

**THE HONG KONG POLYTECHNIC UNIVERSITY**

**Department of Mechanical Engineering**

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Full-time

**BEng (Hons) Scheme in Mechanical Engineering (43499)**

Awards Offered under the Scheme:

**BEng (Hons) in Mechanical Engineering**

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

(4-Year undergraduate degree structure)

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**Definitive Programme Document**

**(For 2017/18 Cohort)**

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## TABLE OF CONTENTS

### PART A PROGRAMME SCHEME

|       |  |      |
|-------|--|------|
| 1.    | GENERAL INFORMATION .....  | A-1  |
| 1.1   | Programme Title and Programme Code .....   | A-1  |
| 1.2   | Host Department.....   | A-1  |
| 1.3   | Award Title.....   | A-1  |
| 1.4   | Mode of Attendance .....   | A-1  |
| 1.5   | Normal and Maximum Periods of Registration.....  | A-1  |
| 1.6   | Minimum Entrance Requirements.....   | A-2  |
| 2.    | PREAMBLE .....   | A-3  |
| 3.    | RATIONALE, AIMS AND OBJECTIVES.....  | A-4  |
| 3.1   | Aims of ME Scheme .....  | A-4  |
| 3.2   | Programme Aims and Objective of BEng (Hons) in Mechanical Engineering.....<br>(BEngME)   | A-4  |
| 3.3   | Programme Aims and Objective of BEng (Hons) in Product Analysis and.....<br>Engineering Design (BEngPAED)                                    | A-5  |
| 4.    | INTENDED LEARNING OUTCOMES (ILOs) .....  | A-7  |
| 4.1   | PolyU Institutional Learning Outcomes .....  | A-7  |
| 4.2   | Desired Learning Outcomes of The Hong Kong Institution of Engineers (HKIE).....  | A-8  |
| 4.3   | Intended Learning Outcomes of BEngME.....  | A-8  |
| 4.3.1 | Relationship of BEngME Intended Learning Outcomes to Institutional Learning .....  | A-9  |
|       | Outcomes   |      |
| 4.3.2 | Relationship of BEngME Intended Learning Outcomes to the Desired Learning .....  | A-10 |
|       | Outcomes of the Hong Kong Institution of Engineers (HKIE)  |      |
| 4.4   | Intended Learning Outcomes of BEngPAED.....  | A-10 |
| 4.4.1 | Relationship of BEngPAED Intended Learning Outcomes to Institutional Learning...<br>Outcomes   | A-11 |
| 4.4.2 | Relationship of BEngPAED Intended Learning Outcomes to the Desired Learning....<br>Outcomes of the Hong Kong Institution of Engineers (HKIE) | A-11 |
| 4.5   | General Approach to Teaching, Learning and Assessment.....   | A-12 |
| 4.6   | Alignment of Teaching, Learning and Assessment Methods with Programme .....  | A-13 |
|       | Outcomes   |      |
| 5.    | PROGRAMME STRUCTURE, CURRICULUM AND STUDY PATTERN .....  | A-14 |
| 5.1   | General Structure and Curriculum of BEngME and BEngPAED .....  | A-14 |
| 5.2   | Normal Study Pattern of BEngME and BEngPAED .....  | A-20 |
| 5.3   | Work-Integrated Education (WIE) .....  | A-25 |
| 5.4   | Curriculum Mapping with Programme Learning Outcomes .....  | A-25 |

|       |  |      |
|-------|--|------|
| 5.5   | Curriculum Design for Senior Year Intakes of BEngME and BEngPAED .....       | A-29 |
| 5.5.1 | Credit Requirement for Graduation.....                                       | A-29 |
| 5.5.2 | Work-Integrated Education (WIE) .....  | A-29 |
| 5.5.3 | General University Requirements (GUR) for BEngME and BEngPAED Senior .....   | A-30 |
|       | Year Intakes   |      |
| 5.5.4 | Discipline-Specific Requirements (DSR) for BEngME Senior Year Intakes .....  | A-30 |
| 5.5.5 | Discipline-Specific Requirements (DSR) for BEngPAED Senior Year Intakes..... | A-31 |
| 5.6   | Normal Study Pattern of Senior-Year Intakes.....                             | A-32 |
| 6.    | ACADEMIC REGULATIONS AND ASSESSMENT .....                                    | A-34 |
| 6.1   | Subject Registration and Withdrawal.....                                     | A-34 |
| 6.2   | Study Load .....   | A-34 |
| 6.3   | Subject Exemption .....  | A-35 |
| 6.4   | Credit Transfer .....  | A-35 |
| 6.5   | Deferment of Study .....   | A-36 |
| 6.6   | Recording of Disciplinary Actions in Students' Records.....                  | A-37 |
| 6.7   | General Assessment Regulations .....   | A-37 |
| 6.8   | Principles of Assessment.....  | A-37 |
| 6.9   | Assessment Methods .....   | A-38 |
| 6.10  | Progression/Academic Probation/Deregistration .....                          | A-38 |
| 6.11  | Retaking of Subjects.....  | A-39 |
| 6.12  | Exceptional Circumstances .....  | A-40 |
| 6.13  | Grading.....   | A-41 |
| 6.14  | University Graduation Requirements .....                                     | A-43 |
| 7.    | SCHEME/PROGRAMME OPERATION AND MANAGEMENT .....                              | A-50 |
| 7.1   | Departmental Undergraduate Programme Committee .....                         | A-50 |
| 7.2   | Programme Executive Group .....  | A-50 |
| 7.3   | Student-Staff Consultative Committee.....                                    | A-50 |
| 7.4   | Academic Advising.....   | A-50 |
| 8.    | MINOR AND DOUBLE MAJOR.....  | A-52 |
| 8.1   | Minor Study.....   | A-52 |
| 8.2   | Double Majors.....   | A-53 |

## **PART B SYLLABI**

### **GUR Subject**

ENG1003 Freshman Seminar for Engineering ..... B-1

### **Core Subjects**

|          |   |       |
|----------|---|-------|
| AF3625   | Engineering Economics .....                                       | B-5   |
| AMA1110  | Basic Mathematics I – Calculus and Probability & Statistics ..... | B-7   |
| AMA1120  | Basic Mathematics II – Calculus and Linear Algebra.....           | B-10  |
| AMA2111  | Mathematics I.....  | B-13  |
| AMA2112  | Mathematics II .....  | B-16  |
| AP10001  | Introduction to Physics.....                                      | B-19  |
| AP10005  | Physics I.....  | B-21  |
| AP10006  | Physics II.....   | B-23  |
| CBS3241P | Professional Communication in Chinese .....                       | B-25  |
| EE2901S  | Basic Electricity and Electronics .....                           | B-28  |
| ELC3521  | Professional Communication in English.....                        | B-31  |
| ENG2001  | Fundamentals of Materials Science and Engineering .....           | B-34  |
| ENG2002  | Computer Programming.....   | B-37  |
| ENG2003  | Information Technology.....                                       | B-40  |
| ENG3003  | Engineering Management .....                                      | B-42  |
| ENG3004  | Society and the Engineer.....                                     | B-45  |
| ENG4001  | Project Management (core subject for BEngPAED only).....          | B-112 |
| ME22003  | Visualization and Communication in Design Engineering .....       | B-49  |
| ME23001  | Engineering Mechanics.....  | B-53  |
| ME31001  | Dynamics and Vibrations.....                                      | B-56  |
| ME31002  | Linear Systems and Control .....                                  | B-59  |
| ME31003  | System Dynamics.....  | B-62  |
| ME32001  | Manufacturing Fundamentals.....                                   | B-65  |
| ME32002  | Engineering Design Fundamentals .....                             | B-68  |
| ME33001  | Mechanics of Materials .....                                      | B-71  |
| ME34002  | Engineering Thermodynamics .....                                  | B-74  |
| ME34003  | Thermofluid Mechanics .....                                       | B-77  |
| ME34004  | Fluid Mechanics.....  | B-80  |
| ME41004  | Mechatronics and Control.....                                     | B-83  |
| ME42005  | CAD/CAE Technologies for Product Development .....                | B-86  |
| ME42007  | Design for Product Safety and Reliability.....                    | B-89  |

|         |  |       |
|---------|--|-------|
| ME42011 | Fundamentals of Robotics (core subject for BEngPAED only)..... | B-144 |
| ME46002 | Numerical Methods for Engineers .....                          | B-92  |
| ME46003 | Numerical Fluid Mechanics and Heat Transfer .....              | B-95  |
| ME49001 | Final Year Capstone Project.....                               | B-98  |
| ME49003 | Capstone Project .....   | B-101 |
| SD3401  | Designing for Humanities .....                                 | B-105 |
| SD348   | Introduction to Industrial Design .....                        | B-109 |

### **Elective Subjects**

|         |   |       |
|---------|---|-------|
| ENG4001 | Project Management (elective subject for BEngME only) .....         | B-112 |
| ISE376  | Entrepreneurship and Innovation .....                               | B-114 |
| ISE4006 | Integrative Studies in Enterprise Systems and Management .....      | B-117 |
| ISE430  | New Product Planning and Development .....                          | B-120 |
| ME41001 | Automatic Control Systems .....                                     | B-123 |
| ME41002 | Noise Abatement and Control.....                                    | B-126 |
| ME41003 | Principles of Sound and Vibration .....                             | B-129 |
| ME42001 | Artificial Intelligence in Products .....                           | B-132 |
| ME42004 | Development of Green Products .....                                 | B-135 |
| ME42008 | Computer-Aided Technology for Design.....                           | B-138 |
| ME42010 | Industrial Automation .....   | B-141 |
| ME42011 | Fundamentals of Robotics (elective subject for BEngME only).....    | B-144 |
| ME43001 | Advanced Materials for Design and Technology.....                   | B-147 |
| ME43003 | Product Testing Technology .....                                    | B-150 |
| ME44001 | Air Conditioning for Indoor Thermal and Environmental Quality ..... | B-153 |
| ME44002 | Engine Technology .....   | B-156 |
| ME44003 | Combustion and Pollution Control.....                               | B-159 |
| ME44004 | Heat and Mass Transfer .....  | B-162 |
| ME44005 | Alternative Fuels .....   | B-165 |
| ME44007 | Fluids Engineering .....  | B-168 |
| ME45001 | Aerodynamics .....  | B-171 |
| ME45002 | Aircraft Systems.....   | B-174 |
| ME45006 | Aircraft Structure and Engineering Composites .....                 | B-177 |
| ME47005 | Aircraft Performance and Flight Management.....                     | B-179 |
| ME47007 | Aircraft and Spacecraft Propulsion .....                            | B-182 |
| ME47008 | Fundamentals of Aircraft and Spacecraft Design .....                | B-184 |
| ME49002 | Environmental Noise.....  | B-187 |

## **Training Subjects**

|         |  |       |
|---------|--|-------|
| IC2105  | Engineering Communication and Fundamentals ..... | B-190 |
| IC348   | Appreciation of Manufacturing Processes .....    | B-195 |
| IC382   | Multidisciplinary Manufacturing Project .....    | B-198 |
| ME29001 | Continuous Professional Development .....        | B-202 |

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





**PART A**

**PROGRAMME SCHEME**



## 1. GENERAL INFORMATION

### 1.1 Programme Title and Programme Code

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

- Scheme Code: 43499
- JUPAS Code: JS3741

### 1.2 Host Department

Department of Mechanical Engineering

### 1.3 Award Title

There are two awards operating under the ME Scheme:

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

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

### 1.4 Mode of Attendance

Full-time

### 1.5 Normal and Maximum Periods of Registration

| Mode of Study | Normal Duration of Study | Maximum Duration of Study |
|---------------|--------------------------|---------------------------|
| Full-time     | 4 Years                  | 8 Years                   |

## 1.6 Minimum Entrance Requirements

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

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

The general minimum entrance requirements are as follows:

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

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

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

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

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

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

### (d) For those with other Qualifications

A relevant Diploma passed with credit or a relevant Higher Certificate from a recognized institution; or

A relevant Associate Degree / Higher Diploma from a recognized institution.

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

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

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

## 2. PREAMBLE

The Hong Kong Polytechnic University (PolyU) aspires to be a leading university that excels in professional education, applied research and partnership with the industry for the betterment of Hong Kong, the nation and the world. It is the mission of the University (a) To 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 Department of Mechanical Engineering (ME Department) follows closely the progress and development of the University, and shares its vision and mission.

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

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

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

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

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

### **3. RATIONALE, AIMS AND OBJECTIVES**

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

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

#### **3.1 Aims of ME Scheme**

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

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

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

The BEngME programme is designed with the following objectives:

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

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

In order for Hong Kong to remain competitive in the export-led international market, our industries need to evolve their role from low cost Original Equipment Manufacturer (OEM) to high-value-added Original Brand Manufacturer (OBM) to maximize profile margin. It is of utmost importance for our industries to have their own brand name of top quality and innovative products, much like the designer label of other well-developed countries, to maintain a strong competition in the international market. In order to achieve these goals, emphasis should be placed on creativity and top quality of products, which implies the increasingly urgent need for inter-disciplinary expertise of high-end innovative product design and development.

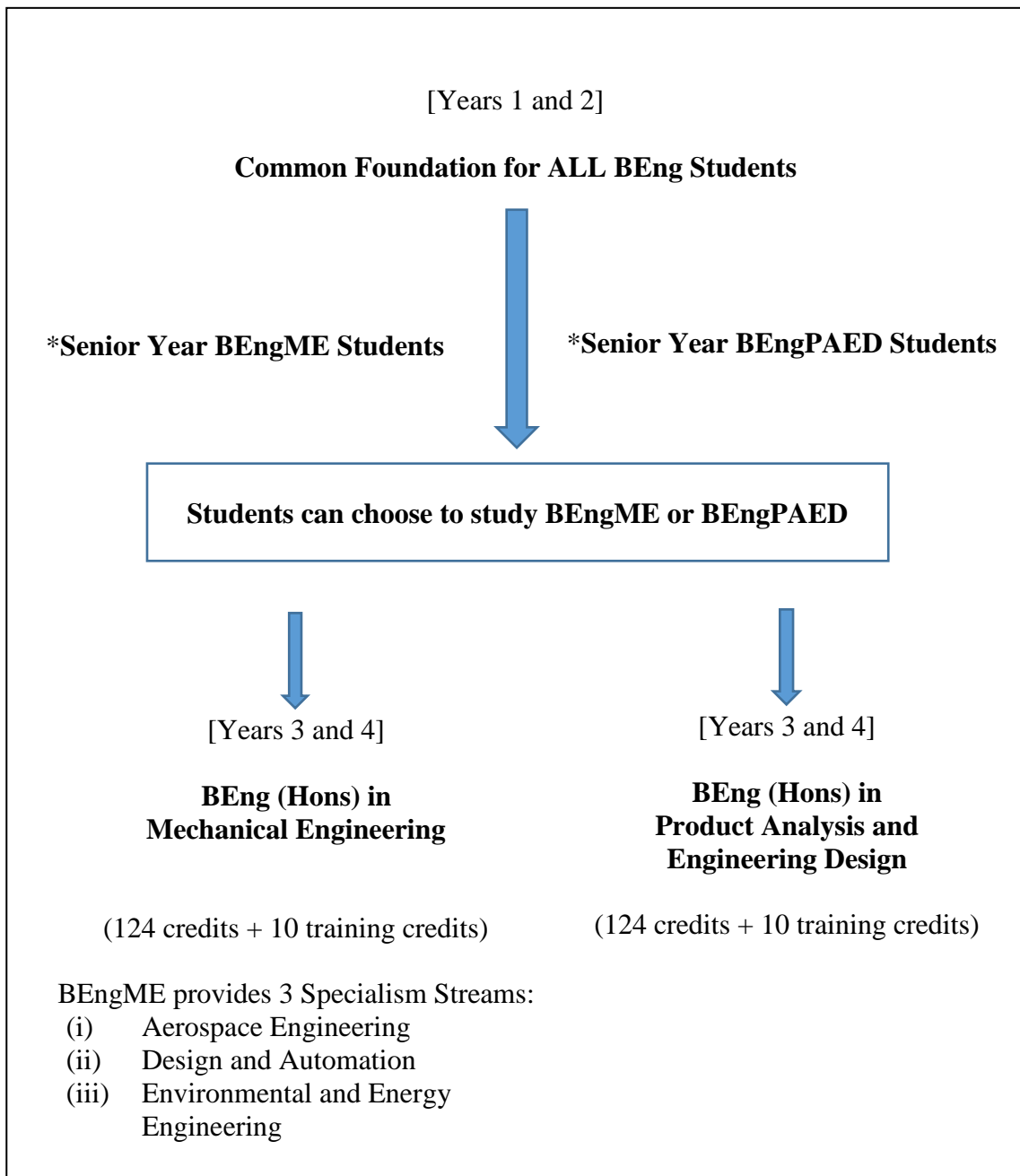
Due to the huge demand of professionals to design and develop innovative high quality products, there are currently several academic programmes offering in Hong Kong at different levels, with the main objective to produce graduates who are able to support the growth of this industrial cluster.

The ME Department identifies an urgent need as well as an excellent opportunity to offer this programme. On the one hand, BEngPAED excels PolyU's niche area in product design and development; on the other hand, BEngPAED produces all-round graduates to support and lead smooth operation and healthy growth of integrated product development cluster in Hong Kong.

The BEngPAED programme is designed with the following objectives:

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

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



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



#### **4. INTENDED LEARNING OUTCOMES (ILOs)**

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

##### **4.1 PolyU Institutional Learning Outcomes**

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

- (a) Competent professional: Graduates should be able to integrate and apply in practice the fundamental knowledge and skills required for functioning effectively as entry-level professionals.
- (b) Critical thinker: Graduates should be able to examine and critique the validity of information, arguments, and different viewpoints, and reach a sound judgment on basis of credible evidence and logical reasoning.
- (c) Effective communicator: Graduates should be able to comprehend and communicate effectively in English and Chinese, orally and in writing, in professional and daily contexts.
- (d) Innovative problem solver: Graduates should be able to identify and define problems in professional and daily contexts, and produce creative and workable solutions to the problems.
- (e) Lifelong learner: Graduates should recognize the need for continual learning and self-development, and be able to plan, manage and improve their own learning in pursuit of self-determined development goals.
- (f) Ethical leader: Graduates should understand leadership and be prepared to lead a team, and should acknowledge their responsibilities as professionals and citizens to society and their own nation, and be able to demonstrate ethical reasoning in professional and daily contexts.

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

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

- (a) an ability to apply knowledge of mathematics, science, and engineering appropriate to the degree discipline;
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- (c) an ability to design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability;
- (d) an ability to function on multi-disciplinary teams;
- (e) an ability to identify, formulate and solve engineering problems;
- (f) an ability to understand professional and ethical responsibility;
- (g) an ability to communicate effectively;
- (h) an ability to understand the impact of engineering solutions in a global and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public;
- (i) an ability to stay abreast of contemporary issues;
- (j) an ability to recognize the need for, and to engage in life-long learning;
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice appropriate to the degree discipline; and
- (l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations

## **4.3 Intended Learning Outcomes of BEngME**

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

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

- (a) an ability to identify, formulate and solve engineering problems;
- (b) an ability to apply their knowledge of mathematics, science and engineering;
- (c) an ability to design and conduct experiments, as well as to analyze and interpret data;
- (d) an ability to design a system, component or process to meet desired needs;
- (e) an ability to use the techniques, skills and modern engineering tools, including computational tools necessary for engineering practice;
- (f) an ability to work professionally in general mechanical systems, including the design and realization of such systems;
- (g) a basic understanding of manufacturing methods.

**(B) Professional outlook and workplace skills (POW)**

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

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

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

**4.3.1 Relationship of BEngME Intended Learning Outcomes to Institutional Learning Outcomes**

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

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

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

## **4.4 Intended Learning Outcomes of BEngPAED**

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

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

- (a) An ability to evaluate consumers' needs and market situation for a new product, and to identify and formulate a design problem by developing design specifications to achieve the planned goals.
- (b) An ability to generate, evaluate and select design concepts with creative design thinking, awareness of business consideration and efficient information search.
- (c) An ability to apply knowledge of arts, mathematics, sciences and engineering, via analytical, computational or experimental approaches, to analyze or predict the performance of a design in the life cycle of product development.
- (d) An ability to assess the impacts of human factors, materials, manufacturing processes, environmental issues, product safety and quality in the design and development of quality products.
- (e) An ability to apply state-of-the-art technology and computer/IT tools related to product development.
- (f) An ability to appreciate the concept and trend in industrial design, and to identify market opportunity, and to understand the approach in generating new design concepts to meet the existing as well as potential market needs.
- (g) An ability to apply project management technique to ensure successful completion of a product development process.

### **(B) Professional outlook and workplace skills (POW)**

- (a) A knowledge of contemporary issues and the broad education necessary to understand the impact of engineering design in a global and societal context.
- (b) An ability to function professionally in a multidisciplinary design team as the leader or team member.
- (c) An awareness of professional ethics and social responsibilities and the drive to achieve quality.
- (d) An ability to communicate effectively and present fluently in English, Chinese and multi-media.
- (e) Recognition of the need for and an ability to engage in life-long learning.

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

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

#### 4.4.1 Relationship of BEngPAED Intended Learning Outcomes to Institutional Learning Outcomes

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

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

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

## **4.5 General Approach to Teaching, Learning and Assessment**

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

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

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

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

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

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

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

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

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

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

## 5 PROGRAMME STRUCTURE, CURRICULUM AND STUDY PATTERN

### 5.1 General Structure and Curriculum of BEngME and BEngPAED

The number of credits required for graduation is 124 academic credits and 10 Industrial Centre Practical Training credits. In addition, students are required to take a non-credit bearing training subject, ME29001 Continuous Professional Development, which requires students to take part in at least 4 industrial visits organized by the Department during the period of their studies. Furthermore, the students are required to fulfill the Work-Integrated Education (WIE).

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

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

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

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

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

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

| Areas  | Credits  |
|--|--|
| Language & Communication Requirements (LCR)  | 9  |
| <ul style="list-style-type: none"> <li>▪ English</li> <li>▪ Chinese</li> </ul>   | <ul style="list-style-type: none"> <li>(6)</li> <li>(3)</li> </ul>                             |
| Cluster Areas Requirements (CAR)   | 12   |
| <ul style="list-style-type: none"> <li>▪ 3 credits from each of the following 4 cluster areas <ul style="list-style-type: none"> <li>○ Human Nature, Relations and Development</li> <li>○ Community, Organisation and Globalisation</li> <li>○ History, Cultures and World Views</li> <li>○ Science, Technology and Environment</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>(3)</li> <li>(3)</li> <li>(3)</li> <li>(3)</li> </ul>   |
| and of which   |  |
| <ul style="list-style-type: none"> <li>▪ A minimum of 3 credits on subjects designated as "China-related"</li> </ul>   |  |
| Other Requirements   | 9  |
| <ul style="list-style-type: none"> <li>▪ Leadership and Intra-personal Development</li> <li>▪ Service-Learning</li> <li>▪ Freshman Seminar</li> <li>▪ Healthy Lifestyle (non-credit bearing)</li> </ul>  | <ul style="list-style-type: none"> <li>(3)</li> <li>(3)</li> <li>(3)</li> <li>(Nil)</li> </ul> |
| <b>Total GUR credits</b>   | <b>30</b>  |



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

| <b>Subject Code</b>  | <b>Subject Title</b>  | <b>Credits</b>                  |
|--|---|---------------------------------|
| AF3625   | Engineering Economics   | 3                               |
| AMA1110  | Basic Mathematics I – Calculus and Probability & Statistics             | 3                               |
| AMA1120  | Basic Mathematics II– Calculus and Linear Algebra                       | 3                               |
| AMA2111  | Mathematics I   | 3                               |
| AMA2112  | Mathematics II  | 3                               |
| AP10005 <sup>(i)</sup>   | Physics I   | 3                               |
| AP10006  | Physics II  | 3                               |
| CBS3241P <sup>(ii)</sup>   | Professional Communication in Chinese                                   | 2                               |
| EE2901S  | Basic Electricity and Electronics                                       | 3                               |
| ELC3521  | Professional Communication in English                                   | 2                               |
| ENG2001 <sup>(iii)</sup>   | Fundamentals of Materials Science and Engineering/<br>Chemistry/Biology | 3                               |
| ENG2002  | Computer Programming  | 3                               |
| ENG2003  | Information Technology  | 3                               |
| ENG3003  | Engineering Management  | 3                               |
| ENG3004  | Society and the Engineer  | 3                               |
| ME22003  | Visualization and Communication in Design Engineering                   | 3                               |
| ME23001  | Engineering Mechanics   | 3                               |
| ME31001  | Dynamics and Vibrations   | 3                               |
| ME31002  | Linear Systems and Control  | 3                               |
| ME32001  | Manufacturing Fundamentals  | 3                               |
| ME32002  | Engineering Design Fundamentals   | 3                               |
| ME33001  | Mechanics of Materials  | 3                               |
| ME34002  | Engineering Thermodynamics  | 3                               |
| ME34004  | Fluid Mechanics   | 3                               |
| ME46002  | Numerical Methods for Engineers   | 3                               |
| ME49001  | Final Year Capstone Project   | 6                               |
| Elective Subject I / II / III / IV / V <sup>(iv)</sup><br>(Students are required to complete five subjects from a pool of elective subjects as listed in Table 5.1.2(a)) |   | 15                              |
| IC2105   | Engineering Communication and Fundamentals                              | 4 (training credits)            |
| IC348  | Appreciation of Manufacturing Processes                                 | 3 (training credits)            |
| IC382  | Multidisciplinary Manufacturing Project                                 | 3 (training credits)            |
| ME29001  | Continuous Professional Development                                     | Nil                             |
| <b>Total number of DSR credits</b>   |   | <b>94 + 10 training credits</b> |

Notes:

- (i) Students who do not have Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics), or the equivalent qualifications, additional credits on “AP10001 Introduction to Physics” should be taken before studying “AP10005 Physics I”.
- (ii) Non-Chinese speakers or those whose Chinese standards are at junior secondary level or below will be exempted from the Discipline-Specific Chinese Language requirement. Students of this category can take a replacement subject of any level to make up for credit requirement.
- (iii) Students must choose one subject from the list of subjects below:

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

#### #Double fulfilment of DSR and CAR

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

- (iv) Elective Subjects<sup>^</sup>  
Students are required to study five elective subjects. They may choose five elective subjects from Table 5.1.2(a). Most of the elective subjects are classified into the following three specialism streams:
  - (a) Aerospace Engineering (AE)
  - (b) Design and Automation (DA)
  - (c) Environmental and Energy Engineering (EE)

Students completing four elective subjects from any one of the above specialism streams are considered to have completed a stream of study in that specialism. A list of elective subjects is shown in Table 5.1.2(a).

