THE HONG KONG POLYTECHNIC UNIVERSITY

Department of Mechanical Engineering

Part-time (self-financed)

Bachelor of Engineering (Honours) Degree

in

Mechanical Engineering

Programme Code: 43091

Definitive Programme Document

(For 2013 Cohort)

August 2013

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

PART A PROGRAMME SCHEME

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 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 mission 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, by placing emphasis on new technologies particularly those that impact teaching and research, and by conducting applied and basic research to serve Hong Kong society and push the frontiers of knowledge forward.

2. GENERAL INFORMATION

2.1 Programme Title and Programme Code

Bachelor of Engineering (Honours) in Mechanical Engineering (43091)

2.2 Host Department

Department of Mechanical Engineering

2.3 Award Title

Bachelor of Engineering (Honours) in Mechanical Engineering

2.4 Mode of Attendance

Part-time

2.5 Normal and Maximum Periods of Registration

Mode of Study	Normal Duration of Study	Maximum Period of Registration
Part-time	4 Years	8 Years

2.6 Entrance Requirements

(a) Higher Diploma in Mechanical Engineering or a related discipline;
(b) Higher Certificate in Mechanical Engineering with Credit or a related discipline;
(c) An Associate Degree in Engineering;
(d) Qualification equivalent to (a), (b) or (c).

Preference will be given to candidates with relevant working experience.

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, perhaps, master 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 preferred 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.

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.

The 'generic skills' set out in PolyU's strategic objective have been integrated into the learning outcomes of the programme. These generic skills will be developed and assessed within the formal curriculum.

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 4.3 and the individual subject syllabus.

4. PROGRAMME STRUCTURE

In the University credit-based system, all academic programmes fit within a common framework, in which subjects of standard size (3 credits) are used as far as possible. General structure, subjects offered and normal study patterns are detailed in this section.

4.1 General Structure

For the part-time programme, the number of credits required for graduation is 66. Students are expected to be employed in a relevant industry. Application for credit transfer will be considered according to the pertinent University policy.

4.2 Normal Study Pattern

This section outlines the normal 4-year study pattern for the part-time BEng(Hons) degree programme.

Year 1: 15 Credits	
Semester 1	**Semester 2**
ME2902 Engineering and the Environment (3)	AMA294 Mathematics II (3)
ME3301 Applied Mechanics (3)	ME3303 Mechanics of Solids (3)
	ME3406 Engineering Thermodynamics (3)
Year 2: 15 Credits	
Semester 1	**Semester 2**
ELC3502 Professional English for Engineering Students (2)	ME3106 Dynamics and Vibrations (3)
ME3407 Fluid Mechanics (3)	ME3901 Project – Design Realization (2)
ENG307 Society and the Engineer (3)	ME3905 Numerical Methods (2)
Year 3: 18 Credits	
Semester 1	**Semester 2**
ME3107 Linear Systems and Control (3)	Advanced Core Subject I (3)
ME3205 Design and Manufacturing II (3)	Advanced Core Subject II (3)
ME4905 Advanced Numerical Methods for Engineers (3)	Advanced Core Subject III (3)
Year 4: 18 Credits	
Semester 1	**Semester 2**
Technical Elective Subject I (3)	Technical Elective Subject I (3)
Technical Elective Subject II (3)	ENG306 Engineering Management (3)
ME4908 Capstone Project – Group based (3)	ME4908 Capstone Project – Group based (3)
Total Credits: 66	

Advanced Core subjects

Students are required to choose any three Advanced Core subjects to supplement their Technical Elective Streams. A list of these subjects is given as follows:

1. ME4205 Manufacturing and Prototyping
2. ME4206 Advanced Materials for Design and Technology
3. ME4308 Automatic Control Systems
4. ME4407 Principles of Sound and Vibration
5. ME4413 Heat and Mass Transfer
6. ME4414 Fluids Engineering

Technical Elective subjects

Three technical streams are offered for students to specialize in. They are required to take at least two Technical Elective subjects in the same stream. The offered subjects in each Stream are listed as follows:

(A) Design and Manufacturing

1. ME4208 Computer Aided Technology for Design
2. ME4211 Development of Green Products
3. ME4217 Industrial Automation
4. ME4307 Environmental Degradation of Materials
5. ME4310 Engineering Composites

(B) Environmental Technology

1. ME4405 Environmental Noise
2. ME4406 Noise Abatement and Control
3. ME4409 Engine Technology
4. ME4411 Air Conditioning for Indoor Thermal and Environmental Quality
5. ME4415 Combustion and Pollution Control

(C) Aviation

1. ME4310 Engineering Composites
2. ME4502 Aircraft Systems
3. ME4503 Aviation Systems
4. ME4504 Aircraft Maintenance Engineering
5. ME4505 Flight Mechanics and Airplane Performance

Subject to the approval of the programme leader, students may select an elective subject from the Programme BEng(Hons) in Product Analysis and Engineering Design to replace one of the Technical Elective subjects.

The advanced core subjects and the Technical 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.

4.3 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 4.2, we detailed the structure of the programme describing a range of subjects which individual students are expected to study. An analysis of the curriculum in terms of the coverage of the programme outcomes (see section 3.2) is presented in Tables 4.1 and 4.2. 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 4.1 displays a curriculum map in which all compulsory subjects are mapped with appropriate PAKs and POWs. The elective subjects (both Advanced Core subjects and Technical Elective subjects) are updated continually to meet the need of the ever-evolving industrial communities in Hong Kong and the South China region. These elective subjects are listed separately in the curriculum map as shown in Table 4.2. Essentially, they cover most of the programme outcomes with variations of themes from subject to subject. The student subject learning outcomes to be achieved by every subject of the programme are listed in the syllabuses shown in Part B.

Table 4.1 Curriculum Map for Compulsory 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**
AMA294	✓	✓			✓						✓	✓
ELC3502									✓		✓	✓
ENG306	✓	✓			✓			✓	✓	✓	✓	✓
ENG307								✓	✓	✓	✓	✓
ME2902	✓	✓			✓	✓		✓		✓		
ME3106	✓	✓	✓	✓				✓			✓	
ME3107	✓	✓	✓	✓								
ME3205	✓	✓			✓				✓			
ME3301	✓	✓				✓					✓	✓
ME3303	✓	✓	✓	✓		✓			✓		✓	✓
ME3406	✓	✓	✓									
ME3407	✓	✓	✓									
ME3901	✓	✓	✓		✓	✓					✓	
ME3905	✓	✓			✓							
ME4905	✓	✓			✓							
ME4908	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

SUBJECT TITLES

AMA294 Mathematics II
ELC3502 Professional English for Engineering Students
ENG306 Engineering Management
ENG307 Society and the Engineer
ME2902 Engineering and the Environment
ME3106 Dynamics and Vibrations
ME3107 Linear Systems and Control Process
ME3205 Design and Manufacturing II
ME3301 Applied Mechanics
ME3303 Mechanics of Solids
ME3406 Engineering Thermodynamics
ME3407 Fluid Mechanics
ME3901 Project – Design Realization
ME3905 Numerical Methods
ME4905 Advanced Numerical Methods for Engineers
ME4908 Capstone Project – Group based

Table 4.2 Curriculum Map for Elective 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
ME4205			✓		✓		✓			✓		
ME4206	✓	✓	✓	✓	✓		✓	✓	✓		✓	
ME4208	✓	✓	✓		✓	✓						
ME4211		✓		✓				✓	✓		✓	✓
ME4217	✓	✓	✓	✓							✓	✓
ME4307	✓	✓	✓		✓			✓		✓	✓	
ME4308	✓	✓	✓	✓					✓		✓	✓
ME4310	✓	✓		✓			✓	✓				
ME4405	✓	✓	✓					✓				
ME4406	✓	✓	✓		✓			✓				
ME4407	✓	✓	✓					✓				
ME4409	✓	✓	✓					✓				
ME4411	✓	✓		✓	✓	✓			✓		✓	
ME4413	✓	✓			✓							
ME4414	✓	✓	✓		✓	✓						
ME4415	✓	✓	✓			✓		✓				
ME4502	✓	✓		✓	✓			✓	✓			
ME4503	✓	✓			✓			✓		✓		
ME4504	✓	✓			✓				✓			
ME4505	✓	✓	✓		✓	✓			✓			

SUBJECT TITLES

ME4205 Manufacturing and Prototyping
ME4206 Advanced Materials for Design and Technology
ME4208 Computer Aided Technology for Design
ME4211 Development of Green Products
ME4217 Industrial Automation
ME4307 Environmental Degradation of Materials
ME4308 Automatic Control Systems
ME4310 Engineering Composites
ME4405 Environmental Noise
ME4406 Noise Abatement and Control
ME4407 Principles of Sound and Vibration
ME4409 Engine Technology
ME4411 Air Conditioning for Indoor Thermal and Environmental Quality
ME4413 Heat and Mass Transfer
ME4414 Fluids Engineering
ME4415 Combustion and Pollution Control
ME4502 Aircraft Systems
ME4503 Aviation Systems
ME4504 Aircraft Maintenance Engineering
ME4505 Flight Mechanics and Airplane Performance

5. GENERAL ASSESSMENT REGULATIONS (GAR)

The General Assessment Regulations adopted in the BEME Programme will be in line with the prevailing GAR of the University. 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.

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 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 Assessment Review Panel as legitimate, the Panel will determine whether the student will have to complete a late assessment and, if so, by what means.

5.4 Grading

Assessment grades shall be awarded on a criterion-referenced basis. A student's overall performance in a subject 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.
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, but for subjects which have been retaken, only the grade 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 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 examination, 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.

5.5 University Graduation Requirements

A student would be eligible for award if he satisfies all the conditions listed below:

1. Accumulation of 66 credits as defined in the definitive programme document.
2. Having a GPA of 2.0 or above at the end of the programme.
3. Satisfy all the remedial subjects as specified when he is admitted.

A student is required to graduate as soon as he satisfies all the above conditions for award. Subject to the maximum study load of 21 credits per semester, a student may take more credits than he needs to graduate in or before the semester within which he becomes eligible for award.

All credits are equally weighted in determining the classification of award. 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. However, 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 counted in the grade point calculation for award classification (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.

A Pass-without-Honours degree award will be recommended only under exceptional circumstances, 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.

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 Tutors

Each student will be assigned an academic tutor from the academic staff of the ME Department. The role of an academic tutor shall include but is not limited to the following:

- identify academic strengths and weaknesses of the student;
- advise the student on electives and answer questions about the curriculum;
- encourage the student at times of academic frustration;
- report the general academic status of the student to the programme leader;
- alert and consult the programme leader as soon as possible about any unexpected situation faced by the student that may affect the student's academic progression;
- bring to the attention of the Student-Staff Consultative Committee any special situation concerning the student that may require special decision by the Committee;
- encourage the student to give feedbacks on the programme and put forward his comments to the Departmental Learning and Teaching Committee.

PART B SYLLABUSES

Subject Description Form

Subject Code	AMA294
Subject Title	Mathematics II
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	The subject aims to introduce students to some fundamental knowledge of engineering mathematics. The emphasis will be on the application of mathematical methods to solving practical engineering problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. apply mathematical reasoning to analyse essential features of different engineering problems such as partial differential equations; 2. extend their knowledge of mathematical techniques, such as expansion in terms of Fourier Series, and adapt known solutions to different situations of engineering context; 3. develop and extrapolate mathematical concepts in synthesizing and solving engineering problems; 4. search for useful information and use statistical tables in solving statistical problems in the context of engineering.
Subject Synopsis/ Indicative Syllabus	*Linear Algebra* Eigenvalues and eigenvectors; Normalisation and orthogonality. *Complex variables:* Revision of complex numbers; Functions of a complex variable; Continuity; Derivatives and Cauchy-Riemann relations. *Partial differential equations:* Formulation pf partial differential equations; Method of separation of variables; Initial and boundary value problems. *Statistics:* Probability and random variables; Probability distributions; Sampling distributions of the mean; Estimation and hypothesis testing; Linear regression.
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
a. Continuous Assessment	40%	✓	✓	✓	✓
b. Examination	60%	✓	✓	✓	✓
Total	100 %				

Continuous assessment comprises of class quizzes, assignments and a mid-term test. A final exam is held at the end of the semester.

Quizzes are used to prompt students to continually study the materials taught in previous lectures. The mid-term test and examination are used to assess the students' understanding of the basic concepts and their ability to use what they have learnt 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.

Student Study Effort Required

Class contact:	
▪ Lecture	28 Hrs.
▪ Tutorial	14 Hrs.
Other student study effort:	
▪ Assignments	20 Hrs.
▪ Self-study	58 Hrs.
Total student study effort	120 Hrs.

