or at an equivalent level or above	Advanced English Reading and Writing Skills	3 credits each
	Persuasive Communication	
	English in Literature and Film	

Chinese

All undergraduate students are required to successfully complete one 3-credit Chinese language subject as stipulated by the University (Table 5.3). These Chinese subjects are designed to suit students' different levels of Chinese language proficiency at entry, as determined by their HKDSE score or the Chinese Language Centre (CLC) entry assessment (when no HKDSE score is available). Students can also opt to take additional Chinese LCR subjects (Table 5.5) in their free electives.

Students who are non-Chinese speakers (NCS), or whose Chinese standards are at junior secondary level or below, will also be required to take one LCR subject designed to suit their language background and entry standard as shown in Table 5.4.

Students who can demonstrate that they have achieved a level beyond that of the course "Advanced Communication Skill in Chinese" as listed in Table 5.3 (based on an assessment made by CLC) may apply for subject exemption or credit transfer of the LCR subject concerned.

Table 5.3: Framework of Chinese LCR subjects

HKDSE	Required Subject
HKDSE Level 4 and 5 or equivalent	Advanced Communication Skills in Chinese (ACSC) 3 credits
HKDSE Level 3 or equivalent	Fundamentals of Chinese Communication (FCC) 3 credits

HKDSE	Required Subject
For non-Chinese speakers or students whose Chinese standards are at junior secondary level or below	One subject from Table 5.4 below

Table 5.4: Chinese LCR Subjects for non-Chinese speakers or students whose Chinese standards are at junior secondary level or below

Subject	Pre-requisite/exclusion	
Chinese I (for non-Chinese speaking students)	• For non-Chinese speaking students at beginners' level	3 credits each
Chinese II (for non-Chinese speaking students)	• For non-Chinese speaking students; and • Students who have completed Chinese I or equivalent	
Chinese III (for non-Chinese speaking students)	• For non-Chinese speaking students at higher competence levels; and • Students who have completed Chinese II or equivalent	
Chinese Literature - Linguistics and Cultural perspectives (for non-Chinese speaking students)	• For non-Chinese speaking students at higher competence levels	

Table 5.5: Other LCR Electives in Chinese

Subject	Pre-requisite/exclusion	
Chinese and the Multimedia	• For students entering with HKDSE level 4 or above; or • Students with advanced competence level as determined by the entry assessment; or • Students who have completed "Fundamentals of Chinese Communication"	3 credits each
Creative writing in Chinese	• For students entering with HKDSE level 4 or above; or • Students with advanced competence level as determined by the entry assessment; or • Students who have completed "Fundamentals of Chinese Communication"	
Elementary Cantonese	For students whose native language is not Cantonese	
Putonghua in the Workplace	• Students have completed "Fundamentals of Chinese Communication" or could demonstrate with proof their basic proficiency in Putonghua • For students whose native language is not Putonghua	

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://www2.polyu.edu.hk/as/Polyu/GUR/index.htm.

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://www2.polyu.edu.hk/as/Polyu/GUR/index.htm.

(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://www2.polyu.edu.hk/as/Polyu/GUR/index.htm.

(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://www2.polyu.edu.hk/as/Polyu/GUR/index.htm.

(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://www2.polyu.edu.hk/as/Polyu/GUR/index.htm.

(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://www2.polyu.edu.hk/as/Polyu/GUR/index.htm

(g) Healthy Lifestyle

Healthy lifestyle is the platform for all-round development. All students are required to successfully complete a non-credit-bearing programme in healthy lifestyle offered by the Student Affairs Office. The programme will cover: (1) fitness evaluation, (2) concepts on health and fitness, (3) sports skills acquisition, and (4) exercise practicum. More details can be found at: http://www.polyu.edu.hk/sao/hlr

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, a student may take more credits than he needs to graduate on top of the prescribed credit requirements for his award in or before the semester within which he becomes eligible for award. 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 counted in the calculation of Award GPA. If a student attempts more elective subjects (or optional subjects) than the requirement for graduation in or before the semester within which he becomes eligible for award, the elective subjects (or optional subjects) with higher contribution shall be included in the computation of the Award GPA (i.e. the passed subjects with lower contribution will be excluded from the grade point calculation for award classification), irrespectively of when the excessive elective subjects (or optional subjects) are enrolled for.

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 2.0 or more, but his Weighted GPA is less than 2.0, 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.

6. PROGRAMME OPERATION AND MANAGEMENT

6.1 Departmental Undergraduate Programme Committee

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

6.2 Programme Executive Group

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

6.3 Student-Staff Consultative Committee

The Student-Staff Consultative Committee consists of Student Representatives together with the Programme Leader. The Committee is normally chaired by the 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.

6.4 Academic Advising

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 build up an early connection between the students and their home departments, and to promote their sense of affiliation to the department and the University,
- To provide students with accurate information about the academic regulations and requirements regarding their Major/programme, as well as the GUR,
- To assist students to explore their interests, abilities and values on academic pursuits, and formulate appropriate intellectual, professional and personal goals,
- To provide advice and guidance to students that enables them to develop and pursue a study plan for their 4 years of study appropriate for meeting their intellectual, professional and personal goals,
- To connect students to resources, opportunities and support within and outside the University that enhance their educational experiences and success.

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

- Building rapport with the students, serving as a bridge that connects them to the department,
- Being accessible and available to students, and responding to their questions and concerns,
- Helping student to consider and clarify their intellectual, professional and personal goals,
- Helping students to develop an appropriate study plan (particularly with regard to their Major), and assisting in their selection of appropriate courses to achieve their identified goals,

- Clarifying to students academic regulations and requirements, particularly those relating to the Major,
- Identifying students with special learning needs or early signs of learning problems, and referring/encouraging them to seek help or support.

7. 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.

Minor Study

Minor study will be a free choice by students and not mandatory. 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, starting from their 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.

(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 first week of the Semester in which they anticipate to become eligible for award.

(vii) Students are required to obtain a GPA of at least 2.0 for both their Major and Minor programmes, and an overall GPA of at least 2.0, in order 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 both the Major and Minor programmes. However, the award designation (BA, BSc, BEng, etc.) will be based on the Major programme. Similarly, the honours classification will be based on the Major GPA, and reflected accordingly on the parchment.

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 (i.e. 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 2.0 or above for the First Major or the Second Major.

(v) Students who wish to withdraw from a Second Major must obtain approval from the Department offering the Second Major.

(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 2.0 for each of the 2 Majors, 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) Only one award parchment will be issued for the Double Majors, and it will list both Majors and the award classification of each Major, which can be different.

8. FAST TRACK INTEGRATED BACHELOR's and MASTER's DEGREE

The Department offers a fast track combined BEng(Hons)/MSc Mechanical Engineering Programme to high quality students. Upon satisfactory completion of the required credits, a student on such a fast-track programme can be conferred with a Bachelor's degree at the end of Year-4. By completing the additional credits required in a part-time, self-financed mode, the student can receive a Master's degree at the end of Year-5. The fast-track students can select to study two MSc level subjects as their final year elective subjects in the BEng programme which will be counted towards the subject requirements of the MSc programme.

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) Expose students to the concept and an understanding 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 search for information, formulate a project plan, and manage a project with initiative (e) Be able to demonstrate an understanding of of academic integrity [Note]. *Note: Outcome (e) is applicable to 4-year degree programmes and those Higher Diploma programmes that require the students to complete the Online Tutorial on Academic Integrity as described in the following sections.*
Subject Synopsis/ Indicative Syllabus	***1. Online Tutorial on Academic Integrity (2 hours*)*** For students studying in 4-year degree programmes, they 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. For students studying Higher Diploma programmes, whether they are required to take this Online Tutorial or not will be stipulated by their host departments. ***2. Renowned Speaker Seminars (8 hours*)*** One seminar will be given by a renowned speaker to introduce students to the engineering broad discipline and to enthuse them about their major study. The seminars will also cultivate students' global outlook. The seminar will be composed of a pre-seminar (2 hours), and then the actual seminar (2 hours). The pre-seminar aims at preparing the students for the actual seminar. The actual seminar will be delivered by the renowned speaker. ***3. Departmental Seminars (14 hours*)*** Four to six 1-hour Departmental Seminars will be delivered by chair professors and/or reputable professionals in the engineering broad discipline to arouse students' interests in engineering and to cultivate their understanding of and sense of belonging to the profession.

	4. Freshman Project (36 hours[*]) There will be 7 2-hour workshops, 1 presentation and 1 demonstration. The freshman project aims at developing students' creativity, problem-solving skills, and team-work abilities through hands-on tasks. Students will work in small groups under the guidance of instructors to design and implement an engineering solution to some given problems. The key elements are *creativity*, *problems solving* through *interaction*, *participation* and *team works*. ***5. Entrepreneurship Project (45 hours[*])*** The entrepreneurship project is designed to develop students' appreciation and understanding about entrepreneurship and the commercialization process by attending seminars/workshops, identifying technology opportunities and developing a simple business plan. ([*] Note: hours indicate total student workload)
Teaching/Learning Methodology	***Online Tutorial on Academic Integrity*** The *Online Tutorial on Academic Integrity* 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. ***Seminars*** The 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 make preparation by searching for information and doing 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* and *team-work abilities*. Assessment tasks will consist of *demonstration*, *presentation*, *reports*, and *reflective essay writings*. These are designed to evaluate individual student's performance and achievement as well as to encourage active participation. ***Entrepreneurship Project*** There will be 3 2½-hour lecture/seminar, 1 1½-hour tutorial, 1 3-hour workshop and 1 3-hour presentation. A general overview of the concepts required to conduct the project will be provided to students through lectures and seminars. 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 [Note]	0%					✓
Seminars Quizzes	20%	✓				
Freshman Project Project demonstration, presentation, report and reflective essay writing	40%		✓		✓	
Entrepreneurship Project Business plan	40%			✓	✓	
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*, *problem-solving skills* and *team-work abilities*. They can also demonstrate their *ability to search for information*, *formulate a project plan*, and *manage a project with initiative*. Through business plan, students can demonstrate their understanding about *entrepreneurship*.

Pass Conditions

For students studying the 4-year degree programmes, and students studying in Higher Diploma programmes whose host departments have stipulated that they are required to take the Online Tutorial, in order to pass this subject, they must obtain a Grade D or above for total marks comprising the Seminars, Freshman Project and Entrepreneurship Project as described here AND passed the Online Tutorial on Academic Integrity on or before week 5 of semester 1 as described in the previous section. For students studying in Higher Diploma programmes whose host departments have not stipulated that they are required to take the Online Tutorial, there is no requirement to pass the Online Tutorial in order to pass this subject.

Note: This is only applicable to 4-year degree programmes and those Higher Diploma programmes that require the students to complete the Online Tutorial on Academic Integrity.

Student Study Effort Expected

Class contact:	
▪ Freshman project: 2 hours per week for 9 weeks	18 Hrs.
▪ Entrepreneurship project: 1.5- 3 hours per week for 6 weeks	15 hours
▪ Renowned Speaker Seminar	4 hours
▪ Departmental Seminar	6 hours

	Other student study effort:	
	▪ 62 hours (for Online Tutorial on Academic Integrity, background information search, project work, meeting and discussion, preparation for presentation and demonstration, report and reflective essay writing)	62 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	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.	

Core Subjects

Subject Description Form

Subject Code	ABCT1700
Subject Title	Introduction to Chemistry
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	No pre-requisite. This subject is intended for students who DO NOT have background in NSS Chemistry
Objectives	This is a one-semester introductory course of Chemistry. This course surveys the fundamental concepts in chemistry for understanding structure and properties of the material universe. Principles will be illustrated with application to daily life.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. understand the core concepts of chemistry; b. describe chemical structures and events using standard representations; c. apply and incorporate the chemical principles and knowledge learned to solve chemical problems and to appreciate modern applications in real life.
Subject Synopsis/ Indicative Syllabus	**Foundation:** atoms, molecules and ionic compounds, masses of atoms, stoichiometry, naming of chemical compounds, physical properties of compounds, Periodic table **Chemical Reactions**: Chemical equations, major reaction types, enthalpy of chemical processes **Atoms:** Light, electrons, quantum numbers and atomic orbitals, electronic configurations; general periodic trends in properties among elements. **Chemical Bonding**: Nature of chemical bonding, ionic bond, covalent bond, valence bond theory and hybridization; resonance; molecular shape by VSEPR method, bond polarity, intermolecular forces. **Chemistry of Carbon**: Naming of compounds containing carbon chains and rings. Isomerism, regioisomers and optical isomers. Major functional groups: alkanes, alkenes, alcohols, aldehydes, ketones, carboxylic acids and esters. Major reactions and properties of functional groups.

<table>
<tr><td>Teaching/Learning Methodology</td><td>Lecture: the fundamental principles of chemistry will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Take-home problem sets will be given, and the students are encouraged to solve the problems before seeking assistance.

Tutorials: students present their solutions on a set of problems in the tutorials. Students should try the problems before seeking assistance. These problem sets provide them opportunities to apply the knowledge gained from the lecture. They also help the students consolidate and familiarize with what they have learned. Furthermore, students can develop a deeper understanding of the subject through group discussion and self-study.</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 (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.written examination</td><td>50</td><td>×</td><td>×</td><td>×</td><td></td><td></td><td></td></tr>
<tr><td>2. continuous assessment</td><td>50</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>

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

Assignments, quizzes and examinations are used to assess student’s learning in key physical concepts in atomic structure, chemical bonding, and chemical reactions. Homework assignments (e.g. end-of-chapter exercises and online assignments) would reinforce student’s knowledge in these key topics and practice for their numerical skills and problem-solving skill through analysis of experimental data.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>36 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>6 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self study</td><td>50 Hrs.</td></tr>
<tr><td>▪ Problem assignments / homework</td><td>16 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>108 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Essential (tentative)

Tro, Nivaldo Introductory Chemistry Pearson 2012</td></tr>
</table>

Subject Description Form

Subject Code	ABCT1741
Subject Title	General Chemistry I
Credit Value	3
Level	1
Pre-requisite	HKDSE Chemistry or Combined Science with Chemistry component Level 3 or Introduction to Chemistry or Chemistry and Modern Living
Objectives	(1) To introduce a molecular perspective for understanding the natural world (2) To identify the fundamental principles underlying any physical and chemical changes of matters (3) To visualize the physical and chemical changes through the understanding of molecular behavior
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) understand the macroscopic properties of the states of matters; (b) understand the basic principles of chemical energetics and equilibria; (c) apply and incorporate the chemical principles and knowledge learned to solve chemical problems and to appreciate modern applications in real life; (d) demonstrate the abilities in communication as well as skills in problem-solving and analytical thinking.
Subject Synopsis/ Indicative Syllabus	**Measurement in Chemistry:** Significant figures; SI units; substances and mixtures; solution and concentration; mole and Avogadro's number; chemical reactions and balanced equations; temperature scales **Thermochemistry**: Heat and Work, The First Law of Thermodynamics, Heat of Reactions (ΔU and ΔH), Hess's law **Chemical Kinetics:** Reaction rates and measurements; the rate law and rate constant; molecularity and mechanism of a reaction; collision theory; activated complexes; transition state theory and; chain reaction; catalysis; enzymatic reactions **Physical Properties of Solutions**: Solution concentration, intermolecular forces and the solution process, solubilities of gases, vapor pressues of solutions, osmotic pressure, freezing point depression and boiling point elevation, solutions of electrolytes, colloidal properties **Principle of Chemical Equilibria**: law of chemical equilibrium and equilibrium constant; Le Chatelier principle

<table>
<tr><td></td><td>Acid-Base Equilibria in Aqueous Solutions: Ionization of water; pH, pOH and pKw; acids and bases; polyprotic acids; buffers; solubility equilibria

Solubility and Complex-Ion Equilibria: Solubility constants and solubility, common ion effects, precipitation, equilibria involving complex ions

Structures and Reactions of Organic Compounds: Isomerisms, functional groups of organic compounds, nucleophilic substation reactions, elimination reactions, addition reactions of alkenes, electrophilic aromatic substitution, reactions of alkanes, polymers and polymerization reactions</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures supplemented with guided reading will be used to introduce the key concepts of the topics. Home works or assignments would be given for students to enhance their learning. Tutorials will be arranged and students would be assigned in small groups for discussion.</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 (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1.written examination</td><td>50</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td></tr>
<tr><td>2. continuous assessment</td><td>50</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>

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures</td><td>28 Hrs.</td></tr>
<tr><td>▪ Tutorials</td><td>14 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>56 Hrs.</td></tr>
<tr><td>▪ Home work and assignments</td><td>20 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>118 Hrs.</td></tr>
</table>
</td></tr>
</table>

Reading List and References	**<u>Essential reading</u>** Petrucci, Herring, Madura and Biossonnette, *General Chemistry: Principle and Modern Applications*, 10th edition, 2011, Pearson

Subject Description Form

Subject Code	AF3625
Subject Title	Engineering Economics
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	**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 Learning Outcomes	Upon successful completion of this subject, students will be able to: a. understand how the relevant economic factors shape the environment within which an engineering company operates; b. evaluate the financial condition of a company based on the financial statements; c. 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, monopoly and oligopoly **Macroeconomic Factors** Government interventions: fiscal policy and monetary policy; 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.