**Table 5.1.2(a) - Elective Subjects for BEngME**

| Elective Subjects ^   | Specialism Stream |    |    |
|---|-------------------|----|----|
|   | AE                | DA | EE |
| ENG4001 Project Management  | √                 | √  | √  |
| ME41001 Automatic Control System                                      |                   | √  |    |
| ME41002 Noise Abatement and Control                                   |                   |    | √  |
| ME41003 Principles of Sound and Vibration                             |                   |    | √  |
| ME42001 Artificial Intelligence in Products                           |                   | √  |    |
| ME42004 Development of Green Products                                 |                   | √  |    |
| ME42008 Computer-Aided Technology for Design                          |                   | √  |    |
| ME42010 Industrial Automation   |                   | √  |    |
| ME42011 Fundamentals of Robotics                                      |                   | √  |    |
| ME43001 Advanced Materials for Design and Technology                  |                   | √  |    |
| ME43003 Product Testing Technology                                    |                   | √  |    |
| ME44001 Air Conditioning for Indoor Thermal and Environmental Quality |                   |    | √  |
| ME44002 Engine Technology   |                   |    | √  |
| ME44003 Combustion and Pollution Control                              |                   |    | √  |
| ME44004 Heat and Mass Transfer  | √                 |    | √  |
| ME44005 Alternative Fuels   |                   |    | √  |
| ME44007 Fluids Engineering  |                   |    | √  |
| ME45001 Aerodynamics  | √                 |    |    |
| ME45002 Aircraft Systems  | √                 |    |    |
| ME45006 Aircraft Structure and Engineering Composites                 | √                 |    |    |
| ME47005 Aircraft Performance and Flight Management                    | √                 |    |    |
| ME47007 Aircraft and Spacecraft Propulsion                            | √                 |    |    |
| ME47008 Fundamentals of Aircraft and Spacecraft Design                | √                 |    |    |
| ME49002 Environmental Noise   |                   |    | √  |

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

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

| <b>Subject Code</b>                               | <b>Subject Title</b>  | <b>Credits</b>                  |
|---|---|---------------------------------|
| AF3625  | Engineering Economics   | 3                               |
| AMA1110   | Basic Mathematics I – Calculus and Probability &                        | 3                               |
| AMA1120   | Basic Mathematics II– Calculus and Linear Algebra                       | 3                               |
| AMA2111   | Mathematics I   | 3                               |
| AP10005 <sup>(i)</sup>                            | Physics I   | 3                               |
| AP10006   | Physics II  | 3                               |
| CBS3241P <sup>(ii)</sup>                          | Professional Communication in Chinese                                   | 2                               |
| EE2901S   | Basic Electricity and Electronics                                       | 3                               |
| ELC3521   | Professional Communication in English                                   | 2                               |
| ENG2001 <sup>(iii)</sup>                          | Fundamentals of Materials Science and Engineering/<br>Chemistry/Biology | 3                               |
| ENG2002   | Computer Programming  | 3                               |
| ENG2003   | Information Technology  | 3                               |
| ENG3004   | Society and the Engineer  | 3                               |
| ENG4001   | Project Management  | 3                               |
| ME22003   | Visualization and Communication in Design Engineering                   | 3                               |
| ME23001   | Engineering Mechanics   | 3                               |
| ME32001   | Manufacturing Fundamentals  | 3                               |
| ME32002   | Engineering Design Fundamentals   | 3                               |
| ME31003   | System Dynamics   | 3                               |
| ME33001   | Mechanics of Materials  | 3                               |
| ME34003   | Thermofluid Mechanics   | 3                               |
| ME41004   | Mechatronics and Control  | 3                               |
| ME42005   | CAD/CAE Technologies for Product Development                            | 3                               |
| ME42007   | Design for Product Safety and Reliability                               | 3                               |
| ME42011   | Fundamentals of Robotics  | 3                               |
| ME46003   | Numerical Fluid Mechanics and Heat Transfer                             | 3                               |
| ME49003   | Capstone Project  | 6                               |
| SD348   | Introduction to Industrial Design                                       | 3                               |
| SD3401  | Designing for Humanities  | 3                               |
| Elective Subject I (as listed in Table 5.1.3(a))  |   | 3                               |
| Elective Subject II (as listed in Table 5.1.3(a)) |   | 3                               |
| IC2105  | Engineering Communication and Fundamentals                              | 4 (training credits)            |
| IC348   | Appreciation of Manufacturing Processes                                 | 3 (training credits)            |
| IC382   | Multidisciplinary Manufacturing Project                                 | 3 (training credits)            |
| ME29001   | Continuous Professional Development                                     | Nil                             |
| <b>Total number of DSR credits</b>                |   | <b>94 + 10 training credits</b> |

Notes:

- (i) Students who do not have Level 2 or above in HKDSE Physics (or Combined Science with a component in Physics), or the equivalent qualifications, additional credits on “AP10001 Introduction to Physics” should be taken before studying “AP10005 Physics I”.
- (ii) Non-Chinese speakers or those whose Chinese standards are at junior secondary level or below will be exempted from the Discipline-Specific Chinese Language requirement. Students of this category can take a replacement subject of any level to make up for credit requirement.
- (iii) Students must choose one subject from the list of subjects below:

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

**#Double fulfilment of DSR and CAR**

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

**Table 5.1.3(a) - Elective Subjects for BEngPAED**

| Elective Subject I <sup>^</sup><br><i>(Students must choose at least one subject from the following list)</i> | Elective Subject II <sup>^</sup><br><i>(Students must choose at least one subject from the following list)</i> |
|---|--|
| ISE376 Entrepreneurship and Innovation  | ME42001 Artificial Intelligence in Products  |
| ISE430 New Product Planning and Development   | ME42004 Development of Green Products  |
| ISE4006 Integrative Studies in Enterprise Systems and Management  | ME43003 Product Testing Technology   |

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

## 5.2 Normal Study Pattern of BEngME and BEngPAED

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

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

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

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

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

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

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

| <b>Year 1 (Common with PAED) (33 academic credits + 4 training credits)</b> |   |
|---|---|
| <b>Semester 1 (15 + 2 training credits)</b>                                 | <b>Semester 2 (18 + 2 training credits)</b>                                   |
| AMA1110 Basic Mathematics I   | AMA1120 Basic Mathematics II  |
| AP10005 Physics I   | AP10006 Physics II  |
| CAR I ^^  | APSS1L01 Tomorrow's Leaders   |
| ENG1003 Freshman Seminars for Engineering                                   | CAR II ^^   |
| LCR I English Language Subject  | ENG2003 Information Technology  |
|   | LCR II English Language Subject   |
| Healthy Lifestyle (non-credit bearing)^^                                    |   |
| IC2105 Engineering Communication and Fundamentals (4 training credits)      |   |
| <b>Year 2 (Common with PAED) (33 academic credits + 3 training credits)</b> |   |
| <b>Semester 1 (15 + 3 training credits)</b>                                 | <b>Semester 2 (18 credits)</b>  |
| AMA2111 Mathematics I   | CAR IV ^^   |
| CAR III ^^  | EE2901S Basic Electricity and Electronics                                     |
| ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology | ENG2002 Computer Programming  |
| ME22003 Visualization and Communication in Design Engineering               | LCR III Chinese Language Subject  |
| ME23001 Engineering Mechanics   | ME32002 Engineering Design Fundamentals                                       |
| IC348 Appreciation of Manufacturing Processes (3 training credits)          | ME33001 Mechanics of Materials  |
| <b>Year 3 (30 academic credits + 3 training credits)</b>                    |   |
| <b>Semester 1 (15 + 1.5 training credits)</b>                               | <b>Semester 2 (15 + 1.5 training credits)</b>                                 |
| AF3625 Engineering Economics  | ME31002 Linear Systems and Control  |
| AMA2112 Mathematics II  | ME32001 Manufacturing Fundamentals  |
| ENG3003 Engineering Management  | ME34004 Fluid Mechanics   |
| ME31001 Dynamics and Vibrations   | ME46002 Numerical Methods for Engineers                                       |
| ME34002 Engineering Thermodynamics  | Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^ |
| IC382 Multidisciplinary Manufacturing Project (3 training credits)          |   |
| <b>Year 4 (28 academic credits)</b>   |   |
| <b>Semester 1 (13 credits)</b>  | <b>Semester 2 (15 credits)</b>  |
| CBS3241P Professional Communication in Chinese (2 credits)                  | ENG3004 Society and the Engineer  |
| ELC3521 Professional Communication in English (2 credits)                   | Elective Subject III  |
| Elective Subject I  | Elective Subject IV   |
| Elective Subject II   | Elective Subject V  |
| ME49001 Final Year Capstone Project (6 academic credits)                    |   |

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

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

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

| <b>Year 1 (Common with PAED) (33 academic credits + 4 training credits)</b> |   |
|---|---|
| <b>Semester 1 (15 + 2 training credits)</b>                                 | <b>Semester 2 (18 + 2 training credits)</b>                                   |
| AMA1110 Basic Mathematics I   | AMA1120 Basic Mathematics II  |
| AP10001 Introduction to Physics   | AP10005 Physics I   |
| CAR I ^^  | APSS1L01 Tomorrow's Leaders   |
| ENG1003 Freshman Seminars for Engineering                                   | CAR II ^^   |
| LCR I English Language Subject  | ENG2003 Information Technology  |
|   | LCR II English Language Subject   |
| Healthy Lifestyle (non-credit bearing)^^                                    |   |
| IC2105 Engineering Communication and Fundamentals (4 training credits)      |   |
| <b>Year 2 (Common with PAED) (36 academic credits + 3 training credits)</b> |   |
| <b>Semester 1 (18 + 3 training credits)</b>                                 | <b>Semester 2 (18 credits)</b>  |
| AMA2111 Mathematics I   | CAR IV ^^   |
| AP10006 Physics II  | EE2901S Basic Electricity and Electronics                                     |
| CAR III ^^  | ENG2002 Computer Programming  |
| ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology | LCR III Chinese Language Subject  |
| ME22003 Visualization and communication in Design Engineering               | ME32002 Engineering Design Fundamentals                                       |
| ME23001 Engineering Mechanics   | ME33001 Mechanics of Materials  |
| IC348 Appreciation of Manufacturing Processes (3 training credits)          |   |
| <b>Year 3 (30 academic credits + 3 training credits)</b>                    |   |
| <b>Semester 1 (15 + 1.5 training credits)</b>                               | <b>Semester 2 (15 + 1.5 training credits)</b>                                 |
| AF3625 Engineering Economics  | ME31002 Linear Systems and Control  |
| AMA2112 Mathematics II  | ME32001 Manufacturing Fundamentals  |
| ENG3003 Engineering Management  | ME34004 Fluid Mechanics   |
| ME31001 Dynamics and Vibrations   | ME46002 Numerical Methods for Engineers                                       |
| ME34002 Engineering Thermodynamics  | Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^ |
| IC382 Multidisciplinary Manufacturing Project (3 training credits)          |   |
| <b>Year 4 (28 academic credits)</b>   |   |
| <b>Semester 1 (13 credits)</b>  | <b>Semester 2 (15 credits)</b>  |
| CBS3241P Professional Communication in Chinese (2 credits)                  | ENG3004 Society and the Engineer  |
| ELC3521 Professional Communication in English (2 credits)                   | Elective Subject III  |
| Elective Subject I  | Elective Subject IV   |
| Elective Subject II   | Elective Subject V  |
| ME49001 Final Year Capstone Project (6 academic credits)                    |   |

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



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

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

| <b>Year 1 (Common with ME) (33 academic credits + 4 training credits)</b>     |  |
|---|--|
| <b>Semester 1 (15 + 2 training credits)</b>                                   | <b>Semester 2 (18 + 2 training credits)</b>                |
| AMA1110 Basic Mathematics I   | AMA1120 Basic Mathematics II                               |
| AP10005 Physics I   | AP10006 Physics II   |
| CAR I ^^  | APSS1L01 Tomorrow's Leaders                                |
| ENG1003 Freshman Seminars for Engineering                                     | CAR II ^^  |
| LCR I English Language Subject  | ENG2003 Information Technology                             |
|   | LCR II English Language Subject                            |
| Healthy Lifestyle (non-credit bearing) ^^                                     |  |
| IC2105 Engineering Communication and Fundamentals (4 training credits)        |  |
| <b>Year 2 (Common with ME) (33 academic credits + 3 training credits)</b>     |  |
| <b>Semester 1 (15 + 3 training credits)</b>                                   | <b>Semester 2 (18 credits)</b>                             |
| AMA2111 Mathematics I   | CAR IV ^^  |
| CAR III ^^  | EE2901S Basic Electricity and Electronics                  |
| ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology   | ENG2002 Computer Programming                               |
| ME22003 Visualization and Communication in Design Engineering                 | LCR III Chinese Language Subject                           |
| ME23001 Engineering Mechanics   | ME32002 Engineering Design Fundamentals                    |
| IC348 Appreciation of Manufacturing Processes (3 training credits)            | ME33001 Mechanics of Materials                             |
| <b>Year 3 (31 academic credits + 3 training credits)</b>                      |  |
| <b>Semester 1 (15 + 1.5 training credits)</b>                                 | <b>Semester 2 (16 + 1.5 training credits)</b>              |
| AF3625 Engineering Economics  | CBS3241P Professional Communication in Chinese (2 credits) |
| ME31003 System Dynamics   | ELC3521 Professional Communication in English (2 credits)  |
| ME32001 Manufacturing Fundamentals  | ENG3004 Society and the Engineer                           |
| SD348 Introduction to Industrial Design                                       | ENG4001 Project Management                                 |
| Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^ | ME41004 Mechatronics and Control                           |
|   | SD3401 Designing for Humanities                            |
| IC382 Multidisciplinary Manufacturing Project (3 training credits)            |  |
| <b>Year 4 (27 academic credits)</b>   |  |
| <b>Semester 1 (15 credits)</b>  | <b>Semester 2 (12 credits)</b>                             |
| ME34003 Thermofluid Mechanics   | ME46003 Numerical Fluid Mechanics and Heat Transfer        |
| ME42005 CAD/CAE Technologies for Product Development                          | Elective Subject I   |
| ME42007 Design for Product Safety and Reliability                             | Elective Subject II  |
| ME42011 Fundamentals of Robotics  |  |
| ME49003 Capstone Project (6 academic credits)                                 |  |

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

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

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

| <b>Year 1 (Common with ME) (33 academic credits + 4 training credits)</b>     |  |
|---|--|
| <b>Semester 1 (15 + 2 training credits)</b>                                   | <b>Semester 2 (18 + 2 training credits)</b>                |
| AMA1110 Basic Mathematics I   | AMA1120 Basic Mathematics II                               |
| AP10001 Introduction to Physics   | AP10005 Physics I  |
| CAR I ^^  | APSS1L01 Tomorrow's Leaders                                |
| ENG1003 Freshman Seminars for Engineering                                     | CAR II ^^  |
| LCR I English Language Subject  | ENG2003 Information Technology                             |
|   | LCR II English Language Subject                            |
| Healthy Lifestyle (non-credit bearing) ^^                                     |  |
| IC2105 Engineering Communication and Fundamentals (4 training credits)        |  |
| <b>Year 2 (Common with ME) (36 academic credits + 3 training credits)</b>     |  |
| <b>Semester 1 (18 + 3 training credits)</b>                                   | <b>Semester 2 (18 credits)</b>                             |
| AMA2111 Mathematics I   | CAR IV ^^  |
| AP10006 Physics II  | EE2901S Basic Electricity and Electronics                  |
| CAR III ^^  | ENG2002 Computer Programming                               |
| ENG2001 Fundamentals of Materials Science and Engineering/Chemistry/Biology   | LCR III Chinese Language Subject                           |
| ME22003 Visualization and communication in Design Engineering                 | ME32002 Engineering Design Fundamentals                    |
| ME23001 Engineering Mechanics   | ME33001 Mechanics of Materials                             |
| IC348 Appreciation of Manufacturing Processes (3 training credits)            |  |
| <b>Year 3 (31 academic credits + 3 training credits)</b>                      |  |
| <b>Semester 1 (15 + 1.5 training credits)</b>                                 | <b>Semester 2 (16 + 1.5 training credits)</b>              |
| AF3625 Engineering Economics  | CBS3241P Professional Communication in Chinese (2 credits) |
| ME31003 System Dynamics   | ELC3521 Professional Communication in English (2 credits)  |
| ME32001 Manufacturing Fundamentals  | ENG3004 Society and the Engineer                           |
| SD348 Introduction to Industrial Design                                       | ENG4001 Project Management                                 |
| Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^ | ME41004 Mechatronics and Control                           |
|   | SD3401 Designing for Humanities                            |
| IC382 Multidisciplinary Manufacturing Project (3 training credits)            |  |
| <b>Year 4 (27 academic credits)</b>   |  |
| <b>Semester 1 (15 credits)</b>  | <b>Semester 2 (12 credits)</b>                             |
| ME34003 Thermofluid Mechanics   | ME46003 Numerical Fluid Mechanics and Heat Transfer        |
| ME42005 CAD/CAE Technologies for Product Development                          | Elective I   |
| ME42007 Design for Product Safety and Reliability                             | Elective II  |
| ME42011 Fundamentals of Robotics  |  |
| ME49003 Capstone Project (6 academic credits)                                 |  |

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

### 5.3 Work-Integrated Education (WIE)

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

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

- (a) Integration into the Final Year Capstone Project (ME49001)/Capstone Project (ME49003), which is industrially/commercially based. However, it is most important that the Final Year Capstone Project and WIE activities should be assessed separately. It is equally important that the WIE activities of students working in the same project team should be assessed individually as they can vary from student to student. In addition, the duration of the WIE activities is not necessarily the same as that of the Final Year Capstone Project. In these cases, the credit value of the project incorporating the WIE component will be counted in full towards the GPA calculation.
- (b) Perform during a summer placement in industrial/commercial sector.
- (c) Conduct in a form proposed by students with the prior approval of the WIE coordinator.

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

### 5.4 Curriculum Mapping with Programme Learning Outcomes

An analysis of the curriculum in terms of the coverage of the programme learning outcomes of BEngME and BEngPAED, respectively (as shown in Sections 3.3 and 3.4, respectively), is presented in Tables 5.4.1 (a, b and c) and 5.4.2 (a, b and c). The tables indicate the subjects of Discipline-Specific requirements (DSR), elective and training natures that we **Teach (T)** students, give students **Practice (P)** and **Measure (M)** achievement of the Intended Learning Outcomes (ILOs). In summary, the curriculum address two programme learning outcomes which students are expected to achieve (A) professional/academic knowledge and skills (PAK), and (B) professional outlook and workplace skills (POW). There are seven items for PAK and five items for POW. The technical elective subjects are updated continually to meet the need of the ever-evolving industrial communities in Hong Kong and the South China region. Essentially, they cover most of the programme learning outcomes with variations of themes from subject to subject. The subject learning outcomes to be achieved by every subject of the programme are listed in the syllabi as shown in Part B of this document.

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

| Subject Code | Intended Learning Outcomes (ILOs) of BEngME |     |     |     |    |    |     |     |     |     |     |     |
|--------------|---|-----|-----|-----|----|----|-----|-----|-----|-----|-----|-----|
|              | PAK   |     |     |     |    |    |     | POW |     |     |     |     |
|              | a   | b   | c   | d   | e  | f  | g   | a   | b   | c   | d   | e   |
| AF3625       | T   | T   |     |     | T  |    |     | T   | T   |     | T   | T   |
| AMA1110      | T   | T   |     |     |    |    |     |     |     |     |     |     |
| AMA1120      | T   | T   |     |     |    |    |     |     |     |     |     |     |
| AMA2111      | T   | T   |     |     |    |    |     |     |     |     |     |     |
| AMA2112      | T   | T   |     |     |    |    |     |     |     |     |     |     |
| AP10005      |   | T   |     |     |    |    |     |     |     |     |     |     |
| AP10006      |   | T   |     |     |    |    |     |     |     |     |     |     |
| CBS3241P     |   |     |     |     |    |    |     |     |     |     | TPM |     |
| EE2901S      | T   | T   | TP  | T   | T  |    |     | T   | T   |     |     | T   |
| ELC3521      |   |     |     |     |    |    |     |     |     |     | TPM |     |
| ENG2001      | T   | T   | P   |     |    |    |     | T   |     |     |     |     |
| ENG2002      | T   | T   | P   |     | T  |    |     | T   |     |     |     |     |
| ENG2003      | T   | T   | P   |     | T  |    |     | T   |     |     |     |     |
| ENG3003      |   |     |     |     | T  |    |     | TPM | TPM | TPM | T   | TPM |
| ENG3004      |   |     |     |     |    |    |     | TPM | TPM | TPM | T   | TPM |
| ME22003      | TP  |     |     | TP  |    |    |     | TP  | TP  | TP  | TP  |     |
| ME23001      | TP  | TP  | T   | T   |    | TP | TP  | TP  |     |     | TP  |     |
| ME31001      | T   | T   | PM  | T   |    |    |     |     |     |     |     |     |
| ME31002      | T   | T   | TPM | T   | P  |    |     |     |     |     |     |     |
| ME32001      |   |     |     | TP  | TP | TP | TPM |     | TP  |     | P   |     |
| ME32002      | TP  |     |     | TPM |    | M  |     | TP  | TP  | TP  | TP  | T   |
| ME33001      | TPM   | TPM | TPM | T   | TP | P  |     |     |     |     |     |     |
| ME34002      | TPM   | TPM | TPM |     |    | TM |     | T   |     |     | P   |     |
| ME34004      | TPM   | TPM | TPM |     | TM | TM |     |     |     |     |     |     |
| ME46002      | TP  | TPM | T   |     | TM |    |     | TP  |     |     | TP  |     |
| ME49001      | TPM   | TPM | TP  | TP  | TP | TP | TP  | TP  | TPM | TP  | TPM | TPM |

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

| Subject Code | Intended Learning Outcomes (ILOs) of BEngME |    |    |    |    |    |    |     |    |    |    |    |
|--------------|---|----|----|----|----|----|----|-----|----|----|----|----|
|              | PAK   |    |    |    |    |    |    | POW |    |    |    |    |
|              | a   | b  | c  | d  | e  | f  | g  | a   | b  | c  | d  | e  |
| ENG4001      | TP  | TP | TP | TP | TP | TP | TP | TP  | TP | TP | TP | TP |
| ME41001      | T   | T  | TP | TP | TP |    |    |     |    |    | P  |    |
| ME41002      | TP  | TP |    | TP | TP |    |    |     |    |    | P  |    |
| ME41003      | TP  | TP |    | TP |    |    |    |     |    |    | P  |    |
| ME42001      | TP  | TP | P  | P  | P  | P  |    |     | P  |    | P  | P  |
| ME42004      | T   |    |    | T  |    |    |    | TP  | P  |    | P  | T  |
| ME42008      | T   | T  | T  |    | T  | T  |    |     |    |    |    |    |
| ME42010      | T   | T  | TP | TP |    |    |    |     | P  |    |    | P  |
| ME42011      | T   | T  | TP | TP |    |    |    |     | P  |    |    | P  |
| ME43001      | T   | T  | T  | T  | T  |    | T  | T   | P  |    | P  |    |
| ME43003      |   |    | T  | T  | T  |    |    |     | P  |    | P  | T  |
| ME44001      | T   | TP |    | T  | TP | T  |    | T   |    |    |    |    |
| ME44002      | T   | TP |    |    |    |    |    | TP  |    |    |    |    |
| ME44003      | T   | TP |    |    |    |    |    | TP  |    |    |    |    |
| ME44004      | TP  | TP |    |    |    |    |    | T   |    |    |    |    |
| ME44005      | TP  | TP |    |    |    |    |    | T   |    |    |    | T  |
| ME44007      | T   | T  | T  |    | T  | T  |    |     |    |    |    |    |
| ME45001      | TP  | TP |    |    |    |    |    | T   |    |    |    |    |
| ME45002      | T   | T  |    |    |    |    |    | T   | T  | T  |    | T  |
| ME45006      | T   | T  |    |    |    |    |    | T   | T  |    |    |    |
| ME47005      | T   | T  |    |    |    |    |    | T   | T  |    |    |    |
| ME47007      | TP  | TP | TP | TP |    |    |    |     |    |    |    |    |
| ME47008      | TP  | TP | TP | TP |    |    |    |     |    |    |    |    |
| ME49002      | TP  | TP |    | TP |    |    |    | TP  |    | T  | PM | PM |

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

| Subject Code | Intended Learning Outcomes (ILOs) of BEngME |    |    |    |    |    |    |     |    |    |   |   |
|--------------|---|----|----|----|----|----|----|-----|----|----|---|---|
|              | PAK   |    |    |    |    |    |    | POW |    |    |   |   |
|              | a   | b  | c  | d  | e  | f  | g  | a   | b  | c  | d | e |
| IC2105       | TP  | TP | TP |    | TP | TP | TP |     |    |    |   |   |
| IC348        |   |    |    | P  | P  | P  | PM |     |    |    |   |   |
| IC382        |   |    |    | PM | P  | PM | P  |     | PM | PM | P |   |
| ME29001      |   |    |    |    |    |    |    | P   |    | P  |   |   |
| WIE          |   |    |    |    |    |    |    | P   | P  | P  | P | P |

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

| Subject Code | Intended Learning Outcomes (ILOs) of BEngPAED |     |     |     |     |     |     |     |     |     |     |     |
|--------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|              | PAK   |     |     |     |     |     |     | POW |     |     |     |     |
|              | a   | b   | c   | d   | e   | f   | g   | a   | b   | c   | d   | e   |
| AF3625       | T   | T   |     |     |     | T   |     | T   | T   |     | T   | T   |
| AMA1110      | T   | T   | T   |     |     |     |     |     |     |     |     |     |
| AMA1120      | T   | T   | T   |     |     |     |     |     |     |     |     |     |
| AMA2111      | T   | T   | T   |     |     |     |     |     |     |     |     |     |
| AP10005      |   |     | T   |     |     |     |     |     |     |     |     |     |
| AP10006      |   |     | T   |     |     |     |     |     |     |     |     |     |
| CBS3241P     |   |     |     |     |     |     |     |     |     |     | TPM |     |
| EE2901S      | T   | T   | TP  | T   | T   |     |     | T   | T   |     |     | T   |
| ELC3521      |   |     |     |     |     |     |     |     |     |     | TPM |     |
| ENG2001      | T   | T   | P   |     |     |     |     | T   |     |     |     |     |
| ENG2002      | T   | T   | P   |     | T   |     |     | T   |     |     |     |     |
| ENG2003      | T   | T   | P   |     | T   |     |     | T   |     |     | TP  |     |
| ENG3004      |   |     |     |     |     |     | TP  | TPM | T   | TPM | T   | T   |
| ENG4001      |   |     |     | TPM | TP  |     | TPM | TP  | TPM |     |     |     |
| ME22003      | TP  |     |     | TP  |     |     |     | TP  | TP  | TP  | TP  |     |
| ME23001      |   | TP  | TPM |     | P   |     |     |     | TP  |     | T   |     |
| ME31003      |   | TP  | TPM |     |     |     |     |     |     |     | T   |     |
| ME32001      |   |     |     | TP  | TP  | TP  | TPM |     | TP  |     | P   |     |
| ME32002      | TP  |     |     | TPM |     | M   |     | TP  | TP  | TP  | TP  | T   |
| ME33001      | TPM   | TPM | TPM | T   | TP  | P   |     |     |     |     |     |     |
| ME34003      | TP  | TPM | TPM |     | TP  |     |     | TP  |     |     | TP  |     |
| ME41004      |   | TPM | TPM | T   | TP  |     |     |     |     |     | P   |     |
| ME42005      |   | TP  | TP  | TP  | TPM | TP  | TP  |     |     |     |     | TPM |
| ME42007      | TP  |     | TP  | TPM | TP  | TP  | TP  | TPM | TPM | TPM | P   |     |
| ME42011      |   |     | TPM |     | TPM |     |     |     | P   |     |     | P   |
| ME46003      |   |     | TPM |     | TPM |     |     |     |     |     | P   | P   |
| ME49003      | TPM   | TPM | TP  | TPM | TP  | TPM | TP  | TP  | TPM | TP  | TPM | TPM |
| SD348        | T   | TP  | TP  | TP  | P   | TP  | TP  | TP  | TP  |     | TP  |     |
| SD3401       |   |     |     |     | P   | TP  |     | TP  |     |     |     |     |

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

| Subject Code | Intended Learning Outcomes (ILOs) of BEngPAED |     |     |     |     |     |   |     |   |   |   |   |
|--------------|---|-----|-----|-----|-----|-----|---|-----|---|---|---|---|
|              | PAK   |     |     |     |     |     |   | POW |   |   |   |   |
|              | a   | b   | c   | d   | e   | f   | g | a   | b | c | d | e |
| ISE376       | TPM   | TPM |     | TPM |     | TPM |   |     | P |   |   | P |
| ISE430       | TPM   | TPM |     | TPM |     | TPM |   |     | P |   |   | P |
| ISE4006      | TPM   | TPM |     | TPM |     | TPM |   |     | P |   |   | P |
| ME42001      |   |     | TPM |     | TPM |     |   | p   |   |   |   | P |
| ME42004      |   |     | TPM |     | TPM |     |   | p   |   |   |   | P |
| ME43003      |   |     | TPM |     | TPM |     |   | p   |   |   |   | P |

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

| Subject Code | Intended Learning Outcomes (ILOs) of BEngPAED |    |    |    |    |    |    |     |    |    |   |   |
|--------------|---|----|----|----|----|----|----|-----|----|----|---|---|
|              | PAK   |    |    |    |    |    |    | POW |    |    |   |   |
|              | a   | b  | c  | d  | e  | f  | g  | a   | b  | c  | d | e |
| IC2105       | TP  | TP | TP |    | TP | TP | TP |     |    |    |   |   |
| IC348        |   |    |    | P  | P  | P  | PM |     |    |    |   |   |
| IC382        |   |    |    | PM | P  | PM | P  |     | PM | PM | P |   |
| ME29001      |   |    |    |    |    |    |    | P   |    | P  |   |   |
| WIE          |   |    |    |    |    |    |    | P   | P  | P  | P | P |

## 5.5 Curriculum Design for Senior Year Intakes of BEngME and BEngPAED

### 5.5.1 Credit Requirements for Graduation

Normally 64 (plus 6 IC training credits)\*

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

### 5.5.2 Work-Integrated Education (WIE)

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

For details, please refer to Section 5.3.

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

| Areas   | Credits  |
|---|----------|
| Cluster Areas Requirements (CAR)<br>■ 6 credits from any <b>two</b> of the following 4 cluster areas <ul style="list-style-type: none"> <li>○ Human Nature, Relations and Development</li> <li>○ Community, Organization and Globalization</li> <li>○ History, Cultures and World Views</li> <li>○ Science, Technology and Environment</li> </ul> and of which <ul style="list-style-type: none"> <li>■ Students need to fulfill the English and Chinese reading and writing requirements and 3 credits of China Studies requirement (CSR).</li> <li>■ Students may apply for a waiver if they have fulfilled the English and Chinese reading and writing requirements and/or CSR requirement in their previous studies.</li> </ul> | 6        |
| Service-Learning  | 3        |
| Language and Communication Requirements (LCR) **  | -        |
| <b>Total GUR credits</b>  | <b>9</b> |
| ** This is normally not required. Only those students not meeting the equivalent standard of the Undergraduate Degree LCR (based on their previous studies in AD/HD programmes and their academic performance) will be required to take degree LCR subjects on top of the normal curriculum requirement.  |          |

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

| Subject Code | Subject Title                         | Credits |
|--------------|---------------------------------------|---------|
| AMA2112      | Mathematics II                        | 3       |
| CBS3241P     | Professional Communication in Chinese | 2       |
| ELC3521      | Professional Communication in English | 2       |
| ENG3003      | Engineering Management                | 3       |
| ENG3004      | Society and the Engineer              | 3       |
| ME31001      | Dynamics and Vibrations               | 3       |
| ME31002      | Linear Systems and Control            | 3       |
| ME32001      | Manufacturing Fundamentals            | 3       |
| ME33001      | Mechanics of Materials                | 3       |
| ME34002      | Engineering Thermodynamics            | 3       |
| ME34004      | Fluid Mechanics                       | 3       |
| ME46002      | Numerical Methods for Engineers       | 3       |
| ME49001      | Final Year Capstone Project           | 6       |



| Subject Code   | Subject Title                           | Credits                        |
|--|---|--------------------------------|
| Elective Subject I / II / III / IV / V<br>(Students are required to complete five subjects from a pool of elective subjects as listed in Table 5.1.2(a)) |   | 15                             |
| IC348  | Appreciation of Manufacturing Processes | 3 (training credits)           |
| IC382  | Multidisciplinary Manufacturing Project | 3 (training credits)           |
| ME29001  | Continuous Professional Development     | Nil                            |
| <b>Total number of DSR credits</b>   |   | <b>55 + 6 training credits</b> |

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

| Subject Code                                      | Subject Title                                | Credits                        |
|---|--|--------------------------------|
| CBS3241P  | Professional Communication in Chinese        | 2                              |
| ELC3521   | Professional Communication in English        | 2                              |
| ENG3004   | Society and the Engineer                     | 3                              |
| ENG4001   | Project Management                           | 3                              |
| ME31003   | System Dynamics                              | 3                              |
| ME32001   | Manufacturing Fundamentals                   | 3                              |
| ME33001   | Mechanics of Materials                       | 3                              |
| ME34003   | Thermofluid Mechanics                        | 3                              |
| ME41004   | Mechatronics and Control                     | 3                              |
| ME42005   | CAD/CAE Technologies for Product Development | 3                              |
| ME42007   | Design for Product Safety and Reliability    | 3                              |
| ME42011   | Fundamentals of Robotics                     | 3                              |
| ME46003   | Numerical Fluid Mechanics and Heat Transfer  | 3                              |
| ME49003   | Capstone Project                             | 6                              |
| SD348   | Introduction to Industrial Design            | 3                              |
| SD3401  | Designing for Humanities                     | 3                              |
| Elective Subject I (as listed in Table 5.1.3(a))  |  | 3                              |
| Elective Subject II (as listed in Table 5.1.3(a)) |  | 3                              |
| IC348   | Appreciation of Manufacturing Processes      | 3 (training credits)           |
| IC382   | Multidisciplinary Manufacturing Project      | 3 (training credits)           |
| ME29001   | Continuous Professional Development          | Nil                            |
| <b>Total number of DSR credits</b>                |  | <b>55 + 6 training credits</b> |

## 5.6 Normal Study Pattern of Senior-Year Intakes

Table 5.6.1 and 5.6.2 outlines the normal 2-year study patterns for BEngME and BEngPAED Senior Year Intakes respectively.