Reading List and References

Textbook:

Chan, C.K., Chan, C.W. & Hung, K.F.	Basic Engineering Mathematics	McGraw Hill 2013

References:

Thomas, G.B., Weir, M.D. & Hass, J.R.	Thomas' Calculus 12th edition	Addison Wesley 2009
James, G.	Modern Engineering Mathematics 4th edition	Prentice Hall 2008
Anton, H.	Elementary Linear Algebra 10th edition	John Wiley & Sons 2010
Walpole, R.E., Myers, R.H., Myers, S.L. & Ye, K.Y.	Probability and Statistics for Engineers and Scientists 10th edition	Prentice Hall 2011

Subject Description Form

Subject Code	ELC3502
Subject Title	Professional English for Engineering Students
Credit Value	2
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	This subject aims to develop the English language skills required by students to communicate effectively in their professional careers.
Intended Learning Outcomes	By the end of the subject, students should be able to communicate effectively in workplace contexts through: a. participating in, and contributing to, workplace meetings; b. writing job-related correspondence; c. writing documents to introduce and promote an organisation as well as a product or service; and d. writing summaries for job-related documents. To achieve the above outcomes, students are expected to use language and text structure appropriate to the context, select information critically, present ideas systematically and logically, and provide support for stance and opinion.
Subject Synopsis/ Indicative Syllabus	This content is indicative. The balance of the components, and the corresponding weighting, will be based on the specific needs of the students. 1. **Workplace meetings** Practising the specific verbal skills required when communicating with co-workers at meetings. 2. **Workplace correspondence** Selecting and using relevant content; organising ideas and information; maintaining appropriate tone, distance and level of formality; achieving coherence and cohesion; adopting an appropriate style, format, structure and layout. 3. **Workplace reports** Selecting and using relevant content; organising ideas and information; writing executive summaries for long reports, describing tables and graphs; discussing and analysing data; adopting an appropriate style, format, structure and layout. 4. **Language appropriacy** Using context-sensitive language in spoken and written English. 5. **Language development** Improving and extending relevant features of grammar, vocabulary and pronunciation.

Teaching/Learning Methodology

The subject is designed to introduce students to the communication skills, both oral and written, that they may need to function effectively in their future professions.

The study method is primarily seminar-project-based. Activities include teacher input as well as individual and group work involving drafting and evaluating texts, mini-presentations, discussions and simulations. Students will be referred to information on the Internet and the ELC's Centre for Independent Language Learning.

Learning materials developed by the English Language Centre are used throughout this course. Additional reference materials will be recommended as required.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks (Continuous assessment)	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d		
1. Meeting	20%	✓					
2. Brochure	30%			✓			
3. Letter of reply to an enquiry	15%		✓				
4. Executive summary of a report	35%				✓		
Total	100 %						

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

Students' oral and writing skills are evaluated through assessment tasks related to the learning outcomes. Students are assessed on the accuracy and the appropriacy of the language used in fulfilling the assessment tasks, as well as the selection and organisation of ideas.

Student Study Effort Required

Class contact:	
▪ Seminars	28 Hrs.
Other student study effort:	
▪ Classwork-related and project-related preparation and self-access work	56 Hrs.
Total student study effort	84 Hrs.

Reading List and References

Coursebook

English Language Centre. (2009). *ELC 3502 Professional English for Engineering Students*. Hong Kong: The Hong Kong Polytechnic University.

Recommended readings

Ashley, A. (1992). *A handbook of commercial correspondence* (2nd ed.). Oxford: Oxford University Press.

Aspinall, T. & Bethell, G. (2003). *Test your business vocabulary in use* (1st ed.). Cambridge: Cambridge University Press.

	Bilbow, G. T. (2004). *Business writing for Hong Kong* (3rd ed.). Hong Kong: Longman. Conradi, M. & Hall, R. (2001). *That presentation sensation*. London: Pearson Education Ltd. Guffey, M. E. (2004). *Essentials of business communication* (6th ed.). Mason, OH: South-Western College Publication. Houp, K. W., Pearsall, T. E., Tebeaux, E. & Dragga, S. (2006). *Reporting technical information* (11th ed.). New York: Oxford University Press. Sampson, E. (2003). *Creative business presentation: Inventive ideas for making an instant impact*. London: Kogan Page. Walther, G. R. (1996). *Power talking skills: How to say what you mean and get what you want.* A video seminar. Newcastle, WA: Speaking From Experience, Inc. White, F. D. (1996). *Communicating technology: Dynamic processes and models for writers*. New York: Harper Collins College Publishers.

July 2012

Subject Description Form

Subject Code	ENG306
Subject Title	Engineering Management
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil/Nil/Nil
Objectives	This subject provides students with 1. skills and techniques involved in the management of people and engineering activities in the production of goods and services; 2. skills in the use and understanding of different quality management tools and techniques in an organization, hence enabling students to interpret the quality of work content of typical jobs; 3. the background to understand ethical and business behaviors in engineering organizations, and the changes in management techniques.
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

<table>
<tr><td></td><td>
3. <u>Project Management</u>

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

4. <u>Management of Change</u>

Strategic leadership and innovation; Organizational change; Leading planned change; Organizational development; Stress management; Factors that affect the execution of change

5. <u>Effects of Environmental Factors</u>

The effects of extraneous factors on the operations of engineering organizations, such as ethics and corporate social responsibilities issues
</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>
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.
</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td></td><td></td></tr>
<tr><td>1. Coursework
• individual presentation (30%)
• group report (10%)</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>2. Final 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>
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.
</td></tr>
<tr><td>Student Study</td><td>Class contact:</td><td></td></tr>
</table>

Effort Required	▪ 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. Babcock, D L and Morse, L C, 2002, *Managing Engineering and Technology: an Introduction to Management for Engineers*, 3rd Ed., Prentice Hall 2. Robbins, S P and Coulter, M, 2005, *Management*, 8th Ed., Prentice Hall 3. Schermerhorn, JR Jr., 2010, *Introduction to Management*, 10th Ed., Wiley	

Subject Description Form

Subject Code	ENG307
Subject Title	Society and the Engineer
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil/Nil/Nil
Objectives	This subject is designed for engineering students as a complementary subject about the role of the professional engineer in practice and their responsibilities towards 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 environment and the implied social costs and benefits. 2. Understand the social, political, legal and economic responsibility and accountability of a profession in engineering and the organizational activities of professional engineering institutions. 3. Be aware of the short-term and long-term effects on the use of technology relating to safety and health aspects. 4. Observe the professional conduct, the legal and more constraints relating to various engineering aspects.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) Identify and evaluate the effects on the use of technology relating to social, culture, economic, legal, health and safety, environment and welfare of the society. (b) Explain the importance of professional training of institutions, professional conduct, ethics and responsibilities in various engineering activities (local and overseas). Particularly the Washington Accord. (c) Work in a team setting to discuss the specific project of the eight dimensions on project issues related to engineers and present the findings.
Subject Synopsis/ Indicative Syllabus	Impact of technology on society: Innovation and creativity, the history and the trend of technology on the social and culture on society. Environmental protection and related issues. Role of the engineer in energy conservation, ecological balance and sustainable development. The outlook of Hong Kong's industry, its supporting organizations and impact on development from the China Markets. Industrial health and safety including the work of the Labour Department and the

	Occupational Health and Safety Council and the legal dimension such as contract law and industrial legislation. The Professional Institutions: both local and overseas. Washington Accord and the qualification and criteria of professional engineers. Professional ethics, bribery and corruption including the work of the ICAC. Social responsibilities of engineers.
Teaching/Learning Methodology	In class, there will be short lectures to provide essential knowledge and information on the relationship between society and the engineer under a range of dimensions. There will be discussions, case studies, seminars to engage student's in-depth analysis of the relationship. Students will form into groups and throughout the course, students will work on engineering cases by completing the following learning activities: 1. Case analysis; students will base on the case analysis, and provide weekly summary report on the relationship of dimensions to the project. 2. The final report will be the Case portfolio which includes i. Presentation slides; ii. Feedback critique; iii. Weekly summary report and iv. Reflection. 3. Final presentation. The coursework of this subject involves students to work in groups to study cases from the perspectives of eight dimensions 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 portfolio reports on these case studies.
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. Continuous	60						
• Group weekly learning activities (40%) • Final presentation (individual presentation) (30%) • Group report and individual reflection report (30%)		✓ ✓ ✓	✓ ✓ ✓	✓ ✓			
2. Examination	40	✓	✓				
Total	100%						

Explanation of the appropriateness of the assessment methods in assessing the

	intended learning outcomes: Continuous Assessment: 60% Examination: 40%	
Student Study Effort Required	Class contact:	
	▪ Lectures and Review	30 Hrs.
	▪ Tutorial and Presentation	12 Hrs.
	Other student study effort:	
	▪ Research and Preparation	60Hrs.
	▪ Report writing	14Hrs.
	Total student study effort	116 Hrs.
Reading List and References	**Reference books:** (1) Johnston, F. Stephen, Gostelow, J.P. and King, W. Joseph (2000) Engineering and society challenges of professional practice. Upper Saddle River, N.J.: Prentice Hall (2) Hjorth, Linda; Eichler, Barbara; Khan, Ahmed (2003) Technology and Society Abridge 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: - Times - Far East Economics Current newspaper: - South China Morning Post - China Daily - Ming Pao Daily	

July 2010

Subject Description Form

Subject Code	ME2902
Subject Title	Engineering and the Environment
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To teach students fundamental concepts of the global environmental problems. 2. To teach students fundamental concepts of air, noise, water and solid waste pollutions, and their impacts to the environment. 3. To teach students fundamental engineering knowledge to tackle the environmental problems. 4. To teach students fundamental concepts of the importance of environmental management.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate and understand the concept of flow of energy, nutrients and pollutants in an ecosystem. b. Understand and identify the global environmental problems. c. Understand and identify the sources of pollutants in our community and their relationship with environmental problems. d. Understand the basic concepts of air, noise, water and solid waste pollutions, and evaluate their impacts to the environment. e. Apply the fundamental engineering knowledge to tackle the environmental problems caused by the air, noise, water and solid waste pollutions. f. Appreciate and understand the roles of different sectors of our community including government, industry and engineers in the development and implementation of environmental management policies and strategies.
Subject Synopsis/ Indicative Syllabus	***Global Environmental Problems –*** Ecosystem, energy flow and nutrient flow. Basic definition of environmental pollutions. Factors enhancing environmental problems. Environmental Impact Matrices. ***Air Pollution*** **-** The atmosphere. Principal air pollutants. Sources and effects of air pollution. Outdoor and indoor air pollution. Air Pollution Index. Control of air pollution. Indoor Air Quality (IAQ). Control of IAQ. ***Noise Pollution*** **-** Basic concepts of sound and noise. Basic concepts of hearing: hearing loss, weighting noise level, Noise Criteria (NC) curves and Speech Interference Level (SIL). Control of noise pollution. ***Water Pollution*** **-** Water quality. Sources of water pollution. Municipal and industrial waste water. Qualities of polluted water. Water treatment processes. Residuals management.

Solid Waste Pollution **-** Solid waste disposal hierarchy. Solid waste sources: municipal and industrial sources. Concept of "Reduce-Reuse-Recycling". Composting. Landfill. Incineration.

Environmental Management **-** Sustainable development. Environmental Impact Assessment (EIA). Environmental Impact Statement (EIS). Government strategies in pollution control. Subsidies and Polluter Pays Principle. Sources of environmental information and regulations.

Teaching/Learning Methodology

Guest lecturers may be invited to give seminars about the state-of-the-art technologies in dealing with pollution. Tutorials and case studies/mini projects are conducted in small groups to facilitate discussion.

Students are required to conduct case studies on recent environmental problems and management techniques.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lecture	√	√	√	√	√	√
Project	√	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
1. Mini project/ Case study	10 %	√	√	√	√	√	√
2. Test	20 %	√	√	√	√	√	
3. Assignment	20 %	√	√	√	√	√	√
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 which provide timely feedbacks to both lecturers and students on various topics of the syllabus. The project is used to help the students to have experiences on solving practical engineering problem.