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		
Continuous Assessment	**50%**					
1. In-class activities	15%	√	√	√		
2. Written assignments	15%	√	√	√		
3. Test	20%	√	√	√		
Final Examination	**50%**	√	√	√		
Total	100 %					

To pass this subject, students are required to obtain Grade D or above in **both** the Continuous Assessment and Examination components.

Student Study Effort Required

Class contact:	
▪ Lecture	28 Hrs.
▪ Tutorial	14 Hrs.
Other student study effort:	
▪ Study and self-learning	45 Hr.
▪ Written assignments	18 Hr.
Total student study effort	105 Hrs.

Reading List and References

Recommended Textbooks

Chan, Park, 2011, *Contemporary Engineering Economics*, 5th Edition, Prentice Hall.

Parkin, Michael, 2010, *Economics*, 9th Edition, Addison Wesley.

References

Drury, Colin, 2008, *Management and Cost Accounting*, 7th Edition, Cengage Learning.

Frank, Robert H., 2007, *The Economic Naturalist: Why Economics Explain Almost Everything?* Basic Books.

Jan 2012

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA1100</td></tr>
<tr><td>Subject Title</td><td>Basic Mathematics - an Introduction to Algebra and Differential Calculus</td></tr>
<tr><td>Credit Value</td><td>2</td></tr>
<tr><td>Level</td><td>1</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>Nil</td></tr>
<tr><td>Objectives</td><td>This subject aims to introduce students to the basic concepts and principles of algebra, limit and differentiation. It is designed for those students with only the compulsory mathematics component in the NSS curriculum. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical techniques in solving 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 mathematical reasoning to solve problems in science and engineering;
(b) make use of the knowledge of mathematical 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>Mathematical Induction; Binomial Theorem; Functions and inverse functions; Trigonometric functions and their inverses. Limit concepts, derivatives and their physical & geometric meanings, rules of differentiation, implicit differentiation, L’Hopital’s rule, maxima and minima of a function.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and techniques of topics in algebra and in elementary differential calculus will be discussed 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="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>d</td><td>e</td><td></td></tr>
<tr><td>1.Homework, quizzes and mid-term test</td><td>40%</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></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Revised June 2013

	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. To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components. 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 algebra, limit and differentiation. 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	21 Hours
	▪ Tutorial	7 Hours
	Other student study effort:	
	▪ Self study	42 Hours
	Total student study effort	70 Hours
Reading List and References	Hung, K.F., Kwan W.C.K. & Pong, G.T.Y. Foundation Mathematics & Statistics, McGraw Hill 2013 Chung, K.C. A short course in calculus and matrices, McGraw Hill 2013 Lang, S. Short Calculus, Springer 2002	

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA1101</td></tr>
<tr><td>Subject Title</td><td>Calculus I</td></tr>
<tr><td>Credit Value</td><td>4</td></tr>
<tr><td>Level</td><td>1</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>Pre-requisite: NSS Mathematics plus Module I or Module II</td></tr>
<tr><td>Objectives</td><td>This subject aims to introduce students to the theory and applications of differential and integral calculus. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical techniques in solving 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 mathematical reasoning to solve problems in science and engineering;
(b) make use of the knowledge of mathematical 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>Review of limit and continuity; derivative and rules of differentiation; relative and absolute extremum; Rolle’s theorem and the mean value theorem with applications; logarithmic, exponential, trigonometric and hyperbolic functions; applications of differential calculus including curve sketching. Indefinite and definite integrals; fundamental theorem of calculus; techniques of integration; Taylor’s theorem with remainders; series expansion for elementary functions; improper integrals; some simple applications of integral calculus.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and techniques of calculus 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="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>d</td><td></td><td></td></tr>
<tr><td>1.Homework, quizzes and mid-term test</td><td>40%</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></tr>
<tr><td></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="6"></td></tr>
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Revised June 2013

	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. To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components. 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 calculus. 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	42 Hrs.
	▪ Tutorial	14 Hr.
	Other student study effort:	
	▪ Homework and self-study	84 Hrs.
	Total student study effort	140 Hrs.
Reading List and References	Hung, K.F., Kwan W.C.K. & Pong, G.T.Y. Foundation Mathematics & Statistics, McGraw Hill 2013 Chung, K.C. A short course in calculus and matrices, McGraw Hill 2013 Thomas, G.B., Weir, M.D., Hass, J. & Giordano F.R. Thomas' Calculus, 11th edition, Pearson Addison Wesley 2008 Lang, S. Short Calculus, Springer 2002	

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA1102</td></tr>
<tr><td>Subject Title</td><td>Calculus IA</td></tr>
<tr><td>Credit Value</td><td>4</td></tr>
<tr><td>Level</td><td>1</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>Pre-requisite: AMA1100 Foundation Mathematics</td></tr>
<tr><td>Objectives</td><td>This subject aims to introduce students to the theory and applications of differential and integral calculus. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical techniques in solving 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 mathematical reasoning to solve problems in science and engineering;
(b) make use of the knowledge of mathematical 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>Review of limit, continuity and derivative; rules of differentiation; relative and absolute extremum; Rolle’s theorem and the mean value theorem with applications; logarithmic, exponential and hyperbolic functions; simple applications of differential calculus; asymptotes of the graph of a function; curve sketching. Indefinite and definite integrals and their properties; fundamental theorem of calculus; techniques of integration; improper integrals; Taylor’s theorem with remainders; series expansion for elementary functions; simple applications of calculus to geometry.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and techniques of calculus 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="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>d</td><td></td><td></td></tr>
<tr><td>1.Homework, quizzes and mid-term test</td><td>40%</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></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
</table>
</td></tr>
</table>

Revised June 2013

	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. To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components. 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 calculus. 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	42 Hrs.
	▪ Tutorial	14 Hr.
	Other student study effort:	
	▪ Homework and self-study	84 Hrs.
	Total student study effort	140 Hrs.
Reading List and References	Hung, K.F., Kwan W.C.K. & Pong, G.T.Y. Foundation Mathematics & Statistics, McGraw Hill 2013. Chung, K.C. A short course in calculus and matrices, McGraw Hill 2013. Thomas, G.B., Weir, M.D., Hass, J. & Giordano F.R. Thomas' Calculus, 11th ed, Pearson Addison Wesley 2008. Lang, S. Short Calculus, Springer 2002.	

Subject Description Form

<table>
<tr><td>Subject Code</td><td>AMA1103</td></tr>
<tr><td>Subject Title</td><td>Introductory Linear Algebra</td></tr>
<tr><td>Credit Value</td><td>2</td></tr>
<tr><td>Level</td><td>1</td></tr>
<tr><td>Pre-requisite / Co-requisite/ Exclusion</td><td>Pre-requisite: NSS Mathematics
Exclusion: NSS Mathematics Module II</td></tr>
<tr><td>Objectives</td><td>This subject aims to introduce students to some basic principles and knowledge of elementary linear algebra. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical techniques in solving 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 mathematical reasoning to solve problems in science and engineering;
(b) make use of the knowledge and techniques in linear algebra and adapt known results 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>Matrices; systems of linear equations and Gaussian elimination; non-singular matrices; determinant; vectors in 2 or 3 dimensions and their inner product; simple applications of vectors in geometry.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and techniques of matrices, linear systems and vector spaces 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="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>d</td><td></td><td></td></tr>
<tr><td>1.Homework, quizzes and mid-term test</td><td>40%</td><td>Γ</td><td>Γ</td><td>Γ</td><td>Γ</td><td></td><td></td></tr>
<tr><td>2. Examination</td><td>60%</td><td>Γ</td><td>Γ</td><td>Γ</td><td>Γ</td><td></td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></td></tr>
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Revised June 2013

	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. To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components. 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 matrices, determinant, linear systems and vectors. 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	21 Hrs.
	▪ Tutorial	7 Hr.
	Other student study effort:	
	▪ Homework and self-study	42 Hrs.
	Total student study effort	70 Hrs
References	Chan, CK, Chan, CW, Hung, KF Basic Engineering Mathematics, McGraw Hill 2013 Anton, H. Elementary Linear Algebra, 10th ed, John Wiley, 2010	

Subject Description Form

Subject Code	**AMA1104**
Subject Title	Introductory Probability
Credit Value	2
Level	1
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: NSS Mathematics Exclusion: NSS Mathematics Module I
Objectives	This subject aims to introduce students to some basic principles and knowledge of probability. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical techniques in solving practical problems in science and engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) apply probabilistic and statistical reasoning to describe and analyze essential features of data sets; (b) make use of the knowledge and techniques in probability and adapt known results to various situations; (c) develop and extrapolate concepts of probability and statistics in data analysis and problem solving; (d) demonstrate abilities of logical and analytical thinking.
Subject Synopsis/ Indicative Syllabus	*Introduction to Probability* Experiment, events and probability. Probability rules. Bayes' Theorem. *Discrete Random Variables* Introduction to discrete random variables such as uniform, binomial, Poisson, etc. and their probability distributions. Mathematical expectation. *Continuous random variables* Concept of continuous random variables such as uniform, exponential, normal, etc. and their probability density functions. Mathematical expectation. Normal approximation to the binomial distribution. *Sampling Distributions* Population and random samples. Sampling distributions related to sample mean, sample proportions, and sample variances. *Estimation of Parameters* Concepts of a point estimator and a confidence interval. Point and interval estimates of a mean and the difference between two means.

Revised June 2013

<table>
<tr><td>Teaching/Learning Methodology</td><td>Basic concepts and techniques of probability and statistics will be taught in lectures. These will be further enhanced in tutorials through practical problem solving and case study.</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 (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1.Homework, quizzes and mid-term test</td><td>40%</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></tr>
<tr><td>Total</td><td>100 %</td><td colspan="6"></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.
To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components.
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 probability distributions, random variables and sampling distribution. 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>21 Hrs.</td></tr>
<tr><td>▪ Tutorial</td><td>7 Hr.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Homework and self-study</td><td>42 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>70 Hrs.</td></tr>
</table>
</td></tr>
<tr><td>References</td><td>Hung KF and Kwan CK. Foundation Mathematics and Statistics, McGraw Hill 2012

Walpole, RE, Myers, RH, Myers, SL and Ye, K.Y. Probability and Statistics for Engineers and Scientist. 9th ed. Prentice Hall 2012</td></tr>
</table>

Revised June 2013

Subject Description Form

Subject Code	AMA2111
Subject Title	Mathematics I
Credit Value	3
Level	2
Pre-requisite	Calculus I (AMA1101) or Calculus IA (AMA1102)
Co-requisite/ Exclusion	Nil
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.
Contribution of the Subject to the Attainment of the Programme Outcomes	**Programme Outcomes:** **(for 42375)** <u>Category A: Professional/academic knowledge and skills</u> • Programme Outcomes 1, 2, 4 and 5. <u>Category B: Attributes for all-roundedness</u> • Programme Outcomes 9 and 10. **(for 42470)** <u>Category A: Professional/academic knowledge and skills</u> • Programme Outcomes 4 and 5. <u>Category B: Attributes for all-roundedness</u> • Programme Outcomes 10 and 11.
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> Review of matrices, determinants and systems of linear equations, vector spaces, inner product and orthogonality, eigenvalues and eigenvectors, applications.

<table>
<tr><td></td><td>3. Ordinary differential equations
ODE of first and second order, linear systems, Laplace transforms, Convolution theorem, applications to mechanical vibrations and simple circuits.

4. Differential calculus of functions of several variables
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.

To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components.

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>28 Hours</td></tr>
<tr><td>• Tutorial</td><td>14 Hours</td></tr>
<tr><td>• Mid-term test and examination</td><td></td></tr>
<tr><td>Other student study effort</td><td>5 hours</td></tr>
<tr><td>• Assignments and Self study</td><td>73 Hours</td></tr>
</table>
</td></tr>
</table>

	Total student study effort:	**120 Hours**
Reading List and References	1. C.K. Chan, C.W. Chan and K.F. Hung, *Basic Engineering Mathematics,* McGraw-Hill, 2013. 2. Anton, H. *Elementary Linear Algebra* (10th edition). John Wiley, 2010. 3. Kreyszig, E. (2011). *Advanced Engineering Mathematics,* 10th ed. Wiley. 4. James, G. (2008). *Modern Engineering Mathematics*, 4th ed. Prentice Hall. 5. Thomas, G. B., Weir, M. D. & Hass, J. R. (2009). *Thomas' Calculus*, 12th ed. Addison Wesley.	

Subject Description Form

Subject Code	AMA2112
Subject Title	Mathematics II
Credit Value	3
Level	2
Pre-requisite	Mathematics I (AMA2111)
Co-requisite/ Exclusion	Nil
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.
Contribution of the Subject to the Attainment of the Programme Outcomes	**Programme Outcomes:** Category A: Professional/academic knowledge and skills • Programme Outcomes 4 and 5. Category B: Attributes for all-roundedness • Programme Outcomes 10 and 11.
Subject Synopsis/ Indicative Syllabus	1. Multiple integrals Double and triple integrals, change of variables, applications to problems in geometry and mechanics. 2. Vector calculus 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. Series expansion Infinite series, Taylor's expansion, Fourier series expansion of a periodic function. 4. Partial differential equations Formulation of PDE of mathematical physics, separation of variables, initial-boundary value problems, introduction to Fourier transforms.

Teaching/Learning Methodology

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.

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	2	3	4	5
1. Homework, quizzes and mid-term test	40%	✓	✓	✓	✓	✓
2. Examination	60%	✓	✓	✓	✓	✓
Total	100%					

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.

To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components.

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.

Student Study Effort Expected

Class contact:	
• Lecture	28 Hours
• Tutorial	14 Hours
• Mid-term test and examination	
Other student study effort	5 hours
• Assignments and Self study	73 Hours
Total student study effort:	**120 Hours**

Reading List and References

1. C.K. Chan, C.W. Chan and K.F. Hung, *Basic Engineering Mathematics*, McGraw-Hill, 2013.
2. Anton, H. *Elementary Linear Algebra* (10th edition). John Wiley, 2010.
3. Kreyszig, E. (2011). *Advanced Engineering Mathematics*, 10th ed. Wiley.
4. James, G. (2008). *Modern Engineering Mathematics*, 4th ed. Prentice

	Hall. 5. Thomas, G. B., Weir, M. D. & Hass, J. R. (2009). *Thomas' Calculus*, 12th ed. Addison Wesley.

Subject Description Form

Subject Code	AP00002
Subject Title	Foundation Physics I
Credit Value	3
Level	0
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with fundamental knowledge in physics focusing on the topics of mechanics and thermal physics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) grasp a basic understanding in selected fundamental physical principles in mechanics and thermal physics; (b) solve real-life problems based on the physical principles; and (c) appreciate the importance of some physical principles as employed in various branches of engineering.
Subject Synopsis/ Indicative Syllabus	**Mechanics**: scalars and vectors; displacement, velocity and acceleration; motion along a straight line; projectile motion; Newton's laws of motions; addition and resolution of forces; work, energy and power; conservation of energy; momentum, impulse and collision; conservation of momentum. **Thermal physics**: temperature and thermometer; heat and internal energy; heat capacity; change of state and latent heat; conduction, convection and radiation; evaporation; general gas law.
Teaching/Learning Methodology	**Lecture**: The fundamentals in mechanics and thermal physics will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. The students are free to request help. Homework problem sets will be given. The students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance. **Student-centered Tutorial**: Students work on a set of problems in the tutorials. Students are encouraged to try to solve problems before seeking assistance. These problem sets provide them opportunities to apply the knowledge gained from the lecture. They also help the students consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to engineering science.

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) Continuous assessment	40	✓	✓	✓
(2) Examination	60	✓	✓	✓
Total	100			

Homework problem sets and tests (assessment method 1) and a final written examination (assessment method 2) all require demonstration of basic understanding of the relevant physics (a), good problem solving skills (b), and being able to relate the fundamental physics to engineering problems (c).

The continuous assessments aim at checking the progress of students study throughout the course, assisting them in self-monitoring of fulfilling the learning outcomes. The examination will be used to assess the knowledge acquired by the students; as well as to determine the degree of achieving the learning outcomes.

Student Study Effort Expected

Class contact:	
• Lecture	28 h
• Tutorial	14 h
Other student study effort:	
• Self-study	78 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.

Giambattista, Richardson and Richardson, **Physics**, 2nd edition, 2010, MaGraw-Hill.

Subject Description Form

Subject Code	AP00003
Subject Title	Foundation Physics II
Credit Value	3
Level	0
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with fundamental knowledge in physics focusing on the topics of waves and electromagnetism.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) grasp a basic understanding in selected fundamental physical principles in waves and electromagnetism; (b) solve real-life problems based on the physical principles; and (c) appreciate the importance of some physical principles as employed in various branches of engineering.
Subject Synopsis/ Indicative Syllabus	**Waves**: nature of waves; wave motion and propagation; longitudinal and transverse waves; reflection and refraction; superposition of waves; standing waves; diffraction and interference; sound waves; light in electromagnetic spectrum; reflection and refraction of light; total internal reflection; image formation by mirrors and lenses; wave nature of light. **Electromagnetism**: electric charges; electric field and potential; current, potential difference and resistance; Ohm's law; series and parallel circuits; electrical power; magnetic force and magnetic field; magnetic effect of electric current; magnetic force on moving charges and current-carrying conductors; Hall effect; electromagnetic induction.
Teaching/Learning Methodology	**Lecture**: The fundamentals in waves and electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. The students are free to request help. Homework problem sets will be given. The students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance. **Student-centered Tutorial**: Students work on a set of problems in the tutorials. Students are encouraged to try to solve problems before seeking assistance. These problem sets provide them opportunities to apply the knowledge gained from the lecture. They also help the students consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to engineering science.