**Table 5.6.1 - Normal Progression Pattern for BEngME Senior Year**

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

| <b>Year 1 (33 academic credits + 6 training credits)</b>                      |  |
|---|--|
| <b>Semester 1 (18 + 3 training credits)</b>                                   | <b>Semester 2 (15 + 1.5 training credits)</b>                        |
| AMA2112 Mathematics II  | CAR II ^^  |
| CAR I ^^  | ME31002 Linear Systems and Control                                   |
| ME31001 Dynamics and Vibrations   | ME32001 Manufacturing Fundamentals                                   |
| ME33001 Mechanics of Materials  | ME34004 Fluid Mechanics  |
| ME34002 Engineering Thermodynamics  | ME46002 Numerical Methods for Engineers                              |
| Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^ | IC382 Multidisciplinary Manufacturing Project (1.5 training credits) |
| IC348 Appreciation of Manufacturing Processes (3 training credits)            |  |
| <b>Summer Term (1.5 training credits)</b>                                     |  |
| IC382 Multidisciplinary Manufacturing Project (1.5 training credits)          |  |
| <b>Year 2 (31 academic credits)</b>   |  |
| <b>Semester 1 (16 credits)</b>  | <b>Semester 2 (15 credits)</b>                                       |
| CBS3241P Professional Communication in Chinese (2 credits)                    | ENG3004 Society and the Engineer                                     |
| ELC3521 Professional Communication in English (2 credits)                     | Elective Subject III   |
| ENG3003 Engineering Management  | Elective Subject IV  |
| Elective Subject I  | Elective Subject V   |
| Elective Subject II   |  |
| ME49001 Final Year Capstone Project (6 credits)                               |  |

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

**Table 5.6.2 - Normal Progression Pattern for BEngPAED Senior Year**

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

| <b>Year 1 (34 academic credits + 6 training credits)</b>                      |  |
|---|--|
| <b>Semester 1 (18 + 3 training credits)</b>                                   | <b>Semester 2 (16 + 1.5 training credits)</b>                        |
| CAR I ^^  | CAR II ^^  |
| ME31003 System Dynamics   | CBS3241P Professional Communication in Chinese (2 credits)           |
| ME32001 Manufacturing Fundamentals  | ELC3521 Professional Communication in English (2 credits)            |
| ME33001 Mechanics of Materials  | ENG4001 Project Management   |
| SD348 Introduction to Industrial Design                                       | ME41004 Mechatronics and Control                                     |
| Service-learning (recommendation: ME3S01 Engineering Design for Community) ^^ | SD3401 Designing for Humanities                                      |
| IC348 Appreciation of Manufacturing Processes (3 training credits)            | IC382 Multidisciplinary Manufacturing Project (1.5 training credits) |
| <b>Summer Term (1.5 training credits)</b>                                     |  |
| IC382 Multidisciplinary Manufacturing Project (1.5 training credits)          |  |
| <b>Year 2 (30 academic credits)</b>   |  |
| <b>Semester 1 (15 credits)</b>  | <b>Semester 2 (15 credits)</b>                                       |
| ME34003 Thermofluid Mechanics   | ENG3004 Society and the Engineer                                     |
| ME42005 CAD/CAE Technologies for Product Development                          | ME46003 Numerical Fluid Mechanics and Heat Transfer                  |
| ME42007 Design for Product Safety and Reliability                             | Elective Subject I   |
| ME42011 Fundamentals of Robotics  | Elective Subject II  |
| ME49003 Capstone Project (6 credits)  |  |

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

## **6. ACADEMIC REGULATIONS AND ASSESSMENT**

The academic regulations described below are based on the information known as of July 2017. They are subject to review and changes from time to time. Students will be informed of the changes as and when appropriate. Important information relating to students' study is also published in the Student Handbook (website: <http://www.polyu.edu.hk/as/webpage/for-student/student-handbook>).

### **6.1 Subject Registration and Withdrawal**

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

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

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

### **6.2 Study Load**

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

The normal study load is 15 credits in a semester. The maximum study load to be taken by a student in a semester is 21 credits, unless exceptional approval is given by the Head of the

programme offering Department (or his/her delegates). For such cases, students should be reminded that the study load approved should not be taken as grounds for academic appeal.

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

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

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

### **6.3 Subject Exemption**

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

### **6.4 Credit Transfer**

Students may be given credits for recognised previous studies including mandatory General University Requirements (GUR) subjects; and the credits will be counted towards meeting the requirements for award. Transferred credits may be counted towards more than one award. The granting of credit transfer is a matter of academic judgment.

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

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

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

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

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

Students should not be granted credit transfer for a subject which they have attempted and failed in their current study.

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

## **6.5 Deferment of Study**

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

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

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

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

## **6.6 Recording of Disciplinary Actions in Students' Records**

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

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

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

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

## **6.7 General Assessment Regulations**

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

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

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

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

## **6.8 Principles of Assessment**

Assessment of learning and assessment for learning are both important for assuring the quality of student learning. Assessment of learning is to evaluate whether students have achieved the intended learning outcomes of the subjects that they have taken and have attained the overall learning outcomes of the academic programme at the end of their study at a standard appropriate to the award. Appropriate methods of assessment that align with the intended learning outcomes should be

designed for this purpose. The assessment methods will also enable the teacher to differentiate students' different levels of performance within the subject. Assessment for learning is to engage students in productive learning activities through purposefully designed assessment tasks.

Assessment will also serve as feedback to students. The assessment criteria and standards should be made explicitly to students before the start of the assessment to facilitate student learning, and feedback provided should link to the criteria and standards. Timely feedback should be provided to students so that they are aware of their progress and attainment for the purpose of improvement.

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

## **6.9 Assessment Methods**

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

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

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

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

## **6.10 Progression/Academic Probation/Deregistration**

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



- (i) eligible for progression towards an award; or
- (ii) eligible for an award; or
- (iii) required to be 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 any one of the following categories which shall be regarded as grounds for deregistration from the programme:

- (i) the student has exceeded the maximum period of registration for that programme as specified in the 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.

When a student falls within the categories as stipulated above, the Board of Examiners shall de-register the student from the programme without exception.

A student may be deregistered from the programme enrolled before the time frame specified in the above conditions (ii) or (iii) if his academic performance is poor to the extent that the Board of Examiners deems that his chance of attaining a GPA of 2.0 at the end of the programme is slim or impossible.

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

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

## **6.11 Retaking of Subjects**

Students may 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. However, students who have passed a General University Requirements (GUR) subject are not allowed to retake the same GUR subject for the purpose of improving their 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. Likewise, students who fail in a Cluster Area Requirement (CAR) subject may need to take another subject from the same Cluster Area in order to fulfill this part of the GUR, since the original CAR subject may not be offered, in such cases, the F grade of the first CAR subject will be taken into account in the calculation of the GPA, despite the passing of the second CAR subject. (Note 1)

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

## **6.12 Exceptional Circumstances**

### ***Absence from an assessment component***

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

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

### ***Aegrotat award***

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

whether the student will be granted an aegrotat award. Aegrotat award will be granted under very exceptional circumstances.

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

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

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

### 6.13 Grading

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

| <b>Subject Grade</b> | <b>Short Description</b>  | <b>Elaboration on Subject Grading Description</b>  |
|----------------------|---------------------------|--|
| 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. For subjects which have been retaken, only the grade point obtained in the final attempt will be included in the GPA calculation

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

- (i) Exempted subjects
- (ii) Ungraded subjects
- (iii) Incomplete subjects
- (iv) Subjects for which credit transfer has been approved, but without any grade assigned
- (v) Subjects from which a student has been allowed to withdraw (i.e. those with the grade “W”)

Subject which has been given an “S” code, i.e. absent from assessment, will be included in the GPA calculation and will be counted as “zero” grade point. GPA is thus the unweighted cumulative average calculated for a student, for all relevant subjects taken from the start of the programme to a particular point of time. GPA is an indicator of overall performance, and is capped at 4.0.

### ***Different Types of GPA's***

GPA's will be calculated for each Semester including the Summer Term. This Semester GPA will be used to determine students' eligibility to progress to the next Semester alongside with the 'cumulative GPA'. However, the Semester GPA calculated for the Summer Term will not be used

for this purpose, unless the Summer Term study is mandatory for all students of the programme concerned and constitutes part of the graduation requirements.

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

Along with the “cumulative” GPA, a weighted GPA will also be calculated, to give an indication to the Board of Examiners on the award classification which a student will likely get if he makes steady progress on his academic studies. GUR subjects will be included in the calculation of weighted GPA for all programmes. Weighted GPA will be computed as follows:

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

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

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

For calculating the weighted GPA (and award GPA) to determine the Honours classification of students who satisfy the graduation requirements of Bachelor's degree awards, a University-wide standard weighting will be applied to all subjects of the same level, with a weighting of 2 for Level 1 and 2 subjects, a weighting of 3 for Level 3, 4 and 5 subjects. Although the Industrial Centre training credits are counted in the GPA calculation, they are excluded from the calculation of weighted GPA and award GPA. Same as for GPA, Weighted GPA is capped at 4.0.

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

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

## 6.14 University Graduation Requirements

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

1. Complete successfully the requisite number of credits as defined in Section 5.
2. Earn a cumulative GPA of 2.0 or above at graduation.
3. Complete successfully the mandatory Work-Integrated Education (WIE) component.
4. Satisfy the residential requirement for at least one-third of the normal credit requirement for the award unless the professional bodies concerned stipulate otherwise.
5. Satisfy any other requirements as specified in the Definitive Programme Document.

6. Satisfy the following GUR requirements:

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

(a) **Language and Communication Requirements (LCR)**

**English**

All undergraduate students must successfully complete two 3-credit English language subjects as stipulated by the University (Table A). These subjects are designed to suit students' different levels of English language proficiency at entry, as determined by their HKDSE score or the English Language Centre (ELC) entry assessment (when no HKDSE score is available).

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

Table A - Framework of English LCR subjects

| HKDSE                 | Subject 1 (3 credits)                                   | Subject 2 (3 credits)                                     |
|-----------------------|---|---|
| Level 5 or Equivalent | ELC1014 Advanced English for University Studies (AEUS)  | Any LCR proficient level subject in English (see Table B) |
| Level 4 or Equivalent | ELC1012/ELC1013 English for University Studies (EUS)    | ELC1014 Advanced English for University Studies (AEUS)    |
| Level 3 or equivalent | ELC1011 Practical English for University Studies (PEUS) | ELC1012/ELC1013 English for University Studies (EUS)      |

Table B - LCR Proficient level subjects in English

|  |  |
|--|--|
| For students entering with HKDSE Level 5, or at an equivalent level or above | ELC2011<br>Advanced English Reading and Writing Skills |
|  | ELC2012<br>Persuasive Communication                    |
|  | ELC2013<br>English in Literature and Film              |

## Chinese

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

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

Students who can demonstrate that they have achieved a level beyond that of the course "Advanced Communication Skill in Chinese" as listed in Table C3 (based on an assessment made by CLC) may apply for subject exemption or credit transfer of the LCR subject concerned.

Table C - Framework of Chinese LCR subjects

| <b>HKDSE</b>  | <b>Required Subject (3 credits)</b>                         |
|---|---|
| HKDSE Level 4 and 5 or equivalent   | CBS1102P<br>Advanced Communication Skills in Chinese (ACSC) |
| HKDSE Level 3 or equivalent   | CBS1101P<br>Fundamentals of Chinese Communication (FCC)     |
| For non-Chinese speakers or students whose Chinese standards are at junior secondary level or below | One subject from Table D below                              |

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

| <b>Subject</b>   | <b>Pre-requisite/exclusion</b>   |
|--|--|
| CBS1151 Chinese I<br>(for non-Chinese speaking students)   | <ul style="list-style-type: none"> <li>For non-Chinese speaking students at beginners' level</li> </ul>  |
| CBS1152 Chinese II<br>(for non-Chinese speaking students)  | <ul style="list-style-type: none"> <li>For non-Chinese speaking students; and</li> <li>Students who have completed Chinese I or equivalent</li> </ul>                              |
| CBS2151 Chinese III<br>(for non-Chinese speaking students) | <ul style="list-style-type: none"> <li>For non-Chinese speaking students at higher competence levels; and</li> <li>Students who have completed Chinese II or equivalent</li> </ul> |
| CBS2154 Chinese IV<br>(for non-Chinese speaking students)  | <ul style="list-style-type: none"> <li>For non-Chinese students at intermediate competence levels; and</li> <li>Students who have completed Chinese III or equivalent</li> </ul>   |

| Subject   | Pre-requisite/exclusion   |
|---|---|
| CBS2152 Chinese Literature - Linguistics and Cultural perspectives<br>(for non-Chinese speaking students) | <ul style="list-style-type: none"> <li>For non-Chinese speaking students at higher competence levels</li> </ul> |

Table E - Other LCR Electives in Chinese

| Subject                     | Pre-requisite/exclusion   |                |
|-----------------------------|---|----------------|
| Chinese and the Multimedia  | <ul style="list-style-type: none"> <li>For students entering with HKDSE level 4 or above; or</li> <li>Students with advanced competence level as determined by the entry assessment; or</li> <li>Students who have completed “Fundamentals of Chinese Communication”</li> </ul> | 3 credits each |
| Creative writing in Chinese | <ul style="list-style-type: none"> <li>For students entering with HKDSE level 4 or above; or</li> <li>Students with advanced competence level as determined by the entry assessment; or</li> <li>Students who have completed “Fundamentals of Chinese Communication”</li> </ul> |                |
| Elementary Cantonese        | <ul style="list-style-type: none"> <li>For students whose native language is not Cantonese</li> </ul>   |                |
| Intermediate Cantonese      | <ul style="list-style-type: none"> <li>Successful completion of “Elementary Cantonese”; or</li> <li>Meet a certain standard in a pre-course assessment</li> </ul>   |                |
| Putonghua in the Workplace  | <ul style="list-style-type: none"> <li>Students have completed “Fundamentals of Chinese Communication” or could demonstrate with proof their basic proficiency in Putonghua</li> <li>For students whose native language is not Putonghua</li> </ul>                             |                |

### **Writing Requirement**

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

### **Reading Requirement**

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



A list of approved CAR subjects for meeting the Writing Requirement (with a “W” designation) and for meeting the Reading Requirement (with an “R” designation) is shown at: <https://www2.polyu.edu.hk/as/Polyu/GUR/index.htm>.

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

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

**(b) Freshman Seminar**

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

A list of Freshman Seminars offered by the Broad Disciplines can be found at: <https://www2.polyu.edu.hk/as/Polyu/GUR/index.htm>.

**(c) Leadership and Intra-Personal Development**

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

A list of designated subjects for meeting the leadership and intra-personal development requirement is available at: <https://www2.polyu.edu.hk/as/Polyu/GUR/index.htm>.

**(d) Service-Learning**

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

A list of designated subjects for meeting the service-learning requirement is available at: <https://www2.polyu.edu.hk/as/Polyu/GUR/index.htm>.

**(e) Cluster Areas Requirement (CAR)**

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

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

A list of CAR subjects under each of the four Cluster Areas is available at: <https://www2.polyu.edu.hk/as/Polyu/GUR/index.htm>.

**(f) China Studies Requirement**

Of the 12 credits of CAR described in (e) above, students are required to successfully complete a minimum of 3 credits on CAR subjects designated as “China-related”. The purpose is to enable students to gain an increased understanding of China (e.g. its history, culture and society, as well as emerging issues or challenges).

A list of approved CAR subjects for meeting the China Studies Requirement is available at: <https://www2.polyu.edu.hk/as/Polyu/GUR/index.htm>

**(g) Healthy Lifestyle**

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

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

<http://www.polyu.edu.hk/ogur/student/4yr/gur/hls/revise>

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

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

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

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

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

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

Under exceptional circumstances, a student who has completed an Honours degree programme, but has not attained Honours standard, may be awarded a Pass-without-Honours degree. A Pass-without-Honours degree award will be recommended, when the student has demonstrated a level of final attainment which is below the 'essential minimum' required for graduation with Honours from the programme in question, but when he has nonetheless covered the prescribed work of the programme in an adequate fashion, while failing to show sufficient evidence of the intellectual calibre expected of Honours degree graduates. For example, if a student in an Honours degree programme has a Grade Point Average (GPA) of 2.0 or more, but his Weighted GPA is less than 2.0, he may be considered for a Pass-without-Honours classification. A Pass-without-Honours is an unclassified award, but the award parchment will not include this specification.

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

## **7. SCHEME/PROGRAMME OPERATION AND MANAGEMENT**

### **7.1 Departmental Undergraduate Programme Committee**

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

### **7.2 Programme Executive Group**

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

### **7.3 Student-Staff Consultative Committee**

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

### **7.4 Academic Advising**

There are two components to the academic advising system which PolyU currently provides for students of 4-year undergraduate degree programmes – department-based academic advising (primarily for broad discipline and major programme matters) and academic advising at the institutional level operated by the Office of General University Requirements (primarily for matters related to the GUR).

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

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

- To connect students to resources, opportunities and support within and outside the University that enhance their educational experiences and success.

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

- Building rapport with the students, serving as a bridge that connects them to the department;
- Being accessible and available to students, and responding to their questions and concerns;
- Helping student to consider and clarify their intellectual, professional and personal goals;
- Helping students to develop an appropriate study plan (particularly with regard to their Major), and assisting in their selection of appropriate courses to achieve their identified goals;
- Clarifying to students academic regulations and requirements, particularly those relating to the Major; and
- Identifying students with special learning needs or early signs of learning problems, and referring/encouraging them to seek help or support.

## 8. MINOR AND DOUBLE MAJOR

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

### 8.1 Minor Study

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

- (i) A Minor programme will comprise a collection of subjects totaling 18 credits, with at least 50% of the subjects (9 credits) at Level 3 or above.
- (ii) Students must apply to and obtain approval from the Minor-offering Department, at the start of second year of study.
- (iii) Subject to approval by the Minor-offering Department, students may count up to 6 credits from their Major/GUR subjects [including Language Communication Requirement (LCR) subjects at proficiency level] towards their chosen Minor. Nevertheless, students must take at least 6 credits from their chosen Minor programme in order to satisfy the residential requirement of their chosen Minor. In addition, to be eligible for the Major and Minor awards, the total number of credits taken by the students for their Major-Minor studies must not be lower than the credit requirement of the single discipline Major programme.
- (iv) Only students with a GPA of 2.5 or above can be considered for Minor study enrolment. The Minor-offering Department can also set a quota and additional requirements for enrolment on their Minors.
- (v) Departments have the discretion to allow students who fail to obtain a GPA of 2.5 or above after enrolment, to stay on the Minor programme for a longer while in order to pull up their GPA to the required level.
- (vi) Students must complete their approved Minor as part of their graduation requirements. Students who wish to withdraw from a Minor need to obtain approval from the Minor-offering Department, before the end of the add/drop period of the last Semester of study.
- (vii) Students are required to obtain a GPA of at least 2.0 to satisfy the requirement for graduation with a Major plus a Minor.
- (viii) Since students are expected to complete their approved Minor as part of their graduation requirements, students taking the Major/Minor route will be considered for an award of both the Major and Minor simultaneously, and not separately.
- (ix) Students graduating with a Major plus a Minor will receive one award parchment, which will list the title of the Major programme only. The honours classification will be based on the Major GPA, and reflected accordingly on the parchment. The award title of the Minor programme will not be reflected on the parchment. It will be recorded in the Transcript of Studies.
- (x) There is no guarantee that a clash-free timetable can be provided for all students who pursue Minor study.

## 8.2 Double Majors

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

- (i) Completion of Double Majors requires more than the normative study period of 4/5 years and extra credits on self-financed basis (therefore require higher tuition fee). The total credit requirements of a Double Major will depend on the degree of commonality between the 2 Majors, but should be more than 120 in all instances. Apart from the 30 credits of GUR subjects, up to 1/3 of the Discipline-Specific Requirements (DSR) of the First Major which are common to the Second Major can be double-counted towards the Second Major.
- (ii) Students who wish to take a Second Major must obtain approval from the host Department of the First Major.
- (iii) Only students with a GPA of 3.0 or above can be considered for admission to a Second Major, while Departments offering the Second Major can stipulate a higher GPA requirement if deemed appropriate.
- (iv) Students will be put on academic probation if they fail to obtain a GPA of 2.0 or above.
- (v) Students who wish to withdraw from a Second Major must obtain approval from the Department offering the Second Major, before the end of the add/drop period of the last Semester of study.
- (vi) Students will not be allowed to drop the First Major and continue with the Second Major only. This is to avoid students using the Double Major mechanism to gain a “backdoor” entry to a “popular” and oversubscribed Major programme.
- (vii) Students are required to obtain an overall GPA of at least 2.0, in order to satisfy the requirement for graduation with Double Majors. They will not be allowed to graduate with one of the 2 Majors.
- (viii) Two award parchments will be issued for the Double Majors (one for each Major programme). The honours classification of the two Major awards need not be identical.

**Intended Blank**



## **PART B SYLLABI**



# **GUR Subject**



## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                                    | ENG1003   |
| <b>Subject Title</b>                                   | Freshman Seminar for Engineering  |
| <b>Credit Value</b>                                    | 3   |
| <b>Level</b>   | 1   |
| <b>Pre-requisite /<br/>Co-requisite/<br/>Exclusion</b> | Nil   |
| <b>Objectives</b>                                      | <p>The objectives of this subject are to:</p> <ol style="list-style-type: none"> <li>(1) Introduce students to the engineering broad discipline and enthuse them about their major study</li> <li>(2) Cultivate students' creativity and problem-solving ability, and global outlook</li> <li>(3) Introduce students to the concept of entrepreneurship</li> <li>(4) Engage the students in desirable forms of learning at university that emphasizes self-regulation, autonomous learning and deep understanding</li> </ol>  |
| <b>Intended Learning Outcomes</b>                      | <p>Upon completion of the subject, students will:</p> <ol style="list-style-type: none"> <li>(a) Be able to demonstrate an understanding and an enthusiasm about the engineering broad discipline and their major study</li> <li>(b) Develop their problem-solving ability and global outlook</li> <li>(c) Be able to demonstrate an understanding of entrepreneurship</li> <li>(d) Be able to research for information, formulate a project plan, and manage a project with initiative</li> <li>(e) Be able to demonstrate an understanding of academic integrity.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>       | <p><b>1. Online Tutorial on Academic Integrity (4 hours*)</b><br/>Students will be required to complete successfully an <i>Online Tutorial on Academic Integrity</i> on or before week 5 of the first semester. The students will understand the importance of academic integrity by completing the Online Tutorial.</p> <p><b>2. Seminars (12 hours*)</b><br/>There will be seminars given by various speakers on various topics to introduce to students the engineering broad discipline, to enthuse them about their major study, to arouse students' interests in engineering and to cultivate their understanding of and sense of belonging to the discipline and the engineering profession, and to cultivate students' global outlook. The formats of the seminars may be, but not limited to, Departmental Seminars, and Renowned Speaker Seminar.</p> <p><b>3. Freshman Project (45 hours*)</b><br/>There will be practical workshops, presentation and demonstration sessions for the Freshman Project. The freshman project aims at developing students' creativity, problem-solving skills, research for information, and project management abilities through practical and hands-on tasks at a level commensurate with their first-year engineering backgrounds. Students will work in small groups under the guidance of teachers/instructors to design and implement an engineering solution to some given problems.</p> |

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

|   |   |   |          |          |          |                 |
|---|---|---|----------|----------|----------|-----------------|
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p>                               | <p>Students' performance in this subject will be assessed by using a letter-grading system in accordance with the University's convention from grade F (failure) to A+. The relative weights of the different assessment components are as follows:</p>   |   |          |          |          |                 |
| <p>Specific assessment methods/tasks</p>  | <p>% weighting</p>  | <p>Intended subject learning outcomes to be assessed (Please tick as appropriate)</p> |          |          |          |                 |
|   |   | <p>a</p>  | <p>b</p> | <p>c</p> | <p>d</p> | <p>e</p>        |
| <p><i>Online Tutorial on Academic Integrity</i></p>   | <p>0%</p>   |   |          |          |          | <p>✓</p>        |
| <p><i>Seminars Quizzes</i></p>  | <p>10%</p>  | <p>✓</p>  | <p>✓</p> |          |          |                 |
| <p><i>Freshman Project</i><br/>Project demonstration, presentation, report and reflective essay writing</p> | <p>45%</p>  |   | <p>✓</p> |          | <p>✓</p> |                 |
| <p><i>Entrepreneurship Project</i><br/>Business plan</p>  | <p>45%</p>  |   |          | <p>✓</p> | <p>✓</p> |                 |
| <p>Total</p>  | <p>100 %</p>  |   |          |          |          |                 |
| <p><b>Student Study Effort Expected</b></p>   | <p>Class contact:</p>   |   |          |          |          |                 |
|   | <ul style="list-style-type: none"> <li>▪ Introduction and Seminars (such as Departmental Seminars, Renowned Speaker Seminar)</li> </ul>   |   |          |          |          | <p>6 hours</p>  |
|   | <ul style="list-style-type: none"> <li>▪ Freshman project: 3 hours per week for 5 weeks</li> </ul>  |   |          |          |          | <p>15 hours</p> |
|   | <ul style="list-style-type: none"> <li>▪ Entrepreneurship project: 3 hours per week for 5 weeks</li> </ul>  |   |          |          |          | <p>15 hours</p> |
|   | <ul style="list-style-type: none"> <li>▪ Other student study effort:<br/>4 hours for Online Tutorial on Academic Integrity; 6 hours for seminars quizzes preparation; 60 hours for Freshman project and Entrepreneurship project: background information search, project work preparation, meeting and discussion, presentation and demonstration, and report writing.</li> </ul> |   |          |          |          | <p>70 Hours</p> |

|                                    |  |           |
|------------------------------------|--|-----------|
|                                    | <ul style="list-style-type: none"> <li>▪ Total student study effort</li> </ul>   | 106 Hours |
| <b>Reading and References List</b> | <p>H. Scott Fogler and Steven E. LeBlanc, <i>Strategies for creative problem solving</i>, Upper Saddle River, N.J. : Prentice Hall, 2008</p> <p>N.J. Smith (ed), <i>Engineering project management</i>, Oxford, UK; Malden, MA: Blackwell, 2008</p> <p>Gene Moriarty, <i>The engineering project: its nature, ethics, and promise</i>, University Park, Pa.: Pennsylvania State University Press, 2008.</p> <p>K. Allen, <i>Entrepreneurship for scientists and engineers</i>, Upper Saddle River, N.J. : Prentice Hall, 2010.</p> <p>The Hong Kong Institution of Engineers, “Engineering Our City”, Youtube clip ref. no. nYMml6vIVeQ</p> <p>HKIE Corporate Video, Youtube clip ref. no. INMV18MuNEY</p> |           |

(revised) June 2017



## **Core Subjects**



## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                            | AF3625  |
| <b>Subject Title</b>                           | Engineering Economics   |
| <b>Credit Value</b>                            | 3   |
| <b>Level</b>                                   | 3   |
| <b>Normal Duration</b>                         | 1-semester  |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | <b>Exclusion:</b> AF2618  |
| <b>Objectives</b>                              | <p>This subject aims to equip students with</p> <ol style="list-style-type: none"> <li>1. the fundamental concepts of micro- and macroeconomics related to the engineering industry;</li> <li>2. the fundamental understanding of finance and costing for engineering operations, budgetary planning and control.</li> </ol>  |
| <b>Intended Learning Outcomes</b>              | <p>Upon successful completion of this subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. understand how the relevant economic factors shape the environment within which an engineering company operates;</li> <li>b. evaluate the financial condition of a company based on the financial statements;</li> <li>c. apply the basic cost accounting techniques in the planning and control of engineering and production activities.</li> </ol>  |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <p><b>Economic Environment of a Firm</b></p> <p><b>Microeconomic Factors</b></p> <p>Scarcity, choice and opportunity cost; Demand, supply and price; Profit-maximizing behavior of the firm; Organization of industry: perfect competition and monopoly</p> <p><b>Macroeconomic Factors</b></p> <p>International trade and globalization</p> <p><b>Accounting and Engineering Economics</b></p> <p>Financial statements; Financial ratio analysis; Return on investment; Composition of cost; Cost-volume-profit analysis; Accounting profit versus economic profit</p> <p><b>Fundamentals of Budgetary Planning and Control</b></p> <p>Principle types of budgets for production and service operations; Approaches to budgeting and the budgeting process; Investment and source of finance; Cost of capital; Evaluation of investment alternatives</p> |
| <b>Teaching/Learning Methodology</b>           | <p>The two-hour lecture each week focuses on the introduction and explanation of key concepts of Engineering Economics. The one-hour tutorial provides students with directed studies to enhance their self-learning capacities. Individual and group activities including discussions and presentations are conducted to facilitate students'</p>  |

|   |  |             |  |   |   |  |
|---|--|-------------|--|---|---|--|
|   | understanding and application of the concepts they have learned to tackling real-life problems in Engineering Economics.   |             |  |   |   |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>  | Specific assessment methods/tasks  | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |
|   |  |             | a  | b | c |  |
|   | <b>Continuous Assessment</b>   | <b>50%</b>  |  |   |   |  |
|   | 1. In-class activities   | 15%         | √  | √ | √ |  |
|   | 2. Written assignments   | 15%         | √  | √ | √ |  |
|   | 3. Test  | 20%         | √  | √ | √ |  |
|   | <b>Final Examination</b>   | <b>50%</b>  | √  | √ | √ |  |
|   | Total  | 100 %       |  |   |   |  |
| To pass this subject, students are required to obtain Grade D or above in <b>both</b> the Continuous Assessment and Examination components.   |  |             |  |   |   |  |
| <b>Student Study Effort Required</b>  | Class contact:   |             |  |   |   |  |
|   | ▪ Lecture  |             | 26 Hrs.  |   |   |  |
|   | ▪ Tutorial   |             | 13 Hrs.  |   |   |  |
|   | Other student study effort:  |             |  |   |   |  |
|   | ▪ Study and self-learning  |             | 48 Hr.   |   |   |  |
|   | ▪ Written assignments  |             | 18 Hr.   |   |   |  |
|   | Total student study effort   |             | 105 Hrs.   |   |   |  |
| <b>Reading List and References</b>  | <b>Recommended Textbooks</b>   |             |  |   |   |  |
|   | Parkin and Bade, 2015, <i>Foundations of Microeconomics</i> , 7 <sup>th</sup> Edition, Pearson.<br>Sullivan, Wicks and Koelling, 2014, <i>Engineering Economy</i> , 16 <sup>th</sup> Edition, Pearson. |             |  |   |   |  |
| <b>References</b>   |  |             |  |   |   |  |
| Drury, Colin, 2008, <i>Management and Cost Accounting</i> , 7 <sup>th</sup> Edition, Cengage Learning.<br>Frank, Robert H., 2007, <i>The Economic Naturalist: Why Economics Explain Almost Everything?</i> Basic Books. |  |             |  |   |   |  |