Student Study Effort Expected	Class contact:	
	▪ Lecture and seminar	34 Hrs.
	▪ Tutorial	4 Hrs.
	▪ Group discussion	4 Hrs.
	Other student study effort:	
	▪ Performing mini project/case study	42 Hrs.
	▪ Literature search and private study	42 Hrs.
	Total student study effort	126 Hrs.
Reading List and References	1. M.L. Davis, and S.J. Masten, Principles of Environmental Engineering and Science, McGraw-Hill, latest edition. 2. J. Glynn Henry, and Gary W. Heinke, Environmental Science and Engineering, Prentice-Hall, latest edition. 3. D.D. Reible, Fundamentals of Environmental Engineering, Lewis Publishers, latest edition. 4. W.W. Nazaroff and L. Alvarez-Cohen, Environmental Engineering Science, John Wiley and Sons, Inc., latest edition. 5. NSI/ASHRAE Standard 62-1989: Ventilation for Acceptable Indoor Air Quality, ASHRAE, latest edition. 6. I. Sharland, Woods Practical Guide to Noise Control, Woods Acoustics, latest edition. 7. EPD of HKSAR: Homepage – http://www.epd.gov.hk 8. US EPA: Homepage – http://www.epa.gov	

March 2012

Subject Description Form

Subject Code	ME3106
Subject Title	Dynamics and Vibrations
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3301 Applied Mechanics Exclusion: ME3104 Dynamics and Control I ME3105 Dynamics and Control II
Objectives	1. To enable students to master the methods of problem formulation and solution for planar motion of particles and rigid bodies. 2. To introduce the concepts and usages of work and energy. 3. To introduce the elementary tools of modelling physical components and systems. 4. To provide fundamental concepts and solution strategies for mechanical vibration problems. 5. To introduce knowledge and techniques for theoretical, numerical and experimental determination of vibration parameters for single-degree-of-freedom systems. 6. To provide methods of calculating safe rotating speed range to avoid whirling of shaft. 7. To show how to solve vibration and dynamics problems occurring in a variety of engineering problems in mechanical engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Describe the planar motion of particles and rigid bodies. b. Apply Newton's second law and use free body diagrams to derive the equations of motion for particles and rigid bodies in planar motion. c. Understand work, potential energy and kinetic energy, and to use work and energy principles to obtain velocity and position, and the work done by external forces. d. Determine the behaviour in transient motion of a single-degree-of-freedom vibratory system from its mathematical description and determine the forced vibration of such a system subjected to constant amplitude or unbalanced excitation. e. Design to avoid or achieve resonance in single-degree-of-freedom mechanical models. f. Calculate and determine the critical rotating speed of whirling of shafts.

Subject Synopsis/ Indicative Syllabus

Dynamics **-** *Kinematics and kinetics of particles*, rectilinear motion, plane curvilinear motion, relative motion, equation of motion, work and energy, impulse and momentum. *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, rotor imbalance 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 are two 2-hour laboratory sessions.
Typical Experiments:
1. Gear train experiment.
2. Linear vibration.
3. Forced vibration.
4. 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 particles and rigid bodies; equation of motions, work and energy, impulse and momentum, and 1 DOF vibrations.

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.

Experiments will provide students with experience on gear train systems, linear vibration, 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.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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	e	f
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:

$0.5 \times$ End of Subject Examination + $0.5 \times$ 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 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.
▪ Laboratory/Tutorial	8 Hrs.
Other student study effort:	
▪ Reading and review	42 Hrs.
▪ Homework assignment	16 Hrs.
▪ Laboratory report	8 Hrs.
Total student study effort	108 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.

August 2013

Subject Description Form

Subject Code	ME3107
Subject Title	Linear Systems and Control
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3106 Dynamics and Vibrations Exclusion: ME3104 Dynamics and Control I ME3105 Dynamics and Control II
Objectives	1. To introduce the mathematical modelling of physical elements in dynamic systems. 2. To provide students with a basic understanding of behaviour of first- and second-order systems due to step, ramp and impulse inputs, and concepts of time-domain specifications. 3. To introduce the basic concepts of frequency response and frequency domain specifications. 4. To introduce feedback control and its application to improve the overall system behaviour. 5. To present the basic concepts of proportional-and-integral-and-derivative feedback, and the setting of control parameters to meet the system goals.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Find the transfer function for a system composed of mechanical and other physical components or given the block diagram of a system. b. Predict the output response of a first- or second-order system both in time and frequency domains subject to typical input signals. c. Understand and grasp how the system dynamic behaviour is related to system specifications and how it can be improved according to these specifications using some combination of parameter tuning and feedback control. d. Describe how changes in parameter values will affect the stability of a control system, and apply Routh-Hurwitz criterion to find the parameter range for stability. e. Understand basic applications of proportional, integral and derivative feedbacks in control systems to improve performance or stability.
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.

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.

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.

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	20 %	√	√	√	√	√			
2. Homework	20 %	√	√	√	√	√			
3. Laboratory report	10 %		√	√	√	√			
4. Examination	50 %	√	√	√	√	√			
Total	100 %								

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

Overall Assessment:

	0.5 × End of Subject Examination + 0.5 × Continuous Assessment Assignments, laboratory reports, and tests are adopted in continuous assessment on students' timely feedback to and on-going understanding of the course. Students' overall understanding of the course and ability in applying the delivered knowledge are further assessed through a formal examination.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Self-study	42 Hrs.
	▪ Homework assignment	15 Hrs.
	▪ Laboratory report	6 Hrs.
	Total student study effort	105 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.	

March 2012

Subject Description Form

Subject Code	ME3205
Subject Title	Design and Manufacturing II
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3204 Design and Manufacturing I
Objectives	1. To provide students in-depth knowledge and skills on the product analysis and simulation, use of CAD/CAE, manufacturing and prototyping techniques of products. 2. To provide students advanced computer modelling and finite element modelling and analysis techniques during the product design process. 3. To enhance students knowledge on environmental impact and marketing skills during the design of products and engineering components.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify, formulate and solve engineering problems. b. Apply their knowledge of mathematics, science and engineering. c. Use the techniques, skills, and modern engineering tools, including computational tools necessary for engineering practice. d. Function professionally in multidisciplinary teams.
Subject Synopsis/ Indicative Syllabus	***Computer-aided Analysis in Product Design (7 weeks)*** Fundamentals in Computer-aided Engineering (CAE) - 3-D Product Analysis - Design Optimisation Technique - CAD and CAM integration ***Integrated Products and Process Design (3 weeks)*** - Concurrent Engineering - Reverse Engineering - Documenting of Design Process Knowledge - Environmental Impact - Computer-aided Manufacturing (CAM) - Internet Applications in Product Design and Manufacture - Process Development and DFX Strategies ***Product Management and Manufacturing Competitiveness (4 weeks)*** - Product Master Platform - Manufacturing and Supply Chain Planning - Six Sigma Technique of Quality Improvement - Product Life-cycle Management (PLM)

Teaching/Learning Methodology

Lectures are used to transfer the required knowledge of engineering design and manufacturing (outcomes a to c).

Tutorials and computer workshops are used for training of using CAE tools for design analysis (outcomes b to c).

Project and case studies are useful for the study and solving real-life engineering problems (outcomes a to d).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d		
Lecture	√	√	√			
Tutorial / workshop		√	√			
Project / case 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		
1. Assignment	10 %	√	√				
2. Test	15 %	√	√				
3. Training report	5 %	√		√			
4. Project report	20 %	√	√	√	√		
5. Examination	50 %	√	√	√			
Total	100 %						

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, assignments and training 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 is used to assess students' on the application of their knowledge and computer tools learnt in this subject to solve a real-life design problem.

Student Study Effort Expected

Class contact:	
▪ Lecture and seminar	34 Hrs.
▪ Tutorial	4 Hrs.
▪ Workshop	4 Hrs.
Other student study effort:	
▪ Case study/Mini project	12 Hrs.
▪ Assignment	12 Hrs.

	▪ Self-study	42 Hrs.
	Total student study effort	108 Hrs.
Reading List and References	1. George E. Dieter, Engineering Design, McGraw-Hill International Editions, latest edition. 2. Warren D. Seider, Product and Process Design Principles: Synthesis, Analysis, and Evaluation, John Wiley & Sons, latest edition. 3. Kunwoo Lee, Principles of CAD/CAM/CAE Systems, Addison Wesley Longman, latest edition. 4. Vince Adams and Abraham Askenazi, Building Better Products with Finite Element Analysis, Onword Press, latest edition. 5. Clive L. Dym and Patrick Little, Engineering Design: A Project-based Introduction, John Wiley & Sons, latest edition. 6. Michael J Etzel, Bruce J Walker and William J Stanton, Marketing, McGraw-Hill, latest edition. 7. George Huang, Internet Applications in Product Design and Manufacturing, Springer, latest edition. 8. D.H. Stamatis, Six Sigma fundamentals: A Complete Guide to the System, Methods and Tools, Productivity Press, latest edition.	

March 2012

Subject Description Form

Subject Code	ME3301
Subject Title	Applied Mechanics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA201 Mathematics I or equivalent
Objectives	1. To develop an understanding of static equilibrium and Newton's laws of motion. 2. To apply static equilibrium and Newton's Laws for solving engineering systems. 3. To promote effective mathematical and graphical communication skills.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the basics of applied mechanics. b. Solve for forces and moments on a simple structure. c. Formulate and solve equivalent force/couple systems. d. Communicate effectively with the support of mathematical and graphical skills.
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. ***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).

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

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

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

Assessment Methods in Alignment with Intended Learning Outcomes

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

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. 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	8 Hrs.
Other student study effort:	
▪ Course work	20 Hrs.
▪ Self-study	42 Hrs.
Total student study effort	104 Hrs.

Reading List and References

R.C. Hibbeler and S.C. Fan, Engineering Mechanics – Statics, SI Edition, Prentice Hall, latest edition.

March 2012

Subject Description Form

Subject Code	ME3303
Subject Title	Mechanics of Solids
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3301 Applied Mechanics
Objectives	1. To introduce concepts of stress, strain and deformation. 2. To teach students the knowledge of analyzing beams under axial and torsional loads. 3. To teach students how to analyze stresses and deflections of beam structures subjected to combination of internal transverse shear and bending moments. 4. To allow students learning how to analyze beams and shells experiencing combined loads. 5. To reinforce students with effective mathematical and graphical communication skills. 6. To promote students with a systematic approach to problem solving.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Draw free body diagrams of an assembled structure and its components. b. Apply the laws of equilibrium to solve for forces and moments on a structure. c. Solve for the principal stresses in structural components subjected to a combined state of loading. d. Formulate and solve problems involving bending of beams and axisymmetric shells. e. Apply the laws of equilibrium to solve for the forces and moments on structures and to determine the system and distribution of internal forces in the structure. f. Analyze simple structures. g. Recognise 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. h. Recognize, formulate and solve statically indeterminate structural components. i. Communicate effectively with the improved mathematical and graphical skills.
Subject Synopsis/ Indicative Syllabus	***Fundamentals*** **-** Free Body Diagram. Static Equilibrium. ***Mechanical Behaviour of Materials*** **-** Concept of stress; strain; Modulus of elasticity; Poisson's ratio; Bulk modulus; Hooke's Law; Stress-strain diagram; Saint Venant's Princicple; Axial stress; Thermal stress; Planar trusses; Axial deformation. Torsional Stress. Torsional deformation. ***Beam*** **-** Equilibrium of beams. Shear force and bending moments. Flexural stresses. Beam deflection. Discontinuous functions for 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. Tensile test
2. Torsion test
3. 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 h).

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

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 g to i).

Teaching/Learning Methodology	Outcomes								
	a	b	c	d	e	f	g	h	i
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	g	h	i
1. Assignment	25 %	√	√	√	√	√	√	√	√	
2. Laboratory report	5 %							√		√
3. Test	10 %	√	√	√	√	√	√	√	√	
4. Examination	60 %	√	√	√	√	√	√	√	√	
Total	100 %									

Overall Assessment:

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

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. 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/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. F.P. Beer, E.R. Johnston and Jr. J.T. DeWolf, Mechanics of Materials, McGraw-Hill, latest edition. 2. P.P. Benham, R.J. Crawford and C.G. Armstrong, Mechanics of Engineering Materials, Longman, latest edition. 3. A.C. Ugural, A.C. and S.K. Fenster, Advanced Strength and Applied Elasticity, Prentice Hall, latest edition.	