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) Continuous assessment	40	✓	✓	✓
(2) Examination	60	✓	✓	✓
Total	100			

Homework problem sets and tests (assessment method 1) and a final written examination (assessment method 2) all require demonstration of basic understanding of the relevant physics (a), good problem solving skills (b), and being able to relate the fundamental physics to engineering problems (c).

The continuous assessments aim at checking the progress of students study throughout the course, assisting them in self-monitoring of fulfilling the learning outcomes. The examination will be used to assess the knowledge acquired by the students; as well as to determine the degree of achieving the learning outcomes.

Student Study Effort Required

Class contact:	
• Lecture	28 h
• Tutorial	14 h
Other student study effort:	
• Self-study	78 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.

Giambattista, Richardson and Richardson, **Physics**, 2nd edition, 2010, MaGraw-Hill.

Subject Description Form

Subject Code	AP10004
Subject Title	Physics Experiments
Credit Value	1
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide the students with hands-on experience in the operation of various kinds of physical instruments and to apply their knowledge in physical principles for practical applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) apply the principles, methodologies and skills for experimental observation and interpretation for scientific and engineering purposes; (b) analyze, evaluate, synthesize and propose solutions to problems of a general nature with innovative/creative ideas where appropriate; and (c) to collaborate smoothly with others in teamwork.
Subject Synopsis/ Indicative Syllabus	Suggested Experiments: 1. Linear motion and Newton's Laws 2. Artwood's Machine and Kinetic Friction 3. Physical Pendulum 4. Specific Heat of objects 5. Ideal Gas Law 6. Heat Engine Cycle 7. Sound Waves and Standing Waves 8. Light Intensity and Polarization 9. Interference from a Single-slit and a Double-slit 10. Electrostatic system 11. Magnetic Fields 12. Electromagnetic induction
Teaching/Learning Methodology	**Laboratory**: Twelve experiments will be conducted. They cover the whole range of fundamental physics, i.e. mechanics, heat, wave, light, and electromagnetism. Students will work in groups and conduct the experiments under the guidance of teaching staff. They are required to analyze their experimental results using basic physical principles. They also have to answer preset questions and complete laboratory reports before they leave the laboratory.

Assessment Method 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
Laboratory Reports	70	✓	✓	✓
Participation	30	✓		✓
Total	100			

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

Method 1 is designed to assess how the students can apply their knowledge and whether they can provide a solution to a practical problem, which are the learning outcomes of (a) and (b). It also encourages the students to work in groups, which is outcome (c).

Student Study Effort Required

Class contact	
• Laboratory	36 h
Total student study effort	36 h

Reading List and Reference

John W. Jewett and Raymond A. Serway, "Physics for Scientists and Engineers", 2010, 8th edition, Brooks/Cole Cengage Learning.

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

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) define simple harmonic motion and solve simple problems; (d) explain the formation of acoustical standing waves and beats; (e) use Doppler's effect to explain changes in frequency received. (f) explain ideal gas laws in terms of kinetic theory; (g) apply the first law of thermodynamics to simple processes; and (h) solve simple problems related to the Carnot cycle.
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; gravitation field; systems of particles; collisions; rigid body rotation; angular momentum; oscillations and simple harmonic motion; pendulum; statics; longitudinal and transverse waves; travelling wave; Doppler effect; acoustics. **Thermal physics**: conduction, convection and radiation; black body radiation and energy quantization; 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	36 h
• Tutorial	6 h
Other student study effort:	
• Self-study	78 h
Total student study effort:	120 h

Reading List and References

John W. Jewett and Raymond A. Serway, “Physics for Scientists and Engineers”, 2010, 8th edition, Brooks/Cole Cengage Learning.

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) explain phenomena related to the wave character of light; (c) define electrostatic field and potential; (d) use Gauss' law in solving problems in electrostatics; (e) solve problems on interaction between current and magnetic field; (f) apply electromagnetic induction to various phenomena; and (g) solve simple problems in AC circuits.
Subject Synopsis/ Indicative Syllabus	**Waves and optics**: nature of light, reflection and refraction; image formation by mirrors and lenses; compound lens; microscope and telescope; superposition of waves; Huygen's principle; interference and diffraction; interferometers and diffraction grating; 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 and RC circuits; magnetic force on moving charges and current; Hall effect; Biot-Savart law and Ampere's law; Faraday's law and Lenz's law; self-inductance and mutual inductance; 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

<table>
<tr><td></td><td>lectures; communication between students and lecturer; delivery of handouts, homework and notices etc.</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="7">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><td>e</td><td>f</td><td>g</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.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>36 h</td></tr>
<tr><td>• Tutorial</td><td>6 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>78 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>John W. Jewett and Raymond A. Serway, “Physics for Scientists and Engineers”, 2010, 8th edition, Brooks/Cole Cengage Learning.

W. Bauer and G.D. Westfall, “University Physics with Modern Physics”, 2011, McGraw-Hill.</td></tr>
</table>

Subject Description Form

Subject Code	CBS3241P
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 • 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

Teaching/Learning Methodology

Learning and teaching approach

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

Collaboration of input/support from the Language Centres and the Engineering discipline

Students of this subject will also take the subject "Professional Communication in English", and will work on the same project in both subjects. In producing professionally acceptable documents and delivering effective presentations, students will be engaged in the use of appropriate Chinese and English language and skills, as well as applying knowledge learned in their Engineering subjects. As such, the planning, design and implementation of the teaching and learning activities and assessments will involve collaboration between the teaching staff from the CLC, the ELC, and staff from the Engineering discipline.

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

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 Chinese	60%	✓		✓			
2. Oral presentation of project proposal	40%		✓	✓			
Total	100 %						

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

1. 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.
- 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.

2. There will be collaboration between the teaching staff from the Language Centres and the discipline in assessing students' performances. It is expected that the teaching staff of the Engineering discipline will provide support in assessing students' application of discipline knowledge. They will be involved in assessing the oral presentations intended for experts rather than those for laymen.

3. Hence the assessment pattern will be as follows:

Assessment type	Intended readers/audience	Timing	Assessors
Oral presentation of project – Team presentation of 30 minutes, in groups of 4 – Simulating a presentation of the proposal in progress	Mainly engineering experts	Weeks 11-12	CLC staff and Engineering staff
Written proposal in Chinese – Document of around 1,500 words for the final proposal	Mainly laymen	Week 14	CLC

Student Study Effort Expected		
	Class contact:	
	▪ Seminars	28 Hrs.
	Other student study effort:	
	▪ Researching, planning, writing, and preparing the project	42 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。

56 contact hours; with seminars for Chinese and English every week continuously over the 14 weeks **(Assessments shaded)**

Writing and presenting projects in English *(Week, contact hours and content)*		*Writing and presenting projects in Chinese* *(Week, contact hours and content)*		*Involvement of Engineering Discipline*
1 (2 hrs)	**Introduction to course and project; pre-course task**	1 (2 hrs)	**Introduction to course and project; pre-course task**	• Setting the scenarios and requirements for the course-long project • Providing discipline-related supplementary information regarding the projects
2-5 (8 hrs)	**Writing project proposals and reports** • Planning and organising project proposals and reports • Explaining the background; objectives; scope; significance • Supporting with the literature • Describing the methodology and anticipated results	2-5 (8 hrs)	**Writing project proposals and reports** • Planning and organising project proposals and reports • Explaining the background; objectives; scope; significance • Supporting with the literature • Describing the methodology and anticipated results	
6 (2 hrs)	**Tutorials on the plan for the proposal**	6-7 (4 hrs)	**Tutorials on the first draft of the proposal**	
7-9 (6 hrs)	**Writing project proposals and reports** (continued) • Describing and analysing project results (e.g. results of pilot study) • Describing the budget; schedule and/or method of evaluation • Writing executive summaries/abstracts	8-9 (4 hrs)	**Writing project proposals and reports** (continued) • Describing and analysing project results (e.g. results of pilot study) • Describing the budget; schedule and/or method of evaluation • Writing executive summaries/abstracts	
10-12 (6 hrs)	**Submit English written proposal in Week 10 (30%)** **(Intended readers: experts)** **Delivering oral presentations of projects** • Analysing needs of different audiences • Selecting relevant and appropriate content • Choosing appropriate language and tone • Using effective interactive strategies	10-12 (6 hrs)	**Delivering oral presentations of projects** • Analysing needs of different audiences • Selecting relevant and appropriate content • Choosing appropriate language and tone • Using effective interactive strategies	• Assessing the English written proposals intended for experts
13-14 (4 hrs)	**Team oral presentations (20%)** **(Intended audience: laymen)**	13-14 (4 hrs)	**Team oral presentations (20%)** **(Intended audience: expert)** **(Submit Chinese written proposal in Week 14 (30%)** **(Intended audience: laymen)**	• Assessing the Chinese team presentations intended for experts

Subject Description Form

Subject Code	EE2901S
Subject Title	Basic Electricity and Electronics
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	AMA2111 and University Physics II/IIA
Objectives	1. To introduce the basic concepts and fundamental principles of electric circuits applicable to ME students. 2. To develop an ability for solving problems involving electric circuits. 3. To develop skills for experimentation on electric circuits. 4. To impart relevant skills and knowledge in basic electricity and electronics for independent learning of other subjects that requires such skills and knowledge.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand fundamental concepts of electrical circuits. b. Understand the operating principles of transformer and electrical machines. c. Solve simple problems using circuit analysis techniques. d. Use suitable instrumentation to carry out experimental investigations to validate the theoretical investigations. e. Understand the basic principles of digital logic and analogue electronic circuits.
Subject Synopsis/ Indicative Syllabus	**DC Circuits —** Potential and potential difference. Charge and flow of charge. Voltage and current as two basic variables. Kirchhoff's current and voltage laws. Independent and dependent sources. Resistance. Simple circuit styles: voltage divider, current divider, series and parallel circuits. Nodal and mesh analyses. Thévenin and Norton theorems. Power dissipation. Source loading and maximum power transfer. **Capacitance, Inductance and First Order Transients —** Constitutive relations of capacitor and inductor. Introduction to time-varying circuits. Simple RC and LC circuits. Important concept of independent state variables. First-order differential equation (with simple solution of exponential form). First order transient analysis. Time-domain solution and transient behaviour of first order circuits. Time constant. **Mutual Inductance and Transformer —** Basic coupled inductance equation.

Concept of ideal transformer (assuming sinusoidal voltages and currents). Dot convention. Applications in voltage/current level conversion and galvanic isolation.

Steady-state Analysis of AC Circuits — Average and rms values. Phasors (rotating vectors). Steady-state analysis of circuits driven by single fixed frequency sinusoidal sources. Impedance and admittance. Analysis approach 1: phasor diagrams for simple circuits. Analysis approach 2: systematic complex number analysis, i.e., same treatment as DC circuits but with complex numbers representing phase and magnitude of AC voltages and currents. Real and reactive powers. Power factor. Three-phase circuits.

Electrical Machines — DC Machines: construction, generator and motor action, e.m.f., torque equations. Three-phase induction motors: construction, rotating magnetic field production and torque-slip curve.

Digital Logic Circuits — Binary number system: addition, subtraction, multiplication and division in binary number systems. Conversion between binary and decimal numbers. Two's complement. Boolean algebra. Basic logic gates. Karnaugh maps. Don't care condition. Combinational logic circuit designs and modules.

Basic Analogue Electronic Circuits — Junction diodes, junction transistors and field-effect transistors.

Laboratory Experiments:

1. Introduction to laboratory instrumentation / Thévenin and Norton theorems.
2. First order transient.
3. Simple digital circuits.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to basic analysis techniques for electrical circuits, transformer, electrical machines, digital logic circuits and basic analogue electronic circuits (outcomes a to e). The learning is strengthened with interactive Q&A and short quizzes.

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

Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience and proper use of equipment and also analytical skills on interpreting experiment results (outcome e).

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. Examination	50%	√	√	√		
2. Class Tests	20%	√	√	√		
3. Quizzes	15%	√	√	√		
4. Lab Logbooks & Reports	15%				√	√
Total	100 %					

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

Overall Assessment:

0.5 x End of subject Examination + 0.5 x continuous Assessment

Examination is adopted to assess students on their overall understanding and the ability of applying the concepts. It is supplemented by the mid-term class tests and regular quizzes which provide timely feedbacks to both lecturers and students on various topics of syllabus. Experiment logbooks and reports reflect the students' laboratory skills, usages of appropriate equipment and data analysis on experiment results.

Student Study Effort Expected

Class contact:	
▪ Lectures	36 Hrs.
▪ Laboratory experiment	6 Hrs.
Other student study effort:	
▪ Supplementary tutorials/consultations	18 Hrs.
▪ Self-study	42 Hrs.
Total student study effort	102 Hrs.

Reading List and References	**Textbook:** 1. G. Rizzoni, *Fundamentals of Electrical Engineering*, New York: McGraw-Hill, latest edition. **References:** 1. C.K. Tse, *Linear Circuit Analysis,* London: Addison-Wesley, latest edition. 2. D.A. Neamen, *Micoelectronics: Circuit Analysis and Design*, Boston: McGraw-Hill, latest edition. 3. R.A. DeCarlo and P.M. Lin, *Linear Circuit Analysis*, Oxford University Press, latest edition. 4. A.H. Robbins and W.C. Miller, *Circuit Analysis: Theory and Practice*, Thomson Learning, latest edition.

Updated on 28 Aug 2012

Subject Description Form

Subject Code	ELC3521
Subject Title	Professional Communication in English
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 proposals in English • Planning and organising project proposals • 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 in English • Selecting content for audience-focused presentations • 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

Teaching/Learning Methodology

Learning and teaching approach

The subject is designed to develop the students' English 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
- giving oral presentations to intended stakeholders of the project

Collaboration of input/support from the English Language Centre and the Engineering discipline

Students of this subject will also take the subject *Professional Communication in Chinese*, and will work on the same project in both subjects. In producing professionally acceptable documents and delivering effective presentations, students will be engaged in the use of appropriate Chinese and English language and skills, as well as applying knowledge learned in their Engineering subjects. As such, the planning, design and implementation of the teaching and learning activities and assessments will involve collaboration between the teaching staff from the CLC, the ELC, and staff from the Engineering discipline.

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

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	60%	✓		✓			
2. Oral presentation of project proposal in English	40%		✓	✓			
Total	100 %						

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

1. 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.

- 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.

2. There will be collaboration between the teaching staff from the English Language Centre and the discipline in assessing students' performances. It is expected that the teaching staff of the Engineering discipline will provide support in assessing students' application of discipline knowledge. They will be involved in assessing the oral presentations intended for experts rather than those for laymen.

3. Hence the assessment pattern will be as follows:

Assessment type	Intended readers/audience	Timing	Assessors
(English) Written proposal in English – Document of around 1,500 words for the initial proposal	Mainly engineering experts	Week 10	ELC and Engineering staff
(English) Oral presentation of project in English – Team presentation of 30 minutes, in groups of 4 – Simulating a presentation of the final proposal	Mainly non-experts	Weeks 13-14	ELC

Student Study Effort Expected

Class contact:	
▪ Seminars	28 Hrs.
Other student study effort:	
▪ Researching, planning, writing, and preparing the project	56 Hrs.
Total student study effort	84 Hrs.

Reading List and References

Beer, D. F. (Ed.). (2003). *Writing and speaking in the technology professions*: *A practical guide* (2nd ed.). Hoboken, NJ: Wiley.

Johnson-Sheehan, R. (2008). *Writing proposals* (2nd ed.). New York: Pearson/Longman.

Kuiper, S. (2007). *Contemporary business report writing* (3rd ed.). Cincinnati, OH: Thomson/South-Western.

Lawrence, M. S. (1975). *Writing as a thinking process*. The University of Michigan Press.

Reep, D. C. (2006). *Technical writing: Principles, strategies and readings* (6th ed.). Pearson, Longman.

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	e	
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	42Hrs.
	Other student study effort:	
	▪ Guided reading, assignments and reports	35Hrs.
	▪ Self-study and preparation for test and examination	46Hrs.
	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 (July 2013)

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: Category A: Professional/academic knowledge and skills 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. Be able to 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. Be able to apply the computer programming techniques to solve practical engineering problems. Category B: Attributes for all-roundedness 6. Be able to solve problems by using systematic approaches in a team.
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; Modular programming; Exceptions and debugging. 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. 8. Using C/C++ in Engineering Applications - Solving practical problems

	using C/C++; Developing graphical user interfaces for engineering applications.
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	1,2,3,4,5	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.
Homework, and tests	1,2,3,4,5	Through working homework, students will develop a firm understanding and comprehension of the knowledge taught. They will analyse given C/C++ applications and apply knowledge in solving problems. For some design type of problems, they will have to synthesize solutions by evaluating different alternatives. To assure students' understanding of fundamental concepts, closed-book tests are arranged regularly. To enhance the students' problem solving skill in a given programming environment, open-book programming tests are arranged regularly.
Mini-project	1,2,3,4,5,6	After all the subject materials have been delivered, students are asked to finish a mini-project in a team. The project involves a practical engineering problem of some stated specification.