Updated June 2017

## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>                              | AMA1110  |
| <b>Subject Title</b>                             | Basic Mathematics I – Calculus and Probability & Statistics  |
| <b>Credit Value</b>                              | 3  |
| <b>Level</b>                                     | 1  |
| <b>Pre-requisite</b>                             | Nil  |
| <b>Objectives</b>                                | This subject aims to introduce students to the basic concepts and applications of elementary calculus and statistics. Emphasis will be on the understanding of fundamental concepts and the use of mathematical techniques in handling practical problems in science and engineering.  |
| <b>Intended Learning Outcomes</b>                | Upon completion of the subject, students will be able to:<br>(a) apply analytical reasoning to solve problems in science and engineering;<br>(b) make use of the knowledge of mathematical/statistical techniques and adapt known solutions to various situations;<br>(c) apply mathematical modeling in problem solving;<br>(d) demonstrate abilities of logical and analytical thinking.   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <u>Elementary calculus</u> : Limit and continuity, derivatives and their geometric meaning, rules of differentiation including chain rule, Leibniz's rule and L'Hopital's rule, exponential and logarithmic functions, trigonometric functions and their inverses, hyperbolic and inverse hyperbolic functions, applications of differential calculus.<br><u>Elementary Probability and Statistics</u> : Descriptive statistics, random variables, probability and probability distributions, binomial, Poisson and normal distributions, applications.<br>Population and random samples. Sampling distributions related to sample mean, sample proportions, and sample variances. Concepts of a point estimator and a confidence interval. Point and interval estimates of a mean and the difference between two means. |
| <b>Teaching/Learning Methodology</b>             | Basic concepts and elementary techniques of differential and integral calculus, elementary statistics and linear algebra will be taught in lectures. These will be further enhanced in tutorials through practical problem solving.  |

| Assessment Methods in Alignment with Intended Learning Outcomes | Specific assessment methods/tasks     | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |
|---|---------------------------------------|-------------|--|---|---|---|
|   |                                       |             | a  | b | c | d |
|   | 1.Homework, quizzes and mid-term test | 40%         | ✓  | ✓ | ✓ | ✓ |
|   | 2. Examination                        | 60%         | ✓  | ✓ | ✓ | ✓ |
| <b>Total</b>  | <b>100 %</b>                          |             |  |   |   |   |

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

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

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

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

*The subject focuses on understanding of basic concepts and application of techniques in differential/integral calculus, elementary statistics and elementary linear algebra. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.*

| Student Study Effort Expected | Class contact:                    |                 |
|-------------------------------|-----------------------------------|-----------------|
|                               | ▪ Lecture                         | 26 Hrs.         |
|                               | ▪ Tutorial                        | 13 Hrs.         |
|                               | Other student study effort:       |                 |
|                               | ▪ Homework and self-study         | 81 Hrs.         |
|                               | <b>Total student study effort</b> | <b>120 Hrs.</b> |

|   |   |
|---|---|
| <p><b>Reading List and References</b></p> | <p>Chung, K.C. <i>A Short Course in Calculus and Matrices</i>, McGraw Hill 2013</p> <p>Hung, K.F., Kwan, Wilson, Pong, T.Y. <i>Foundation Mathematics &amp; Statistics</i>, McGraw Hill 2013</p> <p>Larson, R., Edwards, B. <i>Single Variable Calculus</i>, Brooks/Cole 2012</p> <p>Walpole, R.E., Myers, R.H., Myers, S.L. Ye, K. <i>Probability and Statistics for Engineers and Scientists</i>, Prentice Hall, 2012</p> |
|---|---|

## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>                              | AMA1120  |
| <b>Subject Title</b>                             | Basic Mathematics II –Calculus and Linear algebra  |
| <b>Credit Value</b>                              | 3  |
| <b>Level</b>                                     | 1  |
| <b>Pre-requisite</b>                             | Basic Mathematics I – Calculus and Probability & Statistics (AMA1110)  |
| <b>Objectives</b>                                | This subject aims to introduce students to the basic concepts and applications of elementary calculus and statistics. Emphasis will be on the understanding of fundamental concepts and the use of mathematical techniques in handling practical problems in science and engineering.  |
| <b>Intended Learning Outcomes</b>                | Upon completion of the subject, students will be able to:<br>(a) apply analytical reasoning to solve problems in science and engineering;<br>(b) make use of the knowledge of mathematical/statistical techniques and adapt known solutions to various situations;<br>(c) apply mathematical modeling in problem solving;<br>(d) demonstrate abilities of logical and analytical thinking.   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <u>Elementary calculus</u> : Mean Value Theorem with applications to optimization and curve sketching. Definite and indefinite integrals, fundamental theorem of calculus, methods of integration (integration by substitution, integration by parts, integration of rational functions using partial fractions and integration of trigonometric and hyperbolic functions), reduction formulas, applications to geometry and physics. Improper Integrals.<br><br><u>Linear algebra</u> : Basic properties of matrices and determinants, linear systems, Gaussian elimination, inverse of a square matrix, Cramer’s rule, vectors in 2-space or in 3-space, applications to geometry. |
| <b>Teaching/Learning Methodology</b>             | Basic concepts and elementary techniques of differential and integral calculus and linear algebra will be taught in lectures. These will be further enhanced in tutorials through practical problem solving.   |



|   |   |             |  |   |   |   |
|---|---|-------------|--|---|---|---|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>  | Specific assessment methods/tasks   | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |
|   |   |             | a  | b | c | d |
|   | 1.Homework, quizzes and mid-term test   | 40%         | ✓  | ✓ | ✓ | ✓ |
|   | 2. Examination  | 60%         | ✓  | ✓ | ✓ | ✓ |
|   | Total   | 100 %       |  |   |   |   |
| <p>Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester.</p> <p>Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering.</p> <p>To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components.</p> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p><i>The subject focuses on understanding of basic concepts and application of techniques in differential/integral calculus, elementary statistics and elementary linear algebra. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.</i></p> |   |             |  |   |   |   |
| <b>Student Study Effort Expected</b>  | Class contact:  |             |  |   |   |   |
|   | ▪ Lecture   |             | 26 Hrs.  |   |   |   |
|   | ▪ Tutorial  |             | 13 Hrs.  |   |   |   |
|   | Other student study effort:   |             |  |   |   |   |
|   | ▪ Homework and self-study   |             | 81 Hrs.  |   |   |   |
|   | Total student study effort  |             | 120 Hrs.   |   |   |   |
| <b>Reading List and</b>   | Chung, K.C. <i>A Short Course in Calculus and Matrices</i> , McGraw Hill 2013 |             |  |   |   |   |

|                   |  |
|-------------------|--|
| <b>References</b> | Hung, K.F., Kwan, Wilson, Pong, T.Y. <i>Foundation Mathematics &amp; Statistics</i> , McGraw Hill 2013<br><br>Larson, R., Edwards, B. <i>Single Variable Calculus</i> , Brooks/Cole 2012<br><br>Larson, R. <i>Elementary Linear Algebra</i> , Brooks/Cole 2013 |
|-------------------|--|

## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                              | AMA2111   |
| <b>Subject Title</b>                             | Mathematics I   |
| <b>Credit Value</b>                              | 3   |
| <b>Level</b>                                     | 2   |
| <b>Pre-requisite</b>                             | Calculus I (AMA1101) or<br>Calculus IA (AMA1102) or<br>Basic Mathematics II – Calculus and Linear Algebra (AMA1120) or<br>Foundation Mathematics for Accounting and Finance (AMA1500)   |
| <b>Co-requisite/<br/>Exclusion</b>               | <b>Exclusion:</b> Intermediate Calculus and Linear Algebra (AMA2007), Mathematics for Engineers (AMA2308), Engineering Mathematics (AMA2380), Applied Mathematics I (AMA2511), Mathematics for Scientists and Engineers (AMA2882), Engineering Mathematics (AMA290)   |
| <b>Objectives</b>                                | This subject aims to introduce students to the basic principles and techniques of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.  |
| <b>Intended Learning Outcomes</b>                | <b>Upon completion of the subject, students will be able to:</b> <ol style="list-style-type: none"> <li>1. apply mathematical reasoning to analyze essential features of different problems in science and engineering;</li> <li>2. extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations;</li> <li>3. develop and extrapolate the mathematical concepts in synthesizing and solving new problems</li> <li>4. demonstrate abilities of logical and analytical thinking;</li> <li>5. search for useful information in the process of problem solving.</li> </ol> |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. <u>Algebra of complex numbers</u><br/>Complex numbers, geometric representation, complex exponential functions, n-th roots of a complex number.</li> <li>2. <u>Linear algebra</u><br/>Systems of linear equations, vector spaces, inner product and orthogonality,</li> </ol>   |

|   | <p>eigenvalues and eigenvectors, applications.</p> <p>3. <u>Ordinary differential equations</u><br/>ODE of first and second order, linear systems, Laplace transforms, Convolution theorem, applications to mechanical vibrations and simple circuits.</p> <p>4. <u>Differential calculus of functions of several variables</u><br/>Partial derivatives, total differential, chain rule, Taylor's expansion, maxima and minima, directional derivatives, Lagrange multipliers, implicit differentiation, applications.</p>   |                                   |             |  |   |   |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|---|--|-----------------------------------|-------------|--|---|---|--|--|---|---|---|---|---|---------------------------------------|-----|---|---|---|---|---|----------------|-----|---|---|---|---|---|-------|------|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>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.</p>  |                                   |             |  |   |   |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="477 1025 1447 1518"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td>1.Homework, quizzes and mid-term test</td> <td>40%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>2. Examination</td> <td>60%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester.</p> <p>Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering.</p> <p>To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components.</p> <p>Explanation of the appropriateness of the assessment methods in assessing the</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |  | 1 | 2 | 3 | 4 | 5 | 1.Homework, quizzes and mid-term test | 40% | ✓ | ✓ | ✓ | ✓ | ✓ | 2. Examination | 60% | ✓ | ✓ | ✓ | ✓ | ✓ | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|   |  | 1                                 | 2           | 3  | 4 | 5 |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 1.Homework, quizzes and mid-term test   | 40%  | ✓                                 | ✓           | ✓  | ✓ | ✓ |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 2. Examination  | 60%  | ✓                                 | ✓           | ✓  | ✓ | ✓ |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Total   | 100%   |                                   |             |  |   |   |  |  |   |   |   |   |   |                                       |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |

|                                      |  |                  |
|--------------------------------------|--|------------------|
|                                      | intended learning outcomes:<br><br><i>The subject focuses on understanding of basic concepts and application of techniques in engineering mathematics. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.</i>  |                  |
| <b>Student Study Effort Expected</b> | <b>Class contact:</b>  |                  |
|                                      | • Lecture  | 26 Hours         |
|                                      | • Tutorial   | 13 Hours         |
|                                      | • Mid-term test and examination  |                  |
|                                      | <b>Other student study effort</b>  |                  |
|                                      | • Assignments and Self study   | 78 Hours         |
|                                      | <b>Total student study effort:</b>   | <b>117 Hours</b> |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. C.K. Chan, C.W. Chan and K.F. Hung, <i>Basic Engineering Mathematics</i>, McGraw-Hill, 2015.</li> <li>2. Anton, H. <i>Elementary Linear Algebra</i> (11th edition). Wiley, 2014.</li> <li>3. Kreyszig, E. (2011). <i>Advanced Engineering Mathematics</i>, 10th ed. Wiley.</li> <li>4. James, G. (2015). <i>Modern Engineering Mathematics</i>, 5th ed. Pearson Education Limited</li> <li>5. Thomas, G. B., Weir, M. D. &amp; Hass, J. R. <i>Thomas' Calculus</i>, 14th ed. Pearson Education 2017</li> </ol> |                  |

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | AMA2112  |
| <b>Subject Title</b>                                  | Mathematics II   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 2  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite : Mathematics I (AMA2111)  |
| <b>Objectives</b>                                     | This subject is a continuation of AMA2111. It aims to introduce students to the basic principles and techniques of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.  |
| <b>Intended Learning Outcomes</b>                     | <p><b>Upon completion of the subject, students will be able to:</b></p> <ol style="list-style-type: none"> <li>1. apply mathematical reasoning to analyze essential features of different problems in science and engineering;</li> <li>2. extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations;</li> <li>3. develop and extrapolate the mathematical concepts in synthesizing and solving new problems</li> <li>4. demonstrate abilities of logical and analytical thinking;</li> <li>5. search for useful information in the process of problem solving.</li> </ol> |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <ol style="list-style-type: none"> <li>1. <u>Multiple integrals</u><br/>Double and triple integrals, change of variables, applications to problems in geometry and mechanics.</li> <li>2. <u>Vector calculus</u><br/>Vector and scalar fields, the del operator, line and surface integrals, the theorems of Green, Gauss and Stokes, applications to electromagnetic theory and fluid mechanics.</li> <li>3. <u>Series expansion</u><br/>Infinite series, Taylor's expansion, Fourier series expansion of a periodic function.</li> </ol>   |

|   | <p>4. <u>Partial differential equations</u><br/>Formulation of PDE of mathematical physics, separation of variables, initial-boundary value problems, introduction to Fourier transforms.</p>  |  |   |   |   |                                   |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|---|--|--|---|---|---|-----------------------------------|-------------|--|--|--|--|--|---|---|---|---|---|--|-----|---|---|---|---|---|----------------|-----|---|---|---|---|---|-------|------|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>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.</p>  |  |   |   |   |                                   |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="477 689 1447 1187"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td>1. Homework, quizzes and mid-term test</td> <td>40%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>2. Examination</td> <td>60%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester.</p> <p>Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering.</p> <p>To pass this subject, students are required to obtain grade D or above in both the continuous assessment and the examination components.</p> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p><i>The subject focuses on understanding of basic concepts and application of techniques in engineering mathematics. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.</i></p> |  |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |  | 1 | 2 | 3 | 4 | 5 | 1. Homework, quizzes and mid-term test | 40% | ✓ | ✓ | ✓ | ✓ | ✓ | 2. Examination | 60% | ✓ | ✓ | ✓ | ✓ | ✓ | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                   |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|   |  | 1  | 2 | 3 | 4 | 5                                 |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 1. Homework, quizzes and mid-term test  | 40%  | ✓  | ✓ | ✓ | ✓ | ✓                                 |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 2. Examination  | 60%  | ✓  | ✓ | ✓ | ✓ | ✓                                 |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Total   | 100%   |  |   |   |   |                                   |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| <p><b>Student Study Effort</b></p>  | <p><b>Class contact:</b></p>   |  |   |   |   |                                   |             |  |  |  |  |  |   |   |   |   |   |  |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |

|                                    |  |                  |
|------------------------------------|--|------------------|
| <b>Expected</b>                    | • Lecture  | 26 Hours         |
|                                    | • Tutorial   | 13 Hours         |
|                                    | • Mid-term test and examination  |                  |
|                                    | <b>Other student study effort</b>  |                  |
|                                    | • Assignments and Self study   | 78 Hours         |
|                                    | <b>Total student study effort:</b>   | <b>117 Hours</b> |
| <b>Reading List and References</b> | <ol style="list-style-type: none"> <li>1. C.K. Chan, C.W. Chan and K.F. Hung, <i>Basic Engineering Mathematics</i>, McGraw-Hill, 2015.</li> <li>2. Anton, H. <i>Elementary Linear Algebra</i> (11th edition). Wiley, 2014.</li> <li>3. Kreyszig, E. (2011). <i>Advanced Engineering Mathematics</i>, 10th ed. Wiley.</li> <li>4. James, G. (2015). <i>Modern Engineering Mathematics</i>, 5th ed. Pearson Education Limited</li> <li>5. Thomas, G. B., Weir, M. D. &amp; Hass, J. R. <i>Thomas' Calculus</i>, 14th ed. Pearson Education 2017</li> </ol> |                  |



## Subject Description Form

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

|   | <p>their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.</p> <p><b>e-learning:</b> In order to enhance the effectiveness of teaching and learning processes, electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework and notices etc.</p>   |   |   |   |   |   |   |       |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
|---|---|---|---|---|---|---|---|-------|--|-----------------------------------|-------------|---|--|--|--|--|--|--|-----------|---|---|---|---|---|---|---------------------------|------|------------|---|---|---|---|---|---|-----------------|-----|-----------------------------|---|---|---|---|---|---|-------|-----|--------------|--|--|--|--|--|--|--|------|----------------------------|--|--|--|--|--|--|--|-------|
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="427 562 1490 875"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="7">Intended subject learning outcomes to be assessed<br/>(Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th>f</th> <th>g</th> </tr> </thead> <tbody> <tr> <td>(1) Continuous assessment</td> <td>40</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>(2) Examination</td> <td>60</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100</td> <td colspan="7"></td> </tr> </tbody> </table> <p><b>Continuous assessment:</b><br/>The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students study throughout the course, assisting them in fulfilling the learning outcomes.<br/>Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.<br/>At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.</p> <p><b>Examination:</b> This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.</p> |   |   |   |   |   |   |       |  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed<br>(Please tick as appropriate) |  |  |  |  |  |  | a         | b | c | d | e | f | g | (1) Continuous assessment | 40   | ✓          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | (2) Examination | 60  | ✓                           | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Total | 100 |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| Specific assessment methods/tasks   | % weighting   | Intended subject learning outcomes to be assessed<br>(Please tick as appropriate) |   |   |   |   |   |       |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
|   |   | a   | b | c | d | e | f | g     |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| (1) Continuous assessment   | 40  | ✓   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓     |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| (2) Examination   | 60  | ✓   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓     |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| Total   | 100   |   |   |   |   |   |   |       |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| <p><b>Student Study Effort Expected</b></p>                                   | <table border="1" data-bbox="427 1512 1490 1906"> <tr> <td colspan="9">Class contact:</td> </tr> <tr> <td colspan="8">• Lecture</td> <td>33 h</td> </tr> <tr> <td colspan="8">• Tutorial</td> <td>6 h</td> </tr> <tr> <td colspan="9">Other student study effort:</td> </tr> <tr> <td colspan="8">• Self-study</td> <td>81 h</td> </tr> <tr> <td colspan="8">Total student study effort</td> <td>120 h</td> </tr> </table>  |   |   |   |   |   |   |       |  | Class contact:                    |             |   |  |  |  |  |  |  | • Lecture |   |   |   |   |   |   |                           | 33 h | • Tutorial |   |   |   |   |   |   |                 | 6 h | Other student study effort: |   |   |   |   |   |   |       |     | • Self-study |  |  |  |  |  |  |  | 81 h | Total student study effort |  |  |  |  |  |  |  | 120 h |
| Class contact:  |   |   |   |   |   |   |   |       |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| • Lecture   |   |   |   |   |   |   |   | 33 h  |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| • Tutorial  |   |   |   |   |   |   |   | 6 h   |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| Other student study effort:   |   |   |   |   |   |   |   |       |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| • Self-study  |   |   |   |   |   |   |   | 81 h  |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| Total student study effort  |   |   |   |   |   |   |   | 120 h |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |
| <p><b>Reading List and References</b></p>                                     | <p>John D. Cutnell &amp; Kenneth W. Johnson, <b>Introduction to Physics</b>, 9th edition, 2013, John Wiley &amp; Sons.</p> <p>Hewitt, <b>Conceptual Physics</b>, 11th edition, 2010, Benjamin Cummings.</p>   |   |   |   |   |   |   |       |  |                                   |             |   |  |  |  |  |  |  |           |   |   |   |   |   |   |                           |      |            |   |   |   |   |   |   |                 |     |                             |   |   |   |   |   |   |       |     |              |  |  |  |  |  |  |  |      |                            |  |  |  |  |  |  |  |       |

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | AP10005   |
| <b>Subject Title</b>                                  | Physics I   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 1   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Nil   |
| <b>Objectives</b>                                     | This course provides a broad foundation in mechanics and thermal physics to those students who are going to study science, engineering, or related programmes.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"> <li>(a) solve simple problems in single-particle mechanics using calculus and vectors;</li> <li>(b) solve problems in mechanics of many-particle systems using calculus and vectors;</li> <li>(c) understand simple harmonic motion and solve simple problems;</li> <li>(d) solve problems related to acoustic standing waves;</li> <li>(e) calculate changes in frequency received due to Doppler's effect;</li> <li>(f) apply ideal gas laws to solve problems;</li> <li>(g) apply the first law of thermodynamics to simple processes; and</li> <li>(h) solve simple problems related to the cyclic processes.</li> </ul>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Mechanics:</b> calculus-based kinematics, dynamics and Newton's laws; calculus-based Newtonian mechanics, involving the application of impulse, momentum, work and energy, etc.; conservation law; gravitational force; systems of particles; collisions; rigid body rotation; angular momentum; oscillations and simple harmonic motion; pendulum; statics; longitudinal and transverse waves; travelling wave and standing wave; Doppler effect; sound waves and beats.</p> <p><b>Thermal physics:</b> conduction, convection and radiation; black body radiation; ideal gas and kinetic theory; work, heat and internal energy; first law of thermodynamics; entropy and the second law of thermodynamics; Carnot cycle; heat engine and refrigerators.</p>  |
| <b>Teaching/Learning Methodology</b>                  | <p><b>Lecture:</b> Fundamentals in mechanics, waves and electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Students are free to request help. Homework problem sets will be given.</p> <p><b>Student-centered Tutorial:</b> Students will work on a set of problems in tutorials. Students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.</p> <p><b>e-learning:</b> In order to enhance the effectiveness of teaching and learning processes, electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework and notices etc.</p> |

| Assessment Methods in Alignment with Intended Learning Outcomes   | Specific assessment methods/tasks  | % weighting | Intended subject learning outcomes to be assessed<br>(Please tick as appropriate) |   |   |   |   |   |   |   |
|---|--|-------------|---|---|---|---|---|---|---|---|
|   |  |             | a   | b | c | d | e | f | g | h |
|   | (1) Continuous assessment  | 40          | ✓   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| (2) Examination   | 60   | ✓           | ✓   | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |   |
| Total   | 100  |             |   |   |   |   |   |   |   |   |
| <p><b>Continuous assessment:</b><br/>The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students' study throughout the course, assisting them in fulfilling the learning outcomes.<br/>Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.<br/>At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.</p> <p><b>Examination:</b> This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.</p> |  |             |   |   |   |   |   |   |   |   |
| Student Study Effort Expected   | Class contact:   |             |   |   |   |   |   |   |   |   |
|   | • Lecture  |             | 33 h  |   |   |   |   |   |   |   |
|   | • Tutorial   |             | 6 h   |   |   |   |   |   |   |   |
|   | Other student study effort:  |             |   |   |   |   |   |   |   |   |
|   | • Self-study   |             | 81 h  |   |   |   |   |   |   |   |
|   | Total student study effort:  |             | 120 h   |   |   |   |   |   |   |   |
| Reading List and References   | John W. Jewett and Raymond A. Serway, "Physics for Scientists and Engineers", 2014, 9th edition, Brooks/Cole Cengage Learning. |             |   |   |   |   |   |   |   |   |
|   | Hafez A. Radi, John O. Rasmussen, "Principles of physics: for scientists and engineers", 2013, Springer.                       |             |   |   |   |   |   |   |   |   |
|   | W. Bauer and G.D. Westfall, "University Physics with Modern Physics", 2011, McGraw-Hill.                                       |             |   |   |   |   |   |   |   |   |

## Subject Description Form

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

|  |   |             |  |   |   |   |   |   |
|--|---|-------------|--|---|---|---|---|---|
|  | and notices etc.  |             |  |   |   |   |   |   |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | Specific assessment methods/tasks   | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |   |
|  |   |             | a  | b | c | d | e | f |
|  | (1) Continuous assessment   | 40          | ✓  | ✓ | ✓ | ✓ | ✓ | ✓ |
|  | (2) Examination   | 60          | ✓  | ✓ | ✓ | ✓ | ✓ | ✓ |
|  | Total   | 100         |  |   |   |   |   |   |
|  | <p><b>Continuous assessment:</b><br/>The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students' study throughout the course, assisting them in fulfilling the learning outcomes.<br/>Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.<br/>At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.</p> <p><b>Examination:</b> This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.</p> |             |  |   |   |   |   |   |
| <b>Student Study Effort Expected</b>                                   | Class contact:  |             |  |   |   |   |   |   |
|  | • Lecture   |             | 33 h   |   |   |   |   |   |
|  | • Tutorial  |             | 6 h  |   |   |   |   |   |
|  | Other student study effort:   |             |  |   |   |   |   |   |
|  | • Self-study  |             | 81 h   |   |   |   |   |   |
|  | Total student study effort  |             | 120 h  |   |   |   |   |   |
| <b>Reading List and References</b>                                     | <p>John W. Jewett and Raymond A. Serway, "Physics for Scientists and Engineers", 2014, 9th edition, Brooks/Cole Cengage Learning.</p> <p>Hafez A. Radi, John O. Rasmussen, "Principles of physics: for scientists and engineers", 2013, Springer.</p> <p>W. Bauer and G.D. Westfall, "University Physics with Modern Physics", 2011, McGraw-Hill.</p>   |             |  |   |   |   |   |   |

# The Hong Kong Polytechnic University

## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                          | CBS3241P  |
| <b>Subject Title</b>                         | Professional Communication in Chinese   |
| <b>Credit Value</b>                          | 2   |
| <b>Level</b>                                 | 3   |
| <b>Pre-requisite / Co-requisite</b>          | Chinese LCR subjects  |
| <b>Objectives</b>                            | This subject aims to develop the language competence for professional communication in Chinese required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals and reports.  |
| <b>Intended Learning Outcomes</b>            | <p>Upon completion of the subject, and in relation to effective communication with a variety of intended readers/audiences in Chinese, students will be able to</p> <ol style="list-style-type: none"> <li>a. plan, organise and produce professionally acceptable project proposals and reports with appropriate text structures and language for different intended readers</li> <li>b. plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences</li> <li>c. adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences</li> </ol>  |
| <b>Subject Synopsis/ Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. Project proposals and reports in Chinese <ul style="list-style-type: none"> <li>• Planning and organising project proposals and reports</li> <li>• Explaining the background, rationale, objectives, scope and significance of a project</li> <li>• Referring to the literature to substantiate project proposals</li> <li>• Describing the methods of study</li> <li>• Describing and discussing project results, including anticipated results and results of pilot study</li> <li>• Presenting the budget, schedule and/or method of evaluation</li> <li>• Writing executive summaries./abstracts</li> </ul> </li> <li>2. Oral presentations of projects <ul style="list-style-type: none"> <li>• Selecting content for audience-focused presentations</li> <li>• Choosing language and style appropriate to the intended audience</li> <li>• Using appropriate transitions and maintaining coherence in team</li> </ul> </li> </ol> |

|   | <p>presentations</p> <ul style="list-style-type: none"> <li>Using effective verbal and non-verbal interactive strategies</li> </ul>  |                                   |             |  |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |
|---|--|-----------------------------------|-------------|--|--|--|--|--|--|---|---|---|--|--|--|--------------------------------|-----|---|--|---|--|--|--|--|-----|--|---|---|--|--|--|-------|-------|--|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p><u>Learning and teaching approach</u></p> <p>The subject is designed to develop the students' Chinese language skills, both oral and written, that students need to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects.</p> <p>The study approach is primarily seminar-based. Seminar activities include instructor input as well as individual and group work, involving drafting and evaluating texts, mini-presentations, discussions and simulations.</p> <p>The learning and teaching activities in the subject will focus on a course-long project which will engage students in proposing and reporting on an engineering-related project to different intended readers/audiences. During the course, students will be involved in:</p> <ul style="list-style-type: none"> <li>planning and researching the project</li> <li>writing project-related documents such as project proposals and reports</li> <li>giving oral presentations to intended stakeholders of the project</li> </ul> <p>The study plan outlining the allocation of contact hours is attached.</p>   |                                   |             |  |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1066 1465 1568"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th></th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Project proposal in Chinese</td> <td>60%</td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2. Oral presentation of project proposal</td> <td>40%</td> <td></td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td colspan="6"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The assessments will arise from the course-long engineering-related project.</p> <ul style="list-style-type: none"> <li>Students will be assessed on written documents and oral presentations targeted at different intended readers/audiences. This facilitates assessment of students' ability to select content and use language and style appropriate to the purposes and intended readers/audiences.</li> <li>Students will collaborate in groups in planning, researching,</li> </ul> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |  |  | a | b | c |  |  |  | 1. Project proposal in Chinese | 60% | ✓ |  | ✓ |  |  |  | 2. Oral presentation of project proposal | 40% |  | ✓ | ✓ |  |  |  | Total | 100 % |  |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |
|   |  | a                                 | b           | c  |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |
| 1. Project proposal in Chinese  | 60%  | ✓                                 |             | ✓  |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |
| 2. Oral presentation of project proposal                                      | 40%  |                                   | ✓           | ✓  |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |
| Total   | 100 %  |                                   |             |  |  |  |  |  |  |   |   |   |  |  |  |                                |     |   |  |   |  |  |  |  |     |  |   |   |  |  |  |       |       |  |  |  |  |  |  |