March 2012

Subject Description Form

Subject Code	ME3406
Subject Title	Engineering Thermodynamics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA201 Mathematics I, or CSE280 Applied Mathematical Analysis, or AMA299 Engineering Mathematics Exclusion: ME3401 Thermofluids I ME3402 Thermofluids II ME3404 Thermofluids I
Objectives	1. To provide students fundamental knowledge of basic concepts and systems used in thermal science including thermodynamic laws, processes and cycles, work and heat. 2. To enable students to understand the properties of pure substances, states, phase change, and behaviour of ideal gas. 3. To enable students to understand and apply the Law of Conservation of mass, Law of Conservation of energy, First Law of Thermodynamics and Second Law of Thermodynamics. 4. To enable students to understand various power cycles, heat engine and refrigeration cycle. 5. To enable students to understand properties of mixtures and principle of air-conditioning. 6. To teach basic evaluation techniques of heat transfer processes involving conduction, convection and radiation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Find the correct phase and remaining properties for a substance of a set of properties. b. Find process and compute associated heat and work transfer that is the most reasonable approximation of a physical set up. c. Compute the heat, work transfer and change of internal energy by 1st Law of Thermodynamics of a closed thermal system. d. Compute the heat, work transfer and change of enthalpy by 1st Law of Thermodynamics of an open thermal system. e. Evaluate heat, work transfer and efficiency for ideal heat engine cycles. f. Understand and deduce work output and efficiency of power systems, engine and COP of refrigeration cycle. g. Evaluate the rate of heat transfer via conduction, convection and radiation of a one-dimensional system of a physical construction.

Subject Synopsis/ Indicative Syllabus

Review of Basic Concepts and Properties of a Pure Substance **-** Closed and open systems. Thermal properties. State and equilibrium. Temperature and the Zeroth law. Work and heat. Process and cycle. Ideal gas. Equation of state of ideal gas. Pure substance. Phase diagrams. Evaluation of thermodynamic properties.

The First Law of Thermodynamics **-** Conservation of mass and control volume. The first law for a control mass undergoing a process/cycle. Internal energy and enthalpy. Constant volume and constant pressure specific heats. The first law for a control volume. The steady-flow energy equation and its applications.

The Second Law of Thermodynamics **-** Heat engines and refrigerators. The second law of thermodynamics. 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. Rankine cycle. Gas cycles. Otto cycle. Diesel cycle. Refrigeration cycle.

Psychrometry and Mixtures **-** Dalton model. Amagat model. Wet-bulb and dry bulb temperatures. Psychrometric chart. Air conditioning.

Introduction to Heat Transfer **-** Introduction of three modes of heat transfer (conduction, convection and radiation) and their governing equations. One-dimensional steady state conduction in parallel slabs and cylinders. Thermal resistance. Fins and heat exchangers.

Laboratory Experiment:
There are two 2-hour laboratory sessions:
Typical Experiments:
1. Refrigeration system.
2. Mechanical equivalent of heat.
3. Diesel engine test.
4. Heat conduction and heat convection.

Teaching/Learning Methodology

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

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

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 g).

Teaching/Learning Methodology	Outcomes						
	a	b	c	d	e	f	g
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	g
1. Examination	60 %	√	√	√	√	√	√	√
2. Test	20 %	√	√	√	√	√	√	√
3. Assignment/ Laboratory report	20 %	√	√	√	√	√	√	√
Total	100 %							

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

Overall Assessment:

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

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. 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 / Experiment	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.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.

August 2013

Subject Description Form

Subject Code	ME3407
Subject Title	Fluid Mechanics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA296 Mathematics II or AMA294 Mathematics II ME3406 Engineering Thermodynamics Exclusion: ME3401 Thermofluids I ME3402/ME3405 Thermofluids II
Objectives	1. To teach students the formulation of conservation laws for mass, momentum and energy, and their applications to fluid mechanics. 2. To teach students the significance of dimensionless numbers and techniques of model testing. 3. To teach students the formulation of conservation laws for mass, momentum and energy, and their applications to fluid mechanics problems. 4. To teach students the internal flow and external flow phenomena and their corresponding velocity distributions, pressure distributions, losses etc. 5. To introduce the principle and characteristics of fluid machinery such as pumps and fans. 6. To teach students the equations and characteristics of compressible flows.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the relationship between fluid pressure and hydrostatics, and their applications. b. Understand the nature of laminar flows, turbulent flows and the significance of Reynolds number. c. Deduce various important dimensionless parameters for fluid flows. d. Apply continuity equation and Bernoulli's equation to deduce velocity and pressure at different positions of practical situations and flow measurement devices. e. Apply momentum equation and steady flow energy equation to solve simple flow systems. f. Calculate the drag of a fluid flow over a flat plate, and pressure loss in ducts and pipes. g. Understand the principle of fluid machinery.
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: Typical Experiments: 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 to g). Tutorials are deployed to illustrate the application of fundamental knowledge to practical situations. (outcomes a to g). Experiments are arranged to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (outcomes a and b).

Teaching/Learning Methodology	Outcomes						
	a	b	c	d	e	f	g
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	g
1. Examination	70 %	√	√	√	√	√	√	√
2. Assignment/ Laboratory report / Test	30 %	√	√	√	√	√	√	√
Total	100 %							

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

Overall Assessment:

$0.7 \times$ End of Subject Examination + $0.3 \times$ Continuous Assessment

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

Student Study Effort Expected

Class contact:	
▪ Lecture	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.

March 2012

Subject Description Form

Subject Code	ME3901
Subject Title	Project – Design Realization
Credit Value	2
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with an opportunity to integrate engineering sciences, design and manufacturing technologies to solve engineering design problems. 2. To apply CAD/CAE/CAM systems to engineering design projects. 3. To practice material selections and structural analysis for mechanical parts. 4. To practice data collection and analysis using different measurement equipments and software packages. 5. To practice cost control and failure analysis in integrated design and manufacturing projects.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify, formulate and solve engineering problems. b. Understand the applicability of general theoretical and experimental principles and techniques of science and mathematics that integrate with areas of traditional engineering such as design and analysis. c. Have understanding of sound experimental protocol, including laboratory safety, design and execution of experiments, experimental data handling and analysis, interpretation of data and practical report writing. d. Use the techniques, skills, and modern engineering tools, including computational tools necessary for engineering practice. e. Work professionally in general mechanical systems, including the design and realization of such systems. f. Work as part of a team, communicate and present effectively and adopt project management skills in both practical and non-practical context.
Subject Synopsis/ Indicative Syllabus	***Design Process and Methods*** **-** Descriptive and prescriptive design process models, concept selection technique, clarifying objects, establish functions, setting requirements, generating alternatives, evaluating alternatives and improving details, quality function deployment, failure mode and effect analysis, safety, legal, economics and environmental protection considerations. ***Common Mechanical Components*** **-** Design of common mechanical components: keys, couplings, fasteners, power transmission components, bearing and seals, infinite life design, safe-life design, fail-safe design, and damage tolerance design. ***Materials Selection for Engineering Design*** **-** Metallic and non-metallic, ferrous and non-ferrous, considerations: function, strength, manufacture and cost, materials

	selection process and method, value analysis. ***Computer-aided Design and Manufacturing*** - Applications of CAD/CAM in engineering projects. ***Design Modeling and Analysis*** **-** Parametric and variational CAD modeling, feature-based product modeling, definition and type, design analysis and optimization. **Students are required to conduct an engineering design project** **Project Examples:** **Fan Design -** Focus on the basic fluid dynamic principles and theory used in fan design and the important parameters. Students have to go through the basic project life-cycle of concept, design, implement and handover in design the fan. The design of the fans is of open-ended nature. The group can investigate and select the applications of the fan they want to design. Students should propose their own specifications such as flow rate, pressure, speed and size of the fan they want to design. Detailed design drawing and solid modeling should be submitted. Additional marks will be given for manufacturing the fan and test their performance. Students have to search the performances, size and shape of a real-life fan used in the industry and compare with their design. **Vibration Isolation and Absorption -** The objectives of this project are: (1) To familiarize with the design of suspension system in vehicles and machineries. (2) To apply the theory of mechanical vibration in designing machine mountings with vibration isolation function. (3) To design vibration absorbers for absorbing vibration from machineries. Students are encouraged to design suspension systems or vibration absorbers for small machines such as air-conditioners and washing machines which they can found in their daily lives. They need to study the relevant theories and solve a real-life vibration problem. Experimental testing will be done to test the performance of the suspension system or vibration absorbers designed and made by the students. **Design of a Power Transmission System -** The objectives of the project are: (1) To bring together the individual mechanical components of a mechanical, gear-type power transmission into a unified, complete system. (2) To resolve the interface questions where two components fit together. (3) To establish reasonable tolerances and limit dimensions on key dimensions of components, especially where assembly and operation of the components are critical. (4) To verify that the final design is safe and suitable for its intended purpose. (5) To add details to some of the components that were not considered in earlier analyses. The lecturer will present basic information about the functions and design requirements for the power transmission for an industrial saw that will be used to cut tubing, establish a set of criteria for evaluating design decisions, and implement the design tasks. The saw will received some hp from the shaft of an electric motor rotating at certain rpm. The drive shaft for the saw should rotate at some specified rpm. Students are required to investigate the problem and recommend practical solutions to remedy the situation.

	The study should cover an analysis of (1) Design details of reducer (gear design). (2) Material selection for shafts. (shaft design). (3) Bearing mounting on the shafts and in the housing. (bearing design). (4) Flexible couplings and keys. (coupling and key design). **Burner Design and Analysis -** The objectives of the projects are: (1) Identify the design elements of a burner; (2) Identify different types of flames; (3) Understand how heat is transferred from a flame to an object and the factors affect the heat transfer; (4) Design different burner heads; (5) Conduct experiments to compare the heating efficiency of different burner heads; (6) Conduct experiments to measure the pollutants emitted during the combustion process and compare the pollutants generated by different burners. The lecturer will present the basic concepts of combustion and heat transfer. Students are required to generate different concepts of burners. Feasible designs will be fabricated and tested for comparison of heating efficiency and pollutant emissions. Through this project, students are able to appreciate the design elements of a burner and learn the experimental methods for assessing the performance and emissions of a burner system. **Materials Selection and applications for Engineering Design** – There are various applications of materials to different areas of science and engineering. Understanding of materials is also an important part of forensic engineering and failure analysis in the context of mechanical parts. Thus, the objectives of the projects are: (1) Identify mechanical part of concern in a machinery or materials of interest in any design. (2) Make use of facilities in the laboratory and determine the fundamental properties such as relevant physical and mechanical properties and do the characterization of materials. (3) Suggest design alterations. (4) Suggest another comparable material with experimental evidence. The lecturer will introduce basic concepts and importance of engineering materials and their properties and applications. Materials selection strategy and constraints will be talked about. The experimental techniques used to determine the material properties will also be presented. Some practical examples on application of materials in design will be discussed. Producing prototypes in the project is highly encouraged.
Teaching/Learning Methodology	Lectures are used to deliver the basic knowledge in relation to integrated engineering sciences, design and manufacturing technologies to investigate and solve engineering problems (outcomes a to f). Tutorials are used to apply theoretical knowledge to practical situations (outcomes a to c and f). Project involving experiments is used to demonstrate the transfer of learning on specific topic through search of information, experiments, analysis of data and report writing (outcomes a and c to e).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lecture	√	√	√	√	√	√
Tutorial	√	√	√			√
Project involving 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. Written group report (Project proposal, Project progress report and Project final report)	70 %	√	√	√	√	√	√
2. Individual assessment (involving Test, Peer assessment and Project oral presentation)	30 %	√	√			√	√
Total	100 %						

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

Overall Assessment: 1.0 × Continuous Assessment

Projects/Case-Studies/Laboratory-work/Assignments

The projects will be carried in groups each consisting of three to six students so as to promote the spirit of teamwork. On completion of the project, a written report is required from each project group and each student from the group will be asked to give an oral presentation on their projects. In addition to the group report, marks on the oral skill and technical contents will be given to each student. Thus, it helps in the comprehensive learning of each student.

Student Study Effort Expected

Class contact:	
▪ Lecture and seminar	20 Hrs.
▪ Tutorial	4 Hrs.
▪ Group discussion	4 Hrs.
Other student study effort:	
▪ Conducting design project	28 Hrs.
▪ Conducting experiment	16 Hrs.
▪ Literature search and private study	12 Hrs.
Total student study effort	84 Hrs.

Reading List and References	1. G. Dieter, Engineering Design, McGraw-Hill, latest edition. 2. K. Hurst, Engineering Design Principles, Arnold, latest edition. 3. A. Ertas and J.C. Jones, The Engineering Design Process, John Wiley, latest edition. 4. C.L. Dym, Engineering Design, A Project-based Introduction, John Wiley, latest edition. 5. A.M. Law and D.W. Kelton, Simulation Modeling and Analysis, McGraw-Hill, latest edition. 6. A.I. Kathryn, Reverse Engineering, McGraw-Hill, latest edition.