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	2	3	4	5	6
1. In-class exercises	10	✓	✓	✓	✓	✓	
2. Short-quizzes	10		✓	✓	✓		
3. Closed-book tests	20	✓	✓	✓	✓	✓	
4. Programming tests	30	✓	✓	✓	✓	✓	
5. Mini-project	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, closed-book tests and programming tests are conducted to help students familiarized with the programming language and skills. The problems to be solved by the students are typically presented as practical engineering problems. Through conducting a mini-project that lasts for several weeks, students would be able to experience how to solve problems by using a systematic approach in a team.

Student Study Effort Expected (Within TWO semesters)

Class contact:	64 Hours
▪ Lecture	30 Hours
▪ Tutorial	19 Hours
▪ Test/Quiz	14 Hours
▪ Mini-project presentation	1 Hours
Other student study effort:	61 Hours
▪ Self-studying	40 Hours
▪ Homework	13 Hours
▪ Mini-project/Report	8 Hours
Total student study effort	125 Hours

Reading List and References

Reference Books:

1. S. Rao, Sams Teach Yourself C++ in One Hour a Day. Indianapolis, IN: Sams, 2012.
2. P.J. Deitel and H.M. Deitel, *C++ How To Program*, 8th ed. Boston, MA: Prentice Hall, 2012.
3. J. Liberty and R. Cadenhead, Sams Teach Yourself C++ in 24 hours (5th ed.) Indianapolis, IN: Sams, 2011.
4. I Horton, Ivor Hortons Beginning Visual C++ 2010 [electronic resource]. Indianapolis, IN: Wiley, 2010.

August 2012

Revised (26-July 2013)

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 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 computers and operating 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	1. Introduction to computers Introduction to information technology using Cloud Computing as a real life example. Present applications of information technology in different engineering disciplines. Introduction to modern computers (Personal Computers/Computer Clusters) and operating systems (Resource Management/Privilege Control). 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 Router). 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.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		A1	A2	A3	A4	B1	
1. Continuous Assessment	50%	√	√	√	√		
2. Examination	50%	√	√	√	√	√	
Total	100 %						

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

The assessment methods include an end-of-subject examination (50%), two tests (20%), six laboratory sessions/workshops (20%), and two assignments (10%).
The examination cover intended subject learning outcomes A1, A2, A3, A4 and B1.
The continuous assessments (two tests from the lecture portion and 2 assignments) cover intended subject learning outcomes A1, A2, A3, A4. The laboratory sessions/workshops cover intended subject learning outcomes A2, A3 and B5.
The examination is a 2-hour, closed-book examination, and all of the tests are closed book. The laboratory sessions/workshops give students hands-on experience on setting up internet-applications, building up computer networks, and constructing database.

Student Study Effort Expected

Class contact:	
▪ Lecture	26 Hrs.
▪ Tutorial	8 Hrs.
▪ Laboratory Sessions/Workshops	24 Hrs.
Other student study effort:	
▪ Assignment preparation and laboratory report writing	32 Hrs.
▪ Self study	36 Hrs.
Total student study effort	126 Hrs.

Reading List and References

1. B. Williams and S. Sawyer, *Using Information Technology: A Practical Introduction to Computers and Communications*, 10th ed., McGraw-Hill, 2013.
2. J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach*, 6th ed., Pearson, 2012.
3. D. E. Comer, *Computer Networks and Internets: with Internet Applications*, 5th ed., Prentice-Hall, 2008.
4. B. A. Forouzan, *TCP/IP Protocol Suite*, 4th ed., McGraw-Hill, 2009.
5. W. Stalling, *Data and Computer Communications*, 9th ed., Prentice-Hall, 2011.
6. P. Rob and C. Coronel, *Database Systems: Design, Implementation, and Management*, 9th Edition, Thomson, 2011.
7. M. Mannino, *Database Design, Application Development, & Administration*. 5th ed., McGraw-Hill, 2011.

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 exam 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, 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. <u>Project Management</u>

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

4. Management of Change

Strategic leadership and innovation; Organizational change; Leading planned change; Organizational development; 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 (20%) • Final presentation (individual presentation and group report) (20%)	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	30 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	34 Hrs.
	Total student study effort	116 Hrs.
Reading List and References	1. Morse, L C and Babcock, D L, 2010, *Managing Engineering and Technology: an Introduction to Management for Engineers*, 5th Ed., Prentice Hall 2. White, M A and Bruton, G D, 2010, *The Management of Technology and Innovation: A Strategic Approach*, 2nd Ed., , Cengage Learning 3. Chelsom, J V, Payne, A C and Reavill, L R P, 2004, *Management for Engineers, Scientists and Technologists*, John Wiley & Sons	

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 its 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 of technology applications; 4. observe the professional conduct as well as the legal and other applicable constraints related to various engineering issues.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. identify and evaluate the effects of technology applications in the social, cultural, economic, legal, health, safety, environment, and welfare dimensions of the society; b. explain the importance of local and international professional training, professional conduct, ethics, and responsibilities in various engineering disciplines, particularly the Washington Accord; c. evaluate in a team setting the implications of a specific project in the eight dimensions of project issues related to engineers, and present the findings to laymen and peers.
Subject Synopsis/ Indicative Syllabus	1. <u>Impact of Technology on Society</u> Innovation and creativity; History and trends of technology on social and cultural developments of society 2. <u>Environmental Protection and Related Issues</u> Roles of the engineer in energy conservation, ecological balance, and

sustainable development

3. Outlook of Hong Kong's Industry

Support organizations and impacts on economic development in Greater China and the Pacific Rim

4. Industrial Health and Safety

The Labour Department and the Occupational Health and Safety Council; Legal dimensions such as 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 student's in-depth analysis of the relationship.

Students form groups; throughout the course, they will work on engineering cases by completing the following learning activities:

1. Case analysis where students provide weekly summary reports on the relationships between society and the engineering issues of a project under specific dimensions;

2. The final report as a case portfolio which includes
   i. Presentation slides
   ii. Feedback critique
   iii. Weekly summary report
   iv. Reflection

3. Final 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	60%						
• Group weekly learning activities • Individual final	(24%)	✓	✓	✓			

	presentation • Group report, individual reflection report	(18%) (18%)	✓ ✓	 ✓	 ✓			
	2. Examination	40%	✓	✓				
	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. Through these 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 portfolio reports on the case studies.

The open-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	30 Hrs.
	▪ Tutorial and presentation	12 Hrs.
	Other student study efforts:	
	▪ Research and preparation	60 Hrs.
	▪ Report writing	14 Hrs.
	Total student study effort	116 Hrs.

Reading List and References

Reference books:

1. 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
2. Hjorth, L, Eichler, B, and Khan, A, 2003, *Technology and Society A Bridge to the 21st Century*, Upper Saddle River, N.J.:Prentice Hall

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

Subject Description Form

Subject Code	ME22001
Subject Title	Engineering Design Fundamentals
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with the extensive knowledge in product design and development processes, including product planning, design problem formulation, concept design, configuration design, parameter design, and detail design.
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. Complete a given task in engineering design, such as an assignment or a project, by applying knowledge of engineering design. c. Search for up-to-date information on product design, materials and manufacturing processes. d. Understand of design for X, human factors/ergonomics, product safety and reliability, and the professional and ethical responsibilities in product design and development. e. Present effectively in completing an assignment or a project.
Subject Synopsis/ Indicative Syllabus	***Design processes*** - Product planning - Design problem formulation - Concept design - Configuration design - Parametric design - Detail design - Product testing and prototyping ***Design solution generation in design process*** - Types of design: Variant design, adaptive design, original design, part, assembly and product design, concept design, configuration design, parametric design, detail design. - Design solution generation and its needed input and output. - Solution evaluation, verification and validation. ***Materials and manufacturing processes*** - Product materials - Material selection - Product manufacturing processes

<table>
<tr>
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<td>
- Manufacturing process selection

CAD and CAE applications in engineering design
- Geometry representation: Wireframe modeling, surface modeling and solid modeling.
- Product structure modeling.
- Design solution evaluation by CAE technology

Design for X
- Design for manufacturing
- Design for X: failure, tolerance and environment
- Design for safety and reliability
- Human factors/Ergonomics

Projects, teamwork and ethics
- Projects
- Teamwork
- Ethics and the engineering profession
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<tr>
<td>Teaching/Learning Methodology</td>
<td>
Lectures are used to deliver the fundamental knowledge related to product engineering design and development (Outcomes a – d).

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

Projects are used to relate the concepts to practical applications and students are exposed to the hands-on practices, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes a – e).

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

<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>Project</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Homework/assignment</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
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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. Project	20%	√	√	√	√	√
2. Homework/Assignment	15%	√	√	√	√	√
3. Study report	15%	√	√	√	√	√
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 of applying the concepts. It is supplemented by continuous assessment including projects, homework / assignments and study reports. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.

Student Study Effort Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Laboratory/Tutorial	8 Hrs.
Other student study effort:	
▪ Reading and review	22 Hrs.
▪ Homework assignment	20 Hrs.
▪ Project	20 Hrs.
Total student study effort	104 Hrs.

Reading List and References

1. G. Pahl and W. Beitz, Engineering Design-A systematic approach, Springer, latest edition.
2. K.N. Otto, K.L. Wood, Product design, Prentice Hall, latest edition.
3. George E. Dieter, Engineering Design, McGraw-Hill International Editions, latest edition.
4. R.J. Eggert, Engineering design, Prentice Hall, latest edition.
5. 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.
6. Christopher D. Wickens, John D Lee, Yili Liu and Sallie E Gordon Becher, An Introduction to Human Factors Engineering, Prentice Hall, latest edition.
7. Karl Kroemer, Henrike Kroemer and Katrin Kroemer-Elbert, Ergonomics: How to Design for Ease and Efficiency, Prentice Hall, latest edition.
8. Farid Amirouche, Principles of Computer-aided Design and Manufacturing, Prentice Hall, latest edition.
9. Christopher D. Wickens and Justin G Hollands, Engineering Psychology and Human Performance, Prentice Hall, latest edition.

July 2012

Subject Description Form

Subject Code	ME23001
Subject Title	Engineering Mechanics
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I
Objectives	To provide students the fundamental concepts of mechanics motion and system equilibrium. Additionally, different mathematical approaches are introduced to evaluate different engineering 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 on simple systems. b. Distinguish the basic differences between diverse engineering systems, and select the suitable design in achieving the engineering purposes. c. Employ state-of-art technology in solving mechanics problems encounter in assignments and projects. d. Corporate with students from different disciplines via conduction of experiments and projects. e. Present effectively in completing an assignment or a project. f. Recognize the importance and needs of mechanics in nowadays society.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Mechanics*** **-** Basic concepts of mechanics. Scalar and Vectors: Vector algebra and vector components. Position, unit and force vectors. Two and three-dimensional force systems. Moment of a force about a point. Moment of a force about a line. ***Dynamics*** **-** Kinematics and kinetics of particles, rectilinear motion, plane curvilinear motion, relative motion, equation of motion. ***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; the method of sections. Internal forces developed in structural members. Shear and moment equations and diagrams. 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.

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 c, and f).

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

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 to e).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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	f
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 × End of Subject Examination + 0.40 × 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 Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Course work	20 Hrs.
▪ Self-study	42 Hrs.
Total student study effort	104 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.

July 2012

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. Define and solve problems in two-dimensional dynamics and single-degree-of-freedom vibration of rigid bodies. b. Complete a given task in dynamics and vibration, such as an assignment or a project, by applying concepts and knowledge in engineering dynamics. c. Determine the critical rotating speed of shafts, the behavior of a single-degree-of-freedom system under forced vibration, and the plane kinematics of a mechanical system by experiments and interpret the results. d. Design a single-degree-of-freedom system with the desired transient and steady-state vibration response when subjected to forced excitation.
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, b and d)

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, b and d)

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. (Outcome c)

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lecture	√	√		√
Laboratory			√	
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. 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Reading and review	42 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.	

July 2012

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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Self-study	42 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.	

July 2012

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, 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 working principles and rationales of common manufacturing processes for product development. b. Select appropriate manufacturing processes for product fabrication at up-front design stage. c. Develop prototypes with the related manufacturing techniques. d. Understand the related tooling and die used in manufacturing processes and their designs. e. Present effectively in completing an assignment or a project.
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 advanced manufacturing processes and rapid prototyping technology (Outcomes a – d).

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

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

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
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	d	e
1. Test	20 %	√	√			
2. Homework/assignment	20 %	√	√		√	√
3. Project report	10 %	√	√	√	√	√
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 tests, assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Required	Class contact:	
	▪ Lecture and seminar	34 Hrs.
	▪ Tutorial	8 Hrs.
	Other student study effort:	
	▪ Performing mini-projects/study report	20 Hrs.
	▪ Course work	20 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.	

July 2012

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
Objectives	To introduce students the knowledge of stress-strain behaviors of materials under different loading condition. Also, to provide the fundamental knowledge in analyze the problems with systematic approach.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Solve for forces and moments on a structure and to determine the system and distribution of internal forces in the structure through applying the laws of equilibrium and free body diagrams. b. Evaluate the principal stresses in structural components subjected to a combined state of loading. c. Formulate and solve problems involving bending of beams, axisymmetric shells, and those statically indeterminate structural components. d. Search for state-of-art technology in solving different mechanics calculations e. Recognize the qualitative features of the stresses, strains, materials properties and geometrical properties associated with axial loading, torsion and bending and to derive stresses and deformations in a structural component due to axial load, torsion, and bending acting individually or in combination.
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 c and e).

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

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 to c and e).

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. 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Course work	20 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.	

July 2012

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, heat engine, gas power and refrigeration cycles, air-conditioning, combustion and heat transfer processes.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Solve thermodynamic problems including steam, heat engine, gas turbine or refrigeration cycles by applying knowledge in engineering thermodynamics and mathematics. b. Complete a given task in engineering thermodynamics or heat transfer application, such as an assignment or a project, by applying concepts in thermal science and knowledge in engineering thermodynamics and heat transfer. c. Analyze and interpret data obtained from an experiment in engineering thermodynamics or heat transfer. d. Search for state-of-the-art technology in heat/work conversion in completing an assignment or a project. e. Present effectively in completing an assignment or a project.
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, b, and 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 b to e).

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. Examination	60 %	√	√			√
2. Test	20 %	√	√			√
3. Assignment/Project/ Laboratory Work	20 %	√	√	√	√	√
Total	100 %					

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

Overall Assessment:
0.6 × End of Subject Examination + 0.4 × 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, assignments, projects and laboratory works which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial / Experiment	8 Hrs.
	Other student study effort:	
	▪ Course work	35 Hrs.
	▪ Self-study	35 Hrs.
	Total student study effort	112 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.	

July 2012

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	To teach the conservation laws and their applications in the field of fluid mechanics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply the conservation laws such as conservation of mass, momentum and energy to solve fluid mechanics problems such as internal and external flows, compressible and incompressible flows. b. Apply Dimensional Analysis to form non-dimensional groups. c. Conduct experiments as well as to analyze and interpret data.
Subject Synopsis/ Indicative Syllabus	***Basic Concepts*** **-** Fluid properties, viscosity and shear stress. Newton's Law of viscosity, simple viscometer, compressibility, Newtonian and non-Newtonian fluids. ***Pressure Distribution in a Fluid*** **-** Fluid pressure, Pascal's law, pressure-height relation, manometry, forces on submerged surfaces and buoyancy, force vortex and free vortex motion. ***General Description & Equations of Motion of Fluid Flow*** **-** Flow: steady and unsteady, uniform and non-uniform, incompressible and compressible, laminar and turbulent flow, Eulerian and Langrangian descriptions, streamline and streamtube, Euler equation and Bernoulli equation. Pitot and Pitot-static tubes, Venturi meter and orifice; Momentum Equation and Energy Equation; Pumps systems, pipe friction and losses. ***Dimensional Analysis*** **-** Principle of dimensional homogeneity. Buckingham π theorem. Dimensionless groups and their physical significance. Flow similarity and model testing. ***Conservation Equations*** **-** Continuity equation; Navier-Stokes equations; Energy equation; Exact solutions of N-S equations: Couette flow; Poiseuille flow; Couette-Poiseuille flow; Hagen-Poiseuille Flow through a Pipe. Examples of solving N-S equations by CFD software and numerical simulation models. ***Internal Flow*** **-** Exact solution for fully developed laminar flow in a pipe, Darcy's law; entrance length, Reynolds experiment and turbulence; Moody chart, frictional and minor losses, design for pipes in parallel and in series. ***External Flow*** **-** Viscosity and viscous stress, laminar boundary layer over a flat plate; effects of adverse pressure gradient, concepts of flow separation, and transition to turbulence, velocity profiles; characteristics of flow over bluff bodies and particles, lift, friction and profile drag; boundary layers theory, boundary layer disturbance,

displacement and momentum thicknesses, momentum integral equation, laminar boundary layer profiles, skin friction coefficient, turbulent boundary layers, power law and laws of walls.