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

### Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | EE2901S  |
| <b>Subject Title</b>                                  | Basic Electricity and Electronics  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 2  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Nil  |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To introduce the basic concepts and fundamental principles of electric circuits and electric machines applicable to ME students.</li> <li>2. To develop an ability for solving problems involving electric circuits and electric machines.</li> <li>3. To develop skills for experimentation on electric circuits.</li> <li>4. To impart relevant skills and knowledge in basic electricity and electronics for independent learning of other subjects that requires such skills and knowledge.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the basic concepts of dc and ac electric circuits.</li> <li>b. Solve simple problems using circuit analysis techniques.</li> <li>c. Understand the fundamental principles of analog electronic and digital logic circuits.</li> <li>d. Understand the operating principles of electric machines.</li> <li>e. Use suitable instrumentation to carry out experimental investigations and to validate the theoretical investigations.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>DC Circuit Analysis</b> — Basic electric quantities: charge, potential, current, voltage and power. Sign conversion. Lumped circuit elements. Linear resistor, Ohm's law and simple resistor circuits: series and parallel circuits, voltage and current dividers. Voltage and current sources: ideal and practical sources, independent and dependent sources. Power absorption and delivery. Network description: branch, node, loop and mesh. Kirchhoff's voltage and current laws. Tellegen's theorem. Mesh-current and node-voltage methods. Thévenin and Norton theorems. Source loading and maximum power transfer.</p> <p><b>AC Circuit Analysis</b> — Time-dependent and sinusoidal sources. Periodic signals. Average and rms values. Steady-state analysis: sinusoidal function of time. Phasors and phasor diagrams. Impedance and admittance. Steady-state analysis: phasor approach. Instantaneous, average and complex powers. Power factor. Three-phase power and circuits.</p> <p><b>First-Order Transients</b> — Constitutive relations of capacitors and inductors. Introduction to time-varying circuits. Simple <i>RC</i> and <i>LC</i> circuits. Independent state variables. First-order differential equation (with solution in exponential form). First-order transient analysis. Time-domain solution and transient behavior of first-order circuits. Time constant.</p> <p><b>Basic Analog Electronic Circuits</b> — P-N junction diodes and diode circuits: basic structure and symbol, ideal <i>I-V</i> characteristics, breakdown characteristics, analysis of basic diode circuits, specific diode circuits. Bipolar junction transistors (BJTs) and BJT amplifiers: basic structure and symbol, linear analog amplifiers, basic BJT amplifiers, modes of operation of BJTs, dc equivalent circuit and analysis, load line and Q-point, various dc biasing schemes.</p> |

|   | <p><b>Digital Logic Circuits</b> — Binary number systems: addition, subtraction, multiplication and division. Conversion between binary and decimal numbers. Two's complement. Boolean algebra. Basic logic gates. Karnaugh maps. Combinational logic circuit design.</p> <p><b>Electric Machines</b> — Basic coupled inductance equation. Concept of ideal transformer. Dot conversion. Applications in voltage/current level conversion and galvanic isolation. DC machines: construction, generator and motor actions, electromotive force, torque equations. Three-phase induction motors: construction, generation of rotating magnetic fields, torque-slip curves.</p> <p><b>Laboratory Experiments:</b></p> <ol style="list-style-type: none"> <li>EE2901S-E01: Kirchhoff's Laws, Equivalent Resistance and The Maximum Power Transfer Theorem.</li> <li>EE2901S-E02: Use of NAND Gates.</li> <li>EE2901S-E03: Transients in RC Circuits.</li> </ol>  |                                   |             |   |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
|---|--|-----------------------------------|-------------|---|---|---|--|---|---|---|---|---|---------|-----------------------|-----|---|---|---|-------------------|---|-------------|-----|---|---|------------|---|---|-------|------|--|------------|--|--|--|--|---|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lecture: Students are introduced to the knowledge of the subject and the comprehension is strengthened with interactive Q&amp;A (outcomes 1 to 4).</p> <p>In-class Practice: Students apply what they have learnt in solving the problems in the class (outcomes 1 to 4).</p> <p>Assignment: Students will develop a firm understanding and comprehension of the knowledge taught (outcomes 1 to 4).</p> <p>Laboratory: Students acquire hands-on experience in using electronic equipment and apply what they have learnt in the class to experimentally validate the theoretical investigations (outcome 5).</p> <table border="1" data-bbox="405 1234 1474 1525"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcome</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>In-class Practice</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>Assignment</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>Laboratory</td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcome     |   |   |   |  | 1 | 2 | 3 | 4 | 5 | Lecture | ✓                     | ✓   | ✓ | ✓ |   | In-class Practice | ✓ | ✓           | ✓   | ✓ |   | Assignment | ✓ | ✓ | ✓     | ✓    |  | Laboratory |  |  |  |  | ✓ |
| Teaching/Learning Methodology   | Outcome  |                                   |             |   |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
|   | 1  | 2                                 | 3           | 4   | 5 |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| Lecture   | ✓  | ✓                                 | ✓           | ✓   |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| In-class Practice   | ✓  | ✓                                 | ✓           | ✓   |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| Assignment  | ✓  | ✓                                 | ✓           | ✓   |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| Laboratory  |  |                                   |             |   | ✓ |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="405 1570 1474 1861"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended learning outcomes to be assessed</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> </tr> </thead> <tbody> <tr> <td>Continuous Assessment</td> <td>50%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Examination</td> <td>50%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:</p> <p style="text-align: center;"><math>0.5 \times \text{Continuous Assessment} + 0.5 \times \text{End of Subject Examination}</math></p>   | Specific assessment methods/tasks | % weighting | Intended learning outcomes to be assessed |   |   |  |   | 1 | 2 | 3 | 4 | 5       | Continuous Assessment | 50% | ✓ | ✓ | ✓ | ✓                 | ✓ | Examination | 50% | ✓ | ✓ | ✓          | ✓ |   | Total | 100% |  |            |  |  |  |  |   |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended learning outcomes to be assessed |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
|   |  | 1                                 | 2           | 3   | 4 | 5 |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| Continuous Assessment   | 50%  | ✓                                 | ✓           | ✓   | ✓ | ✓ |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| Examination   | 50%  | ✓                                 | ✓           | ✓   | ✓ |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |
| Total   | 100%   |                                   |             |   |   |   |  |   |   |   |   |   |         |                       |     |   |   |   |                   |   |             |     |   |   |            |   |   |       |      |  |            |  |  |  |  |   |

|                                      |   |         |
|--------------------------------------|---|---------|
|                                      | <p>Continuous Assessment covers all intended learning outcomes 1 to 5, while examination involves intended learning outcomes 1 to 4. Continuous Assessment (50%) contains Assignment (15%), Test (20%) and Laboratory Logs &amp; Report (15%). Examination (50%) is in form of a three-hour, closed book, end-of-subject examination.</p> <p>Continuous Assessment is able to provide timely feedbacks to students on various topics of syllabus, including their assignment works, laboratory skills, usages of appropriate equipment and data analysis on experiment results, etc. Examination is able to assess their overall understanding and ability of applying the concepts.</p>  |         |
| <b>Student Study Effort Expected</b> | Class contact:  |         |
|                                      | <ul style="list-style-type: none"> <li>▪ Lecture</li> </ul>   | 24 Hrs. |
|                                      | <ul style="list-style-type: none"> <li>▪ In-class Practice</li> </ul>   | 6 Hrs.  |
|                                      | <ul style="list-style-type: none"> <li>▪ Laboratory</li> </ul>  | 9 Hrs.  |
|                                      | Other student study effort:   |         |
|                                      | <ul style="list-style-type: none"> <li>▪ Self-study</li> </ul>  | 32 Hrs. |
|                                      | <ul style="list-style-type: none"> <li>▪ Assignment</li> </ul>  | 12 Hrs. |
|                                      | <ul style="list-style-type: none"> <li>▪ Laboratory logbook &amp; report writing</li> </ul>   | 8 Hrs.  |
|                                      | Total student study effort  | 91 Hrs. |
| <b>Reading List and References</b>   | <p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. G. Rizzoni, <i>Principles and Applications of Electrical Engineering</i>, 6<sup>th</sup> Edition, New York: McGraw-Hill (2015).</li> <li>2. Donald A. Neamen, <i>Microelectronics: Circuit Analysis and Design</i>, 4<sup>th</sup> Edition, Boston: McGraw-Hill (2010).</li> </ol> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. W. H. Hayt, J. E. Kemmerly, and S. M. Durbin, <i>Engineering Circuit Analysis</i>, 8<sup>th</sup> Edition, New York: McGraw-Hill (2012).</li> <li>2. A. H. Robbins and W. C. Miller, <i>Circuit Analysis: Theory and Practice</i>, 5<sup>th</sup> Edition, Thomson Learning (2013).</li> <li>3. C. K. Tse, <i>Linear Circuit Analysis</i>, London: Addison-Wesley (1998).</li> <li>4. R. A. DeCarlo and P. M. Lin, <i>Linear Circuit Analysis</i>, 2<sup>nd</sup> Edition, Oxford University Press (2001).</li> </ol> |         |

# The Hong Kong Polytechnic University

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                           | ELC3521   |
| <b>Subject Title</b>                          | Professional Communication in English   |
| <b>Credit Value</b>                           | 2   |
| <b>Level</b>                                  | 3   |
| <b>Pre-requisite / Co-requisite</b>           | English LCR subjects  |
| <b>Objectives</b>                             | This subject aims to develop the language competence for professional communication in English required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals.  |
| <b>Intended Learning Outcomes</b>             | <p>Upon completion of the subject, and in relation to effective communication with a variety of intended readers/audiences in English, students will be able to:</p> <ol style="list-style-type: none"> <li>a. plan, organise and produce professionally acceptable project proposals with appropriate text structures and language for different intended readers</li> <li>b. plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences</li> <li>c. adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences</li> </ol>   |
| <b>Subject Synopsis / Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. Project proposal in English <ul style="list-style-type: none"> <li>• Planning and organising a project proposal</li> <li>• Explaining the background, rationale, objectives, scope and significance of a project</li> <li>• Referring to the current situation or existing literature to substantiate a project proposal</li> <li>• Describing the methods of study</li> <li>• Describing and discussing anticipated project results and (if applicable) results of a pilot study</li> <li>• Presenting the budget, schedule and (if applicable) method of evaluation</li> <li>• Writing an executive summary</li> </ul> </li> <li>2. Oral presentation of project proposal in English <ul style="list-style-type: none"> <li>• Selecting content for an audience-focused presentation</li> <li>• Choosing language and style appropriate to the intended audience</li> <li>• Using appropriate transitions and maintaining coherence in a team presentation</li> <li>• Using effective verbal and non-verbal interactive strategies</li> </ul> </li> </ol> |
| <b>Teaching/Learning Methodology</b>          | The subject is designed to develop the English language skills, both oral and written, that students need to use to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects.  |

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

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

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

**Assessment Methods in Alignment with Intended Learning Outcomes**

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

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

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

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

**Student Study**

Class contact:

|                                    |  |         |
|------------------------------------|--|---------|
| <b>Effort Expected</b>             | Seminars   | 26 Hrs. |
|                                    | Other student study effort:  |         |
|                                    | Researching, planning and writing the project<br>Rehearsing the presentation   | 52 Hrs. |
|                                    | Total student study effort:  | 78 Hrs. |
| <b>Reading List and References</b> | <ol style="list-style-type: none"> <li>1. D.F. Beer, (Ed.), <i>Writing and speaking in the technology professions: A practical guide</i>, 2<sup>nd</sup> ed., Hoboken, NJ: Wiley, 2003.</li> <li>2. R. Johnson-Sheehan, <i>Writing proposals</i>, 2<sup>nd</sup> ed., New York: Pearson/Longman, 2008.</li> <li>3. S. Kuiper, <i>Contemporary business report writing</i>, 3<sup>rd</sup> ed., Cincinnati, OH: Thomson/South-Western, 2007.</li> <li>4. M.S. Lawrence, <i>Writing as a thinking process: Teacher's manual</i>. Ann Arbor, Mich: University of Michigan Press, 1975.</li> <li>5. D.C. Reep, <i>Technical writing: Principles, strategies and readings</i>, 6<sup>th</sup> ed., Pearson, Longman, 2006.</li> </ol> |         |

## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>                            | ENG2001  |
| <b>Subject Title</b>                           | Fundamentals of Materials Science and Engineering  |
| <b>Credit Value</b>                            | 3  |
| <b>Level</b>                                   | 2  |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | Nil  |
| <b>Objectives</b>                              | <ol style="list-style-type: none"> <li>1. To realize the impact of the development of engineering materials on human civilization;</li> <li>2. To enable students to establish a broad knowledge base on the structure and properties of materials for solving engineering problems.</li> <li>3. To enable students to understand the applications and selection of engineering materials based on the consideration of properties, cost, ease of manufacture, environmental issues and their in service performance.</li> </ol>   |
| <b>Intended Learning Outcomes</b>              | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. comprehend the importance of materials in engineering and society;</li> <li>b. explain the properties and behaviour of materials using fundamental knowledge of materials science.</li> <li>c. apply the knowledge of materials science to analyze and solve basic engineering problems related to stress, strain and fracture of materials;</li> <li>d. select appropriate materials for various engineering applications taking into consideration of issues in cost, quality and environmental concerns.</li> </ol>  |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <ol style="list-style-type: none"> <li>1. <u>Introduction</u><br/>Historical perspective; Evolution of engineering materials; Materials science and engineering; Classification of materials</li> <li>2. <u>Atomic Structure and Structures of Materials</u><br/>Atomic structure; Bonding forces and energies; Primary interatomic bonds and secondary bonding; Crystalline and non-crystalline materials; Phase diagram and microstructure of alloys</li> <li>3. <u>Electrical and Optical Properties of Materials</u><br/>Conductors and insulators; Semi-conductor materials; N-type and P-type semiconductors; P/N junction; Light interactions with materials; Light emitting diode (LED) and photovoltaics; Light propagation in optical fibers; Liquid crystal; Photoelasticity</li> </ol> |



|   | <p>4. <u>Mechanical Properties of Materials</u><br/>         Concept of stress and strain; Stress-strain behaviour; Elastic and plastic properties of materials; Concepts of dislocations and strengthening mechanisms; Tensile properties; Elastic recovery after plastic deformation; Hardness; Stress concentration; Impact energy, Fracture toughness; Design and safety factors</p> <p>5. <u>Introduction to Failure Analysis and Prevention</u><br/>         Fundamentals of fracture: ductile, brittle, fatigue and creep; Corrosion; Nondestructive testing; Techniques for failure analysis and prevention</p> <p>6. <u>Selection of Engineering Materials</u><br/>         Characteristics of metallic, polymeric, ceramic, electronic and composite materials; Economic, environmental and recycling issues</p>   |                                   |             |  |   |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
|---|--|-----------------------------------|-------------|--|---|--|--|--|--|---|---|---|---|--|--|----------------|-----|---|---|---|---|--|--|---------|-----|--|---|---|---|--|--|----------------------|----|--|---|---|--|--|--|----------------|-----|--|---|---|---|--|--|-------|-------|--|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>The subject will be delivered mainly through lectures but tutorials, case studies and laboratory work will substantially supplement which. Practical problems and case studies of material applications will be raised as a focal point for discussion in tutorial classes, also laboratory sessions will be used to illustrate and assimilate some fundamental principles of materials science. The subject emphasizes on developing students' problem solving skills.</p>   |                                   |             |  |   |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1055 1465 1592"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Assignments</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Laboratory report</td> <td>5%</td> <td></td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3. 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></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The assignments are designed to reflect students' understanding of the subject and to assist them in self-monitoring of their progress.</p> <p>The laboratory report is designed to assess the capability of students in analyzing and reporting experimental data relates to learning outcome (b).</p> <p>The test and examination are for determining students' understanding of key concepts as well as for assessing their achievement of the learning outcomes.</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |  |  |  | a | b | c | d |  |  | 1. Assignments | 15% | √ | √ | √ | √ |  |  | 2. Test | 20% |  | √ | √ | √ |  |  | 3. Laboratory report | 5% |  | √ | √ |  |  |  | 3. Examination | 60% |  | √ | √ | √ |  |  | Total | 100 % |  |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
|   |  | a                                 | b           | c  | d |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
| 1. Assignments  | 15%  | √                                 | √           | √  | √ |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
| 2. Test   | 20%  |                                   | √           | √  | √ |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
| 3. Laboratory report  | 5%   |                                   | √           | √  |   |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
| 3. Examination  | 60%  |                                   | √           | √  | √ |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |
| Total   | 100 %  |                                   |             |  |   |  |  |  |  |   |   |   |   |  |  |                |     |   |   |   |   |  |  |         |     |  |   |   |   |  |  |                      |    |  |   |   |  |  |  |                |     |  |   |   |   |  |  |       |       |  |  |  |  |  |  |

|                                      |  |         |
|--------------------------------------|--|---------|
| <b>Student Study Effort Expected</b> | Class contact:   |         |
|                                      | ▪ Lectures, tutorials, practical   | 39Hrs.  |
|                                      | Other student study effort:  |         |
|                                      | ▪ Guided reading, assignments and reports  | 37Hrs.  |
|                                      | ▪ Self-study and preparation for test and examination  | 47Hrs.  |
|                                      | Total student study effort   | 123Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. William D. Callister, Jr., David G. Rethwisch, <i>Fundamentals of materials science and engineering</i>, 4<sup>th</sup> edition, <i>E-Text</i><br/>John Wiley &amp; Sons; ISBN: 978-1-118-53126-6</li> <li>2. William D. Callister, Jr., David G. Rethwisch, <i>Materials Science and Engineering</i>, 8<sup>th</sup> edition, <i>E-Text</i><br/>John Wiley &amp; Sons; ISBN: 978-1-118-37325-5</li> <li>3. Materials World<br/>(Magazine of the Institute of Materials, Minerals and Mining)</li> </ol> |         |

Revised (April 2014)

### Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                             | ENG2002   |
| <b>Subject Title</b>                            | Computer Programming  |
| <b>Credit Value</b>                             | 3   |
| <b>Level</b>                                    | 2   |
| <b>Pre-requisite / Co-requisite / Exclusion</b> | Nil   |
| <b>Objectives</b>                               | <ul style="list-style-type: none"> <li>(i) To introduce the fundamental concepts of computer programming</li> <li>(ii) To equip students with sound skills in C/C++ programming language</li> <li>(iii) To equip students with techniques for developing structured and object-oriented computer programs</li> <li>(iv) To demonstrate the techniques for implementing engineering applications using computer programs.</li> </ul>   |
| <b>Intended Learning Outcomes</b>               | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Familiarize themselves with at least one C/C++ programming environment.</li> <li>2. Be proficient in using the basic constructs of C/C++ to develop a computer program.</li> <li>3. Be able to develop a structured and documented computer program.</li> <li>4. Understand the fundamentals of object-oriented programming and be able to apply it in computer program development.</li> <li>5. Be able to apply the computer programming techniques to solve practical engineering problems.</li> </ol>  |
| <b>Subject Synopsis/ Indicative Syllabus</b>    | <p><b>Syllabus:</b></p> <ol style="list-style-type: none"> <li>1. Introduction to programming - Components of a computer; Programming environment; Process of application development.</li> <li>2. Bolts and Nuts of C/C++ - Preprocessor; Program code; Functions; Comments; Variables and constants; Expressions and statements; Operators.</li> <li>3. Program Flow Control - Branching and looping; Function parameters passing; Return values; Local and global variables; Scope of variables.</li> <li>4. Program Design and Debugging - Structured program design; Debugging a program. Case study: Using the Visual C++ debugger.</li> <li>5. Basic Object Oriented Programming - Objects and classes; Private versus public; Implementing class methods; Constructors and destructors.</li> <li>6. Pointer and Array - Stack and Free store; Create and delete objects in the free store; Pointer arithmetic; Passing function arguments by pointer; Returning values by pointer; Array of objects; Array and pointer; Array of pointers; Pointer of array; Character array; Command-line processing.</li> <li>7. Stream I/O - Input and output as streams; File I/O using streams.</li> </ol> |

|  |   |  |  |          |          |          |          |
|--|---|--|--|----------|----------|----------|----------|
| <b>Teaching/Learning Methodology</b>                                   | <b>Teaching and Learning Method</b>   | <b>Intended Subject Learning Outcome</b> | <b>Remarks</b>   |          |          |          |          |
|  | Lectures, supplemented with short quizzes                                     | 2,3,4                                    | Students are introduced to the knowledge of computer programming through explanation and illustrative examples. Comprehension of the knowledge is strengthened with short quizzes. Students will be able to monitor the skills of using C/C++ and apply the techniques of developing structured object-oriented applications.  |          |          |          |          |
|  | Laboratories/tutorials where problems are given to students for them to solve | 1,2,3,4,5                                | Students apply what they have learnt in lectures and solve problems in exercises. The purpose is to ensure students have captured the important points. Tutors will aid the lecturer in helping the students finishing the exercises, and interactive Q&A will take place.   |          |          |          |          |
|  | Homework, tests and final examination   | 1,2,3,4,5                                | By doing homework, students will develop a firm understanding and comprehension of the knowledge taught. They will analyse given C/C++ applications and apply knowledge in solving problems. For some design type of problems, they will have to synthesize solutions by evaluating different alternatives. To enhance the students' problem solving skill in a given programming environment, open-book programming tests are arranged regularly. To assure students' understanding of fundamental concepts, a closed-book final examination is arranged. |          |          |          |          |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <b>Specific assessment methods/tasks</b>                                      | <b>% weighting</b>                       | <b>Intended subject learning outcomes to be assessed</b>   |          |          |          |          |
|  |   |  | <b>1</b>   | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|  | 1. In-class exercises   | 10                                       | ✓  | ✓        | ✓        | ✓        | ✓        |
|  | 2. Short-quizzes  | 15                                       |  | ✓        | ✓        | ✓        |          |
|  | 3. Programming tests  | 30                                       | ✓  | ✓        | ✓        | ✓        | ✓        |
|  | 4. Homework   | 15                                       | ✓  | ✓        | ✓        | ✓        | ✓        |
|  | 5. Final examination  | 30                                       | ✓  | ✓        | ✓        | ✓        | ✓        |
| <b>Total</b>   | 100 %   |  |  |          |          |          |          |

|                                      |   |           |
|--------------------------------------|---|-----------|
|                                      | <b>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</b>  |           |
|                                      | The short-quizzes are for assessing the understanding of fundamental concepts. The in-class exercises are conducted to help students familiarized with the programming language and skills. The programming tests are for assessing the ability of students on solving computer problems through programming within a specified period. Through doing homework, students will be able to experience how to solve computer problems and design solutions by using a systematic approach. The final examination is for assessing the students' ability on using the programming language and analysing computer problems. |           |
| <b>Student Study Effort Expected</b> | <b>Class contact:</b>   | 39 Hours  |
|                                      | ▪ Lectures, Tests and Quizzes   | 26 Hours  |
|                                      | ▪ Laboratory/Tutorial   | 13 Hours  |
|                                      | <b>Other student study effort:</b>  | 71 Hours  |
|                                      | ▪ Self-studying   | 57 Hours  |
|                                      | ▪ Homework  | 14 Hours  |
|                                      | <b>Total student study effort</b>   | 110 Hours |
| <b>Reading List and References</b>   | <b>Reference Books:</b>   |           |
|                                      | <ol style="list-style-type: none"> <li>1. S. Rao, Sams Teach Yourself C++ in One Hour a Day. Indianapolis, IN: Sams, 2012.</li> <li>2. P.J. Deitel and H.M. Deitel, <i>C++ How To Program</i>, 9<sup>th</sup> ed. Boston, MA: Prentice Hall, 2014.</li> <li>3. J. Liberty and R. Cadenhead, Sams Teach Yourself C++ in 24 hours (5th ed.) Indianapolis, IN: Sams, 2011.</li> <li>4. I Horton, Ivor Hortons Beginning Visual C++ 2010 [electronic resource]. Indianapolis, IN: Wiley, 2010.</li> </ol>   |           |

(revised) June 2015

## Subject Description Form

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|--|--|
| <b>Subject Code</b>                            | ENG2003  |
| <b>Subject Title</b>                           | Information Technology   |
| <b>Credit Value</b>                            | 3  |
| <b>Level</b>                                   | 2  |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | Nil  |
| <b>Objectives</b>                              | To provide the foundation knowledge in internet applications, computer networks, and database management that is essential to modern information system design   |
| <b>Intended Learning Outcomes</b>              | <p>Upon completion of the subject, students will be able to:</p> <p><u>Category A: Professional/academic knowledge and skills</u></p> <ol style="list-style-type: none"> <li>1. Understand the functions and features of modern computing systems.</li> <li>2. Understand the client-server architecture and be able to set up multiple internet applications.</li> <li>3. Understand the principles of computer networks and be able to set up simple computer networks.</li> <li>4. Understand the basic structure of a database system and be able to set up a simple database system.</li> </ol> <p><u>Category B: Attributes for all-roundedness</u></p> <ol style="list-style-type: none"> <li>1. Solve problems using systematic approaches.</li> </ol>   |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <ol style="list-style-type: none"> <li>1. <u>Introduction to computers</u><br/>Introduction to information technology using Internet of Things as a real life example. Introduction to modern computing systems.</li> <li>2. <u>Computer Networks</u><br/>Introduction to computer networks (Client-Server Architecture). Study different internet applications (HTTP/FTP/DNS). Explain basic concepts on packet routing (Data Encapsulation/IP Addressing/Functions of Routers). Introduction to basic network security measures.</li> <li>3. <u>Introduction to data processing and information systems</u><br/>Database systems – architecture, relational database concept, structural query language (SQL), database management systems, Web and database linking, database application development. Introduction to Information systems. Workflow management.<br/>Case study: Database design, implementation and management.</li> </ol> |
| <b>Teaching/Learning Methodology</b>           | There will be a mix of lectures, tutorials, and laboratory sessions/workshops to facilitate effective learning. Students will be given case studies to understand and practice the usage of modern information systems.  |

|  |  |             |  |    |    |    |          |
|--|--|-------------|--|----|----|----|----------|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>   | Specific assessment methods/tasks  | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |    |    |    |          |
|  |  |             | A1   | A2 | A3 | A4 | B1       |
|  | 1. Continuous Assessment   | 50%         | √  | √  | √  | √  | √        |
|  | 2. Examination   | 50%         | √  | √  | √  | √  | √        |
| Total  | 100 %  |             |  |    |    |    |          |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The assessment methods include an end-of-subject 2-hour closed-book examination (50%) and continuous assessment (50%), including open-booked quizzes, a closed-book mid-term test, laboratory sessions/workshops, and assignments. The examination, mid-term test, and quizzes cover intended subject learning outcomes A1, A2, A3, A4, and B1. The laboratory sessions/workshops cover intended subject learning outcomes A2, A3, A4, and B1. The laboratory sessions/workshops give students hands-on experience on setting up internet-applications, building computer networks, and constructing database.</p> |  |             |  |    |    |    |          |
| <b>Student Study Effort Expected</b>   | Class contact:   |             |  |    |    |    |          |
|  | <ul style="list-style-type: none"> <li>▪ Lectures (18), tutorials (6), and workshops (15)</li> </ul>   |             |  |    |    |    | 39 Hrs.  |
|  | Other student study effort:  |             |  |    |    |    |          |
|  | <ul style="list-style-type: none"> <li>▪ Workshops preparation (6/workshop)</li> </ul>   |             |  |    |    |    | 30 Hrs.  |
|  | <ul style="list-style-type: none"> <li>▪ Self study (3/week)</li> </ul>  |             |  |    |    |    | 39 Hrs.  |
|  | Total student study effort   |             |  |    |    |    | 108 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. B. Williams and S. Sawyer, <i>Using Information Technology: A Practical Introduction to Computers and Communications</i>, 11<sup>th</sup> ed., McGraw-Hill, 2014.</li> <li>2. J. F. Kurose and K. W. Ross, <i>Computer Networking: A Top-Down Approach</i>, 7<sup>th</sup> ed., Pearson, 2016.</li> <li>3. D. E. Comer, <i>Computer Networks and Internets</i>, 6<sup>th</sup> ed., Pearson, 2015.</li> <li>4. B. A. Forouzan, <i>TCP/IP Protocol Suite</i>, 4<sup>th</sup> ed., Tmh, 2010.</li> <li>5. W. Stalling, <i>Data and Computer Communications</i>, 10<sup>th</sup> ed., Pearson, 2013.</li> <li>6. S. Morris and C. Coronel, <i>Database Systems: Design, Implementation, and Management</i>, 11<sup>th</sup> Edition, Course Technology, 2014.</li> <li>7. M. Mannino, <i>Database Design, Application Development, &amp; Administration</i>. 6<sup>th</sup> ed., Chicago Business Press, 2014.</li> </ol> |             |  |    |    |    |          |