March 2012

Subject Description Form

Subject Code	ME3905
Subject Title	Numerical Methods
Credit Value	2
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA201 Mathematics I or equivalent
Objectives	1. To enable students to understand, formulate simple engineering problems and use computational methods to solve typical engineering problems. 2. To teach students to solve non-linear equations, simultaneous linear algebraic equations and eigenvalue problems in engineering problems. 3. To enable students to apply interpolating polynomials, interpolation using splines, and least-squares regression for curve fitting and plotting experimental data. 4. To teach students numerical differentiation and numerical integration for engineering problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Solve non-linear equations in engineering by computer software such as Matlab. b. Solve sets of simultaneous linear algebraic equations by matrix inversion using Matlab, Cramer's method and Gaussian elimination. c. Solve eigenvalue problems and find the natural frequency with modes of vibrations of mechanical systems. d. Apply interpolating polynomials, interpolation using splines, and least-squares regression for curve fitting and plot experimental data. e. Use numerical differentiation and numerical integration for simple engineering problems.
Subject Synopsis/ Indicative Syllabus	***Introduction to Mathematical Meodelling and Computational Methods*** **-** Mathematical & numerical modelling and applications of commercial software packages such as MATLAB. Limitation, validation and sources of errors. Functions and plotting using Matlab. ***Computer Solution of Non-linear Equations*** - Bracketing Methods. Bisection Method. Open Methods. Newton-Raphson Method. Secant Method. ***Simultaneous Linear Equations*** **-** Solving simultaneous linear equations by Matrix Inversion. Cramer's Rule. Gauss Elimination. Gauss-Jordan Elimination. Engineering applications and choice of methods. ***Eigenvalue Problems*** **-** Standard and General Eigenvalues Problems. Methods of solving Eigenvalue problems. Applications in vibrations and Model 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, difference equations. Trapezoidal rule. Simpson's rule. Applications of numerical differentiation and integration in heat transfer and fluid flow problems.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to numerical methods.

Tutorials will be conducted in small groups to facilitate discussions.

Computational workshops provide hands-on experience in using software to solve numerical problems.

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	15 %		√	√	√	√	
2. Assignment	15 %	√	√	√	√	√	
3. Examination	70 %		√	√	√	√	
Total	100 %						

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

Overall Assessment:

$0.7 \times$ End of Subject Examination + $0.3 \times$ Continuous Assessment

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

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

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

Student Study Effort Expected	Class contact:	
	▪ Lecture	24 Hrs.
	▪ Tutorial	2 Hrs.
	▪ Computational Workshop	2 Hrs.
	Other student study effort:	
	▪ Performing assignment	26 Hrs.
	▪ Applying computational software	6 Hrs.
	▪ Private study	12 Hrs.
	Total student study effort	72 Hrs.
Reading List and References	1. S.C. Chapra and R.R. Canale, Numerical Methods for Engineers, McGraw-Hill, latest edition. 2. S.S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice-Hall, latest edition. 3. A. Biran and Moshe Breiner, Matlab for Engineers, Addison Wesley, latest edition. 4. D.M. Etter, Engineering Problem Solving with Matlab, Prentice-Hall, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4905
Subject Title	Advanced Numerical Methods for Engineers
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3905 Numerical Methods
Objectives	1. To enable students to understand, formulate advanced engineering problems and use computational methods to solve typical engineering problems. 2. To teach students to solve complex non-linear equations, simultaneous linear algebraic equations and eigenvalues problems common in engineering problems. 3. To teach students to solve ordinary differential equations common in engineering problems. 4. To teach students to solve unsteady heat and fluid flow problems by finite different method. 5. To enable students to understand the basic theory of finite element method.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Formulate advanced engineering problems by mathematical modelling. b. Solve sets of simultaneous linear algebraic equations common in engineering. c. Use Euler and Runge-Kutta methods in solving simple engineering problems such as motion of particles and flying objects. d. Solve unsteady heat and fluid flow problems by finite difference method. e. Solve boundary value problems by finite difference method. f. Understand the basic theory of finite element method so that they can choose appropriate elements, mesh sizes and solvers for simulation.
Subject Synopsis/ Indicative Syllabus	***Computer Solution of Non-linear Equations and Simultaneous Linear Equations*** **-** Roots of polynomials. Solving of simultaneous linear equations by Matrix Inversion using modern software, Gaussian-Seidal method. Special matrices. Mathematical modeling of engineering problems. Curve fitting, non-linear regressions, Fourier approximations and interpolation using modern software. ***Numerical Differentiation, Integration and Ordinary Differential Equations*** **-** Difference Equations, Ordinary Differential Equations with initial conditions, Euler's Method, Heun's method and Runge-Kutta methods. Aplications of Runge-Kutta method in solving engineering problems such as motion of particles. Stiff equations. ***Finite Difference Method*** **-** Finite differences for elliptic equations and parabolic equations.—Initial-and boundary-value problems: discretization of differential equations into linear equation sets; Explicit and implicit methods. Solving of transient heat conduction and fluid flow problems.

Finite Element Method **-** Finite elements for elliptic systems and boundary-value problems: Basic theory, discretization, interpolation function, formulation of element characteristic matrices and incorporation of the boundary conditions and solving the final matrix equation through examples in one-dimensional and two dimensional inviscid flow and heat conduction problems.

Teaching/Learning Methodology

This subject will be taught via lectures, tutorials and class exercises.

Lectures are aimed at providing students with the knowledge of mathematical modeling, simultaneous linear algebraic equations, Euler and Runge-Kutta methods and finite difference methods, etc. (outcomes a to f).

Tutorials are aimed at enhancing students' skills necessary for solving advanced engineering problems (outcomes a to f).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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	f
1. Test	20 %	√	√	√	√	√	√
2. Assignment	10 %	√	√	√	√	√	√
3. Examination	70 %	√	√	√	√	√	√
Total	100 %						

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

Overall Assessment:

$0.7 \times$ End of Subject Examination + $0.3 \times$ Continuous Assessment

Examination is adopted to assess students on understanding and the ability to apply the concepts. It is supplemented by test and assignment 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	8 Hrs.
Other student study effort:	
▪ Conducting assignment	20 Hrs.
▪ Practicing computational software	20 Hrs.

	▪ Private study	40 Hrs.
	Total student study effort	122 Hrs.
Reading List and References	1. S.S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice-Hall, latest edition. 2. A. Brian and Moshe Breiner, Matlab for Engineers, Addison Wesley, latest edition. 3. S.S. Rao, The Finite Element Method in Engineering, Pergamon Press, latest edition. 4. D.M. Etter, Engineering Problem Solving with Matlab, Prentice-Hall, latest edition. 5. S.C. Chapra and R.P. Canale, Numerical Methods for Engineers, McGraw-Hill, latest edition. 6. J.D. Anderson, Computational Fluid Dynamics, McGraw-Hill, latest edition. 7. D.W. Pepper and J.C. Heinrich, The Finite Element Method, Hemish Publishing Corp., latest edition.	

March 2012

Subject Description Form

Subject Code	ME4908
Subject Title	Capstone Project – Group based
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3106 Dynamics and Vibrations ME3107 Linear Systems and Control ME3205 Design and Manufacturing II ME3303 Mechanics of Solids ME3406 Engineering Thermodynamics ME3407 Fluid Mechanics
Objectives	1. To provide students with an excellent opportunity of in-depth exploration of a particular topic in mechanical engineering. 2. To teach students how to apply the general engineering sciences and fundamentals in solving an open-ended real-world engineering technical problem with a critical manner. 3. To further develop students' creativity and overall skills of problem formulation, development of appropriate solution methods, design and implementation of a final chosen solution. 4. To develop and strengthen students' oral and written presentations of the project findings and recommendations. 5. To practice data collection and analysis using different measurement equipments and software packages. 6. To engage students in a team setting to horizontally integrate all mechanical engineering knowledge that they have learnt in a comprehensive design and engineering final year project. 7. To teach how to make good oral presentation and report writing.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Select an appropriate concept and clarify the objectives in the final year project. b. Conduct literature search including patents, books, archived publications and product catalogues, and to perform the state-of-the-art and benchmark studies. c. Articulate the results and findings with scientific and logical arguments. d. Evaluate the potential impact of their designed solution on performance, safety, cost and environment. e. Participate and lead in a multi-functional team. f. Take into account of safety, legal, environmental protection considerations in an engineering project. g. Communicate their project work to sponsors (if any), supervisors, other peer teams, and even non-technical audience. h. Develop a set of appropriate assumptions and exercise engineering judgement to formulate the problem and suggest a practical solution, by given an open-ended real-world engineering problem. i. Apply appropriate engineering tool (analytical, experimental, and/or computational) for carrying out tasks in the development and implementation of a designed solution

	with a critical approach. j. Identify a set of critical variables for the given engineering problem, derive the governing equations and optimize the design solution. k. Design, plan and carry out scientific and engineering experiments (physical tests and/or computer numerical simulations) to prove the feasibility of their designed solutions.
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.

Teaching/Learning Methodology	Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
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
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 x 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

Subject Description Form

Subject Code	ME4205
Subject Title	Manufacturing and Prototyping
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3205 Design and Manufacturing II
Objectives	1. To teach the students to understand the fundamentals of manufacturing and prototyping for product design and development. 2. To teach the students to gain practical experience in manufacturing and prototyping for product design and development. 3. To teach the students to develop ability to apply up-to-date technology in manufacturing products with considerations of safety and environmental factors.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Describe the principle and operation of common manufacturing and rapid prototyping processes for product development. b. Decide on the use of appropriate manufacturing processes in the manufacture of a product at the design stage. c. Develop a prototype with modern prototyping techniques. d. Apply up-to-date technology in manufacturing products with considerations of safety and environmental factors. e. Apply the reverse engineering process for product developmen. f. Appreciate and report on the common practice in the product development industry.
Subject Synopsis/ Indicative Syllabus	***Advanced Manufacturing Process*** - Working Principle and Operation of Conventional and Modern Manufacturing Processes for Product Development. - Tolerance and Processes for Precision Production. - Hot Metal Processing, Metal Cutting Processes, Laser Cutting, Water Jet Cutting Technology, Precision Metal Removal. - Plastic Processing. - Manufacturing Process of Advanced Composite Materials. - Advanced Manufacturing Techniques (Physical and chemical vapour deposition (PVD and CVD) processes, photo-chemical machining, precision casting …). - Advanced Surface Finishing Technology. ***Rapid Prototyping Technology*** - Rapid Prototyping Processes and Interfacing. - Rapid Tooling. - Safety and Environmental Control in RP. - Reverse Engineering (Application filed and prospect of RE, steps in RE, technologies applied in RE, 3D scanning and digitizing).

Laboratory experiment:
Using RP technology for making real parts

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge related to advanced manufacturing processes and rapid prototyping technology (outcomes a to f).

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

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 d).

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

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lecture	√	√	√	√	√	√
Tutorials and case study	√	√	√	√	√	√
Experiment	√	√	√	√		
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	f
1. Test	20 %	√	√			√	
2. Homework/assignment	20 %		√		√		√
3. Laboratory report	10 %	√	√	√			√
4. Examination	50 %	√	√		√	√	√
Total	100 %						

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

Overall Assessment:

$0.5 \times$ 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 Expected	Class contact:	
	▪ Lecture and seminar	34 Hrs.
	▪ Tutorial	2 Hrs.
	▪ Laboratory work and workshop	6 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. R. Budde, Prototyping: An Approach to Evolutionary System Development, Springer-Verlag, Berlin, New York, latest edition. 2. B. Benhabib, Manufacturing: Design, Production, Automation and Integration, Marcel Dekker, latest edition. 3. P.N. Rao, CAD/CAM Principles and Applications, McGraw Hill, latest edition. 4. S. Kalpakjian, S. Schmid, manufacturing engineering and technology, Prentice Hall, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4206
Subject Title	Advanced Materials for Design and Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3303 Mechanics of Solids
Objectives	1. To provide advanced knowledge on the design and development, processing, applications and structural evaluations of advanced materials and structures. 2. To provide advanced knowledge on the principle and applications of smart materials for product design. 3. To provide advanced knowledge on the consideration of environmental impacts for product design, aircraft and aerospace structures and environmentally friendly products.
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 to c).

Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to 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:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the assignments and laboratory reports which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written report and oral presentation on a specific project or case study are used to assess the students' knowledge on smart materials.