Applications on Fluid Machinery **-** Dynamics of flow over an airfoil and through a cascade, Euler equation for turbo-machinery, characteristics of fans and pumps;

Compressible Flows - Review of Thermodynamics, propagation of sound waves. Isentropic flow equations. Mach cone. Subsonic and supersonic flows nozzles. Normal shock waves and oblique shock waves.

Laboratory Experiment
There are two 2-hour laboratory sessions and the typical Experiments are:
1. Compressible flow nozzle
2. Centrifugal Pump Testing
3. Potential Flow Visualization (Hele-Shaw Expt.)
4. Wind Tunnel Testing of Cylinder and aerofoil
5. Universal velocity Profile
6. Boundary Layer Experiment

Teaching/Learning Methodology

Lectures aim to deliver the fundamental knowledge in relation to fluid mechanics (Outcomes a and b).

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

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 (Outcome 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. Examination	60%	√	√	
2. Assignment / Laboratory report / Test	40%	√	√	√
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 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial / Laboratory	8 Hrs.
	Other student study effort:	
	▪ Course work	20 Hrs.
	▪ Self-study	42 Hrs.
	Total student study effort	104 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.	

July 2012

Subject Description Form

Subject Code	ME36001
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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial	7 Hrs.
	▪ Computational Workshop	1 Hr.
	Other student study effort:	
	▪ Performing assignment	36 Hrs.
	▪ Applying computational software	10 Hrs.
	▪ Private study	18 Hrs.
	Total student study effort	106 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.	

July 2012

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 a real-world 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 four academic staff (both FT and PT programmes usually use the same panel).

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.
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	42 Hrs.
	Other student study effort:	
	▪ Conducting project	152 Hrs.
	▪ Literature search and private study	58 Hrs.
	Total student study effort	252 Hrs.
Reading List and References	To be advised by supervisor	

July 2012

Elective Subjects

Subject Description Form

Subject Code	ENG3002
Subject Title	Multidisciplinary Project
Credit Value	6
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	Engineering practice is often conducted in groups of professionals with different backgrounds. Hence students will be benefited from doing a multidisciplinary project with members from different fields. This provides them with the chance to apply knowledge and skills in a more realistic setting involving group work. The objectives of this course are: 1. To provide students with opportunities to operate in a multidisciplinary team to accomplish specific tasks in the project. 2. To enable students to analyze engineering problems and synthesize solutions while considering various constraints. 3. To provide students with opportunities to operate within a multidisciplinary group for the accomplishment of the overall objectives of the project.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the background, objectives (time, cost, and technical requirements), and deliverables of the project. 2. Realize applicable constraints, and produce optimal results, when designing a solution to an engineering problem. 3. Apply professional skills and knowledge in engineering to achieve the objectives of the project and to produce the deliverables. 4. Use the appropriate tools and facilities to develop the product/prototype for the project. <u>Category B: Attributes for all-roundedness</u> 5. Communicate effectively. 6. Work in a multidisciplinary team with people from different backgrounds.
Subject Synopsis/ Indicative Syllabus	The progression of the project will be guided by a framework, which consists of the following indicative stages. The specific details will vary from project to project. **Project Specification** In this stage, the students will work in conjunction with the project supervisor to draw up a concrete project plan specifying at least the following: 1. Background of the project 2. Aims and objectives 3. Deliverables 4. Methodology to be adopted 5. Schedule

	Structured Study • *Project definition: time, cost, and technical requirements; constraints, values and challenges; project scope, deliverables and process* • *The stakeholders; project organization; roles of the Project Manager* • *Project life cycle; strategies for managing multi-projects* • *Project planning; project scheduling: critical path method; resource levelling; time-cost trade-off* **Project Execution** This is the major part of the project. The contribution of each individual within the group will be specified before implementation of the project plan. After the specification is done, the project team will work towards achievement of the project objectives and produce the project deliverables in accordance with the schedule and budget constraints. The students and the project supervisor(s) will meet regularly to discuss the progress. In particular the following should be demonstrated: 1. Adherence to the schedule 2. Division of labour and collaboration among students towards accomplishing the overall objectives of the project 3. The group meets regularly to review progress of the project. These meetings are led by the students 4. Initiatives of the students to work, design, and to solve problems 5. Inquisitiveness of the student (e.g. to probe into different phenomena or to try different approaches) 6. Tenacity and resourcefulness of the students to achieve the project objectives 7. Systematic documentation of data, design, results, …etc. throughout the project process ***Structured Study*** • *Key performance indicators. Project problems. Risk management* • *Work break down structure. Project cost control.* **Project Report** On completion of the project, it is important that the student is able to disseminate the results for others to review. Through this dissemination process, project achievements can be communicated, experience can be shared, knowledge and skills learnt can be retained and transferred. The following elements will be important: 1. Project log book to be kept by each individual student 2. Project report (hardcopy and softcopy) 3. Presentation and Oral Examination
Teaching/Learning Methodology	Structured study will be provided to the students so that they learn how to plan, design, and evaluate a project. Then, the project team will meet the project supervisor regularly to discuss their project design, information searching, implementation, testing, trouble-shooting, report writing, and presentation. The students in a group will meet more frequently themselves to conduct the project. The students' progress will be documented in their log-books and the supervisor will give them continuous feedback and comments with regard to the extent to which the students have adhered to the schedule, and the quality of their works over time.

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	2	3	4	5	6
Group Assessment:							
1. Communication and progress management	10%					✓	✓
2. Product/prototype development and demonstration	15%	✓	✓	✓	✓		
Individual Assessment:							
3. Structured study	15%	✓	✓				
4. Teamwork skills, originality and resourcefulness	10%		✓	✓	✓	✓	✓
5. Project proposal, log-book, oral presentation, project report	15%	✓	✓	✓	✓	✓	✓
6. Technical competence	35%		✓	✓	✓		
Total	100%						

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

Students are evaluated based on their performances working as a group member and their individual contributions to their projects.

1. Through the evaluation of the students' performance in terms of communication and progress management, they can demonstrate their communication skills and their ability to work with people in a multidisciplinary team. This addresses learning outcomes (5) and (6).

2. Through the development of a product/prototype and the set-up of a demonstration, students can show their understanding of the project and the ways to accomplish its goals. This addresses learning outcomes (1) to (4).

3. Through the structured study provided to the students, they can demonstrate how to plan, implement, and evaluate their projects. This addresses learning outcomes (1) and (2).

4. Through the assessment of leadership skills, teamwork skills, originality and resourcefulness in the development of the product/prototype, students can demonstrate their ability in the design of the solution to an engineering problem,

<table>
<tr><td></td><td colspan="2">the application of their knowledge, the use of appropriate tools, and working as an effective member of a team. All these address learning outcomes (2) to (6).

5. Through the project proposal, log-book, presentations, and project report, students will demonstrate their understanding of the project. They will document the progress of the project throughout the entire project period, can give detailed explanations of their design, solution, use of tools and results, and can communicate their achievement to an audience. Hence, all 6 learning outcomes can be assessed.

6. Through the technical competence of the individual students, their capability in designing and implementing a project can be assessed. This will address learning outcomes (2) and (3).</td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Structured study (2 hours per week for 6 weeks)</td><td>12 Hrs</td></tr>
<tr><td>▪ Meeting with project supervisor (1 hours per week)</td><td>28 Hrs.</td></tr>
<tr><td>▪ Meeting among the group members (3 hours per week) - search for information, study the background knowledge, design, implement solutions, testing, trouble-shooting</td><td>84 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Reports writing, preparing for presentation and oral examination</td><td>86 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>210 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">General Text:

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.

Weissman, Jerry, The power presenter: technique, style, and strategy from America's top speaking coach, Hoboken, N.J.: Wiley, c2009.

Specific Text:

To be prescribed by the project supervisor.</td></tr>
</table>

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. engineering 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. develop suitable project methodologies and techniques in various phases of the project life cycle; b. select appropriate project variables and practices that are applicable to engineering projects; c. propose project management solutions, taking into consideration the project objectives and constraints; and d. measure and report project progress.
Subject Synopsis/ Indicative Syllabus	1. <u>Project Overview, Management Principles, and the Systems Approach</u> Characteristics of projects and project management. Management principles. Project organisation. Team development. Systems concepts and principles. Conflict management. 2. <u>Project Methodologies, Project Templates, 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>Pricing, Estimation, and Cost Control for Projects</u> Pricing process. Types of estimates. Budgeting project costs. Experience curve. Cost schedules and forecasts. Cost control systems. 4. <u>Assessment and Control of Projects</u> Earned value measurement system. Managing project risks. Computer-aided project management. Status reporting. Project closeout and termination. Project management maturity.

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. Continuous assessment	40%	✓	✓	✓	✓
2. Written examination	60%	✓	✓	✓	✓
Total	100%				

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

Continuous assessment: short tests, written reports, and tutorial exercises are used to assess students' understanding and application of the knowledge that they have learnt relative to learning outcomes (a), (b), (c), and (d).

Written examination: questions are designed to assess learning outcomes (a), (b), (c), and (d). Students are required to answer five questions, each of which covers at least one of the learning outcomes.

Student Study Effort Expected

Class contact:		
▪ Lectures	2 hours/week for 12 weeks	24 Hrs.
▪ Tutorials	1 hour/week for 9 weeks	9 Hrs.
▪ Case studies	3 hours/week for 2 weeks	6 Hrs.
▪ Laboratory work	3 hours/week for 1 week	3 Hrs.
Other student study effort:		
▪ Preparation for assignments, short tests, and the written examination		76 Hrs.
Total student study effort		118 Hrs.

Reading List and References

1. Kerzner, H 2009, *Project Management: a Systems Approach to Planning, Scheduling, and Controlling*, John Wiley, New York

2. Meredith JR and Mantel SJ 2009, *Project Management: a Managerial Approach*, Wiley, Hoboken NJ

3. Smith, NJ (ed.) 2008, *Engineering Project Management*, Blackwell, Oxford

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. Design controllers to satisfy the system requirements. b. Determine the control parameters to satisfy the relative stability requirements of a system given its transfer function or frequency response data. c. Design compensators for feedback control systems given the performance specifications using Bode diagrams. d. Model and analyze a dynamic system using a state-space approach for controller design. e. Design feedback controller for plant or process using computer tools.
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 - e).

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 - e).

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 - e).

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. 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Course work	26 Hrs.
	▪ Self-study	42 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.	

July 2012

Subject Description Form

Subject Code	ME41002
Subject Title	Noise Abatement and Control
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 concept and knowledge of sound generation mechanism and noise abatement technology.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the sound generation mechanisms, and the method to identify and analyze the type of noise source. b. Understand the physics of sound wave propagation. c. Understand the importance and usage of the noise assessment criterion for a given problem in duct or room noise applications. d. Apply the state-of the-art noise abatement technology and design elementary reactive muffler and absorptive duct lining for use in duct noise control and room acoustics application.
Subject Synopsis/ Indicative Syllabus	***Noise Sources and Control Strategy*** **-** Sound and its energy flux, intensity measurements for source identification. Elementary noise source mechanisms, categorization of actual noise sources in transport, product and other applications. Flow induced noise sources. Overview of control strategy for different frequency ranges. ***Sound Reflection*** **-** Propagation and decay of duct acoustics modes, sound reflection by expansion chamber, and acoustic admittance of pipe systems, Helmholtz resonator, quarter-wavelength resonator, numerical simulation of reactive silencers. ***Sound Absorption*** **-** Characteristics of sound propagation in porous materials, empirical formulas and numerical modelling of sound absorption materials, grazing incident sound, and performance of duct lining. ***Active Noise Control*** **-** Destructive interference, sensors, actuators and controllers, concept of feedback and feedforward control. ***Room Acoustic Control*** **-** Basic concepts of room acoustic modes, sound and vibration transmission in buildings, measurement of transmissions, basic techniques of sound and vibration insulation. ***Mini Project*** **-** This involves the use of numerical and/or experimental methods for noise abatement in a realistic application.

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, b, c and 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, 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. Class test	20%	√	√	√	√
2. Homework	20%	√	√		√
3. Lab 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 adopted to assess students on understanding and the ability to apply the concepts. It is supplemented by the class test, homework and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Student Study Effort Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Reading and review	38 Hrs.
	▪ Homework assignment	10 Hrs.
	▪ Laboratory report	8 Hrs.
	Total student study effort	98 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.	

July 2012

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 sound propagation in duct and room. b. Determine the coefficients of 1D sound reflection and transmission through a junction and a flat interface of acoustic media. c. Understand the mechanisms of basic measurement devices for sound 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 - 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	10%	√	√	√
2. Homework	20%	√	√	√
3. Laboratory report	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

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 Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial/Laboratory	8 Hrs.
Other student study effort:	
▪ Reading and review	40 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.

July 2012

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 expert and fuzzy inference systems 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 and fuzzy inference systems to analyze a product design via analytical and computational approaches. b. Understand the applications of AI in high-tech 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 design project involving the application of AI. d. Appreciate the state-of-the-art applications of AI in product design and present a design project via written report. e. Recognize the need to develop the ability of life-long learning.
Subject Synopsis/ Indicative Syllabus	***Expert Systems for Products*** **-** Principles of expert systems; Knowledge representations; Knowledge acquisition; Inference mechanisms; Learning and heuristics; Application of expert systems to product design and product data management; Understanding expert system shells, such as Prolog or Lisp; Building expert systems using Prolog or available software packages. [Case study 1: Apply expert system in product design] ***Fuzzy Inference Systems in Product Design and Development*** **-** 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. [Case study 2: Apply fuzzy inference Systems in product design]

Teaching/Learning Methodology

1. The lectures are aimed at providing fundamental knowledge on product expert system and fuzzy inference systems for product design and development.
2. The tutorials are aimed at enhancing applicable skills of the students. Examples on the expert systems and fuzzy inference systems in commercial products will be involved.
3. The project is aimed at integrating the knowledge that will be applied through a team project on product design and development with expert systems and fuzzy inference systems.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
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	e
1. Class Test	25%	√	√			
2. Homework	10%	√	√			
3. Group Project	15%	√	√	√	√	√
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 expert systems and fuzzy inference systems for products. The examination is used to assess the knowledge acquired by the students for understanding expert systems and fuzzy inference systems of the products.

Student Study Effort Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Laboratory / project / tutorial	8 Hrs.
	Other student study effort:	
	▪ Reading and review	20 Hrs.
	▪ Homework assignment	25 Hrs.
	▪ Project / Laboratory report	18 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. Boca Raton, FL, A first course in fuzzy and neural control**,** Chapman & Hall/CRC Press, latest edition. 4. Ross, Timothy J., Fuzzy logic with engineering applications, Chichester; Hoboken, NJ: Wiley, latest edition.	

July 2012

Subject Description Form

Subject Code	ME42002
Subject Title	Design for Packaging and No-Assembly
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials
Objectives	To equip students with basic knowledge on design and selection of appropriate packaging solutions for products and to introduce product mechanism design using the contemporary approach of design for no-assembly.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Design packaging for a new product by considering market needs, product safety, manufacturing processes, environmental, commercial and storage factors. b. Apply knowledge of mathematics and material engineering to analyze the effectiveness and safety of a packing design via analytical and computational approaches. c. Understand and apply the approach of design for no-assembly in packaging and mechanism design. d. Critically evaluate the effectiveness of existing packaging solutions for products and develop better solutions. e. Work effectively as a member of a project team to develop a packaging solution for a product and communicate the project outcomes through oral presentations and written report.
Subject Synopsis/ Indicative Syllabus	***Elements of Packaging*** **-** Positioning and challenges of packaging in product design and development; making of product packaging – ideas and technology; approach to package development; packaging liability; environmental implications of packaging. ***Paper, Board and Structural Design*** **-** Types of paper and board; properties of paper and paperboard; selection and design for product packaging – folding cartons, setup boxes, corrugated fiberboard packaging. ***Non-Paper Packaging*** **-** Packaging design with plastics; shaping and molding techniques for plastics; flexible packaging; glassware; metal containers. ***Cushioning*** **-** Vibration and impact analysis for product packaging; fatigue problems; cushioning design with software tools; temperature and humidity considerations; uses of blocking, loose fill, bubble sheet and foam in place. ***Design for No-Assembly*** **-** Review of working principles of mechanisms; conventional and compliant mechanism designs; advantages and challenges of compliant mechanisms; compliant mechanisms and nature; utilization of flexibility and deflection of beams; application examples.

Teaching/Learning Methodology

1. The lectures are aimed at providing students with an integrated knowledge required for understanding of the storage requirements and structural design for product packaging and design for no-assembly. They provide a necessary framework for such subsequent self-learning and group-learning activities.

2. 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 create portfolio for packaging of selected products. The students are required to participate in the mini-project through literature survey, information search, system design and evaluation, discussions, report writing and presentation of results. Innovative thinking is encouraged.

3. The tutorials are aimed at enhancing the students' skills necessary for analyzing the quality and feasibility of packaging ideas and/or compliant design. Examples may include the evaluation of loading limits of a prescribed packaging structure, the evaluation of flexibility of a compliant mechanism, etc. Therefore, the students will be able to solve real-world problems using the knowledge they acquired in the class.