(revised) June 2017

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                         | ENG3003   |
| <b>Subject Title</b>                        | Engineering Management  |
| <b>Credit Value</b>                         | 3   |
| <b>Level</b>                                | 3   |
| <b>Pre-requisite/Co-requisite/Exclusion</b> | Nil   |
| <b>Objectives</b>                           | <p>This subject provides students with:</p> <ol style="list-style-type: none"> <li>1. A practical introduction to management and a comprehensive guide to the tools and techniques used in managing people and other resources.</li> <li>2. Opportunities to trace the historical development and describe the functions of management, from planning, and decision making to organizing, staffing, leading, motivating, and controlling. It also includes a discussion on engineering ethics.</li> <li>3. Opportunities to explore the core business strategy, technology, and innovation, and examine how these functions intertwine to play a central role in structural design, as well as supporting an organization's overall success.</li> </ol> |
| <b>Intended Learning Outcomes</b>           | <p>Upon completion of the subject, students will be able to</p> <ol style="list-style-type: none"> <li>a. perform tasks in an organization related to organizing, planning, leading and controlling project and process activities;</li> <li>b. select appropriate management techniques for improving organizational structures, work procedures, and quality performance of operational tasks;</li> <li>c. analyze the factors that affect changes in the work environment, and be aware of the approaches in implementing change in an organization;</li> <li>d. be aware of the imperatives of ethical and business behaviors in engineering organizations in a fast-changing business environment.</li> </ol>                                      |
| <b>Subject Synopsis/Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. <u>Introduction</u><br/>           General management concepts in organizations; Functions and types of industrial organizations; Organizational structures; Corporate objectives, strategy, and policy</li> <li>2. <u>Industrial Management</u><br/>           Roles of managers: Process of management, leadership, planning, organizing, motivating, and control of social and engineering activities;<br/>           Quality management: Related tools and techniques</li> </ol>  |



|   | <p>3. <u>Project Management</u></p> <p>Project scope and objectives; Network analysis; Tools that support engineering operations and task scheduling</p> <p>4. <u>Management of Change</u></p> <p>Change leadership; Organizational change; Phases of planned change; Stress management; Factors that affect the execution of change</p> <p>5. <u>Effects of Environmental Factors</u></p> <p>The effects of extraneous factors on the operations of engineering organizations, such as ethics and corporate social responsibilities issues</p>  |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
|---|--|-----------------------------------|-------------|---|---|--|--|--|--|---|---|---|---|--|--|---------------|-----|---|---|---|---|--|--|-----------------------------------|--|--|--|--|--|--|--|-----------------------------------|--|--|--|--|--|--|--|----------------------|-----|---|---|---|---|--|--|-------|------|--|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>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.</p> <p>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.</p>   |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1122 1469 1653"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Coursework</td> <td>40%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>• Group learning activities (10%)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>• Presentation (individual) (30%)</td> <td></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></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>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.</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |   |  |  |  |  | a | b | c | d |  |  | 1. Coursework | 40% | ✓ | ✓ | ✓ | ✓ |  |  | • Group learning activities (10%) |  |  |  |  |  |  |  | • Presentation (individual) (30%) |  |  |  |  |  |  |  | 2. Final examination | 60% | ✓ | ✓ | ✓ | ✓ |  |  | Total | 100% |  |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed |   |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
|   |  | a                                 | b           | c   | d |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| 1. Coursework   | 40%  | ✓                                 | ✓           | ✓   | ✓ |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| • Group learning activities (10%)   |  |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| • Presentation (individual) (30%)   |  |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| 2. Final examination  | 60%  | ✓                                 | ✓           | ✓   | ✓ |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| Total   | 100%   |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |               |     |   |   |   |   |  |  |                                   |  |  |  |  |  |  |  |                                   |  |  |  |  |  |  |  |                      |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lectures and review  | 27 Hrs.  |
|                                      | ▪ Tutorials and presentations  | 12 Hrs.  |
|                                      | Other student study effort:  |          |
|                                      | ▪ Research and preparation   | 30 Hrs.  |
|                                      | ▪ Report writing   | 10 Hrs.  |
|                                      | ▪ Preparation for oral presentation and examination  | 37 Hrs.  |
|                                      | Total student study effort   | 116 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. John R. Schermerhorn, Jr., 2013, Introduction to Management, 12th Ed., John Wiley</li> <li>2. Robbins, S P, DeCenzo, D A, and Coulter, M, 2013, Fundamentals of Management Essential Concepts and Applications, 8th Ed., Pearson</li> <li>3. Morse, L C and Babcock, D L, 2010, Managing Engineering and Technology: an Introduction to Management for Engineers, 5th Ed., Prentice Hall</li> <li>4. White, M A and Bruton, G D, 2011, The Management of Technology and Innovation: A Strategic Approach, 2nd Ed., South-Western Cengage Learning</li> </ol> |          |

*(revised) July 2015*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                         | ENG3004  |
| <b>Subject Title</b>                        | Society and the Engineer   |
| <b>Credit Value</b>                         | 3  |
| <b>Level</b>                                | 3  |
| <b>Pre-requisite/Co-requisite/Exclusion</b> | Nil  |
| <b>Objectives</b>                           | <p>This subject is designed for engineering students as a complementary subject on the role of the professional engineer in practice and their responsibilities toward the profession, colleagues, employers, clients, and the public. The objectives of the subject are to enable students to</p> <ol style="list-style-type: none"> <li>1. appreciate the historical context of modern technology and the nature of the process whereby technology develops and the relationship between technology and the environment, as well as the implied social costs and benefits;</li> <li>2. understand the social, political, legal, and economic responsibilities and accountability of the engineering profession and the organizational activities of professional engineering institutions;</li> <li>3. be aware of the short-term and long-term effects related to safety and health, and the environmental impacts of technology;</li> <li>4. observe professional conduct, as well as the legal and other applicable constraints, related to various engineering issues; and</li> <li>5. develop a strong vision to optimize their contribution to sustainable development.</li> </ol> |
| <b>Intended Learning Outcomes</b>           | <p>Upon completion of the subject, students will be able to</p> <ol style="list-style-type: none"> <li>a. identify and evaluate the effects of technology as it applies to the social, cultural, economic, legal, health, safety, and environmental dimensions of society;</li> <li>b. explain the importance of local and international professional training, professional conduct and ethics, and responsibilities in various engineering disciplines, particularly the Washington Accord;</li> <li>c. evaluate and estimate, in a team setting, the impact of contemporary issues, planned projects, and unforeseen technological advances related to engineers; effectively communicate and present the findings to laymen and peers.</li> </ol>  |

|   |   |
|---|---|
| <p><b>Subject Synopsis/<br/>Indicative Syllabus</b></p> | <ol style="list-style-type: none"> <li>1. <u>Impact of Technology on Society</u><br/><br/>Historical cases and trends of technological innovation explored through their impact on social and cultural developments of civilization and their commonalities.</li> <li>2. <u>Environmental Protection and Related Issues</u><br/><br/>Roles of the engineer in energy conservation, ecological balance, and sustainable development.</li> <li>3. <u>Global Outlook for Hong Kong's Economy and Industries</u><br/><br/>Support organizations, policies and their impacts on industrial and economic development in Greater China, the Pacific Rim, and the world.</li> <li>4. <u>Regulatory Organizations and Compliance</u><br/><br/>Discussion of engineer's responsibilities within different regulatory frameworks and environments; Examples from various entities such as the Labour Department and the Occupational Health and Safety Council; Legal dimensions to engineering such as liability, contract law, and industrial legislation.</li> <li>5. <u>Professional Institutions</u><br/><br/>Local and overseas professional institutions; Washington Accord and the qualifications and criteria of professional engineers.</li> <li>6. <u>Professional Ethics</u><br/><br/>Prevention of bribery and corruption; The work of the Independent Commission Against Corruption (ICAC); Social responsibilities of engineers.</li> </ol> |
| <p><b>Teaching/Learning<br/>Methodology</b></p>         | <p>Class comprises short lectures to provide essential knowledge and information on the relationships between society and the engineer under a range of dimensions.</p> <p>Other methods include discussions, case studies, and seminars to develop students' in-depth analysis of the relationships.</p> <p>Students are assembled into groups; throughout the course, they will work on engineering cases by completing the following learning activities:</p> <ol style="list-style-type: none"> <li>1. Case analysis where students explore the relationships between society and the engineering issues of a project under specific dimensions;</li> <li>2. Construction and assembly of a case portfolio which includes <ol style="list-style-type: none"> <li>i. Presentation slides</li> <li>ii. Feedback critiques</li> <li>iii. Weekly summary reports</li> <li>iv. A report on Sustainable Development</li> </ol> </li> </ol>  |

|  |   |             |   |          |   |
|--|---|-------------|---|----------|---|
|  | v. Individual Reflections                                       |             |   |          |   |
|  | 3. Final oral presentation                                      |             |   |          |   |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>   | Specific assessment methods/tasks                               | % weighting | Intended subject learning outcomes to be assessed |          |   |
|  |   |             | a   | b        | c |
|  | 1. Continuous assessment  | 60%         |   |          |   |
|  | • Group weekly learning activities                              | (24%)       | ✓   | ✓        | ✓ |
|  | • Individual final presentation                                 | (18%)       | ✓   | ✓        |   |
|  | • Group project report, SD report, individual reflection report | (18%)       | ✓   | ✓        | ✓ |
|  | 2. Examination  | 40%         | ✓   | ✓        |   |
| Total  | 100%  |             |   |          |   |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>The coursework requires students to work in groups to study cases from the perspectives of the eight dimensions in an engineering setting. Through these exercises, students' ability to apply and synthesize acquired knowledge can be assessed on the basis of their performance in group discussion, oral presentations, and the quality of their portfolio reports on the case studies.</p> <p>The open-book examination is used to assess students' critical thinking and problem-solving skills when working on their own.</p> |   |             |   |          |   |
| <b>Student Study Effort Expected</b>   | Class contact:  |             |   |          |   |
|  | ▪ Lectures and review   |             | 27 Hrs.   |          |   |
|  | ▪ Tutorial and presentation                                     |             | 12 Hrs.   |          |   |
|  | Other student study efforts:                                    |             |   |          |   |
|  | ▪ Research and preparation                                      |             | 63 Hrs.   |          |   |
|  | ▪ Report writing  |             | 14 Hrs.   |          |   |
|  | Total student study effort                                      |             |   | 116 Hrs. |   |

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| <p><b>Reading List and References</b></p> | <p><b>Reference Books &amp; Articles:</b></p> <ol style="list-style-type: none"> <li>1. Education for Sustainable Development - An Expert Review of Processes and Learning, UNESCO, 2011</li> <li>2. Engineering-Issues, Challenges and Opportunities for Development, USECO, 2010</li> <li>3. Engineering for Sustainable Development: Guiding Principles, Royal Academy of Engineering, 2005</li> <li>4. Securing the future: delivering UK sustainable development strategy, 2005</li> <li>5. Johnston, F S, Gostelow, J P, and King, W J, 2000, <i>Engineering and Society Challenges of Professional Practice</i>, Upper Saddle River, N.J.: Prentice Hall</li> <li>6. Hjorth, L, Eichler, B, and Khan, A, 2003, <i>Technology and Society A Bridge to the 21<sup>st</sup> Century</i>, Upper Saddle River, N.J.:Prentice Hall</li> <li>7. The Council for Sustainable Development in Hong Kong, <a href="http://www.enb.gov.hk/en/susdev/council/">http://www.enb.gov.hk/en/susdev/council/</a></li> <li>8. Poverty alleviation: the role of the engineer, <a href="http://publications.arup.com/publications/p/poverty_alleviation_the_role_of_the_engineer">http://publications.arup.com/publications/p/poverty_alleviation_the_role_of_the_engineer</a></li> </ol> <p><b>Reading materials:</b></p> <p>Engineering journals:</p> <ul style="list-style-type: none"> <li>- Engineers by The Hong Kong Institution of Engineers</li> <li>- Engineering and Technology by The Institution of Engineers and Technology</li> </ul> <p>Magazines: Time, Far East Economic Review</p> <p>Current newspapers: South China Morning Post, China Daily, Ming Pao Daily</p> |
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(revised) July 2017

## The Hong Kong Polytechnic University

### Subject Description Form

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|---|---|
| <b>Subject Code</b>                                   | ME22003   |
| <b>Subject Title</b>                                  | Visualization and Communication in Design Engineering   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 2   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Nil   |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To enhance the students' three-dimensional visualization skills and equip them with range of visual communication tools; and</li> <li>2. To provide students with fundamental understanding of the engineering design process.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Appreciate the qualities of a well-designed product and have awareness of the need of specific disciplinary knowledge to develop functional products that meet customer's and manufacturer's need;</li> <li>b. Communicate engineering design details with confidence using range of visualization and communication tools including hand-sketching, CAD geometric models, mechanism simulations, engineering drawings and physical prototypes;</li> <li>c. Work in a team to modify or improve an existing consumer product; and</li> <li>d. Apply project management techniques in meeting planned schedule.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Appreciation of Design Engineering</i></b> – Characteristics of good design, customer's perspective, manufacturer's perspective, role of materials, investigation of manufacturing methods, skills of a design engineer, examples of successful design.</p> <p><b><i>Creativity and Design process</i></b> – What is design? Basic introduction to engineering design process, creativity in design, Visual thinking (brainstorming, concept mapping) and its relationship with design innovation, applications of computer in design.</p> <p><b><i>Visualization and Communication techniques for Design Engineering</i></b> – hand-sketching, 3-D solid modelling, assembly modeling and simulation, engineering drawings, prototyping (virtual prototypes, 3-D printing, physical prototypes).</p> <p><b><i>Working in a Team Environment</i></b> – Multi-disciplinary project team: its importance in modern industry/community. Functions of design project team: team roles, design logbook, project scheduling, review and assessment of design stages, project outcome communication including interim report, oral presentation, final report and prototype presentation.</p> |
| <b>Teaching/<br/>Learning Methodology</b>             | This introductory course aims at arousing students' interest in design engineering and related skills important for engineering design. It also aims at developing interest and curiosity in all relevant subsequent subjects. Students are learnt to   |

appreciate the qualities of well-designed products through direct interaction with the products. The importance of design visualization and communication will be experienced with in-class group/individual activities. Design communication tools including hand- sketching, CAD geometric modeling, mechanism simulation, engineering drawings, and 3D printing will be introduced with the use of real product examples. The focus of software introduction is not mere training but education in fundamentals to equip the students with sound skills for lifelong career.

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

Following is the suggested study plan:

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



| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>   | Specific assessment methods/tasks   | % weighting | Intended subject learning outcomes to be assessed |   |                 |   |
|--|---|-------------|---|---|-----------------|---|
|  |   |             | a   | b | c               | d |
|  | 1. Individual assignments   | 30%         | √   | √ |                 |   |
|  | 2. Group assignments  | 20%         | √   | √ | √               |   |
|  | 3. Oral communication:<br>Group oral presentation                             | 20%         | √   | √ | √               |   |
|  | 4. Written communication:<br>Group technical report<br>(with peer evaluation) | 30%         | √   | √ | √               | √ |
| <b>Total</b>   | <b>100 %</b>  |             |   |   |                 |   |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment: 1.0 x Continuous Assessment</p> <p>Written examination is not suitable for this course since a specific set of knowledge is not the intended learning outcome. Focus is more on the skill development, critical thinking and creativity improvement. Individual assessment of students can be achieved through individual assignments, oral presentation and peer evaluation. Project assessment consists of an oral presentation and a written report. The assessment is performed by a panel of assessors that includes guest assessors from the industry. Project assessment is mainly based on the performance of the whole project group to encourage team spirit. Intra-group peer evaluation is performed to elicit the individual contribution for project activities.</p> |   |             |   |   |                 |   |
| <b>Student Study Effort Expected</b>   | <b>Class contact:</b>   |             |   |   | <b>Time</b>     |   |
|  | ▪ Lectures  |             |   |   | 15 Hrs.         |   |
|  | ▪ Small group activities/Workshops/Consultations                              |             |   |   | 24 Hrs.         |   |
|  | <b>Other student study effort:</b>  |             |   |   | <b>Time</b>     |   |
|  | ▪ CAD and sketching skills development  |             |   |   | 40 Hrs.         |   |
|  | ▪ Independent study and homework  |             |   |   | 20 Hrs.         |   |
|  | ▪ Project   |             |   |   | 20 Hrs.         |   |
|  | <b>Total student study effort</b>   |             |   |   | <b>119 Hrs.</b> |   |

|  |  |
|--|--|
| <b>Reading List<br/>and<br/>References</b> | <ol style="list-style-type: none"><li>1. D.K. Lieu and S. Sorby, Visualization, Modeling, and Graphics for engineering Design, CENGAGE Learning, Latest Edition.</li><li>2. M.N. Horenstein, Design Concepts for Engineers, Prentice Hall, latest edition.</li><li>3. T. Taura, Creative design engineering : introduction to an interdisciplinary approach, Academic Press, Latest Edition.</li></ol> |
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*Modified July 2017*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME23001  |
| <b>Subject Title</b>                                  | Engineering Mechanics  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 2  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Nil  |
| <b>Objectives</b>                                     | To provide students the fundamental concepts of mechanics of motion and system equilibrium.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Apply the fundamental knowledge of mechanics to solve for forces and moments on simple systems.</li> <li>b. Distinguish the basic differences between diverse engineering systems, and select the suitable design in achieving the engineering purposes.</li> <li>c. Employ engineering mechanics to solve the problems encountered in assignments and projects.</li> <li>d. Collaborate with peers from different disciplines in experiments and projects and present effectively the results of experiment or project.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Fundamentals of Mechanics</i></b> - 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.</p> <p><b><i>Dynamics</i></b> - Kinematics and kinetics of particles, rectilinear motion, plane curvilinear motion, relative motion, equation of motion.</p> <p><b><i>Statics</i></b> - 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.</p> <p><b><i>Equivalent Systems</i></b> - 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.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to the topics as described in the section subject synopsis (Outcomes a, b and c).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a, b and c).</p> <p>Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes c and d).</p> <table border="1" data-bbox="499 517 1249 786"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |  |          |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  | a | b | c | d | Lecture | √             | √   | √ |   | Tutorial | √ | √       | √   |   | Experiment |   |  | √              | √   |   |   |   |  |       |      |  |  |  |  |
|--|---|--|----------|---|---|-----------------------------------|-------------|--|--|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|---------|-----|---|------------|---|--|----------------|-----|---|---|---|--|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | a   | b  | c        | d |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
| Lecture  | √   | √  | √        |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
| Tutorial   | √   | √  | √        |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
| Experiment   |   |  | √        | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="499 824 1406 1182"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>3. Examination</td> <td>60%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.60 \times \text{End of Subject Examination} + 0.40 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |          |   |   | 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% |  |  |  |  |
| 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%  |  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
| <b>Student Study Effort Expected</b>                                   | Class contact:  |  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Lecture</li> </ul>   | 33 Hrs.  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Tutorial/Laboratory</li> </ul>   | 6 Hrs.   |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | Other student study effort:   |  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Course work</li> </ul>   | 23 Hrs.  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Self-study</li> </ul>  | 43 Hrs.  |          |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |
|  | Total student study effort  |  | 105 Hrs. |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |         |     |   |            |   |  |                |     |   |   |   |  |       |      |  |  |  |  |

**Reading List and  
References**

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

*Revised July 2017*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME31001   |
| <b>Subject Title</b>                                  | Dynamics and Vibrations   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 3   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME23001 Engineering Mechanics  |
| <b>Objectives</b>                                     | To teach students basic concepts of rigid body planar motion and mechanical vibration.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate and solve planar motion problems in rigid body dynamics by applying knowledge of dynamic analyses and mathematics.</li> <li>b. Formulate and solve vibration problems in single DOF mechanical systems by applying knowledge of vibration theory and mathematics.</li> <li>c. Analyse and interpret data obtained from experiments in dynamics and vibrations.</li> <li>d. Present effectively in completing written reports of laboratory work.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Dynamics</b> - <i>Plane kinematics of rigid bodies</i>, rotation, absolute motion, relative velocity, instantaneous centre of zero velocity, relative acceleration, motion relative to rotating axes. <i>Plane kinetics of rigid bodies</i>, force, mass and acceleration, general equation of motion, applications, e.g., four-bar linkage and slider-crank mechanisms, gear trains, work and energy, impulse, momentum, impulse-momentum equations, impact and applications and whirling of rotating shafts.</p> <p><b>Vibration of a Single-degree-of-freedom System</b> - 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.</p> <p><b>Laboratory Experiment</b><br/>There is one 2-hour laboratory session.<br/>Typical Experiments:</p> <ol style="list-style-type: none"> <li>1. Gear train experiment</li> <li>2. Forced vibration</li> <li>3. Whirling of shaft</li> </ol> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures aim at providing students with an integrated knowledge required for understanding dynamics and single-degree-freedom vibration systems. Theories and examples will be presented to cover the syllabus on kinematics and kinetics of rigid bodies; equation of motions, work and energy, impulse and momentum, and one DOF vibrations. (Outcomes a and b)</p> <p>Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skills of solving different engineering problems using the knowledge of dynamics and single-degree-freedom vibration systems. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a and b)</p> <p>Experiments will provide students with experience on gear train systems, forced vibration systems and whirling of shafts. These experiments are designed to train students how to apply theories to practical applications, how to analyze and present experimental data. (Outcomes c and d)</p> <table border="1" data-bbox="443 725 1463 987"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Laboratory</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table> |  |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  | a | b | c | d | Lecture | √             | √   |   |   | Tutorial | √ | √           |     |   | Laboratory |  |  | √             | √  |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
|--|---|--|---|---|---|-----------------------------------|-------------|--|--|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|-------------|-----|---|------------|--|--|---------------|----|--|--|---|---|----------------|-----|---|---|--|--|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
|  | a   | b  | c | d |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Lecture  | √   | √  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Tutorial   | √   | √  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Laboratory   |   |  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 1043 1463 1442"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>30%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Homework</td> <td>15%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Laboratory</td> <td>5%</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability to apply the concepts. It is supplemented by the tests, assignments and laboratory report which provide timely feedbacks to both lecturers and students on various topics of the syllabus.</p>  |  |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |   | a | b | c | d       | 1. Class test | 30% | √ | √ |          |   | 2. Homework | 15% | √ | √          |  |  | 3. Laboratory | 5% |  |  | √ | √ | 4. Examination | 50% | √ | √ |  |  | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
|  |   | a  | b | c | d |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 1. Class test  | 30%   | √  | √ |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 2. Homework  | 15%   | √  | √ |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 3. Laboratory  | 5%  |  |   | √ | √ |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 4. Examination   | 50%   | √  | √ |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Total  | 100%  |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |            |  |  |               |    |  |  |   |   |                |     |   |   |  |  |       |      |  |  |  |  |

|                                      |  |         |
|--------------------------------------|--|---------|
| <b>Student Study Effort Expected</b> | Class contact:   |         |
|                                      | ▪ Lecture  | 31 Hrs. |
|                                      | ▪ Laboratory/Tutorial  | 8 Hrs.  |
|                                      | Other student study effort:  |         |
|                                      | ▪ Reading and review   | 45 Hrs. |
|                                      | ▪ Homework assignment  | 22 Hrs. |
|                                      | ▪ Laboratory report  | 6 Hrs.  |
| Total student study effort           | 112 Hrs.   |         |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. F.P. Beer and E.R. Johnson, Vector Mechanics for Engineers: Dynamics, McGraw-Hill, latest edition.</li> <li>2. J.L. Meriam and L.G. Kraige, Engineering Mechanics, John Wiley, latest edition.</li> <li>3. S. Graham Kelly, Fundamentals of Mechanical Vibrations, McGraw Hill, latest edition.</li> <li>4. W.T. Thomson, Theory of Vibration with Applications, Prentice Hall, latest edition.</li> </ol> |         |

*Revised July 2014*



## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME31002  |
| <b>Subject Title</b>                                  | Linear Systems and Control   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 3  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31001 Dynamics and Vibrations   |
| <b>Objectives</b>                                     | To teach students time and frequency responses of dynamic systems to different inputs and the feedback control of such systems using PID controllers   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Model physical elements in dynamic systems and find the transfer function of a system comprising mechanical and other physical components.</li> <li>b. Predict the output response of a first- or second-order system both in time and frequency domains subject to typical input signals.</li> <li>c. Complete a given task in linear system control, such as an assignment or a project, by applying concepts in dynamics and control systems.</li> <li>d. Analyze and interpret the data obtained from a control experiment.</li> <li>e. Design a first-order and second-order system with suitable parameters and/or PID controller that will be stable and has the required system performance.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Dynamic Responses of First-Order and Second-Order Systems</i></b> - 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.</p> <p><b><i>Frequency Response of First-Order and Second-Order Systems</i></b> - Harmonic response, Bode diagrams, frequency domain specifications, frequency response applications.</p> <p><b><i>Introduction to Feedback Control</i></b> - 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.</p> <p><b><i>Feedback Control Systems</i></b> - Automatic controllers, basic P, PD, PID controllers, Routh-Hurwitz stability criterion, numerical computations for the frequency-domain analysis of dynamical systems.</p> <p><b>Laboratory Experiment</b><br/>There are two 2-hour laboratory sessions.<br/>Typical Experiments:</p> <ol style="list-style-type: none"> <li>1. Digital simulation of feedback control systems</li> <li>2. DC servomechanism</li> <li>3. Water level control</li> </ol> |

| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures aim at providing students with an integrated knowledge required for understanding and analyzing feedback control systems. (Outcomes a, b, c and e)</p> <p>Tutorials aim at enhancing analytical skills of students. Examples on system modeling, transient and frequency response of dynamic systems, and performance and stability of control systems will be involved. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a, b, c and e)</p> <p>Experiments will provide students with hands-on experience on the instrumentation and measurement of physical variables such as motor speed and water level, and their control. It also trains students in the analysis and presentation of experimental data. (Outcome d)</p> <table border="1" data-bbox="443 611 1471 875"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td></td> <td>√</td> <td></td> </tr> </tbody> </table>   |  |   |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  |  | a | b | c | d | e | Lecture | √             | √   | √ |   | √ | Tutorial | √ | √           | √   |   | √ | Experiment |  |   |                      | √   |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
|---|--|--|---|---|---|---|-----------------------------------|-------------|--|--|--|--|---|---|---|---|---|---------|---------------|-----|---|---|---|----------|---|-------------|-----|---|---|------------|--|---|----------------------|-----|--|--|--|---|--|----------------|-----|---|---|---|--|---|-------|------|--|--|--|--|--|
| Teaching/Learning Methodology   | Outcomes   |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
|   | a  | b  | c | d | e |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| Lecture   | √  | √  | √ |   | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| Tutorial  | √  | √  | √ |   | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| Experiment  |  |  |   | √ |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 925 1471 1323"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>25%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>2. Homework</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>3. Laboratory report</td> <td>10%</td> <td></td> <td></td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |   |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |   | a | b | c | d | e       | 1. Class test | 25% | √ | √ | √ |          | √ | 2. Homework | 15% | √ | √ | √          |  | √ | 3. Laboratory report | 10% |  |  |  | √ |  | 4. Examination | 50% | √ | √ | √ |  | √ | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
|   |  | a  | b | c | d | e |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| 1. Class test   | 25%  | √  | √ | √ |   | √ |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| 2. Homework   | 15%  | √  | √ | √ |   | √ |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| 3. Laboratory report  | 10%  |  |   |   | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| 4. Examination  | 50%  | √  | √ | √ |   | √ |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |
| Total   | 100%   |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |  |   |                      |     |  |  |  |   |  |                |     |   |   |   |  |   |       |      |  |  |  |  |  |

|                                      |   |          |
|--------------------------------------|---|----------|
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 31 Hrs.  |
|                                      | ▪ Laboratory/Tutorial   | 8 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Self-study  | 45 Hrs.  |
|                                      | ▪ Homework assignment   | 20 Hrs.  |
|                                      | ▪ Laboratory report   | 8 Hrs.   |
|                                      | Total student study effort  | 112 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition.</li> <li>2. N.S. Nise, Control Systems Engineering, John Wiley, latest edition.</li> <li>3. C.L. Phillips and R.D. Harbor, Feedback Control Systems, Prentice-Hall, latest edition.</li> <li>4. M.R. Driels, Linear Control Systems Engineering, McGraw-Hill, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME31003  |
| <b>Subject Title</b>                                  | System Dynamics  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 3  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME23001 Engineering Mechanics   |
| <b>Objectives</b>                                     | To provide students the knowledge in modeling and solving different dynamic systems including plane kinematics and kinetics of rigid bodies through theoretical and mathematical principles.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Construct and analyze the dynamic models of different systems by applying knowledge of physical laws and mathematical techniques.</li> <li>b. Formulate and analyze the translational and rotational motions of mechanical systems by applying knowledge of rigid body dynamics.</li> <li>c. Complete a given task in modeling and analysis of dynamic systems such as an assignment or a project by applying concepts and knowledge in system dynamics, mathematical and simulation tools.</li> <li>d. Present effectively in completing written reports of a given task.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><i>Dynamics - Plane kinematics of rigid bodies</i>, translation and rotation, relative velocity, instantaneous centre of zero velocity, relative acceleration, motion relative to rotating axes. <i>Plane kinetics of rigid bodies</i>, force, mass and acceleration, general equation of motion, applications, e.g., four-bar linkage and slider-crank mechanisms, principles of work, energy, impulse and momentum.</p> <p><i>Modelling of Linear Systems</i> – Dynamic equations of multi-degrees-of-freedom spring-mass-damper systems, and other systems; introduction to Laplace transform and analysis of vibration systems; block diagram construction and simplification; Transfer functions; Characteristic equations, Zeros and poles; Transient responses of 1<sup>st</sup> and 2<sup>nd</sup> order systems.</p> |
| <b>Teaching/Learning Methodology</b>                  | <p>Lectures aim at providing students with an integrated knowledge required for understanding and analyzing the dynamics of rigid bodies and systems. (Outcomes a to c)</p> <p>Tutorials aim at enhancing the analytical skills of the students. Examples will be provided to teach students the skill of modeling dynamic systems and determining their responses. (Outcomes a to c)</p> <p>Assignments aim at providing opportunities for students to apply concepts and knowledge in system dynamics and mathematical tools in solving real-world problems. The project aims at providing opportunities for students to design/enhance a real-life product or system using the knowledge they acquired in the class. (Outcomes a to d)</p>  |