Student Study Effort Expected	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Course work Assignment	12 Hrs.
	▪ Self-study	40 Hrs.
	Total student study effort	94 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	ME4208
Subject Title	Computer-Aided Technology for Design
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3205 Design and Manufacturing II Exclusion: ME4203 Product Design and Management
Objectives	1. To provide students advanced knowledge on the computer-aided related technologies for product design and development. 2. To provide students advanced knowledge on the principles and applications of computer-aided modelling and analysis. 3. To provide students advanced knowledge on the use of computer-aided techniques and software to solve structural, stress, heat transfer and dynamic problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Use the computer-aided techniques to facilitate the process of product design and development. b. Understand the interface among CAD, CAE and CAM during the product design process by using up-to-date software. c. Identify a set of design variables and the governing equations to analyze a conceptual design. d. Optimize the mesh size and type and apply appropriate types of boundary constraints in the CAE process. e. Analyze and optimize a design with the aid of modern CAE software.
Subject Synopsis/ Indicative Syllabus	***Computer-aided Modelling*** - Geometric Models of Products - Mathematical Modelling • Curve Modelling • Surface Modelling • Solid Modelling - 3-D Product Analysis - Modelling and Simulations - Product Animation ***Design Analysis and Evaluation*** - Finite Element Modelling and Analysis • Modelling Techniques • Mesh Types • Boundary Constraints • Material and Property Types - Mathematical Modelling - Mechanical and Thermal Stress Analyses

- Dynamic Response
- Product Optimizations (Size and Shape)
- Non-linear Stress Analysis

CAD/CAE/CAM Integration
- Interface between CAD/CAE/CAM
- Applications of CAD/CAE/CAM

Teaching/Learning Methodology

Lectures will be given to explain the theories behind CAD, CAE and CAM.

Tutorials will be used to teach the students how to conduct design analysis and evaluation after finishing the process of computer-aided modeling using state-of-the-art software such as SolidWORKS, ANSYS. Students will be given sets of exercises to learn how to evaluate the structural strength, vibration frequencies of a product, the response to thermal stresses and drop test and the parameters involved in product optimization.

A mini-project will be given to students so that they will go through all the phases of a design process using computer-aided technology to achieve the design objectives.

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

Assessment Methods in Alignment with Intended Learning Outcomes

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

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

Overall Assessment:

$0.5 \times$ 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, written and computer

	assignments which provide timely feedbacks to both lecturers and students on various topics of the syllabus. Written reports on various case studies and mini-project are used to assess the students' knowledge in the application of state-of-the-art CAD/CAE software to facilitate the product design and analysis process. Mini-project report and presentation assess the students' ability to assimilate the learnt knowledge for solving a more realistic, open-ended design problem systematically.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	32 Hrs.
	▪ Tutorial	4 Hrs.
	▪ Guided study of CAD/CAE	6 Hrs.
	Other student study effort:	
	▪ Performing CAD/CAE in design (tutorial problems)	20 Hrs.
	▪ Performing modeling of design problems (case studies and mini-project)	24 Hrs.
	▪ Literature search and private study	20 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. Michael E. Mortenson, Geometric Modeling, John Wiley & Sons, latest edition. 2. Kunwoo Lee, Principles of CAD/CAM/CAE System, Addison-Wesley Longman, latest edition. 3. Vince Adams and Abraham Askenazi, Building Better Products with Finite Element Analysis, Onword Press, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4211
Subject Title	Development of Green Products
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME2902 Engineering and the Environment; or ISE388 Environmental Issues in Product Development
Objectives	1. To provide students with the concepts of green products with design. 2. To introduce the energy and resource saving products, while giving careful thought on environmental issues in product development and planning. 3. To provide students with the knowledge in the development of green products and procurement of green materials. 4. To introduce students with the knowledge of environmental assessment for evaluating the green products.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate greening opportunity and be aware of the environmental issues during the product design and development. b. Integrate the greening concepts into all development phases of a product within the constraints. c. Apply the knowledge of green procurement of materials. d. Understand the environmental assessment of green products. e. Able to identify and evaluate an existing/future of greener company/product/system/technology, and present their findings via oral presentation and written report. f. Able to recognise the need to develop the ability of life-long learning in the green future.
Subject Synopsis/ Indicative Syllabus	***Concept of Green Product with Design*** - Natural resource, material and energy conservation. Pollution prevention. Environmental impact on packaging, packaging materials, durability, repairability recyclability, and waste emissions. Life cycle impact assessment. Eco-labelling and energy-labelling product programmes. User's perception, social and cultural preference on green product design. Green product aesthetics and semantics. ***Green and Sustainable Product Development Processes*** - Concept of green and sustainable product development: product design, planning and innovation for environment. Product development processes and flows. Product development of organizations and functions. International environmental management standards. ***Green Procurement of Materials*** - Material assessment and survey. Green procurement evaluation criteria. Evaluation of materials and suppliers. ***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.

The Green Future **-** More from less. Reducing risk and nuisance. Opportunities from green technology. Green taxes. Concern for nature. Pollution and waste reduction. A positive future.

Teaching/Learning Methodology

The continuous assessment and examination are aimed at providing students with integrated knowledge required for emerging development of green/sustainable products.

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

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. Homework assignment	15%	√	√	√	√		
2. Test & tutorial	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:

0.5 x End of Subject Examination + 0.5 x Continuous Assessment.

1. The continuous assessment will comprise three components: homework assignments (15%), test & tutorials (15%) and mini-project/case study report & presentation (20%). The homework assignments, and test & tutorials 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 mini-project/case study is aimed at assessing students to apply their learnt knowledge, and enhancing the written and oral communication skills in English and team-work spirit of the students.

2. The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ 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. Ulrich, K.T. and Eppinger, S.D., Product Design and Development, McGraw-Hill, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4217
Subject Title	Industrial Automation
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3107 Linear Systems and Control Exclusion: ME4204 Mechatronic Systems
Objectives	1. To teach students the mechanisms and selection of sensors, available techniques for sensor interfacing and protection circuits in automation systems. 2. To teach students the principle of analog-to-digital conversion, the importance of anti-alias filtering and the common methods of analog or digital signal transmissions. 3. To teach students the mechanics and control of industrial robots used in flexible automation. 4. To teach students the principle of industrial logic control systems used in manufacturing automation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the major components of mechatronic systems used in automation such as commonly used sensors and common techniques for sensor interfacing and protection circuits. b. Understand the common forms of signal transmissions, the importance to suppress transmission noise in mechatronic systems, analog-to-digital converters, anti-alias filters, and sampling rates for real-time applications. c. Understand the mechanisms of commonly used actuators and how to select a proper set of sensors and actuators for a practical mechatronic system. d. Understand various types of robots for industrial applications. e. Understand industrial control logic design using ladder diagram and programmable logic controller.
Subject Synopsis/ Indicative Syllabus	***Sensors and Actuators*** **-** Generic components for mechatronic systems in automation: sensors and transducers such as displacement sensors, force sensors, ultrasonic sensors, fibre optic devices, *etc*; actuators such as dc motors, stepper motors, piezoelectric actuators, *etc*. ***Interfacing*** **-** Sensor protection circuits; Signal transmission and noise suppression; Analog-to-digital and digital-to-analog conversion; Sampling frequency; Anti-alias filtering. ***Industrial Robotics*** **–** Robot geometry; Basic forward and inverse kinematics; Robot drives; Motion control; Robot Tooling; Robot applications; Economic justifications; Robot implementation.

Discrete Control Using PLCs **-** Relay logic; Combinational and sequential control; Minimization of logic equations; Ladder logic diagrams; Programmable logic controllers (PLCs); PLC components; Programming; I/O addresses; Timer and counters; PLC applications.

Laboratory Experiment:
There are two 2-hour laboratory sessions.
Typical Experiments:
1. Sequential control using PLC.
2. Programming and control of gantry robot.
3. Motor control systems.

Teaching/Learning Methodology

Lectures aim at providing students with an integrated knowledge required for the design and implementation of industrial automation systems.

Tutorials aim at enhancing the analytical skills of the students. Examples on sensors, actuators, analog-to-digital conversion, interfacing and signal conditioning circuits, programmable logic controllers (PLCs), robot kinematics and economic justifications will be provided and analyzed. Students will be able to solve real-world problems using the knowledge they acquired in the class.

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 c and e).

Experiments will provide the students with hand-on experience on developing logic controllers using PLCs, implementing and testing industrial automations systems. It also trains students in the analysis and presentation of experimental data.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lecture	√	√	√	√	√
Tutorial	√	√		√	√
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	e
1. Class test	20 %	√	√	√	√	√
2. Homework	10 %	√	√	√	√	√
3. Laboratory	10 %			√	√	√
4. Case study report / presentation	10 %	√	√	√	√	√
5. Examination	50 %	√	√	√	√	√
Total	100 %					

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Overall Assessment: 0.5 × End of Subject Examination + 0.5 × Continuous Assessment Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the tests, 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 case study is used to assess the students' knowledge in the selection of sensors and actuators in a certain industrial automation scenario.	
Student Study Effort Expected	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Laboratory/Tutorial	8 Hrs.
	Other student study effort:	
	▪ Reading and revision	38 Hrs.
	▪ Homework assignment	12 Hrs.
	▪ Laboratory report	6 Hrs.
	▪ Case study report	10 Hrs.
	Total student study effort	108 Hrs.
Reading List and References	1. D. Shetty, and R.A. Kolk, Mechatronics System Design, PWS Publishing Company, latest edition. 2. D.M. Auslander and C.J. Kempf, Mechatronics - Mechanical System Interfacing, Prentice-Hall, Inc., latest edition. 3. W. Kleitz, Microprocessor and Microcontroller Fundamentals, Prentice-Hall, Inc., latest edition. 4. M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, Prentice Hall, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4307
Subject Title	Environmental Degradation of Materials
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3302 Engineering Materials
Objectives	1. To provide students with the concepts and principles of environmental degradation of materials. 2. To provide students with the fundamental knowledge of protection and prevention technologies in systems design. 3. To provide students with the knowledge in material selection against environmental degradation for product development.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the basic forms of environmental degradation of engineering structures and products. b. Identify typical causes of real mechanical structures and materials degradation. c. Analyze typical degradation problems in a quantitative way. d. Select appropriate and economical methods for protecting engineering structures and materials against environmental degradation. e. Understand degradation of material and select appropriate materials against environmental degradation for typical engineering systems and product design.
Subject Synopsis/ Indicative Syllabus	***Significance of Environmental Degradation*** **-** Definitions and forms of environmental degradation; impacts and implications to economy and society. ***Surface Examination and Testing Techniques*** **-** Surface morphology, chemistry and structure examination techniques; surface mechanical testing techniques. ***Corrosion*** **-** Principles and basic theory of corrosion; effects of metal structures; forms of corrosion; corrosion rate determination; environmentally induced cracking; corrosive environment and prevention; hydrogen embrittlement; hydride formation and cracking; corrosive erosion, fretting and wear; preventive methods. ***Oxidation*** **-** Oxidation at elevated temperature; thermodynamics of oxidation; oxidation rate; effects of defects and alloying; coatings for oxidation protection. ***Environmental Degradation of Polymers*** **-** Typical polymer molecules; types of polymer degradation; photodegradation; biodegradation. ***Materials Selection and Design*** **-** Selection of alloys and other materials for corrosion prevention; considerations in preventive product/structure design.

Laboratory Experiments:

1. Examination of magnetic structure on a floppy disk using Atomic Force Microscopy (AFM).
2. Corrosion rate measurement on steel.
3. Measurement of oxidation rate of copper.

Teaching/Learning Methodology

Lectures are used to deliver the basic knowledge in relation to the environmental degradation of materials (outcomes a to e).

Tutorials are used to apply theoretical knowledge to practical situations (outcomes a to d).

Project or case study is used to demonstrate the transfer of learning on specific topic through search of information, analysis of data and report writing (outcomes b to d).

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

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	
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	e	
1. Examination	50 %	√	√	√	√	√	
2. Assignment	30 %	√	√	√	√	√	
3. Project / case study report	10 %		√	√	√		
4. Laboratory report	10 %			√		√	
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 assignments and laboratory reports as a continuous assessment which provides timely feedback to both lecturers and students on various topics of the syllabus. Written report on a specific project or case study is used to assess the students' knowledge on impact of environment on degradation of materials.

Student Study Effort Expected	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Tutorial/Laboratory	8 Hrs.
	Other student study effort:	
	▪ Assignment	12 Hrs.
	▪ Project/case study	10 Hrs.
	▪ Self-study	38 Hrs.
	Total student study effort	102 Hrs.
Reading List and References	1. Samuel A. Bradford, Corrosion Control, Edmonton, Alberta: CASTI Publishing Inc., latest edition. 2. Corrosion: Understanding the Basics, Materials Park, Ohio: ASM International, latest edition. 3. Denny A. Jones, Principles and Prevention of Corrosion, Prentice Hall, latest edition.	