4. The assignments are aimed at providing students with an opportunity to use the acquired knowledge to analyze, assess and solve real-world packaging design problems.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√		
Tutorial	√	√	√		
Assignments		√	√	√	
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	15%	√	√			
2. Assignment	15%	√	√	√	√	
3. Mini-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 × End of Subject Examination + 0.50 × Continuous Assessment.

	1. The continuous assessment will comprise of three components: one closed-book test (15%), assignments (15%), and a mini-project (20%). The closed-book test is aimed at assessing the interim knowledge gained by the student. The assignments are aimed at providing students with an opportunity to use the acquired knowledge to analyze, assess and solve real-world packaging design problems and provide timely feedback on the progress of their learning. The mini-project is aimed at assessing the student's self-learning and problem-solving capability and communication skills. 2. The examination will be used to assess the knowledge acquired by the individual student in understanding and analysing related problems and to determine the degree of achieving the subject learning outcomes.	
Student Study Effort Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial / mini-project consultations and presentations	8 Hrs.
	Other student study effort:	
	▪ Conducting mini-project	28 Hrs.
	▪ Working on assignments	15 Hrs.
	▪ Literature search and private study	20 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. Hanlon, J. F., Handbook of Packaging Engineering, McGraw Hill, latest edition. 2. Jönson, G., Corrugated Board Packaging, Pira International, latest edition. 3. DeMaria, K., The Packaging Development Process: A Guide for Engineers and Project Managers, Technomic Publishing Company, latest edition. 4. Soroka, W., Fundamentals of Packaging Technology, Institute of Packaging Professionals, latest edition. 5. Jenkins, C. H., Compliant Structure in Nature and Engineering, WIT, latest edition. 6. Lobontiu, N., Compliant Mechanisms: Design of Flexure Hinges, CRC Press, latest edition.	

July 2012

Subject Description Form

Subject Code	ME42003
Subject Title	Design for Six Sigma
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I
Objectives	To provide students an overview of product design using Design for Six Sigma (DFSS) technique and to introduce related tools and best practices.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Generate and evaluate design concepts in addressing a market need by applying the design for six sigma technique in which various important factors including manufacturing processes, material engineering, cost-effectiveness, quality and environmental issues are considered. b. Apply knowledge of mathematics and various design techniques including design for "x" and design for robustness and design reliability to analyze the effectiveness and safety of a product design via analytical and computational approaches. c. Apply Design for Six Sigma technique to carry out a design project and present outcome of the project via oral presentation and written report.
Subject Synopsis/ Indicative Syllabus	***Introduction*** **-** Major processes used in design for Six Sigma in product design. Management of product development cycle-time. Product design using Design For Six Sigma (DFSS) technique. ***Critical Parameter Management in Design*** **-** Introduction to Critical Parameter Management. The architecture of the Critical Parameter Management Process. The process of Critical Parameter Management in product design. The tools and best practices of Critical Parameter Management (CPM). Metrics for project management within CPM. Data acquisition and database architectures in CPM. ***Tools for Concept Development*** **-** Gathering and processing the Voice of the Customer. Quality Function Deployment: The Houses of Quality. Concept generation and design for x methods. The Pugh concept. Evaluation and selection process. Modelling: ideal/transfer Functions, robustness additive models, and the Variance model. ***Tools for Design*** **-** Design Failure Modes and Effects Analysis. Reliability prediction. Descriptive statistics. Inferential statistics. Measurement systems analysis. Capability studies. Regression models. Design of experiments. ***Tools for Optimization*** **-** Taguchi methods for robust design. Response surface methods. Optimization methods. ***Tools for Verifying Capability*** **-** Analytical Tolerance Design**.** Empirical tolerance design**.** Reliability evaluation. Statistical process control.

Teaching/Learning Methodology

1. Lectures are aimed at providing students with basic understanding of related concepts, tools and techniques for Design for Six Sigma and arouse interest.
2. Group discussions and tutorials help students to consolidate their knowledge acquired from lecture materials.
3. Assignments, through which students learn to compile, assimilate, assess and analyze.
4. Through thematic projects students would keep abreast of latest development in product liability laws and learn how to apply DFSS in product design. The presentation of reports allows students develop communication skills.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	
Tutorial	√	√	
Assignments	√	√	√
Mini-Project	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		1	2	3
1. Group project	15%	√	√	√
2. Project oral presentation	10%	√	√	√
3. Individual assignment reports	25%			√
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 individual projects in class. 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. Marked assignments provide feedback and reinforcement on learning key concepts and outcomes.
3. 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 DFSS practices;

	iii. Tackle diverse and unstructured questions; iv. Tell thoughts, feelings, ideas so that others may understand; v. Support and lead others in discussion.	
Student Study Effort Required	Class contact:	
	▪ Lecture and seminar	34 Hrs.
	▪ Tutorial and group discussion	8 Hrs.
	Other student study effort:	
	▪ Conducting project	23 Hrs.
	▪ Conducting case study and assignment	20 Hrs.
	▪ Literature search and private study	20 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. C.M. Creveling, J.L. Slutsky and D. Antis, Jr. Design for six sigma in technology and product development, latest edition. 2. Kai Yang and Basem El-Haik, Design for Six Sigma, McGraw Hill, latest edition.	

July 2012

Subject Description Form

Subject Code	ME42004
Subject Title	Development of Green Products
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME22002 Integrated Product Development Fundamentals; or ME32001 Manufacturing Fundamentals; or CSE370 Environmental Science I
Objectives	To enhance students' awareness of environmental issues and green design concepts related to product development and assess the environmental impact during the life cycle of a product.
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. e. Able to recognize the opportunities arising from green technologies and green consumerism.
Subject Synopsis/ Indicative Syllabus	***Environmental issues of concern*** - Depletion and degradation of natural resources, pollution and history of responses to pollution, waste and waste disposal issues, global warming, consumerism and its affect 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-redesign, 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, 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 of products.

The Green Future **-** More from less, green consumerism, opportunities from green technologies, green taxes and their effect on product development and marketing, pollution and waste reduction strategies.

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.
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.
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.
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.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture/Tutorial	√	√	√		√
Homework assignments/Case studies	√	√		√	√
Mini-project report & presentation			√	√	

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. Homework assignments/ Case studies	15%	√	√		√	√
2. Test	15%	√	√	√		√
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 × End of Subject Examination + 0.50 × Continuous Assessment. 1. The continuous assessment will comprise three components: homework assignments & case studies (15%), test (15%) 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Mini-project discussion & presentation	8 Hrs.
	Other student study effort:	
	▪ Self study/coursework	40 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 6. Ulrich, K.T. and Eppinger, S.D., Product Design and Development, McGraw-Hill, latest edition.	

July 2012

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
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. Appropriately apply advanced materials and technology in the process of designing products/structures. Understand the mechanics of composites and smart materials and apply them in the product design process. b. Understand the limitations and constraints by using advanced materials at different environments. c. Design innovative products/structures using smart materials and intelligent technology. 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 b)

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:

$0.50 \times$ 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 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Assignment	18 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.	

August 2013

Subject Description Form

Subject Code	ME43002
Subject Title	Nano- and Micro-technology Applications to Product Development
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials Exclusion: ME43004 Fundamentals of Nanoscience and Nanotechnology
Objectives	To introduce students up-to-date knowledge and technical principles of nano- and micro-technology for product applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Apply knowledge of mathematics, engineering sciences, micro-technology and nano-technology to analyze a product design via analytical and computational approaches. b. Understand the environmental, health and safety issues in applying micro-technology and nano-technology in high-tech product design and development. c. Appreciate the state-of-the-art applications of micro-technology and nano-technology to product design and present a design project via written report. d. Recognize the need to develop the ability of life-long learning.
Subject Synopsis/ Indicative Syllabus	***Introduction to Nano and Micro Science*** **-** Concepts, principles, physical, mechanical and thermal properties at nano and microscales. ***Characterization and Testing Techniques at Nano and Microscales*** **-** Scanning probe microscopy, SEM, TEM, nano-indentation, nano-scratch and wear. ***Applications of Nano and Microtechnology to Products*** **-** Health and environmental products (e.g., nano marks); toys; textile products; home appliances (e.g., washing machines with nanotechnology); electronic products, sensors and actuators; computing products and information storage; nanofibracation and manufacturing. ***Frontiers in Nano and Microtechnology*** **-** Nanofluids, carbon nano-materials, nanocomposites, NEMS, MEMS, nanolithography, molecular self-assembly. ***Ethic and Political Issues in Nano and Microtechnology*** **-** Potential impact to human society.

Teaching/Learning Methodology

1. The lectures are aimed at providing students with an integrated knowledge required for understanding nano- and micro-technology related theories and methodologies.

2. The mini-project is aimed at enhancing the written and oral communication skills in English and team-work spirit of the students. The students are expected to develop and/or discover applications of nano- and micro-technology in the design of products and systems. The students are required to participate in the mini-project through literature survey, information search, discussions, field trips, report writing and presentation of results. Innovative thinking is encouraged.

3. The tutorials are aimed at enhancing the analytical skills of the students. Examples on applications of nano- and micro-technology will be discussed in-depth. So the students will learn to solve real-world problems using the knowledge they acquired in the class.

4. The experiments will provide the students with hands-on experience on the instrumentation of nano- and micro-technology and measurement at nano- and micro-scale. It also trains students in the analysis and presentation of experimental data.

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learing outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
1. Assignment	10%	√	√	√	√
2. Test	20%	√	√		
3. Mini-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 × End of Subject Examination + 0.50 × Continuous Assessment. 1. The continuous assessment will comprise of three components: assignments (20%), laboratory reports (10%) and one mini-project (20%). The assignments are aimed at assisting the students in preparation for the tests and checking the progress of their study. The laboratory report is aimed at assessing the capability of the student in analyzing and reporting experimental data. The mini-project is aimed at assessing the student's self-learning and problem-solving capability and communication skill in English. 2. The examination will be used to assess the knowledge acquired by the students for understanding and analyzing the problems, critically and individually, related to nano- and micro-sciences and technologies.	
Student Study Effort Required	Class contact:	
	▪ Lecture	33 Hrs.
	▪ Laboratory / Tutorial	9 Hrs.
	Other student study effort:	
	▪ Reading & Reviewing	20 Hrs.
	▪ Assignment / Laboratory Report	43 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. W.A. Goddard, Handbook of nanoscience, engineering, and technology, Baca Raton, CRC Press, latest edition. 2. Poole and Owens, Introduction to Nanotechnology, John Wiley & Sons, latest edition. 3. T.R. Hsu, MEMS & microsystems design and manufacture, Boston, McGraw Hill, latest edition. 4. B. Bhushan, Springer handbook of nanotechnology, Berlin, Springer-Verlag, latest edition. 5. H. Fujita, Micromachines as tools for nanotechnology, Berlin, Springer, latest edition.	

August 2013

Subject Description Form

Subject Code	ME43003
Subject Title	Product Testing Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001Mechanics 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; Harness 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.
2. 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.
3. 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.
4. 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.

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 Required	Class contact:	
	▪ Lecture	32 Hrs.
	▪ Laboratory / Tutorial	10 Hrs.
	Other student study effort:	
	▪ Reviewing and Reading	25 Hrs.
	▪ Assignment / Laboratory Report	38 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.	

July 2012

Subject Description Form

Subject Code	ME43004
Subject Title	Fundamentals of Nanoscience and Nanotechnology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME33001 Mechanics of Materials Exclusion: ME43002 Nano- and Micro-Technology Applications to Product Development
Objectives	To take students to the frontiers of knowledge and engineering methods in the fundamental and associated areas of nanotechnology.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the concepts of length scales, nanostructures and nanotechnology. Understand the principles of processing, manufacturing and characterization of nanomaterials and nanostructures. b. Apply the electronic microscopy, scanning probe microscopy and nanoindentation techniques to characterize the nanomaterials and nanostructures. c. Understand the mechanical properties of bulk nanostructured metals and alloys, nanocomposites and carbon nanotubes. d. Analyze the micro-electro-mechanical systems and nano-electro-mechanical systems.
Subject Synopsis/ Indicative Syllabus	***Introduction to Nanoscience and Nanotechnology*** **-** Characteristic length scales. Definition of nanotechnology. Concepts of nanomaterials and nanostructures. Low-dimensional systems. Quantum effect. Physical properties of nanocrystalline solids. Concepts of micro-electro-mechanical systems (MEMS) and nano-electro-mechanical systems (NEMS). Perspective of nanotechnology. ***Fundamentals of Nanoscience*** **-** Crystal structures. Nanocrystals. Molecules and bio-systems. Top-down and bottom-up nano-fabrications. Principles of electron microscopy. Principles of scanning probe microscopy. Principles of lithography technology. Mechanical behaviours of nanocrystalline metals, alloys and carbon nanotubes. Electro-magneto-mechanical coupling in nano-scales. Nano-fluidic flows. ***Nanotechnology in Mechanical Engineering*** **-** Elasticity and plastic deformation of nanostructures. Processing and manufacturing of nanomaterials and nanostructures. Devices constructed with nanometer-scale and micrometer-scale systems. Nano-scale resonators. Nanosensors and actuators. Industrial applications of nanocrystalline solids and nanodevices. ***Current Progresses in Nanoscience and Nanotechnology*** **-** Nano-biotechnology. Nanotechnology in energy and environmental engineering. Functional nanomaterials. Nanoelectronics. **Laboratory Experiment**

<table>
<tr><td></td><td>Typical experiment:
1. Preparation of nanocrystalline metals
2. Mechanical properties of nanocrystalline metals</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lectures are used to deliver the fundamental knowledge of nanoscience and nanotechnology. (Outcomes a, b and d).

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

Laboratory experiments will be conducted to teach the fundamental nano- fabrication and characterization techniques. (Outcome c).

<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>Tutorial</td><td>√</td><td>√</td><td></td><td>√</td></tr>
<tr><td>Laboratory</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>25%</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Test</td><td>15%</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Laboratory report</td><td>10%</td><td></td><td></td><td>√</td><td>√</td></tr>
<tr><td>4. 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

Assignments will be used to assess students’ learning on fundamental knowledge of nanoscience and nanotechnology and on applying the fundamental knowledge to the industrial applications of nanotechnology.

Tests will be conducted to assess students’ learning on fundamental knowledge of nanoscience and nanotechnology.

Laboratory reports will be used to assess students’ understanding on the mechanical properties of nanostructures and the characterization of such properties.

Examination will be conducted to assess students’ learning on the principles in relation to nanoscience and nanotechnology.</td></tr>
<tr><td>Student Study</td><td>Class contact:</td><td></td></tr>
</table>

Effort Required	▪ Lecture	33 Hrs.
	▪ Tutorial	6 Hrs.
	▪ Laboratory	3 Hrs.
	Other student study effort:	
	▪ Performing assignment	40 Hrs.
	▪ Private study	24 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. Gabor L. Hornyak, H. F. Tibbals, Joydeep Dutta, John J. Moore, Introduction to nanoscience and nanotechnology, CRC Press, latest edition. 2. Carl C. Koch, Edited, Nanostructured materials: processing, properties, and applications, William Andrew Publishing, latest edition. 3. W.A. Goddard, D.W. Brenner, S.E. Lyshevski, and G.J. Iafrate, Edited, Handbook of Nanoscience, Engineering and Technology, CRC Press, latest edition.	

July 2012

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
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. Apply the general knowledge of indoor thermal comfort and environmental health. c. Apply the knowledge of moist air properties and conditioning processes. d. Apply the knowledge of heating and cooling loads required for a building. e. Apply 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. ***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. ***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. Fenestration. Internal heat gains. Zone air heat balance. Implementation of the heat balance method. Radiant time series method. Supply air quantities. ***Refrigeration*** **-** Refrigerants. Mechanical vapour-compression refrigeration cycles. Modifications to basic cycles. Reciprocating compressors. Cooling towers.

Teaching/Learning Methodology

Lectures are used to deliver the knowledge in relation to air conditioning for indoor thermal and environmental quality (learning outcomes (a to e).

Tutorials will be conducted to facilitate discussions of coursework assignments and typical examples.

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 Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Self-study/Coursework	64 Hrs.
Total student study effort	106 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.

July 2012

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 the general knowledge of engine components and terminology worldwide. b. Understand and evaluate physical parameters of engine design and operating characteristics. c. Apply the knowledge of air-standard and real air-fuel engine cycles. d. Apply the knowledge of thermochemistry and fuels. e. 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 engine combustion, fuel injection, ignition delay and combustion rates. 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 e).

Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments.

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' studies, 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 the 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 Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Self-study/Coursework	64 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.

July 2012

Subject Description Form

Subject Code	ME44003
Subject Title	Combustion and Pollution Control
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34001 Engineering Thermodynamics
Objectives	To provide 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. Understand the fundamental knowledge of thermodynamics and chemical kinetics of combustion. b. Apply the general principles of combustion of fuels. c. Explain the formation mechanisms of combustion-generated air pollutants. d. Understand and select 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 (learning outcomes a to e). Tutorials will be conducted in small groups to facilitate assignment discussions.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
1. Lecture	√	√	√	√	√
2. 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	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:

$0.50 \times$ End of Subject 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 the 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 Required	Class contact:	
	▪ Lecture	36 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study/coursework	64 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.	