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

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

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

Overall Assessment:  
 $0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}$

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

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

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

**Reading List and  
References**

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

*Revised March 2017*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME32001   |
| <b>Subject Title</b>                                  | Manufacturing Fundamentals  |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 3   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME22001 Engineering Design Fundamentals, or<br>ME32002 Engineering Design Fundamentals, and<br>ME23001 Engineering Mechanics   |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of manufacturing processes and to teach students on how to apply manufacturing processes in product design and development.  |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Understand the basic working principles and rationales of common manufacturing processes and the related tooling for product development.</li> <li>b. Select appropriate manufacturing processes for product fabrication at up-front design stage.</li> <li>c. Present the completed mini-project related to manufacturing.</li> </ul>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Machining</b> - The principle, operation, mechanisms and the related machines of boring, drilling, facing, grinding, milling, planning, turning, sawing, ECM and EDM.</p> <p><b>Finishing</b> - The principles and realization of anodizing, honing, painting, plating and polishing and their related facilities.</p> <p><b>Bulk Plastic Deformation</b> - The principles, rationales and realization related to facilities of extrusion, forging, rolling, bar drawing, wire drawing processes.</p> <p><b>Sheet Metal Forming</b> - The principles, design rationales and the process realization of drawing, blanking, bending, punching, shearing and spinning processes.</p> <p><b>Casting</b> - The operation, realization and principles of die casting, investment casting, permanent mold casting, sand casting, and centrifugal casting.</p> <p><b>Polymer Processing</b> - The process, principles and the realization of blow molding, casting, compression molding, extrusion, injection molding, and thermoforming.</p> <p><b>Assembly</b> - Introduction to the process principle of welding (fusion, brazing &amp; soldering, solid state), adhesive bonding and mechanical fastening. Process determination, die and tooling design, plastic deformed components design and product quality for bulk metal forming, sheet metal forming, casting and polymer processing.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge related to advanced manufacturing processes and rapid prototyping technology (Outcomes a – c).</p> <p>Tutorials and case studies are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a – c).</p> <p>Mini-project/study report is used to enhance the understanding and use of the learned knowledge (Outcomes a – c).</p> <table border="1" data-bbox="488 479 1398 797"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="3">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorials</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Mini-project</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Study report</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>   |  |   |         |  | Teaching/Learning Methodology     | Outcomes    |  |  | a | b                     | c | Lecture | √       | √       | √          | Tutorials | √ | √                           | √      | Mini-project                | √ | √ | √                                   | Study report | √                                       | √ | √ |                |         |   |   |  |       |       |  |  |  |
|--|--|--|---|---------|--|-----------------------------------|-------------|--|--|---|-----------------------|---|---------|---------|---------|------------|-----------|---|-----------------------------|--------|-----------------------------|---|---|-------------------------------------|--------------|---|---|---|----------------|---------|---|---|--|-------|-------|--|--|--|
| Teaching/Learning Methodology  | Outcomes   |  |   |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
|  | a  | b  | c |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| Lecture  | √  | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| Tutorials  | √  | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| Mini-project   | √  | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| Study report   | √  | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="488 860 1473 1294"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>1. Test</td> <td>20 %</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>2. Mini-project with report</td> <td>15 %</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>3. Presentation of the mini-project</td> <td>15 %</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>50 %</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.5 \times \text{End of Subject Examination} + 0.5 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |   |         |  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |   | a                     | b | c       | 1. Test | 20 %    | √          | √         |   | 2. Mini-project with report | 15 %   | √                           | √ |   | 3. Presentation of the mini-project | 15 %         | √                                       | √ | √ | 4. Examination | 50 %    | √ | √ |  | Total | 100 % |  |  |  |
| Specific assessment methods/tasks                                      | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
|  |  | a  | b | c       |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| 1. Test  | 20 %   | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| 2. Mini-project with report  | 15 %   | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| 3. Presentation of the mini-project                                    | 15 %   | √  | √ | √       |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| 4. Examination   | 50 %   | √  | √ |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| Total  | 100 %  |  |   |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| <b>Student Study Effort Expected</b>                                   | <table border="1" data-bbox="435 1720 1481 1986"> <tr> <td>Class contact:</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>▪ Lecture and seminar</td> <td></td> <td></td> <td></td> <td>33 Hrs.</td> </tr> <tr> <td>▪ Tutorial</td> <td></td> <td></td> <td></td> <td>6 Hrs.</td> </tr> <tr> <td>Other student study effort:</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>▪ Performing mini-projects/study report</td> <td></td> <td></td> <td></td> <td>20 Hrs.</td> </tr> </table>   |  |   |         |  | Class contact:                    |             |  |  |   | ▪ Lecture and seminar |   |         |         | 33 Hrs. | ▪ Tutorial |           |   |                             | 6 Hrs. | Other student study effort: |   |   |                                     |              | ▪ Performing mini-projects/study report |   |   |                | 20 Hrs. |   |   |  |       |       |  |  |  |
| Class contact:   |  |  |   |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| ▪ Lecture and seminar  |  |  |   | 33 Hrs. |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| ▪ Tutorial   |  |  |   | 6 Hrs.  |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| Other student study effort:  |  |  |   |         |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |
| ▪ Performing mini-projects/study report                                |  |  |   | 20 Hrs. |  |                                   |             |  |  |   |                       |   |         |         |         |            |           |   |                             |        |                             |   |   |                                     |              |   |   |   |                |         |   |   |  |       |       |  |  |  |



|                                    |   |          |
|------------------------------------|---|----------|
|                                    | ▪ Course work   | 23 Hrs.  |
|                                    | ▪ Literature search and private study   | 22 Hrs.  |
|                                    | Total student study effort  | 104 Hrs. |
| <b>Reading List and References</b> | <ol style="list-style-type: none"> <li>1. S. Kalpakjian, S. Schmid, manufacturing engineering and technology, Prentice Hall, latest edition.</li> <li>2. B. Benhabib, Manufacturing: Design, Production, Automation and Integration, Marcel Dekker, latest edition.</li> <li>3. J.Y.H. Fuh, Y.F. Zhang, A.Y.C. Nee, M.W. Fu, Computer-aided injection mold design and manufacture, Marcel Dekker, Inc, latest edition.</li> <li>4. Jiri Tlustý, Manufacturing processes and equipment, Prentice Hall, latest edition.</li> <li>5. Robert H. Wagoner, Jean-Loup Chenot, Fundamental of metal forming, New York: Wiley, latest edition.</li> <li>6. MW Fu, Design and development of metal-forming processes and products aided by finite element simulation, Springer, 2017</li> </ol> |          |

*Revised August 2017*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME32002  |
| <b>Subject Title</b>                                  | Engineering Design Fundamentals  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 2  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME22003 Visualization and Communication in Design Engineering   |
| <b>Objectives</b>                                     | To provide students with an extensive knowledge in product design and development process, and professional obligations of an engineer with the use of real world open-ended engineering problems.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Identify, formulate and solve engineering design problems and search for design related/needed data, information and knowledge for decision-making and design solution generation in product design and development.</li> <li>b. Explore up-to-date information on product design, materials and manufacturing processes.</li> <li>c. Recognize the design for X, human factors/ergonomics, product safety and reliability, and the professional and ethical responsibilities in product design and development.</li> <li>d. Use different modes of communications effectively to present outcomes of design activities.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Overview of Design Process</b> - Design problem formulation, identifying product function and establishing engineering specifications, generating and evaluating design alternatives, detail design, product testing and prototyping, communicating the design outcome: virtual/physical prototypes, engineering drawings, oral and written reports</p> <p><b>Types of Design Problems</b> – Selection design, configuration design, variant design, adaptive design, original design, redesign</p> <p><b>Design of Common Mechanical Components</b> – Load and stress analysis, material selection, strategies for failure prevention, safety factors, overview and design/selection design of common engineering components (gears, bearings, couplings, belt and train drives, shafts, keys, springs, etc.)</p> <p><b>Design for X</b> – Design for manufacture, assembly, tolerance, affordability, safety &amp; reliability, quality, environment, human factors / ergonomics</p> <p><b>Cost Estimation in Design Engineering</b> – Time value of money, design to cost, cost and price estimation, break-even economics</p> <p><b>Ethics in Design</b> – Professional obligations, codes of ethics</p> |

| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>This subject provides students with the opportunity to develop essential skills required for a professional design engineer and understanding of key concepts through activity-, project-, and problem-based (APPB) learning approach. APPB-learning challenges students to continually hone their interpersonal skills, creative abilities and understanding of the design process. It also allows students to develop strategies to enable and direct their own learning, which is the ultimate goal of education.</p> <p>Lectures are used to deliver the fundamental knowledge related to product engineering design and development (Outcomes a – c).</p> <p>Group/individual design activities and case studies are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a – c).</p> <p>Group project is used to apply concepts learned to develop design solution/s for real-world open-ended engineering problem and enhance team-working skills, communication skills, project management skills, etc. (Outcomes a – d).</p>  |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
|---|--|---|----------|---|---|--|---|---|---|---|---------|---|---|---|--|------------------------|---|---|---|---|---------|---|---|---|---|---------------------|---|---|---|---|-----------------------------------|-------------|---|--|--|--|---|---|---|---|------------------|------|--|--|--|--|---------------------------------|--|--|--|--|-----------------------|---|---|---|---|----------------------------|--|--|--|--|------------------------------------|--|--|--|--|-------------------------|------|---|---|---|---|---------|------|---|---|---|--|-------|-------|--|--|--|--|
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="470 788 1417 1122"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Small group activities</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Homework/assignment</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table><br><table border="1" data-bbox="470 1167 1417 1832"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Group Project</td> <td rowspan="4">60 %</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>    a. Individual concept solutions</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>    b. Final group report</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>    c. Group oral presentation</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>    d. Peer and facilitator evaluation</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2. Homework/Assignments</td> <td>15 %</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Test</td> <td>25 %</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> | Teaching/Learning Methodology                     | Outcomes |   |   |  | a | b | c | d | Lecture | √ | √ | √ |  | Small group activities | √ | √ | √ | √ | Project | √ | √ | √ | √ | Homework/assignment | √ | √ | √ | √ | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |  | a | b | c | d | 1. Group Project | 60 % |  |  |  |  | a. Individual concept solutions |  |  |  |  | b. Final group report | √ | √ | √ | √ | c. Group oral presentation |  |  |  |  | d. Peer and facilitator evaluation |  |  |  |  | 2. Homework/Assignments | 15 % | √ | √ | √ | √ | 3. Test | 25 % | √ | √ | √ |  | Total | 100 % |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes   |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
|   | a  | b   | c        | d |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| Lecture   | √  | √   | √        |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| Small group activities  | √  | √   | √        | √ |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| Project   | √  | √   | √        | √ |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| Homework/assignment   | √  | √   | √        | √ |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  | Intended subject learning outcomes to be assessed |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
|   |  | a   | b        | c | d |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| 1. Group Project  | 60 %   |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| a. Individual concept solutions   |  |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| b. Final group report   |  | √   | √        | √ | √ |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| c. Group oral presentation  |  |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| d. Peer and facilitator evaluation  |  |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| 2. Homework/Assignments   | 15 %   | √   | √        | √ | √ |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| 3. Test   | 25 %   | √   | √        | √ |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |
| Total   | 100 %  |   |          |   |   |  |   |   |   |   |         |   |   |   |  |                        |   |   |   |   |         |   |   |   |   |                     |   |   |   |   |                                   |             |   |  |  |  |   |   |   |   |                  |      |  |  |  |  |                                 |  |  |  |  |                       |   |   |   |   |                            |  |  |  |  |                                    |  |  |  |  |                         |      |   |   |   |   |         |      |   |   |   |  |       |       |  |  |  |  |

|   |   |                |
|---|---|----------------|
|   | <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/>1.0 x Continuous Assessment</p> <p>The group project is intended to be carried out by student groups of 3-4 members. The outcome of the group design project is presented orally in group oral presentation and in a detailed design project report. Other than the contribution for group activities each student in the group need to develop individual conceptual designs which will be assessed individually. Peer and facilitator assessments will be used to decide the individual contribution by group members for project activities. Individual homework assignments are used to enhance students' comprehension and assimilation of selected design concepts. Test is adopted for assessment of individual student's overall understanding and the ability of applying engineering design concepts.</p> |                |
| <p><b>Student Study Effort Required</b></p> | <p>Class contact:</p>   |                |
|   | <ul style="list-style-type: none"> <li>▪ Lectures</li> </ul>  | <p>24 Hrs.</p> |
|   | <ul style="list-style-type: none"> <li>▪ Small group activities/ Workshops/ Consultations</li> </ul>  | <p>15 Hrs.</p> |
|   | <p>Other student study effort:</p>  |                |
|   | <ul style="list-style-type: none"> <li>▪ Reading and review</li> </ul>  | <p>20 Hrs.</p> |
|   | <ul style="list-style-type: none"> <li>▪ Homework assignment</li> </ul>   | <p>20 Hrs.</p> |
|   | <ul style="list-style-type: none"> <li>▪ Project</li> </ul>   | <p>40 Hrs.</p> |
| <p>Total student study effort</p>           | <p>119 Hrs.</p>   |                |
| <p><b>Reading List and References</b></p>   | <ol style="list-style-type: none"> <li>1. C.L. Dym and P. Little, Engineering Design – A Project-Based Introduction, Jon Wiley &amp; Sons, latest edition</li> <li>2. D.G. Ullman, The Mechanical Design Process, McGraw Hill Education, latest edition</li> <li>3. R.J. Eggert, Engineering design, Prentice Hall, latest edition.</li> <li>4. B. Hyman, Fundamentals of Engineering Design, Prentice Hall, latest edition.</li> <li>5. George E. Dieter, Engineering Design, McGraw-Hill International Editions, latest edition.</li> <li>6. G. Pahl and W. Beitz, Engineering Design-A systematic approach, Springer, latest edition.</li> <li>7. R.C. Juvinall, Fundamentals of machine component design, John Wiley &amp; sons, latest edition</li> <li>8. J.A. Collins, Mechanical design of machine elements and machines: a failure prevention perspective, John Wiley &amp; sons, latest edition</li> </ol>  |                |

Revised March 2017

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME33001  |
| <b>Subject Title</b>                                  | Mechanics of Materials   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 3  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME23001 Engineering Mechanics; and<br>ENG2001 Fundamentals of Materials Science and Engineering   |
| <b>Objectives</b>                                     | To introduce the fundamental mechanics knowledge of solid materials under basic loading conditions. And to introduce practical approaches to solve for the stress and strain/deformation of solid materials under external mechanical loadings.  |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Solve for external forces and moments applied on a structure and determine the distribution of internal forces and moments in the structure by using free body diagrams and the laws of equilibrium.</li> <li>b. Recognize the crucial material and geometrical properties for a structural component under different types of loading, and solve for stress and deformation in a structural component due to axial loading, torsion, and bending acting individually or in combination.</li> <li>c. Evaluate the principal stresses in structural components subjected to a combined state of loading.</li> <li>d. Formulate and solve problems involving tension, compression, torsion or bending for statically indeterminate structural components.</li> </ul>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Fundamentals</b> - Free Body Diagram; Equilibrium of a deformable body; General state of stress; Strain; Mechanical properties of materials.</p> <p><b>Axial Load</b> - Saint-Venant's Principle; Axial elastic deformation; Principle of superposition; Statically indeterminate axially loaded member; Thermal stress.</p> <p><b>Torsion</b> - Torsional deformation; Torsional Stress; Angle of twist; Statically indeterminate torque-loaded members.</p> <p><b>Bending</b> - Equilibrium of beams; Shear force and bending moments; Flexural stresses; Beam deflection; Slope and deflection by method of superposition; Statically indeterminate systems.</p> <p><b>Combined Loading</b> - 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.</p> |

|   | <p><b>Laboratory Experiment</b><br/> There are two 2-hour laboratory sessions.<br/> Typical Experiments:<br/> 1. Torsion test<br/> 2. Deflection of beam</p>  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|---|---|-----------------------------------|-------------|--|---|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|----------------------|----|---|------------|---|---|---------|-----|---|---|---|---|----------------|-----|---|---|---|---|-------|------|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to the topics as described in the section subject synopsis (Outcomes a to d).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (Outcomes a to d).</p> <p>Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes a and d).</p> <table border="1" data-bbox="443 725 1445 987"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Experiment</td> <td>√</td> <td></td> <td></td> <td>√</td> </tr> </tbody> </table>  | Teaching/Learning Methodology     | Outcomes    |  |   |  | a | b | c | d | Lecture | √             | √   | √ | √ | Tutorial | √ | √                    | √  | √ | Experiment | √ |   |         | √   |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|   | a   | b                                 | c           | d  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Lecture   | √   | √                                 | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Tutorial  | √   | √                                 | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Experiment  | √   |                                   |             | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1055 1445 1487"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>25%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Laboratory report</td> <td>5%</td> <td>√</td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>3. Test</td> <td>10%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>60%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="4"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.60 \times \text{End of Subject Examination} + 0.40 \times \text{Continuous Assessment}</math></p> <p>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.</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   | a | b | c | d       | 1. Assignment | 25% | √ | √ | √        | √ | 2. Laboratory report | 5% | √ |            |   | √ | 3. Test | 10% | √ | √ | √ | √ | 4. Examination | 60% | √ | √ | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting   |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|   |   | a                                 | b           | c  | d |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 1. Assignment   | 25%   | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 2. Laboratory report  | 5%  | √                                 |             |  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 3. Test   | 10%   | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 4. Examination  | 60%   | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Total   | 100%  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                      |    |   |            |   |   |         |     |   |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 33 Hrs.  |
|                                      | ▪ Tutorial/Laboratory  | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Course work  | 23 Hrs.  |
|                                      | ▪ Self-study   | 42 Hrs.  |
|                                      | Total student study effort   | 104 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. R.C. Hibbeler, Mechanics of Materials, Pearson Prentice Hall, latest edition.</li> <li>2. F.P. Beer, E.R. Johnston and Jr. J.T. DeWolf, Mechanics of Materials, McGraw-Hill, latest edition.</li> <li>3. A.C. Ugural, A.C. and S.K. Fenster, Advanced Strength and Applied Elasticity, Prentice Hall, latest edition.</li> </ol> |          |

*Revised August 2014*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME34002  |
| <b>Subject Title</b>                                  | Engineering Thermodynamics   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 3  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: AP10005 Physics I, and<br>AMA2111 Mathematics I<br>Exclusion: ME34001 Engineering Thermodynamics  |
| <b>Objectives</b>                                     | To provide fundamental knowledge of steam and gas power cycles and refrigeration cycle, and air-conditioning, combustion and heat transfer processes.  |
| <b>Intended Learning Outcomes</b>                     | <ol style="list-style-type: none"> <li>a. Formulate and solve thermodynamic problems relating to steam power, gas power and refrigeration cycles; and air-conditioning, combustion and heat-transfer processes by applying knowledge in engineering thermodynamics, air-conditioning, combustion, heat-transfer and mathematics.</li> <li>b. Complete a given task such as a design project in thermodynamics by applying knowledge acquired in the subject and information obtained through literature search.</li> <li>c. Analyze and interpret data obtained from experiments in engineering thermodynamics, combustion and heat transfer.</li> <li>d. Present effectively in completing written reports of laboratory work and the given task.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Review of Basic Concepts of Thermodynamics</b> - Thermal properties. Ideal gas. First law of thermodynamics. Non-flow and steady-flow processes. Second law of thermodynamics.</p> <p><b>Second Law of Thermodynamics</b> - Kelvin-Planck and Clausius statements. Reversible and irreversible processes. Carnot cycle. Thermodynamic temperature scale. Inequality of Clausius. Entropy. The second law for a control mass/control volume. Isentropic efficiency.</p> <p><b>Power and Refrigeration Cycles</b> - Vapour cycles: Carnot cycle and Rankine cycle. Superheat and reheat. Air standard engine cycles: Otto cycle and Diesel cycle. Gas turbine cycles. Carnot efficiency. Refrigerator and heat pump. Vapor compression cycle. Coefficient of Performance.</p> <p><b>Psychrometry and Air Conditioning</b> - Psychrometry. Psychrometric chart. Introduction to air conditioning.</p> <p><b>Combustion</b> - Hydrocarbon fuels. Combustion equations. Stoichiometric air fuel ratio. Lean and rich mixture.</p> <p><b>Review of Fundamental Heat Transfer</b> - Mechanisms and governing equations of conduction, convection and radiation.</p> <p><b>Convection Heat Transfer</b> - Forced, free and mixed convection. Hydrodynamic and thermal boundary layers. Use of non-dimensional parameters: Reynolds number;</p> |



|   | <p>Nusselt number; Prandtl number; Grashof number and Richardson number. Application of convective heat transfer correlations to solve convective heat transfer problems.</p> <p><b>Laboratory Experiment</b><br/> There are two 2-hour laboratory sessions with the typical experiments:</p> <ol style="list-style-type: none"> <li>1. Refrigeration system</li> <li>2. Diesel engine test-bed</li> <li>3. Convection heat transfer</li> <li>4. Combustion</li> </ol>   |                                   |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
|---|--|-----------------------------------|-------------|--|---|--|---|---|---|---|---------|----------------|-----|---|---|----------|---|---------|-----|---|------------|--|--|----------------------|-----|---|---|--|---|----------------------------|-----|--|--|---|---|-------|------|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to thermodynamics and heat transfer (outcomes a and b).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a, b and d).</p> <p>Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (outcomes c and d).</p> <table border="1" data-bbox="443 880 1442 1140"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table>   | Teaching/Learning Methodology     | Outcomes    |  |   |  | a | b | c | d | Lecture | √              | √   |   |   | Tutorial | √ | √       |     | √ | Experiment |  |  | √                    | √   |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes   |                                   |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
|   | a  | b                                 | c           | d  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| Lecture   | √  | √                                 |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| Tutorial  | √  | √                                 |             | √  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| Experiment  |  |                                   | √           | √  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1211 1463 1615"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>60%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Given Task/Report</td> <td>10%</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>4. Laboratory Work/Reports</td> <td>10%</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="4"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.6 \times \text{End of Subject Examination} + 0.4 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts and knowledge. It is supplemented by the tests, assignments, projects and laboratory works which provide timely feedbacks to both lecturers and students on various topics of the syllabus.</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   | a | b | c | d       | 1. Examination | 60% | √ | √ |          |   | 2. Test | 20% | √ | √          |  |  | 3. Given Task/Report | 10% | √ | √ |  | √ | 4. Laboratory Work/Reports | 10% |  |  | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
|   |  | a                                 | b           | c  | d |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| 1. Examination  | 60%  | √                                 | √           |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| 2. Test   | 20%  | √                                 | √           |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| 3. Given Task/Report  | 10%  | √                                 | √           |  | √ |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| 4. Laboratory Work/Reports  | 10%  |                                   |             | √  | √ |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |
| Total   | 100%   |                                   |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |                      |     |   |   |  |   |                            |     |  |  |   |   |       |      |  |  |  |  |

|                                      |   |          |
|--------------------------------------|---|----------|
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Tutorial / Experiment   | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Course work   | 39 Hrs.  |
|                                      | ▪ Self-study  | 39 Hrs.  |
|                                      | Total student study effort  | 117 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. R.E. Sonntag, C. Borgnakke and G.J.V. Wylen, Fundamentals of Thermodynamics, John Wiley and Son, latest edition.</li> <li>2. T.D. Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, Pearson, latest edition.</li> <li>3. K. Wark, and D. Richards, Thermodynamics, McGraw-Hill, latest edition.</li> <li>4. K.D. Hagen, Heat Transfer with Applications, Prentice Hall, latest edition.</li> <li>5. F.D. Incropera, and D.P. Dewitt, Introduction to Heat Transfer, Wiley, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

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|--|--|
| <b>Subject Code</b>                            | ME34003  |
| <b>Subject Title</b>                           | Thermofluid Mechanics  |
| <b>Credit Value</b>                            | 3  |
| <b>Level</b>                                   | 3  |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | Pre-requisite: AP10005 Physics I   |
| <b>Objectives</b>                              | <ol style="list-style-type: none"> <li>1. To provide fundamental concepts and knowledge of fluid mechanics, acoustics and heat transfer.</li> <li>2. To provide fundamental concepts and knowledge of internal and external flow systems, pump and fan systems, heating and cooling systems and their applications to product design.</li> </ol>   |
| <b>Intended Learning Outcomes</b>              | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate and solve fluid-mechanic/heat-transfer/acoustic problems by applying knowledge of thermofluids, heat transfer, acoustics and mathematics.</li> <li>b. Complete a design project of a thermofluid system by applying knowledge acquired in the subject with the aid of computer technology.</li> <li>c. Analyze and interpret data obtained from experiments in fluid mechanics, acoustics and heat transfer.</li> <li>d. Search for updated technology in thermofluid engineering in completing a design project of a thermofluid system.</li> <li>e. Communicate effectively in completing written reports of laboratory work and design project.</li> </ol>   |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <p><b>Fluid Mechanics</b> – Basic concepts. Fluid pressure and manometers. Bernoulli, energy and momentum equations. Pitot tubes. Laminar and turbulent flow in pipes. Moody chart, frictional and minor losses. Design for pipes in parallel and in series. Pump matching in pipe flow system. Parallel flow over flat plates, flow over cylinders and spheres. Dimensional Analysis. Buckingham <math>\pi</math> theorem. Flow similarity and modeling.</p> <p><b>Flow Generation</b> – Conservation of angular momentum and working principles of fluid machinery. Performance characteristics of fans, pumps and blowers and their design selections. Engineering estimates of the working point of the fluid machines in products.</p> <p><b>Heat Transfer</b> – Revision: basic heat transfer modes; one-dimensional steady state heat conduction in plane walls and cylinders; electrical analogy method. Thermal insulation. Critical thickness of insulation. Fins. Natural convection over surfaces. Forced convection over flat plates and in pipes. Heat exchangers. Thermal, blackbody and gray body radiations. View factors. Radiative exchange between surfaces in enclosures.</p> |

|   | <p><b>Noise</b> – Sound pressure and sound power levels. Point source models. Common noise source mechanisms involving flow and vibration and their sound power laws. Simple noise control design.</p> <p><b>Experimental Work</b><br/>There are two 2-hour laboratory sessions with the following typical experiments:</p> <ol style="list-style-type: none"> <li>1. Flow pattern at exit of a hair dryer</li> <li>2. Heat transfer via a heat sink</li> <li>3. Natural convection and radiation heat transfer</li> <li>4. Noise control technique</li> </ol>  |                               |          |   |   |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |
|---|---|-------------------------------|----------|---|---|--|--|---|---|---|---|---|---------|---|---|--|--|--|----------|---|---|--|---|--|--------------------------|--|--|---|--|---|-----------------------|---|---|--|---|---|
| <p><b>Teaching/Learning Methodology</b></p> | <ol style="list-style-type: none"> <li>1. The subject intends to lay a solid scientific foundation for the design and analysis of a product in which thermofluid sciences play a crucial role. Systematic lectures are required to achieve such foundation building coupled with assignments (outcomes a, and b).</li> <li>2. Tutorials are used to illustrate the applications of fundamental knowledge to practical situations (outcomes a, b, and d).</li> <li>3. Laboratory works are essential for students to have hands-on experience of the thermofluid systems to be learned (outcomes c and e).</li> <li>4. The design project aims to integrate the thermofluid sciences to engineering design of a thermofluid system, and this design task provides opportunity to apply knowledge of mathematics, thermofluid sciences and acoustics to design a real-life product (outcomes a, b, d and e).</li> </ol> <p>It is intended to make use of these teaching/learning methodologies to achieve the intended subject learning outcomes as indicated in the following table:</p> <table border="1" data-bbox="440 1104 1391 1413"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>Experimental Work/Report</td> <td></td> <td></td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Design Project/Report</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology | Outcomes |   |   |  |  | a | b | c | d | e | Lecture | √ | √ |  |  |  | Tutorial | √ | √ |  | √ |  | Experimental Work/Report |  |  | √ |  | √ | Design Project/Report | √ | √ |  | √ | √ |
| Teaching/Learning Methodology               | Outcomes  |                               |          |   |   |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |
|   | a   | b                             | c        | d | e |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |
| Lecture                                     | √   | √                             |          |   |   |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |
| Tutorial                                    | √   | √                             |          | √ |   |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |
| Experimental Work/Report                    |   |                               | √        |   | √ |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |
| Design Project/Report                       | √   | √                             |          | √ | √ |  |  |   |   |   |   |   |         |   |   |  |  |  |          |   |   |  |   |  |                          |  |  |   |  |   |                       |   |   |  |   |   |

|  |   |             |   |   |   |   |   |
|--|---|-------------|---|---|---|---|---|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>   | Specific assessment methods/tasks   | % weighting | Intended subject learning outcomes to be assessed |   |   |   |   |
|  |   |             | a   | b | c | d | e |
|  | 1. Examination  | 50%         | √   | √ |   |   |   |
|  | 2. Test   | 25%         | √   | √ |   |   |   |
|  | 3. Assignments  | 7.5%        | √   |   |   | √ |   |
|  | 3. Design Project/Report  | 10%         | √   | √ |   | √ | √ |
|  | 4. Laboratory Work/Report   | 7.5%        |   |   | √ |   | √ |
|  | Total   | 100%        |   |   |   |   |   |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:</p> <p style="text-align: center;"><math>0.5 \times \text{End of Subject Examination} + 0.5 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on their overall understanding and ability in applying the concepts and knowledge of thermofluid mechanics. It is supplemented by homework assignments, design project/report and laboratory works/reports. The mid-term test which covers the first half of the course materials provides useful timely feedback to both lecturer and the students on the topics.</p> |   |             |   |   |   |   |   |
| <b>Student Study Effort Expected</b>   | Class contact:  |             |   |   |   |   |   |
|  | ▪ Lecture   |             | 33 Hrs.   |   |   |   |   |
|  | ▪ Tutorial/laboratory   |             | 6 Hrs.  |   |   |   |   |
|  | Other student study effort:   |             |   |   |   |   |   |
|  | ▪ Coursework (Assignments, Design Project/ Laboratory Works and Reports)  |             | 39 Hrs.   |   |   |   |   |
|  | ▪ Self Study  |             | 39 Hrs.   |   |   |   |   |
|  | Total student study effort  |             | 117 Hrs.  |   |   |   |   |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Cengel Y.A., Turner R. H. and Cimbala J. M., Fundamentals of thermal-fluid sciences. McGraw Hill, latest edition.</li> <li>2. Holman J. P., Heat Transfer, McGraw Hill, latest edition.</li> <li>3. Wright T., Fluid machinery: performance, analysis, and design, CRC Press, latest edition.</li> <li>4. Munson B. R., Young D. F., Okiishi T. H., Huebsch W. W., Fundamentals of Fluid Mechanics, John Wiley, latest edition.</li> <li>5. Barron, R. F., Industrial Noise Control and Acoustics, Marcel Dekker Inc., latest edition.</li> </ol> |             |   |   |   |   |   |