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Subject Description Form

Subject Code	ME4308
Subject Title	Automatic Control Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3107 Linear Systems and Control
Objectives	1. To provide students with a thorough understanding of controller design in time domain. 2. To provide students with a thorough treatment of compensators design in frequency domain. 3. To provide students with a thorough understanding of state-space modeling and analysis of dynamic control systems. 4. To provide students with a thorough understanding of feedback controller design using a state-space approach.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Design controllers to satisfy the system requirements. b. Understand the concepts of system compensation in feedback control system. c. Determine the control parameters to satisfy the relative stability requirements of a system given its transfer function or frequency response data. d. Design lead compensators, lag compensators and lag-lead compensators for feedback control systems given the performance specifications such as the phase margin, gain margin and the static velocity error constant using Bode diagrams. e. Model and analyze a dynamic system using a state-space approach for controller design. f. 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 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 (outcome a to 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 (outcome a to f).

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 (outcome d to f).

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. 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:

$0.5 \times$ 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 Expected	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.	

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Subject Description Form

Subject Code	ME4310
Subject Title	Engineering Composites
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3303 Mechanics of Solids Exclusion: ME4305 Mechanics and Composites for Aircraft Structures ME4306 Thermoplastic and Composite Materials
Objectives	1. To provide students with knowledge of the mechanical behaviour of composite materials. 2. To provide students with understanding of the processing, fabrication and the influence of fabrication and environment on the properties of structural composites. 3. To be able to design with composite laminae or laminates so that students gain an appreciation of the wide design flexibility composites afford.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Have knowledge of the types and properties of composites used in engineering. b. Have knowledge in processing and fabrication of structural composites. c. Analyze the effects of various load or displacement boundary conditions by applying laminate analysis to composite structures. d. Understand the differences in matrix materials and the implications for composites as substitute materials in design to meet several competing requirements when monolithic components cannot.
Subject Synopsis/ Indicative Syllabus	***Introduction to Engineering Composites*** - Classification and characteristics of composite materials. Mechanical behaviour of composite materials. Reinforcements. Matrix materials. ***Composite Interfaces*** - Fibre-matrix interfaces. Interfacial properties. Stress transfer through composite interfaces. ***Lamina Stress-strain Relationships*** - lamina and laminate theories. Transformation and prediction of elastic parameters. Load-deformation relationship. ***Analysis of Continuous Fibre-Reinforced Lamina and Laminates*** - Macromechanical behaviour of a lamina. Macromechanical behaviour of a laminate. ***Processing and Fabrication*** - Structural composites and their processing technology. Manufacture of laminated fibre-reinforced composite materials. Influence of fabrication and environment on properties. ***Failures, Design, and Applications of Composites*** - Failure theories. Design optimization. Engineering applications of composites.

Laboratory Experiments
Typical experiments:
1. Manufacturing of composites
2. Tensile test of composites

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to advanced composite materials (outcomes a to d).

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

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

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d		
1. Examination	60 %	√	√	√	√		
2. Assignment	20 %	√	√	√	√		
3. Test	10 %	√		√	√		
4. Laboratory report	10 %	√	√				
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. 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	▪ 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. Ronald F. Gibson, Principles of Composite Material Mechanics, McGraw-Hill International Editions, latest edition. 2. C.T. Sun, Mechanics of Aircraft Structures, John Wiley & Sons, latest edition. 3. Celine A. Mahieux, Environmental Degradation in Industrial Composites, Elsevier, latest edition. 4. A. Brent Strong, Fundamentals of Composites Manufacturing-Materials, Methods and Applications, Society of Manufacturing Engineers, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4405
Subject Title	Environmental Noise
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics
Objectives	1. To teach the students a basic understanding of practical aspects in environmental noise. 2. To equip the students to use a range of available techniques for the measurement, assessment and prediction of noise due to transportation and industrial noise sources. 3. To examine the noise assessment methodology which correlate with human perception in the context of legal requirements in Hong Kong.
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 and rail traffic noise. b. Elucidate the various terms and factors involved in the evaluation of environmental and occupational noise. c. Understand the fundamentals of room acoustics.
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 two-hour laboratory sessions:
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.

Tutorials are aimed at enhancing students' skills necessary for analyzing noise assessment method and legal requirement in Hong Kong.

Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems.

Teaching/Learning Methodology	Outcomes					
	a	b	c			
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			
1. Class test	25 %	√	√	√			
2. Homework	5 %	√	√	√			
3. Experiment	5 %	√	√				
4. Report	15 %	√	√	√			
5. 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. 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 Expected	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	

March 2012

Subject Description Form

Subject Code	ME4406
Subject Title	Noise Abatement and Control
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics ME3407 Fluid Mechanics
Objectives	1. To understand the elementary noise sources, and the method to identify and analyze the type of noise source in practical engineering problems. 2. To learn the state-of-the-art noise abatement technology, which at the present includes dissipative, reactive and active methods. 3. To solve a problem in noise abatement and control engineering by using appropriate design tools.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the physics of sound wave propagation in different medium. b. Understand the difference between transmission loss, insertion loss and related concepts, and choose appropriate evaluation criterion for a given problem which can be either duct noise or room acoustics application. c. Design elementary reactive muffler and absorptive duct lining, e.g. Helmholz resonator and expansion chamber, by analytical method and understand the assumptions involved in the analytical theory.
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.

Tutorials are aimed at enhancing students' skills necessary for analyzing and designing the noise control method.

Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems.

The mini project is to develop the students' interest and curiosity in the design of noise control method.

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

Assessment Methods in Alignment with Intended Learning Outcomes

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

March 2012

Subject Description Form

Subject Code	ME4407
Subject Title	Principles of Sound and Vibration
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics
Objectives	1. To teach the underlying physics of the origin of sound, wave propagation, and the measurement of sound and vibration. 2. To lay a solid foundation for further studies in all major aspects of noise and vibration control engineering.
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. Calculate 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 to c).

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

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

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c			
1. Class test	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:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

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

Student Study Effort Expected

Class contact:	
▪ Lecture	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.

March 2012

Subject Description Form

Subject Code	ME4409
Subject Title	Engine Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics
Objectives	1. To teach the students fundamental concepts and applications of engine technology. 2. To teach the students basic knowledge of engine fuels, and its related combustion and 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 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. Test	35 %	√	√	√	√	√	
3. Assignment	15 %	√	√	√	√	√	
Total	100 %						

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by tests and assignments 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	8 Hrs.
Other student study effort:	
▪ Course work	28 Hrs.
▪ Self study	42 Hrs.
Total student study effort	112 Hrs.

Reading List and References

1. C.R. Ferguson and A.T. Kirkpatrick, Internal Combustion Engines, John Wiley & Sons Inc., latest edition.
2. J.C. Guibet, Fuels and Engines- Technology, Energy and Environment, Vol. 1 & 2, Technip, Paris, latest editiion.
3. W.W. Pulkrabek, Engineering Fundamnetals of the Internal Combustion Engine, Prentice Hall, latest edition.

March 2012

Subject Description Form

Subject Code	ME4411
Subject Title	Air Conditioning for Indoor Thermal and Environmental Quality
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics
Objectives	1. To teach the students fundamental concepts and applications of air conditioning engineering. 2. To teach the students fundamental knowledge of indoor thermal and environmental quality. 3. To teach the students fundamental concepts and applications of refrigeration engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate and understand the concept 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 heat transmissions in building envelope. e. Understand and evaluate the physical parameters which have important effects on both the heat gain and heat loss of a building. f. Apply the knowledge of heating and cooling loads required for a building. g. Identify the refrigerant properties and safety group classification. h. 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 and Environmental Health*** **-** 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 fundamental knowledge in air conditioning systems included both heating and refrigeration systems, and their relationships with the indoor air quality.

Homework assignments are used to relate the concepts into practical systems. The questions are based on the daily life air conditioning systems and equipments. Both calculation and discussion type problems are included in the assignments.

A project is used to illustrate the approach and methodology for solving the complex indoor air conditioning and thermal problems.

Teaching/Learning Methodology	Outcomes							
	a	b	c	d	e	f	g	h
Lecture	√	√	√	√	√	√	√	√
Project					√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
		a	b	c	d	e	f	g	h
1. Examination	50 %	√	√	√	√	√	√	√	√
2. Test	20 %	√	√	√	√				
3. Assignment	20 %	√	√	√	√	√	√	√	√
4. Project report	10 %					√	√	√	√
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 homework assignments. The mid-term test which covers the first half of the course material provides useful feedback to both lecturer and the students on the topics. The project is used to help the students to have experiences on solving practical engineering problem.

Student Study Effort Expected	Class contact:	
	▪ Lecture	34 Hrs.
	▪ Project	8 Hrs.
	Other student study effort:	
	▪ Course work	28 Hrs.
	▪ Self-study	35 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	1. ASHRAE Handbooks on Fundamentals, Refrigeration, HVAC Applications and HVAC Systems and Equipment, 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. B. Stein and J.S. Reynolds, Mechanical and Electrical Equipment for Buildings, John Wiley & Sons, latest edition.	

March 2012

Subject Description Form

Subject Code	ME4413
Subject Title	Heat and Mass Transfer
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics ME3407 Fluid Mechanics
Objectives	1. To understand the three modes of heat transfer and apply the techniques of heat conduction, convection and radiation for practical applications. 2. To understand the principle of numerical methods in heat transfer. 3. To understand the fundamentals of mass transfer.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the concept of thermal resistance and the evaluation techniques of heat conduction through parallel slabs and composite cylindrical tubes. b. Understand forced and free convective heat transfer around plates, cylinders/tubes and spheres. c. Apply the heat transfer equations to steady and unsteady conditions using numerical techniques. d. Understand radiation exchange between surfaces and its network approach. e. Design different types of fins and heat exchangers. f. Understand basic equations in 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.

Radiation - Black body and grey body. Absorptivity and emissivity. View factors. Irradiation and radiosity. Radiation exchange between surfaces and its network approach.

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.

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 and mass transfer (outcomes a to f).

Tutorials will be conducted in small groups to facilitate assignment discussions.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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	e	f
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 tests which cover the first half of the subject material provide 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 Expected	Class contact:	
	▪ Lecture	36 Hrs.
	▪ Tutorial	6 Hrs.
	Other student study effort:	
	▪ Performing assignment	40 Hrs.
	▪ Private study	24 Hrs.
	Total student study effort	106 Hrs.
Reading List and References	1. Y.A. Cengel and A.J. Ghajar, Heat and Mass Transfer, 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	ME4414
Subject Title	Fluids Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3407 Fluid Mechanics
Objectives	1. To teach students the principle of rotodynamic machines applied to fan design. 2. To teach students to the phenomena of flows around cylinders and the applications in flow-induced vibrations 3. To teach students to the phenomena of flows around spherical particles and the applications in environmental engineering. 4. To teach students the basic theory and applications of computational fluid dynamics (CFD).
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the principle of rotodynamic machines applied to fan design. b. Understand the characteristics and performance of different type of centrifugal fans and axial flow fans. c. Design centrifugal fans and axial flow fans for different applications. d. Understand the phenomena of flows around cylinders and spheres for different Reynolds number and the resulting force characteristics. e. Apply the knowledge in flow around cylinders and sphere in flow induced vibration and environmental protection devices. f. Understand basic theory in computational fluid dynamics.
Subject Synopsis/ Indicative Syllabus	***Fluid Machinery*** - Classification. Pumps, fans, compressors and turbines. Energy equation. Euler equation. ***Centrifugal Fans*** - Velocity triangles. Radial entry. Blade angles. Dimensionless coefficients. Reaction effect. Characteristics for infinite number of blades. Finite number of blades. Slip formulae and losses. Efficiencies. Actual fan characteristics for backward, radial & forward bladed fans. Fan laws. Design of impeller and volute. Case study. ***Axial Flow Fans*** - Aerofoil lift/drag coefficients and angle of attack. Carpet Plot of fan blades. Ideal cascade flows. Relation of lift coefficient with blade solidity and flow deflection angle. Pressure rise. Free vortex design. Circular arc camber line and stagger angle. Aerofoil blades with losses. Velocity diagrams and pressure for different axial flow fans. Fan operation and system. Fans in series and in parallel. Operational instability and temperature effects. Design illustration.

Flows around Cylinders - Effect of Reynolds numbers. Flow separations. Vortex shedding. Pressure coefficients. Mean & fluctuating forces. Velocity distributions: Prandtl's mixing length model. Flow-induced vibrations. Multi-cylinders. Effects of interference on flow field. Control of vortex induced vibrations.