July 2013

Subject Description Form

Subject Code	ME44004
Subject Title	Heat and Mass Transfer
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34001 Engineering Thermodynamics; and ME34002 Fluid Mechanics
Objectives	To provide the fundamental knowledge of heat and mass transfer.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the concepts and applications of heat transfer mechanisms, namely conduction, convection and radiation. b. Evaluate different types of fins and heat exchangers. c. Apply the numerical techniques in heat transfer applications. d. Understand the concepts and applications 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. Water vapour migration in buildings. Simultaneous heat and mass transfer.
Teaching/Learning Methodology	Lectures are used to deliver the fundamental knowledge in relation to heat transfer and mass transfer. (learning outcomes a to d) Tutorials will be conducted in small groups to facilitate assignment discussions.

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 × 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 tests which cover the first half of the subject material provides useful feedback to both lecturer and the 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 Required	Class contact:	
	▪ Lecture	36 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Self-study/Coursework	64 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.	

July 2013

Subject Description Form

Subject Code	ME44005
Subject Title	Renewable Energy I : Alternative Fuels
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics
Objectives	To provide students with the knowledge on the properties, applications, limitations and environmental impacts of different fuels
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the need for alternative fuels. b. Solve renewable energy related problems with knowledge in fossil fuels and alternative fuels. c. Demonstrate knowledge in production methods of different alternative fuels. d. Select from different alternative fuels available for specific potential applications. e. Understand the socio-economic, environmental impacts, limitations and applications of alternative fuels.
Subject Synopsis/ Indicative Syllabus	***Fuels*** **-** Fossil fuel and alternative fuels; Hydrogen, biomass and biofuels; Environmental benefits of alternative fuels. ***Biomass*** **-** Composition of biomass; Biomass combustion; Application of biomass combustion; Exergy analysis. ***Biodiesel*** **-** Production of biodiesel from plant oil, animal oil and waste cooking oil; Application of biodiesel to diesel engines. ***Hydrogen*** **-** Production and storage of hydrogen; Application of hydrogen to fuel cells and motor vehicles. ***Other biofuels, their Production and Applications*** **-** Bioethanol; Fischer-Tropsch Diesel; Biofuels from Microalgae and Seaweeds; Methane Biogas; Biomethanol and Biomethane ***Limitations of Biofuels*** **-** Economic, social and environmental impact of biofuels, Life cycle analysis of biofuels

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge on alternative fuels (Outcomes a to e).

Tutorials are used to illustrate the application of alternative fuels. (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. Tests	35%	√	√	√	√	√
3. Assignments	15%	√	√	√	√	√
Total	100 %					

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

Overall Assessment:

0.5 x End of Subject Examination + 0.5 x Continuous Assessment

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

Student Study Effort Expected

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Course work	39 Hrs.
▪ Self-study	42 Hrs.
Total student study effort	123 Hrs.

Reading List and References	Reference Books 1. R.B. Gupta, Hydrogen fuel production, transport and storage, CRC Press, latest edition. 2. S.V. Loo and J. Koppejan, The handbook of biomass combustion and co-firing, Earthscan, latest edition. 3. A.A. Vertes, N. Qureshi, H.P. Blaschek, H. Yukawa, Biomass to biofuels, Wiley, latest edition. 4. J.H. Wright, D.A. Evans, New research on biofuels, Nova Science Publishers, Inc., latest edition. 5. J.C.J Bart, N. Palmeri, S. Cavallaro, Biodiesel science and technology from soil to oil, CRC Press, latest edition. 6. J. M. Marchetti, Biodiesel production technologies, Nova Science Publishers, Inc., latest edition. Reference Journals 1. International journal of hydrogen energy 2. Biofuels, bioproducts and biorefining - Biofpr 3. Bioresource technology 4. Biomass & bioengineering

July 2012

Subject Description Form

Subject Code	ME44006
Subject Title	Renewable Energy II : Solar and Wind Power
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: ME34004 Fluid Mechanics
Objectives	To provide students with concepts of renewable energy including solar and wind energy along with energy conversion, storage and distribution.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Solve renewable energy related real-life engineering problems with knowledge in existing solar and wind energy technologies. b. Recognize the current R&D in the field of renewable energy and how the cutting edge technological issues interface with solar and wind energy. c. Complete an assignment or a project on design, analyze and interpret a solar and wind energy system for off-grid application. d. Create awareness about the interaction between public policy, the economic options and development of solar and wind energy. e. Present effectively in completing an assignment, technical reports or a project.
Subject Synopsis/ Indicative Syllabus	***Global Energy Consumption and Problems*** - conventional fuel, energy consumption, green house gases and global warming effects. ***Solar Energy Conversion*** - introduction of photovoltaic, photothermal, and thermoelectric systems. ***Photovoltaics (PV)*** - Fundamentals of solar cells: types of solar cells, semiconducting materials, band gap theory, solar cell properties and design; p-n junction photodiodes, electron and holes transports, I-V characteristics and output power, single junction and triple-junction solar panels, metal-semiconductor heterojunctions, and semiconducting materials for solar cells. ***Applications of Solar Cells*** - PV cell interconnection, module structure and module fabrication, equivalent circuits, load matching, optimization for maximum power, design of stand-alone PV systems, solar cell manufacturing processes - material resources, chemistry, and environmental impacts. ***Wind Energy*** - fundamentals of fluid mechanics, wind generation and dissipation mechanisms, wind farms, capacity factor, small and large scale wind power. ***Wind Turbines*** - types of wind turbines, design and construction of wind turbines, mechanics of wind turbines, vibration and dynamics of wind turbines.

	Energy Conversion and Storage **-** installation and measurements; DC to AC conversion, inverters, storage system and batteries.
Teaching/Learning Methodology	Lectures are used to deliver knowledge about solar and wind power. (Outcomes a, b and d) Tutorials and projects are conducted to facilitate discussion. They are used to explain the fundamental concepts and to illustrate and analyze their application to practical situations. (Outcomes c and e)

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
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	e
1. Assignment	25%	√	√	√		
2. Project	25%	√	√	√	√	√
3. 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

Assignments are included as the continuous assessment component. In addition to use as an assessment component, they also provide timely feedbacks to both lecturers and students on various topics of the syllabus.

Case study and project are used to let the students to apply their knowledge gained in the lectures to solve real life engineering problems in solar and wind energy. A presentation and a report are required for the project.

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	34 Hrs.
	▪ Tutorial/Small group discussion	8 Hrs.
	Other student study effort:	
	▪ Assignment/Case study and project report	40 Hrs.
	▪ Self-study	33 Hrs.
	Total student study effort	115 Hrs.
Reading List and References	1. G. Boyle, Renewable Energy: Power for a Sustainable Future, Second Edition, Oxford University Press, latest edition. 2. J. F. Manwell, J. G. McGowan, A. L. Rogers, Wind Energy Explained: Theory, Design and Application, Second Editions, Wiley, latest edition. 3. S. R. Wenham, M. A. Green, M. E. Watt, R. Corkish, Applied Photovoltaics, second edition, Earthscan Publications, latest edition. 4. J. Nelson, The Physics of Solar Cells, Imperial College Press, latest edition.	

July 2012

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. Demonstrate a good understanding of the fundamental physical principles of low-speed flow past two-dimensional aerodynamic bodies. b. Solve the governing equations for inviscid and incompressible flows over airfoils and aerodynamic bodies. c. Determine the downwash and induced drag phenomena for finite wings using techniques derived from laws of vortex motion. d. Demonstrate a good understanding of the definition of compressibility and its role in wave phenomena in aerodynamics. e. Apply one-dimensional compressible flow equations to design the flow through nozzles and diffusers. f. Determine the oblique shock and expansion waves of a supersonic flow past aerodynamic bodies.
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 f). Tutorials are used to illustrate the application of fundamental principles to practical engineering situations (outcomes b, e and f). 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 b and f). 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 and d).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lecture	√	√	√	√	√	√
Tutorial		√			√	√
Project		√				√
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	f
1. Assignment	20%		√	√		√	√
2. Project 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial	8 Hrs.
	Other student study effort:	
	▪ Self-study	42 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.	

July 2012

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. 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial	8 Hrs.
	Other student study effort:	
	▪ Course work	20 Hrs.
	▪ Self-study	42 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.	

July 2012

Subject Description Form

Subject Code	ME45003
Subject Title	Aviation Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students an overview of essential aviation systems, and develop students' understanding of aviation industry and current operational concepts, technology applications and practices in aviation industry.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Explain the relationship among major aviation systems and identify future trends of the industry. b. Demonstrate understanding of air logistics, airlines operation, airport management, flight standards and airworthiness services. c. Explain the key roles and future plans of the Government Flying Service. d. Identify the quality assurance procedures in aircraft maintenance organizations. e. Identify the environmental impact of aviation-related activities. f. Analyze the activities of local aviation organizations in promotion of an aviation culture in Hong Kong.
Subject Synopsis/ Indicative Syllabus	***Aviation Systems*** **-** An overview of the relationship among major aviation systems such as civil aviation authorities, airlines, airports and aviation organizations. ***Civil Aviation Administration*** **-** Air service agreements. Air traffic management. Search and rescue. Provision of ground and flight operations support. Flight standards. Aviation safety and accident investigation. ***Managing Airline Operations*** **-** Flight planning and operations. Training of flight crew, aircraft engineers and technical support staff. Management of engineering operations. Flight simulator training. ***Airport Management*** **-** Organization structure of the Hong Kong Airport Authority. Passenger and air cargo terminal operations. Provisions for general aviation activities. ***Government Flying Service*** **-** Role of Government Flying Service: Search and rescue, air ambulance, police support, fire fighting, aerial survey, and general SAR Government support. Helicopter and fixed-wing aircraft maintenance. ***Aircraft Maintenance*** **-** Quality assurance of aircraft maintenance. Aircraft modifications. Engine testing. ***Aviation and the Environment*** **-** Aircraft noise and abatement policy. Air pollution and fuel usage. ***Other Local Aviation Organizations*** **-** Hong Kong Air Cadet Corps. Hong Kong

	Historical Aircraft Association. Hong Kong Air Traffic Control Association. Hong Kong Aviation Club. Hong Kong Aviation Industry Association.
Teaching/Learning Methodology	Lectures are used to deliver the fundamental knowledge in relation to various aspects of aviation systems (outcomes a to f). Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to f). Group mini-projects are used to help students to deepen their knowledge on a specific topic through search of information, analysis of data and report writing (outcomes a and c). 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 f).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lecture	√	√	√	√	√	√
Tutorial	√	√	√	√	√	√
Mini-project	√		√			
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 a sessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Assignment	20%	√	√	√	√	√	√
2. Group mini-project	20%	√		√			
3. Industrial field visit and visit report, report for seminar	10%	√	√	√		√	√
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, group mini-project, industrial visits and special seminars. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. In particular, group mini-project is 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 working in the aviation industry.	
Student Study Effort Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial	8 Hrs.
	Other student study effort:	
	▪ Course work	20 Hrs.
	▪ Self-study	42 Hrs.
	Total student study effort	104 Hrs.
Reading List and References	1. Richard De Neufville. Airport Systems: Planning, Design, and Management, McGraw-Hill, latest edition. 2. Alexander T. Wells and Seth B. Young, Airport Planning and Management, McGraw-Hill, latest edition. 3. Jon D. Fricker and Robert K. Whitford, Fundamentals of Transportation Engineering: A Multimodel Systems Approach, Prentice-Hall, latest edition. 4. ICAO Journal, International Civil Aviation Organization, latest edition. 5. Aviation Week and Space Technology, McGraw-Hill, latest edition.	

July 2012

Subject Description Form

Subject Code	ME45004
Subject Title	Aircraft Maintenance Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I
Objectives	To provide students fundamental knowledge and basic concepts on reliability and aircraft maintenance engineering, including Markov modeling, risk analysis and human factors.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Characterize aircraft system failures with statistical distributions. b. Apply the concept of redundancy in the provision of increased reliability. c. Explain mandatory aircraft maintenance activities. d. Apply risk evaluation techniques and human factors in aircraft maintenance. e. Apply maintenance optimization and airworthiness requirements to maintenance organizations.
Subject Synopsis/ Indicative Syllabus	***Reliability and Rates of Failure*** **-** Reliability characterizations. The Bathtub curve. Random failures. The exponential distribution. Time-dependent failure rates. The Weibull distribution. The Poisson distribution. ***Redundancy*** **-** Parallel components. Single redundancy. Multiple redundancy. Standby redundancy. Independent failure modes. Common-mode failures. Series-parallel configurations. Linked configurations. ***Maintained Systems*** **-** Preventive maintenance. Corrective maintenance. Availability and maintainability. Constant repair rates. Condition Monitored Maintenance. ***Failure Interactions*** **-** System level reliability and availability analysis. Markov Modelling. Reliability with standby systems. ***Risk Analysis & Error Reduction in Aircraft Maintenance*** **–** Maintenance errors. Fault tree analysis. Failure mode and effect analysis. SHEL model. Reason's model. ***Aircraft Maintenance Management*** **–** Aircraft repair and overhaul services. Optimisation of inspection and maintenance activities. Airworthiness requirements for maintenance personnel licensing and maintenance organizations.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to various aspects of reliability engineering and aircraft maintenance (outcomes a to e).

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

Project/case study is used to allow students to deepen their knowledge on a specific topic through exploration of information, analysis of data and report writing (outcomes a to e).

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	√
Tutorial	√	√	√	√	√
Project / case study	√	√	√	√	√

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	60%	√	√	√	√	√
2. Test	20%	√	√	√	√	√
3. Project/case study	20%	√	√	√	√	√
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 adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Summary and oral presentation on a specific project or case study is used to assess the students' knowledge in contemporary aircraft maintenance practices.

Student Study Effort Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Course work	20 Hrs.
▪ Self-study	42 Hrs.
Total student study effort	104 Hrs.

Reading List and References	1. C.E. Ebeling. An Introduction to Reliability and Maintainability Engineering. Waveland Press, latest edition. 2. Civil Aviation Department. CAD 418 Condition Monitored Maintenance: an Explanatory Handbook. Latest edition. 3. Dhillon, B.S. Human reliability, error, and human factors in engineering maintenance : with reference to aviation and power generation. CRC Press, latest edition.

July 2012

Subject Description Form

Subject Code	ME45005
Subject Title	Flight Mechanics and Airplane Performance
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34004 Fluid Mechanics
Objectives	To teach students the fundamental principles of atmospheric flight and the airplane performance analysis of steady and accelerated flight.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate a good understanding of the aerodynamic forces created on different aerodynamic features of an airplane; b. Define different combinations of airplane aerodynamic features and propulsion methods for steady and accelerated flight requirements; c. Describe the relationships among the power requirement, maximum velocity, stall velocity, climb characteristics, and flight characteristics of steady flight; d. Explain the factors undermining a level turn and pull-up/pull-down of an airplane, and describe their roles in determining the structural loading limits; e. Evaluate key performance measures for takeoff and landing.
Subject Synopsis/ Indicative Syllabus	***Basic Aerodynamics*** **-** Sources of aerodynamic forces. Standard atmosphere. Equations of motion. Four forces of flight. Effects of compressibility. Speed of sound. Measurement of airspeed. ***Airplane Aerodynamics*** **-** Aerodynamic lift, drag and moments. Aerodynamic center. NACA airfoil family. Lift and drag buildup. Concept of drag polar. ***Propulsion Characteristics*** **-** Tradeoff between thrust and efficiency. Reciprocating-engine/propeller combination. Turbojet engine. Turbofan engine. Turboprop. Afterburning. ***Steady Flight Performance*** **-** Equations of motion for steady and level flight. Fundamental steady flight parameters. Thrust and Power requirements. Maximum flight velocity and drag divergence. Stalling Velocity. Rate of climb. Time to climb. Range and endurance. ***Accelerated Flight Performance*** **-** Level turn. Pull-up and pull-down maneuvers. Load factor diagram. Limiting case for large load factor. Accelerated rate of climb. Takeoff performance. Landing performance.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to various aspects of atmospheric flight mechanics of airplanes as well as their influence in determining the airplane flight performance (Outcomes a to e).

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

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 b and d).

Experiment(s) on evaluating the effects on aircraft wing profile on aerodynamic force characteristics, either in laboratory or numerical setup, is(are) provided for bridging the knowledge of fluid mechanics with flight performance. Students are exposed to proper use of knowledge taught and analysis skills on evaluating their experimental results (Outcomes a, and e).

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	√
Tutorial	√	√	√		√
Project		√		√	
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 report	20%		√		√	
3. Test	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 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 aerodynamics and flight mechanics of an airplane. The projects provide students an opportunity to capitalize on the knowledge they learn for tackling practical airplane flight performance problems. 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 Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial	8 Hrs.
	Other student study effort:	
	▪ Self-study	42 Hrs.
	▪ Homework assignment	12 Hrs.
	▪ Project/case study	12 Hrs.
	Total student study effort	108 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. Anderson Jr., J. D., Aircraft Performance and Design, McGraw-Hill, latest edition. 4. Hull, D. G., Fundamentals of Airplane Flight Mechanics, Springer, latest edition. 5. Torenbeek, E., and Wittenberg, H., Flight Physics, Springer, latest edition.	