Flows around Spheres - Forces in particle flows. Stokes' law. Trajectory modelling. Terminal velocity. Pressure variation. Gas-solid separation. Gravity settling and centrifugal separation. Cyclone. Velocity Distribution. Flows through packed particles. Fluidization. Ergun's equation.

Introduction to CFD - General approaches. Pre-processing. Mesh generation. Governing equations (Solver). Post-processing. Solutions of ODE by Runge-Kutta methods: one-dimensional motion of flying objects. Introduction to Finite difference method: Difference equation for Elliptic equations, Parabolic equations, and Wave equations. Introduction to Finite volume method. Introduction to Finite element methods for fluid flow. Commercial packages: Finite element, finite difference and finite volume solvers: FLUENT, CFX etc.

Laboratory Experiments:
There are 2 two-hour laboratory sessions:
Typical experiments:
1. Performance of centrifugal fans.
2. Fluidization and Cyclone experiments.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to fans, flows around cylinders and spheres, CFD (outcomes a to f).

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

Project or case study is used to allow students to deepen their knowledge and software applications on CFD such as FLUENT (outcome f).

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 and d).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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	e	f
1. Examination	50 %	√	√	√	√	√	√
2. Test	25 %	√	√	√	√	√	
3. Assignment	15 %	√	√	√	√	√	√
4. Laboratory report	5 %		√		√		
5. Mini-project report	5 %						√
Total	100 %						

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on 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 report and oral presentation on a specific CFD project is used to assess the students' knowledge and applications of commercial package such as FLUENT.

Student Study Effort Expected

Class contact:	
▪ Lecture	34 Hrs.
▪ Laboratory/Tutorial	8 Hrs.
Other student study effort:	
▪ Assignment, Laboratory report, Mini-project	20 Hrs.
▪ Self-study	40 Hrs.
Total student study effort	102 Hrs.

Reading List and References

1. Darby, R., Chemical Engineering Fluid Mechanics, Marcel Dekker Inc., latest edition.
2. Zdravkovich, M.M., Flow around Circular Cylinders, Oxford University Press, latest edition.
3. Shaw, C.T., Using Computational Fluid Dynamics, Prentice Hall, latest edition.
4. Wallis, R.A., Axial Flow Fans and Ducts, John-Wiley, latest edition.
5. Osborne, W.C., Fans, Pergamon, latest edition.

March 2012

Subject Description Form

Subject Code	ME4415
Subject Title	Combustion and Pollution Control
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3406 Engineering Thermodynamics Exclusion: ME4401 Emission and Pollution Control ME4404 Combustion Applications
Objectives	1. To understand fundamental concepts of combustion phenomena and emissions in utilising different fuels. 2. To understand the formation and control of air pollutants. 3. To understand the mathematical models of air pollutant dispersion.
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 mechanisms leading to the formation of different air pollutants. d. Understand the methods and principles of reducing air pollution. e. Select appropriate methods for controlling air pollution. f. Determine the air pollutant concentration and dispersion from source(s).
Subject Synopsis/ Indicative Syllabus	***Thermodynamics and Chemical Kinetics of Combustion*** **-** Application of First Law of Thermodynamics. Reactant and product gaseous mixtures. Enthalpy of combustion. Adiabatic flame temperatures. Chemical and partial equilibrium. Global versus elementary reaction rates. Chemical time scales. Preignition kinetics. Global and quasi-global mechanisms. Nitrogen oxide kinetics. ***Combustion of Gaseous and Vaporised Fuels*** **-** Laminar and turbulent premixed flames. Diffusion flames. Mechanisms of flame stabilisation. Explosion limits. Mechanisms of quenching, flammability and ignition. ***Combustion of Liquid Fuels*** **-** Spray formation. Size distribution. Fuel injectors. Spray dynamics. Vaporisation of single droplet. ***Air Pollutants and Their Formation*** **-** Formation of carbon monoxide, nitrogen oxides, unburnt hydrocarbon, soot and particulates. Measurement techniques and quantification of air pollutants. ***Fuels and Emissions*** **-** Gasoline and diesel fuels. LPG, natural gas and biodiesel as alternative fuels. Oxygenated fuels. Effect of sulphur contents on diesel emissions.

Aftertreatment for Motor Vehicle and Power Plant Emissions **-** Two and three way catalysts. Cyclones, precipitators, filters and traps, evaluation of capturing efficiency. Scrubbers for flue gas desulphurisation. NOx reduction. Advanced aftertreatment devices/systems.

Introduction to Air Pollutant Dispersion **-** Chimneys, inversions and the atmosphere. Air pollutant concentration and dispersion from motor vehicles and chimneys. Street canyon effect.

Teaching/Learning Methodology

Lectures are used to deliver the fundamental knowledge in relation to combustion and pollution control. (outcomes a to f)

Tutorials will be conducted in small groups to facilitate assignment discussions.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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	f
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:

$0.5 \times$ End of Subject Examination + $0.5 \times$ 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 tests which cover the first half of the subject material provide 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 Expected	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	ME4502
Subject Title	Aircraft Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3407 Fluid Mechanics
Objectives	To develop students' knowledge of the 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 a good understanding of the principles of flight control. b. Derive transmission and propulsive efficiencies for an aircraft engine. c. Explain the need for transfer and booster pumps in the fuel systems of high-performance aircraft and estimate the maximum take-off weight. d. Identify the flight control and utility functions to be considered in the design of an aircraft hydraulic system. e. Explain the major electrical loads and the characteristics of modern aircraft electrical system. f. Describe the relationship of engine bleed air with major aircraft systems. g. Explain the need for cabin and avionics conditioning and outline recent advances in aircraft environmental control system design. h. 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. ***Powerplant*** **-** 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 h). Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to h). 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 (outcomes e and g).

Teaching/Learning Methodology	Outcomes							
	a	b	c	d	e	f	g	h
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	f	g	h
1. Examination	50 %	√	√	√	√	√	√	√	√
2. Assignment and test	40 %	√	√	√	√	√	√	√	√
3. Industrial field visit and visit report, report for special seminar	10 %					√		√	
Total	100 %								

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5× Continuous Assessment

Examination is adopted to assess students on 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 which provide timely feedbacks to both lecturers and students on various topics of the syllabus. In particular, the assignments are aimed at assisting the students in preparation for the examination and checking the study progress. The reports for field visits and special seminars are aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.

Student Study Effort Expected	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. 2. I. Moir amd A.G. Seabridge, Design and Development of Aircraft Systems – An Introduction, AIAA Education Series, latest edition.	

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Subject Description Form

Subject Code	ME4503
Subject Title	Aviation Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA296 Mathematics II or AMA294 Mathematics II
Objectives	1. To provide an overview of aviation systems to a student that has an interest in the development of careers in aviation. 2. To develop students' understanding of the aviation industry, which comprises various supporting unit systems, operating within one framework to achieve the global objectives of air transport safety and security and the unit-system objectives of operational efficiency and cost-effectiveness. 3. To develop students' understanding of the up-to-date operational concepts, technology applications and practices.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Explain the relationship among major aviation systems and to identify future directions of the industry, taking account of national and global events within and outside the industry. b. Demonstrate an understanding of air traffic management, flight standards and airworthiness services provided by regulatory bodies. c. Understand the management operations of an international airline. d. Understand the logistics issues to be considered in the future development of the Hong Kong International Airport. e. Explain the key role and future plan of the Government Flying Service. f. Identify the quality assurance procedures adopted in aircraft maintenance organizations within Hong Kong and China. g. Identify the environmental impacts of aviation-related activities. h. Analyze the activities of various local aviation organizations in the 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. Aviation Development Council. Guild of Air Pilots and Navigators.
Teaching/Learning Methodology	Lectures are used to deliver the fundamental knowledge in relation to various aspects of aviation systems (outcomes a to h). Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to h). 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, c and h). 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 various aspects of aviation systems (outcomes a, b, c, e, f and h).

Teaching/Learning Methodology	Outcomes							
	a	b	c	d	e	f	g	h
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 assessed (Please tick as appropriate)							
		a	b	c	d	e	f	g	h
1. Assignment	30 %	√	√	√	√	√	√	√	√
2. Group mini-project (including presentation and report)	50 %	√		√					√
3. Industrial field visit and visit report, report for special seminar	20 %	√	√	√		√	√		√
Total	100 %								

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

Overall Assessment: 1.0 × Continuous Assessment

The assessment of the subject is fully based on continuous assessment, including assignments, group mini-projects, industrial visits and special seminars on various topics of the syllabus.

In particular, the assignments are aimed at assisting the students in preparation for the examination and checking the study progress.

Group mini-project is aimed at assessing the students' capacities of self-learning and problem-solving and communication skill in English.

The reports for field visits and special seminars are aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.

Student Study Effort Expected

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.
5. Aviation Week and Space Technology, McGraw-Hill.

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Subject Description Form

Subject Code	ME4504
Subject Title	Aircraft Maintenance Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA296 Mathematics II or AMA294 Mathematics II
Objectives	1 To teach students the fundamental principles of reliability and maintenance engineering. 2 To teach students practical knowledge of mandatory airworthiness requirements and aircraft maintenance.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate a good understanding of aircraft equipment failures and model random failures with statistical distributions. b. Improve aircraft system reliability through multiple redundancy. c. Explain major types of aircraft maintenance activities. d. Demonstrate the ability to deal with component failure interactions. e. Explain the characteristics of major risk evaluation methods and the application of human factors in aircraft maintenance. f. Understand the need for aircraft maintenance programme management.
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. Independent failure modes. Common-mode failures. Series-parallel configurations. Linked configurations. ***Maintained Systems*** **-** Preventive maintenance. Idealized and imperfect maintenance. Corrective maintenance. Availability and maintainability. Constant repair rates. Condition-based maintenance. ***Failure Interactions*** **-** Markov Analysis. Reliability with standby systems. Standby redundancy. ***Risk Analysis & Error Reduction in Aircraft Maintenance*** **-** Fault tree analysis. Failure mode and effect analysis. SHEL model. Reason's model. ***Aircraft Maintenance Programme Management*** **-** MSG 3 analysis. Aircraft repair and overhaul services. Optimisation of maintenance programmes. Low utilization programmes. Maintenance programme management. Modification and continued airworthiness aspects.

Case Studies (Typical examples) - UA Flight 2311, AA Flight 191, etc.

Teaching/Learning Methodology

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

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

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 e and f).

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
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 (Please tick as appropriate)					
		a	b	c	d	e	f
1. Assignment	15 %	√	√	√	√		
2. Project / Case study report and Presentation	15 %	√				√	√
3. Test	20 %	√	√	√	√	√	√
4. Examination	50 %	√	√	√	√	√	√
Total	100 %						

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

Overall Assessment:

0.5 × End of Subject Examination + 0.5 × Continuous Assessment

Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by the assignments and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Written report and oral presentation on a specific project or case study is used to assess the students' knowledge in contemporary aircraft maintenance engineering.

Student Study Effort Expected	Class contact:	
	▪ Lecture	34 Hrs
	▪ Tutorial	8 Hrs
	Other student study effort:	
	▪ Course work: Assignment Project/case study	 12 Hrs 12 Hrs
	▪ Self-study	42 Hrs
	Total student study effort	108 Hrs
Reading List and References	1. HKAR66, CAD, Hong Kong. 2. CAD 418 Condition Monitored Maintenance: an Explanatory Handbook, Civil Aviation Department, Hong Kong, latest edition. 3. J.P. Bentley, An Introduction to Reliability and Quality Engineering, Addison-Wesley, latest edition.	

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Subject Description Form

Subject Code	ME4505
Subject Title	Flight Mechanics and Airplane Performance
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME3407 Fluid Mechanics
Objectives	1. To teach students the fundamental principles of atmospheric flight and airplane aerodynamics. 2. To teach students the consideration of the propulsion characteristics on flight performance. 3. To teach students the principles and 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 different flight operation requirements. c. Explain the roles of fundamental aerodynamic design parameters for steady flight. d. Describe the relationships between the power requirement, maximum velocity, stall velocity, climb characteristics, and flight characteristics of steady flight. e. 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. f. 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.

Experiment(s) on evaluating the effects on aircraft wing profile on aerodynamic force characteristics is/are provided for bridging the knowledge of fluid mechanics with flight performance.

Teaching/Learning Methodology

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

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

Experiments, either in laboratory or numerical setup, are used to relate the concepts to practical applications. Students are exposed to proper use of knowledge taught and learn analysis skills on evaluating their experimental results (outcomes a, c and f).

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. Homework 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:

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

All 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. Examination serves to evaluate how good the students learn and integrate the subject knowledge.	
Student Study Effort Expected	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.	

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