July 2012

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
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. 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*** – Stress and strain. Equations of equilibrium in a non-uniform stress field. Principal stresses. Linear stress-strain relations. ***Torsion*** – Torsion of uniform bars. Bars with circular cross-section. Bars with narrow rectangular cross-sections. Closed single-cell thin-walled sections. Bending and Flexural shear - Bernoulli-Euler beam equation. Bi-directional bending. Transverse shear stress due to transverse force in symmetric sections. ***Flexural Shear Flow in Thin-Walled Sections*** – 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 straight bars. Initial imperfections. Post-buckling behaviour. Bar of unsymmetric section. 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 Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Course work	20 Hrs.
▪ Self-study	42 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.

July 2012

Subject Description Form

Subject Code	ME45007
Subject Title	Avionic Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE2901S Basic Electricity and Electronics
Objectives	To provide students fundamental knowledge and basic concepts of avionic systems in commercial aircraft, including navigation and flight control systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify avionics systems which interface directly with the pilot. b. Evaluate the function of a fly-by-wire system in the provision of automatic stabilization of the aircraft. c. Apply Euler angles to derive the spatial attitude of an aircraft. d. Apply airborne navigation systems in vertical and azimuth monitoring. e. Apply air data measurements to derive true airspeed. f. Explain the principles of autopilots and flight management systems.
Subject Synopsis/ Indicative Syllabus	***The Avionic Environment*** - Importance and role of avionics. Core avionics systems. Weight, environmental and reliability requirements. ***Cockpit Display Systems –*** Head up displays. Primary flight information. Navigation information. Engine data. Airframe data. Warning information. ***Fly-by-wire System*** - Fly-by-wire flight control features. Control laws. Electrical data transmission. Redundancy and failure survival. Common mode failures. Digital implementation and data problems. ***Inertial Sensors and Attitude Derivation*** - Gyroscopes. Accelerometers. Spatial attitude of an aircraft. Stable platform and strap-down systems. Euler angles. Effect of coning motion. ***Navigation Systems*** – Definitions. Position fixing navigation systems. Basic DR navigation systems. Inertial navigation. Global positioning system. Integration of GPS and INS. ***Air Data Systems*** - Air data measurement. Air data for the pilot and key subsystems. Altitude-static pressure relationship. Air density vs. altitude relationship. Pressure-speed relationship. Air data sensors and computing. ***Autopilots and Flight Management Systems*** - Height and heading control. Instrument landing system visibility categories and autopilot requirements. Flight planning. Flight path optimization and performance prediction.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to various aspects of aviation systems (outcomes a to f).

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

Group mini-projects are 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 f).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lecture	√	√	√	√	√	√
Tutorial	√	√	√	√	√	√
Group Mini-project	√	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcom s to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Examination	60%	√	√	√	√	√	√
2. Test	20%	√	√	√	√	√	√
3. Group Mini-project	20%	√	√	√	√	√	√
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 adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Group mini-project is aimed at assessing the students' capacities of self-learning and problem-solving and communication skill in English.

Student Study Effort Required

Class contact:	
▪ Lecture	34 Hrs.
▪ Tutorial	8 Hrs.
Other student study effort:	
▪ Course work	20 Hrs.
▪ Self-study	42 Hrs.
Total student study effort	104 Hrs.

Reading List and References	1. A. Helfrick. Principles of Avionics. Avionics Communications, latest edition. 2. I. Moir & A. G. Seabridge. Civil Avionics Systems. American Institute of Aeronautics and Astronautics, latest edition. 3. Aviation Week and Space Technology, McGraw-Hill, latest edition.

July 2012

Subject Description Form

Subject Code	ME49002
Subject Title	Environmental Noise
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics
Objectives	To teach students the practical aspects in environmental noise; the techniques for the measurement, assessment and prediction of transportation and industrial noise.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the simple sound fields and identify the noise sources and their respective mitigation measures for road traffic noise. b. Understand basic concept of room acoustics. c. Elucidate the various terms and factors involved in the evaluation of environmental and occupational noise. d. Understand the noise assessment methodology which correlate with human perception in the context of legal requirements and comply with local noise regulations.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Noise*** **-** Sound Pressure Levels and Sound Power Levels; L_{eq} and Sound Exposure Level of Noise Events; Prediction and Measurement of a Simple Noise Source; Directivity effects. Basic Concepts of Sound Propagation Outdoors: Refraction, Scattering, Diffraction, and Absorption of Sound in Air; Attenuation of Sound over Ground; Noise Reduction by Barriers. Models for Room Acoustics; Reverberation time; Random incidence absorption coefficients; Noise from ventilation and air-conditioning systems; Fundamentals and techniques of sound insulation; Measurement and prediction of airborne and impact sound insulation; Noise ingression and emission from buildings. ***Transportation Noise*** **-** Sources of noise and their method of mitigation for road and railway vehicles; Models for predicting road, rail and aircraft noise; Use of the Calculation of Road Traffic Noise (CRTN) in the noise impact assessment for large infrastructure projects. ***Noise Assessment*** **-** Speech inference and noise annoyance criteria; Risks of hearing damages due to noise exposure; Noise criteria and noise ratings; Descriptors for determining human response to noise; Standards and legislations of controlling environmental noise in Hong Kong; Application of control noise permit in Hong Kong. **Laboratory Experiment**

There are two 2-hour laboratory sessions.
Typical Experiments:
1. Outdoor traffic noise measurement
2. Classroom reverberation time measurement

Teaching/Learning Methodology

Lectures are aimed at providing students with the knowledge of environmental noise and transportation noise for achieving the subject outcomes. (Outcomes a, b, c and d)

Tutorials are aimed at enhancing students' skills necessary for analyzing noise assessment method and legal requirement in Hong Kong. (Outcomes a, b, c and d)

Experiments, Project/Case Study are conducted to improve students' ability to apply their knowledge to implement real engineering systems. (Outcomes b, c and d)

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. Class test	20%	√	√	√	
2. Homework	10%	√	√	√	
3. Lab report	10%		√	√	√
4. Project report	10%			√	√
5. 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 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. Written reports on specific projects/case studies are used to assess the students' knowledge in contemporary road noise traffic prediction method and control, and room noise control.

Student Study Effort Required	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Reading and review	38 Hrs.
	▪ Homework assignment	6 Hrs.
	▪ Laboratory report/ Project Report	22 Hrs.
	Total student study effort	108 Hrs.
Reading List and References	1. M.J. Crocker, (Ed.), Handbook of Acoustics, John Wiley & Sons, latest edition. 2. P.M. Nelson, (Ed.), Transportation Noise Reference Book, Butterworths, latest edition. 3. The Open University Press, Unit 11-13, T234 Environmental Control and Public Health, The Open University, latest edition. 4. The Open University Press, Noise Block, T334 Environmental Monitoring and Control, The Open University, latest edition. 5. Engineering noise control: theory and practice**,** Spon Press/Taylor & Francis, latest edition. 6. Calculation of road traffic noise**,** Harlow, England: Addison Wesley Longman, latest edition. 7. http://www.epd.gov.hk/epd/noise_education/web/ENG_EPD_HTML/m3/ordinance_7.html	

July 2012

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 coverage on various engineering fundamental matters, including Engineering Drawing and CAD, Basic Scientific Computing, Basic Mechatronic Practice, and Industrial Safety, that aims at providing the necessary fundamental knowledge and computing skills to all year 1 students interested in engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) explain 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, electrical, electronic and information engineering; b) apply scientific computing software for computing in science and engineering including visualization and programming; c) design and analyze practical controller hardware, software, actuation devices and human-machine interface for simple mechatronic systems including basic practice in hydraulic, pneumatic and electric systems with common engineering components such as motor drives, mechanical drives, gears, cams, belts, pulleys, couplings, bearings, seals and fasteners; and d) explain basic occupational health and industrial safety requirements for engineering practice.

Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. (TM8050) Engineering Drawing and CAD 1.1. Fundamentals of Engineering Drawing and CAD Principles of orthographic projection; sectioning; dimensioning; sketching; general tolerances and surface finishes; conventional representation of screw threads and fasteners; types of drawings including part drawing and assembly drawing. Introduction to CAD; 2D drawings and general concepts on 3D computer modeling including extruding, revolving, sweeping, and lofting; 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. 1.3. Electronic Design Automation Introduction to electronic design automation software; circuit schematics capture and representation; placement of components, capturing, annotation, labeling, net list. Electronic parts library, symbols, decals, physical packages, discrete components, integrated circuits, logic and analogue circuits, electronic parts creation and application. 2. (TM3012) Basic Scientific Computing 2.1. 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. 2.2. Basic plotting, formatting graph, 2D and 3D plots, annotations, contour, mesh and surface plots, colormap. 2.3. M-file programming and debugging; scripts, functions, logic operations, flow control and graphic user interfaces.

	3. (TM0510) Basic Mechatronic Practice 3.1. 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. 3.2. 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. 4. (TM2009) Industrial Safety 4.1. Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures. 4.2. Safety Law: F&IU Ordinance and principal regulations, OSH Ordinance and principal regulations. 4.3. Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling. 4.4. 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.
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
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	**TM8050**	**TM3012**	**TM0510**	**TM2009**
▪ Lecture	12 Hrs.	9 Hrs.	6 Hrs.	14 Hrs.
▪ In-class Assignment/ Hands-on Practice	36 Hrs.	18 Hrs.	24 Hrs.	1 Hr.
Other Study Effort				
▪ Coursework	4 Hrs.			
Total Study Effort	**124 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. PADS from Mentor Graphics Inc. **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/IC287
Objectives	This subject aims at developing students' understanding on: - • the principles and operations of common manufacturing processes, and • the properties and application of common 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 different manufacturing processes. *(Objective 1 and Syllabus Item 1-9). Category A*; b) justify appropriate manufacturing processes for specific product requirements. *(Objective 1 and Syllabus Item 1-9). Category A*; c) select and use various common engineering materials for specific purpose. *(Objective 1 and Syllabus Item 1-9). Category A*; and d) collaboratively complete an application oriented project through group work and discussions, and discuss current industrial practices and technologies *(Objective 1 and Syllabus Item 1-9). Category B.*

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. 7) Application of dimensional and geometrical measuring tools.
Learning Methodology	The teaching and learning methods include tutorials, demonstrations, hands-on training, and report writing for the mini-project. Assignments require both "group effort" and "individual effort". An integrated mini-project type of work will be employed in a holistic approach to enable students to appreciate the processes and materials selected for the project through hands-on practical work. Students will be divided into groups with each consists of 5 to 6 members. An IC staff will be allocated to each group as its mentor who is responsible to provide students with advice and guidance in understanding the processes concerned and helping them to solve the problems encountered throughout the training. Periodic mentor sessions will be arranged for the mentors to stretch the students' intellectuals and technical ability.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed			
		a	b	c	d
1. Individual Workshop Assignment	40	✓	✓	✓	
2. Group Project	20				✓
3. Group Presentation	10	✓			✓
4. Individual Report	30		✓	✓	
Total	100				

The Individual Workshop Assignment is aimed at assessing student's performance and practical ability in using various processes to produce the components for the project.

The Group Project is aimed at assessing students' self-learning, organization, project management and problem solving capability.

The Group Presentation is designed to facilitate students to demonstrate their understanding in product development workflow.

The Individual Report is aimed at assessing student's appreciation and understanding on all the processes involved in the project.

Student Study Effort Required

Class Contact	
▪ Hands-on Practice	112 Hrs.
▪ Induction / Tutorial / Presentation	8 Hrs.
Other Study Effort	0 Hr.
Total Study Effort	**120 Hrs.**

Reading List and References	Reading Materials published by the Industrial Centre : 1. Metal Cutting 2. CNC Machining 3. Non-Conventional Machining 4. Hot Metals Processing 5. Plastics Processing 6. Sheet Metal Processing 7. Surface Finishing

Subject Description Form

Subject Code	IC349
Subject Title	Integrated Manufacturing Project
Credit Value	3 Training Credits
Level	3
Pre-requisite	IC348
Objectives	This subject aims at developing students' ability in applying and integrating the engineering knowledge and practical experience that acquired from the related engineering subjects and the industrial training. Through undertaking group projects, students would be able to appreciate all the stages involved in handling a manufacturing project including: Design and Drafting, Costing, Project Planning and Control, Manufacturing, Assembly, Testing and Evaluation. The subject also provides opportunity for students to develop their personal and professional qualities such as leadership, communication skill, co-operative attitude, and co-ordination ability as well as enthusiasm for accepting technical responsibility.
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 design, drafting, process planning, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation; b) select and use appropriate technology building blocks, components and manufacturing processes to develop a solution for an industrial problem; and c) develop personal and professional qualities such as leadership, communication skill, co-operative attitude, and co-ordination ability as well as enthusiasm for accepting technical responsibility.

Subject Synopsis/ Indicative Syllabus	All projects assigned will be of 'real' work basis selected from various Units in IC or certain customers from the industry. Typical projects are automated devices or systems for a specific application, innovative transportation device, material handling systems, testing jig and fixture…etc. These projects are always having a real problem of serious interest to the clients which requires students to meet the expected demand. Students are required to work through the various project stages step by step starting from problem identification, engineering design, material procurement, costing, manufacturing onwards up to assembly, testing and evaluation.
Learning Methodology	Students will be divided into groups to work on projects that are required to satisfy an existing demand in IC or a certain customers from the industry. The project are divided into two stages:- • The 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 for this problem. Furthermore, students are required to search and track down parts and components with suppliers to obtain materials for the following manufacturing stage. • The manufacturing stage The entire project highly emphases on personal commitment, cooperation and coordination among team members. Each team member is responsible for undertaking a certain part of the project which will eventually get together to form the final assembly. For projects collaborating with customers from the industry, students are required to work for an additional two weeks in the summer if they wish to claim their projects as WIE equivalent. This ensures that they would have enough time to discuss with the industrial client and to solve problems that may arise during project installation and commissioning.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed		
		a	b	c
1. Performance	40	✓	✓	✓
2. Report	20	✓	✓	✓
3. Oral Presentation	20	✓	✓	✓
4. Reflective Journal	20	✓	✓	
Total	100			

In each of the assessment components above, it consists of both "group work" and "individual work" to reflect the student's performance.

Performance is to assess how well the deliverable of the project meets with client's requirement in terms of completeness, functionality, and accuracy in order to reflect the intended learning outcomes (a) & (b).

Reports allow students to provide periodic review on the project progress and to ensure the design can be completed before the commencement of the manufacturing stage. Assessment of the final report will focus on the adequacy of the technical content, clarity and fluency of the presentation, discussion, comment and recommendation. It is used to assess students' ability in attainment of learning outcomes (a), (b) and (c).

Oral Presentations allow students to demonstrate their ability in presenting their project clearly and logically including the project objectives, their approach to solve the problem and the deliverable of their project. It is appropriated for the assessment of all intended learning outcomes.

Individual Reflective Journal is to facilitate students to review and sum up the activities and processes of the project holistically of their contribution.

<table>
<tr><td rowspan="6">Student Study Effort Required</td><td colspan="2">Class Contact</td></tr>
<tr><td>▪ Tutorial / Hands-on Practice</td><td rowspan="3">120 Hrs.</td></tr>
<tr><td>▪ Workshop Training</td></tr>
<tr><td>▪ Project Presentation / Documentation</td></tr>
<tr><td colspan="2">Other Study Effort</td></tr>
<tr><td>▪ Reading and Project Preparatory Work</td><td>40 Hrs.</td></tr>
<tr><td>Total Study Effort</td><td>160 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reading Materials published by the Industrial Centre :
1. Metal Cutting
2. CNC Machining
3. Non-Conventional Machining
4. Hot Metals Processing
5. Plastics Processing
6. Sheet Metal Processing
7. Photo-chemical Machining
8. Surface Finishing</td></tr>
</table>

Subject Description Form

<table>
<tr><td>Subject Code</td><td>ME29001</td></tr>
<tr><td>Subject Title</td><td>Continuous Professional Development</td></tr>
<tr><td>Credit Value</td><td>Non-credit bearing</td></tr>
<tr><td>Level</td><td>2</td></tr>
<tr><td>Pre-requisite/
Co-requisite/
Exclusion</td><td>Nil</td></tr>
<tr><td>Objectives</td><td>To encourage students' participation in industrial visits organized by the Department. This will help students to relate what they learn in class to the real world situation and nurture their interest in Mechanical Engineering.</td></tr>
<tr><td>Intended Learning Outcomes</td><td>Upon completion of the subject, students will be able to:

a. Appreciate and understand the roles of different sectors of our community including government, industry and utility in engineering discipline.</td></tr>
<tr><td>Subject Synopsis/
Indicative Syllabus</td><td>Not applicable.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Students are required to attend a minimum of 4 industrial visits. The industrial visits enable students to learn how mechanical engineering knowledge is put into practice.
<table>
<tr><td rowspan="2">Teaching/Learning Methodology</td><td colspan="6">Outcome</td></tr>
<tr><td>a</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Industrial Visit</td><td>√</td><td></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="6">Intended subject learning outcome to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1. Attendance of industrial visit</td><td>100%</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 subject is neither credit bearing nor graded. The students will be awarded a "Pass" grade if they meet the minimum attendance requirement.</td></tr>
<tr><td rowspan="3">Student Study Effort Required</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Attendance of industrial visit</td><td>16 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>16 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Not applicable</td></tr>
</table>

July 2012