Revised July 2014

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME34004   |
| <b>Subject Title</b>                                  | Fluid Mechanics   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 3   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: AMA2112 Mathematics II   |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To teach fundamental concepts and knowledge of fluid mechanics.</li> <li>2. To provide fundamental concepts and knowledge of inviscid and viscous flows, low-Reynolds number and high-Reynolds number flows, incompressible and compressible flows, their applications in mechanical engineering.</li> </ol>  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate and solve flow problems by applying knowledge of fluid mechanics and mathematics.</li> <li>b. Analyze and interpret data obtained from experiments in fluid mechanics.</li> <li>c. Search for updated technology in fluid engineering in completing a design project of a fluid system.</li> <li>d. Communicate effectively in completing written reports of laboratory work and design project.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Basic Concepts</b> - Fluid properties, viscosity and shear stress. Newton's Law of viscosity, simple viscometer, compressibility, Newtonian and non-Newtonian fluids.</p> <p><b>Pressure Distribution in a Fluid</b> - Fluid pressure, Pascal's law, pressure-height relation, manometry, forces on submerged surfaces and buoyancy, force vortex and free vortex motion.</p> <p><b>General Description &amp; Equations of Motion of Fluid Flow</b> - Flow: steady and unsteady, uniform and non-uniform, incompressible and compressible, laminar and turbulent flow, Eulerian and Lagrangian 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.</p> <p><b>Dimensional Analysis</b> - Principle of dimensional homogeneity. Buckingham <math>\pi</math> theorem. Dimensionless groups and their physical significance. Flow similarity and model testing.</p> <p><b>Conservation Equations</b> - 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.</p> <p><b>Internal Flow</b> - Exact solution for fully developed laminar flow in a pipe, Darcy's law;</p> |

|   | <p>entrance length, Reynolds experiment and turbulence; Moody chart, frictional and minor losses, design for pipes in parallel and in series.</p> <p><b>External Flow</b> - 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.</p> <p><b>Applications on Fluid Machinery</b> - Dynamics of flow over an airfoil and through a cascade, Euler equation for turbo-machinery, characteristics of fans and pumps;</p> <p><b>Compressible Flows</b> - Review of Thermodynamics, propagation of sound waves. Isentropic flow equations. Mach cone. Subsonic and supersonic flows nozzles. Normal shock waves and oblique shock waves.</p> <p><b>Laboratory Experiment</b><br/>There are two 2-hour laboratory sessions and the typical Experiments are:</p> <ol style="list-style-type: none"> <li>1. Compressible flow nozzle</li> <li>2. Centrifugal Pump Testing</li> <li>3. Potential Flow Visualization (Hele-Shaw Expt.)</li> <li>4. Wind Tunnel Testing of Cylinder and aerofoil</li> <li>5. Universal velocity Profile</li> <li>6. Boundary Layer Experiment</li> </ol> |                               |          |   |  |  |   |   |   |   |         |   |   |  |   |          |   |   |  |   |            |  |  |   |   |
|---|---|-------------------------------|----------|---|--|--|---|---|---|---|---------|---|---|--|---|----------|---|---|--|---|------------|--|--|---|---|
| <p><b>Teaching/Learning Methodology</b></p> | <p>Lectures aim to deliver the fundamental knowledge in relation to fluid mechanics (Outcomes a, b, and d).</p> <p>Tutorials are deployed to illustrate the application of fundamental knowledge to practical situations (Outcomes a, b, and d).</p> <p>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 c and d).</p> <table border="1" data-bbox="440 1460 1334 1727"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table>   | Teaching/Learning Methodology | Outcomes |   |  |  | a | b | c | d | Lecture | √ | √ |  | √ | Tutorial | √ | √ |  | √ | Experiment |  |  | √ | √ |
| Teaching/Learning Methodology               | Outcomes  |                               |          |   |  |  |   |   |   |   |         |   |   |  |   |          |   |   |  |   |            |  |  |   |   |
|   | a   | b                             | c        | d |  |  |   |   |   |   |         |   |   |  |   |          |   |   |  |   |            |  |  |   |   |
| Lecture                                     | √   | √                             |          | √ |  |  |   |   |   |   |         |   |   |  |   |          |   |   |  |   |            |  |  |   |   |
| Tutorial                                    | √   | √                             |          | √ |  |  |   |   |   |   |         |   |   |  |   |          |   |   |  |   |            |  |  |   |   |
| Experiment                                  |   |                               | √        | √ |  |  |   |   |   |   |         |   |   |  |   |          |   |   |  |   |            |  |  |   |   |

|  |   |             |  |   |   |   |
|--|---|-------------|--|---|---|---|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | 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/Laboratory report   | 12.5%       | √  | √ | √ | √ |
|  | 3. Test   | 37.5%       | √  | √ | √ | √ |
| Total  | 100%  |             |  |   |   |   |
|  | <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> |             |  |   |   |   |
| <b>Student Study Effort Expected</b>                                   | Class contact:  |             |  |   |   |   |
|  | ▪ Lecture   |             | 33 Hrs.  |   |   |   |
|  | ▪ Tutorial / Laboratory   |             | 6 Hrs.   |   |   |   |
|  | Other student study effort:   |             |  |   |   |   |
|  | ▪ Course work   |             | 20 Hrs.  |   |   |   |
|  | ▪ Self-study  |             | 45 Hrs.  |   |   |   |
|  | Total student study effort  |             | 104 Hrs.   |   |   |   |
| <b>Reading List and References</b>                                     | <ol style="list-style-type: none"> <li>1. Y.A. Cengel J.M. Cimbala, Fluid Mechanics (Fundamentals and Applications), McGraw-Hill, latest edition.</li> <li>2. F.M. White, Fluid Mechanics, McGraw-Hill, latest edition.</li> <li>3. J.F. Douglas, J.M. Gasiorek and J.A. Swaffield, Fluid Mechanics, Pearson, latest edition</li> <li>4. M.C. Potter, and D.C. Wiggert, Mechanics of Fluids, Prentice-Hall, latest edition.</li> </ol>  |             |  |   |   |   |

Revised September 2016



## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME41004   |
| <b>Subject Title</b>                                  | Mechatronics and Control  |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31003 System Dynamics  |
| <b>Objectives</b>                                     | To provide students the knowledge in designing mechatronic systems for product development which integrate mechanical, electrical and control systems engineering.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate and solve problems related to sensors, actuators, and signal conditioning in mechatronic systems, controller design and stability analysis, and performance specifications for mechatronic systems.</li> <li>b. Design and analyze a given task or project in mechatronics system by applying knowledge acquired in the subject and information obtained through literature search.</li> <li>c. Analyze and interpret data obtained from experiments to evaluate the performance and/or stability of mechatronic systems.</li> <li>d. Present effectively in completing written reports of laboratory work and the given task.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Sensors and Actuators</b> - Instrumentation and measurement principles; frequency response characteristics; sensors for motion and position measurement; force, pressure and acceleration sensors, <i>etc</i>; actuators such as direct current motors, stepper motors, piezoelectric actuators, <i>etc</i>.</p> <p><b>Signal Conditioning and Transmission</b> - Concepts and principles; analogue electronics with operational amplifier; conversion between analog and digital signals, multiplexing; data acquisition principles, signal filtering.</p> <p><b>Digital Logic Controller and PLC</b> - Logic; controller design in mechatronic system integration, combinational and sequential control, minimization of logic equations; ladder logic diagrams; introduction to microcontrollers and programmable logic controllers (PLC).</p> <p><b>Introduction to Feedback Control</b> – Analysis of open-loop and closed-loop systems; transfer functions and block diagrams, time-domain specifications such as overshoot, settling time, steady-state error <i>etc</i>.</p> <p><b>Feedback Control Systems</b> – Automatic controllers, basic P, PD, PI, PID controllers, Routh-Hurwitz stability criterion, controller design to satisfy the design specifications.</p> |

|   | <p><b>Laboratory Experiment</b><br/>There are two laboratory sessions.<br/>Typical Experiments:</p> <ol style="list-style-type: none"> <li>1. Displacement Measurement using Linear Variable Differential Transformer (LVDT)</li> <li>2. Sequential control using programmable logic controller (PLC)</li> <li>3. DC servomechanism</li> <li>4. Water level control</li> </ol>  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
|---|---|-----------------------------------|-------------|--|---|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|----------------|-----|---|-------------|---|---|----------------------|-----|------------|--|---|---|------------|---------|---|---|--|---|----------------|-----|---|---|--|--|-------|------|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to sensors and actuators, signal conditionings, digital logic controllers, feedback control systems and stability analysis (Outcomes a and b).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situation (Outcomes a and b).</p> <p>Assignments are used to help students in developing a firm understanding in the concepts taught (Outcomes a and b).</p> <p>Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results (Outcomes c and d).</p> <p>The project is used to help students in enhancing their ability to apply the knowledge in relation to sensors and actuators in designing a real-life system (Outcomes a, b and d).</p> <table border="1" data-bbox="443 1048 1455 1451"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Assignments</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Project</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcomes    |  |   |  | a | b | c | d | Lecture | √             | √   |   |   | Tutorial | √ | √              |     |   | Assignments | √ | √ |                      |     | Experiment |  |   | √ | √          | Project | √ | √ |  | √ |                |     |   |   |  |  |       |      |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
|   | a   | b                                 | c           | d  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Lecture   | √   | √                                 |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Tutorial  | √   | √                                 |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Assignments   | √   | √                                 |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Experiment  |   |                                   | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Project   | √   | √                                 |             | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1505 1455 2018"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Class Test</td> <td>15%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Assignments</td> <td>10%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Laboratory Report</td> <td>10%</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Project</td> <td>15%</td> <td>√</td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>5. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   | a | b | c | d       | 1. Class Test | 15% | √ | √ |          |   | 2. Assignments | 10% | √ | √           |   |   | 3. Laboratory Report | 10% | √          |  | √ | √ | 4. Project | 15%     | √ | √ |  | √ | 5. Examination | 50% | √ | √ |  |  | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting   |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
|   |   | a                                 | b           | c  | d |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 1. Class Test   | 15%   | √                                 | √           |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 2. Assignments  | 10%   | √                                 | √           |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 3. Laboratory Report  | 10%   | √                                 |             | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 4. Project  | 15%   | √                                 | √           |  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 5. Examination  | 50%   | √                                 | √           |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Total   | 100%  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                |     |   |             |   |   |                      |     |            |  |   |   |            |         |   |   |  |   |                |     |   |   |  |  |       |      |  |  |  |  |

|                                      |  |         |
|--------------------------------------|--|---------|
|                                      | <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math>.</p> <p>Tests, assignments, laboratory reports, and project are adopted in continuous assessment on students' timely feedback to and on-going understanding of the course. Students' overall understanding of the course and ability in applying the delivered knowledge are further assessed through a formal examination.</p>   |         |
| <b>Student Study Effort Expected</b> | Class contact:   |         |
|                                      | ▪ Lecture  | 33 Hrs. |
|                                      | ▪ Laboratory / Tutorial  | 6 Hrs.  |
|                                      | Other student study effort:  |         |
|                                      | ▪ Self-study   | 36 Hrs. |
|                                      | ▪ Homework assignment  | 15 Hrs. |
|                                      | ▪ Laboratory report  | 6 Hrs.  |
|                                      | ▪ Project  | 9 Hrs.  |
| Total student study effort           | 105 Hrs.   |         |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>Shetty, D. and Kolk, R. A., <i>Mechatronic System Design</i>, PWS Publishing Company, latest edition.</li> <li>Alciatore, D. G. and Hinand, M. B., <i>Introduction to Mechatronics and Measurement Systems</i>, McGraw Hill, latest edition.</li> <li>Bolton, W., <i>Mechatronics: Electronic Control Systems in Mechanical Engineering</i>, Prentice Hall, latest edition.</li> <li>Ogata, K., <i>Modern Control Engineering</i>, Prentice Hall, latest edition.</li> <li>Gopal, M., <i>Control Systems Principles and Design</i>, Tata McGraw-Hill, latest edition.</li> <li>Nise, N.S., <i>Control Systems Engineering</i>, John Wiley, latest edition.</li> </ol> |         |

Revised March 2017

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME42005   |
| <b>Subject Title</b>                                  | CAD/CAE Technologies for Product Development  |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: AMA2111 Mathematics I  |
| <b>Objectives</b>                                     | To provide students with computer-aided design (CAD) and computer-aided engineering (CAE) technologies and the ability in using CAD and CAE software for product design and development.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Use CAD and CAE technologies to support product design activities, including geometry modeling, design solution modeling, analysis and evaluation, in different design process of the whole product design and development cycle.</li> <li>b. Understand data exchange standards and practices between CAD and CAE models and systems and their interoperability and associativity.</li> <li>c. Use CAD and CAE commercial software systems for product design and development in terms of geometry modeling, kinetics simulation, design solution analysis and evaluation.</li> <li>d. Optimize design solutions with the aid of CAD and CAE technologies.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Computer-aided Design</i></b></p> <ul style="list-style-type: none"> <li>- Geometric Models of Products <ul style="list-style-type: none"> <li>• Wireframe model</li> <li>• Surface model</li> <li>• Solid Model</li> </ul> </li> <li>- Geometry modeling technologies <ul style="list-style-type: none"> <li>• Curve Modeling</li> <li>• Surface Modeling</li> <li>• Solid Modeling</li> </ul> </li> <li>- Product kinetics modeling and simulation</li> </ul> <p><b><i>Design Analysis and Evaluation</i></b></p> <ul style="list-style-type: none"> <li>- Finite element modeling and analysis <ul style="list-style-type: none"> <li>• Basic concept of finite element method</li> <li>• Modeling techniques</li> <li>• Mesh types</li> <li>• Boundary constraints</li> <li>• Material and Properties</li> <li>• Symmetry in modeling and analysis</li> </ul> </li> <li>- Mechanical and thermal stress analyses</li> <li>- Dynamic response</li> <li>- Analysis on heat transfer problems in product design</li> <li>- Analysis on fluid dynamics problems in product design</li> </ul> |

|   | <p><b>CAD/CAE Integration</b></p> <ul style="list-style-type: none"> <li>- Data exchange standards: STL, STEP and IGES</li> <li>- Interoperability and associativity between CAD and CAE</li> <li>- Model defect and repairing</li> </ul>   |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
|---|---|-----------------------------------|-------------|--|---|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|--------------------------------|-----|---|--------------|---|---|-------------------------------------|-----|---|---|---|---|----------------|-----|---|--|---|---|-------|------|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures will be given to explain the theories behind CAD and CAE and their applications. (Outcomes b, c and d)</p> <p>Tutorials will be used to teach the students on how to conduct product design, analysis and evaluation using state-of-the-art CAD and CAE software commercial software systems. (Outcomes a, c and d)</p> <p>Students will be given mini-projects to learn how to represent and model the products from geometry perspective, how to evaluate and analyze the design solutions from mechanical, fluid dynamics and heat transfer perspectives and how to optimize the design solutions in terms of product size, shape and material. (Outcomes a to d)</p> <table border="1" data-bbox="443 801 1455 1070"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Mini-project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>   | Teaching/Learning Methodology     | Outcomes    |  |   |  | a | b | c | d | Lecture |               | √   | √ | √ | Tutorial | √ |                                | √   | √ | Mini-project | √ | √ | √                                   | √   |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
|   | a   | b                                 | c           | d  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| Lecture   |   | √                                 | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| Tutorial  | √   |                                   | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| Mini-project  | √   | √                                 | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1173 1455 1653"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Written/computer assignment</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Mini-project report/presentation</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <ol style="list-style-type: none"> <li>1. Examination is adopted to assess students on the overall understanding and the ability of applying the concepts.</li> <li>2. Tests, written and computer assignments could provide timely feedbacks to both</li> </ol> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   | a | b | c | d       | 1. Class test | 15% | √ | √ | √        | √ | 2. Written/computer assignment | 15% | √ | √            | √ | √ | 3. Mini-project report/presentation | 20% | √ | √ | √ | √ | 4. Examination | 50% | √ |  | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting   |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
|   |   | a                                 | b           | c  | d |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| 1. Class test   | 15%   | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| 2. Written/computer assignment  | 15%   | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| 3. Mini-project report/presentation   | 20%   | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| 4. Examination  | 50%   | √                                 |             | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |
| Total   | 100%  |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |                                |     |   |              |   |   |                                     |     |   |   |   |   |                |     |   |  |   |   |       |      |  |  |  |  |

|                                      |   |         |
|--------------------------------------|---|---------|
|                                      | lecturers and students on various topics of the syllabus.   |         |
|                                      | 3. Written reports on 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.  |         |
|                                      | 4. Mini-project presentation assesses the students' ability to assimilate the learnt knowledge for solving a more realistic, open-ended design problem systematically.  |         |
| <b>Student Study Effort Expected</b> | Class contact:  |         |
|                                      | ▪ Lecture   | 30 Hrs. |
|                                      | ▪ Tutorial  | 3 Hrs.  |
|                                      | ▪ Guided study of CAD/CAE   | 6 Hrs.  |
|                                      | Other student study effort:   |         |
|                                      | ▪ Performing CAD/CAE in design (tutorial problems)  | 20 Hrs. |
|                                      | ▪ Performing modeling of design problems (mini-project)   | 34 Hrs. |
|                                      | ▪ Literature search and private study   | 23 Hrs. |
| Total student study effort           | 116 Hrs.  |         |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Michael E. Mortenson, Geometric Modeling, John Wiley &amp; Sons, latest edition.</li> <li>2. Kunwoo Lee, Principles of CAD/CAM/CAE System, Addison-Wesley Longman, latest edition.</li> <li>3. Vince Adams and Abraham Askenazi, Building Better Products with Finite Element Analysis, Onword Press, latest edition.</li> <li>4. J.Y.H. Fuh, Y.F. Zhang, A.Y.C. Nee, M.W. Fu, Computer-aided injection mold design and manufacture, Marcel Dekker, Inc, latest edition.</li> </ol> |         |

Revised Feb 2017

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME42007  |
| <b>Subject Title</b>                                  | Design for Product Safety and Reliability  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME22002 Integrated Product Development Fundamentals   |
| <b>Objectives</b>                                     | To provide students an overview of the product liability and legal aspects in launching of new consumer products and develop their understanding of the management strategy in achieving product safety.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Identify problems related to liability, safety and reliability for an existing product design and apply their knowledge in reliability engineering to devise a technically and economically feasible solution.</li> <li>b. Apply knowledge of mathematics and engineering sciences via analytical and computational approaches to assess the risks of a product design and development project, and to assess the impacts of various key elements in achieving product safety.</li> <li>c. Develop systematically a safer and more reliable design for an existing product via a group project and present in a professional manner their ideas using multimedia and written reports.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Product Reliability</b> – Definition of product reliability, reliability programme plan, reliability requirements, parameters, modeling, prediction, test requirement, and design for reliability.</p> <p><b>Product Liability</b> - Meaning of product liability. Definition of defective product. Product liability in Hong Kong. Product liability law in Hong Kong. Product liability law in other Jurisdictions.</p> <p><b>The Management of Design Risks</b> - Management strategy in product safety. Reducing product design risks through design reviewing systems. Personal and environmental risk identification of the whole product life from manufacturing to end of services disposal.</p> <p><b>Product Safety Standards</b> - The consumer Product Safety Acts. The safety standards used in different countries such as Underwriters Laboratories Inc. (UL) in USA, British Standards in United Kingdom and International Electro-technical Commission (IEC) in Europe. Overview of the application and testing procedures in obtaining product safety markings for new products. Planning, implementation and control in product test and assurance.</p> |

|   | <p><b>Product Risk Identification Methods</b> - Fault Tree Analysis (FTA). Failure Mode and Effect Analysis(FMEA). Hazard and Operability Study (HAZOP) and Hazard Analysis Critical Control Point (HACCP). The use of quantitative and statistical methods in assessing product risks and design optimisation.</p> <p><b>Product Risk Management</b> - Product Risk transfer through insurance and contract conditions.</p>  |                                   |              |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
|---|---|-----------------------------------|--------------|--|--|---|---|---|---------|------------------|-----|---|----------|---|----------------------|-----|------------|---|---|-----------------------|---------|---|---|---|----------------|-----|---|---|---|-------|------|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <ol style="list-style-type: none"> <li>Lectures give coverage and exposure and arouse interest. (Outcomes a to c)</li> <li>Group discussions and tutorials help students consolidate lecture materials. (Outcomes a to c)</li> <li>Assignments, through which students learn to compile, assimilate, assess and analyze. (Outcomes a to c)</li> <li>Through thematic projects students would keep abreast of current product liability law and strategies for management of design risks. The presentation of reports allows students develop communication skills. (Outcomes a to c)</li> </ol> <table border="1" data-bbox="443 730 1406 1037"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="3">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Assignment</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Project</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  | Teaching/Learning Methodology     | Outcomes     |  |  | a | b | c | Lecture | √                | √   | √ | Tutorial | √ | √                    | √   | Assignment | √ | √ | √                     | Project | √ | √ | √ |                |     |   |   |   |       |      |  |  |  |
| Teaching/Learning Methodology   | Outcomes  |                                   |              |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
|   | a   | b                                 | c            |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| Lecture   | √   | √                                 | √            |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| Tutorial  | √   | √                                 | √            |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| Assignment  | √   | √                                 | √            |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| Project   | √   | √                                 | √            |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1104 1433 1648"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weightin g</th> <th colspan="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>1. Group project</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Individual report</td> <td>25%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Class presentation</td> <td>10%</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/>0.50 x End of Subject Examination + 0.50 x Continuous Assessment.</p> <ol style="list-style-type: none"> <li>For continuous assessment evaluation, each student is required to submit a minimum of three reports. One of these reports is group-based and the other two are individual assignments. Besides assessing all the written assignments, students will be required to present the group and/or individual projects in class.</li> </ol> | Specific assessment methods/tasks | % weightin g | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |   | a | b | c       | 1. Group project | 15% | √ | √        | √ | 2. Individual report | 25% | √          | √ | √ | 3. Class presentation | 10%     | √ |   |   | 4. Examination | 50% | √ | √ | √ | Total | 100% |  |  |  |
| Specific assessment methods/tasks   | % weightin g  |                                   |              | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
|   |   | a                                 | b            | c  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| 1. Group project  | 15%   | √                                 | √            | √  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| 2. Individual report  | 25%   | √                                 | √            | √  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| 3. Class presentation   | 10%   | √                                 |              |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| 4. Examination  | 50%   | √                                 | √            | √  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |
| Total   | 100%  |                                   |              |  |  |   |   |   |         |                  |     |   |          |   |                      |     |            |   |   |                       |         |   |   |   |                |     |   |   |   |       |      |  |  |  |



|                                      |  |          |
|--------------------------------------|--|----------|
|                                      | <p>Class presentation and participation in discussions will be assessed.</p> <ol style="list-style-type: none"> <li>2. To achieve the intended learning outcomes, it is considered that more emphasis on formative assessment would be appropriate as students' performance will be improved via written and verbal feedback.</li> <li>3. Marked assignments provide feedback and reinforcement on learning key concepts and outcomes.</li> <li>4. Through presentations/discussions, students will learn how to: <ol style="list-style-type: none"> <li>i. Work effectively with diverse group of people;</li> <li>ii. Persuasively explain in both oral and written form their product safety concepts;</li> <li>iii. Tackle diverse and unstructured questions;</li> <li>iv. Tell thoughts, feelings, ideas so that others may understand;</li> <li>v. Supports and leads others in discussion.</li> </ol> </li> <li>5. The examination will be used to assess the knowledge acquired by the students to deal with product design risks in a strategic manner. It provides a reference of standards with which the learning outcomes are measured.</li> </ol> |          |
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture and seminar  | 33 Hrs.  |
|                                      | ▪ Tutorial and group discussion  | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Performing group project   | 25 Hrs.  |
|                                      | ▪ Conducting case study and assignment   | 23 Hrs.  |
|                                      | ▪ Literature search and private study  | 18 Hrs.  |
|                                      | Total student study effort   | 105 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Abbot, Howard: Safer by design: a guide to the management and law of designing for product safety, Gower, latest edition.</li> <li>2. Hammer, Willie: Product Safety management and engineering, American Society for Safety Engineers, latest edition.</li> <li>3. The Law Reform Commission of Hong Kong: Report on Civil Liability for Unsafe Products, latest edition.</li> </ol>  |          |

Revised July 2014

## Subject Description Form

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|---|--|
| <b>Subject Code</b>                                   | ME46002  |
| <b>Subject Title</b>                                  | Numerical Methods for Engineers  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 3  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: AMA2111 Mathematics I   |
| <b>Objectives</b>                                     | To teach students numerical methods of solving typical engineering problems.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate simple engineering problems with knowledge in engineering mathematics.</li> <li>b. Solve non-linear equations, simultaneous linear algebraic equations, eigenvalue problems, using numerical methods.</li> <li>c. Perform numerical differentiation and integration and analyze the errors.</li> <li>d. Apply curve fitting to experimental data.</li> <li>e. Use MATLAB or other numerical software tools to compute the solutions of engineering problems using the appropriate numerical methods.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Introduction to Mathematical Modelling and Computational Methods</i></b> – Importance of computational modelling in engineering. Data representation and errors. Applications of commercial software packages such as MATLAB. Functions and plotting using MATLAB.</p> <p><b><i>Computer Solution of Non-linear Equations</i></b> - Bracketing Methods. Bisection Method. Open Methods. Newton-Raphson Method. Secant Method. Convergence of methods. Determination of multiple roots. Engineering applications.</p> <p><b><i>Simultaneous Linear Equations</i></b> - Solving simultaneous linear equations by Matrix Inversion. Cramer's Rule. Gauss Elimination. Gauss-Jordan Elimination. LU decomposition method. Engineering applications and choice of methods.</p> <p><b><i>Eigenvalue Problems</i></b> - Standard and General Eigenvalues Problems. Methods of solving Eigenvalue problems. Applications in vibrations and Modal Analysis.</p> <p><b><i>Curve Fitting and Interpolation</i></b> - Collocation-Polynomial Fit. Lagrange Interpolation. Newton's Divided-Difference Interpolating Polynomials. Interpolation using splines. Least-Squares Regression.</p> <p><b><i>Numerical Differentiation and Integration</i></b> - Taylor's series expansion. Finite differences for the first derivative and the second derivative. High-accuracy differentiation formulas. Trapezoidal rule. Simpson's rule. High-order Newton-Cotes formulas. Applications of numerical differentiation and integration in heat transfer, solid mechanics and fluid flow problems.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to numerical methods. (Outcomes a - d)</p> <p>Tutorials will be conducted in small groups to facilitate discussions. (Outcomes a - d)</p> <p>Computational workshops provide hands-on experience in using software to solve numerical problems. (Outcomes b - e)</p> <table border="1" data-bbox="443 443 1469 705"> <thead> <tr> <th data-bbox="443 443 922 544" rowspan="2">Teaching/Learning Methodology</th> <th colspan="5" data-bbox="927 443 1469 488">Outcomes</th> </tr> <tr> <th data-bbox="927 488 1031 544">a</th> <th data-bbox="1035 488 1139 544">b</th> <th data-bbox="1144 488 1248 544">c</th> <th data-bbox="1252 488 1356 544">d</th> <th data-bbox="1361 488 1469 544">e</th> </tr> </thead> <tbody> <tr> <td data-bbox="443 544 922 600">Lecture</td> <td data-bbox="927 544 1031 600">√</td> <td data-bbox="1035 544 1139 600">√</td> <td data-bbox="1144 544 1248 600">√</td> <td data-bbox="1252 544 1356 600">√</td> <td data-bbox="1361 544 1469 600"></td> </tr> <tr> <td data-bbox="443 600 922 656">Tutorial</td> <td data-bbox="927 600 1031 656">√</td> <td data-bbox="1035 600 1139 656">√</td> <td data-bbox="1144 600 1248 656">√</td> <td data-bbox="1252 600 1356 656">√</td> <td data-bbox="1361 600 1469 656"></td> </tr> <tr> <td data-bbox="443 656 922 705">Computational workshop</td> <td data-bbox="927 656 1031 705"></td> <td data-bbox="1035 656 1139 705">√</td> <td data-bbox="1144 656 1248 705">√</td> <td data-bbox="1252 656 1356 705">√</td> <td data-bbox="1361 656 1469 705">√</td> </tr> </tbody> </table>  |  |   |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  |  | a | b | c | d | e | Lecture | √       | √   | √ | √ |   | Tutorial | √ | √             | √   | √ |   | Computational workshop |   | √ | √              | √   | √ |   |   |  |  |       |      |  |  |  |  |  |
|--|---|--|---|---|---|---|-----------------------------------|-------------|--|--|--|--|---|---|---|---|---|---------|---------|-----|---|---|---|----------|---|---------------|-----|---|---|------------------------|---|---|----------------|-----|---|---|---|--|--|-------|------|--|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
|  | a   | b  | c | d | e |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Lecture  | √   | √  | √ | √ |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Tutorial   | √   | √  | √ | √ |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Computational workshop   |   | √  | √ | √ | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 768 1469 1115"> <thead> <tr> <th data-bbox="443 768 770 902" rowspan="2">Specific assessment methods/tasks</th> <th data-bbox="775 768 927 902" rowspan="2">% weighting</th> <th colspan="5" data-bbox="932 768 1469 857">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th data-bbox="932 857 1035 902">a</th> <th data-bbox="1040 857 1144 902">b</th> <th data-bbox="1149 857 1252 902">c</th> <th data-bbox="1257 857 1361 902">d</th> <th data-bbox="1366 857 1469 902">e</th> </tr> </thead> <tbody> <tr> <td data-bbox="443 902 770 958">1. Test</td> <td data-bbox="775 902 927 958">20%</td> <td data-bbox="932 902 1035 958">√</td> <td data-bbox="1040 902 1144 958">√</td> <td data-bbox="1149 902 1252 958">√</td> <td data-bbox="1257 902 1361 958">√</td> <td data-bbox="1366 902 1469 958"></td> </tr> <tr> <td data-bbox="443 958 770 1014">2. Assignment</td> <td data-bbox="775 958 927 1014">30%</td> <td data-bbox="932 958 1035 1014">√</td> <td data-bbox="1040 958 1144 1014">√</td> <td data-bbox="1149 958 1252 1014">√</td> <td data-bbox="1257 958 1361 1014">√</td> <td data-bbox="1366 958 1469 1014">√</td> </tr> <tr> <td data-bbox="443 1014 770 1070">3. Examination</td> <td data-bbox="775 1014 927 1070">50%</td> <td data-bbox="932 1014 1035 1070"></td> <td data-bbox="1040 1014 1144 1070">√</td> <td data-bbox="1149 1014 1252 1070">√</td> <td data-bbox="1257 1014 1361 1070"></td> <td data-bbox="1366 1014 1469 1070"></td> </tr> <tr> <td data-bbox="443 1070 770 1115">Total</td> <td data-bbox="775 1070 927 1115">100%</td> <td colspan="5" data-bbox="932 1070 1469 1115"></td> </tr> </tbody> </table> <p data-bbox="443 1153 1469 1220">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p data-bbox="443 1254 1469 1321">Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p data-bbox="443 1355 1469 1400">Tests will be conducted to assess students' learning on numerical methods.</p> <p data-bbox="443 1433 1469 1534">Assignments will be used to assess students' learning on using numerical methods in solving engineering problems and using computational software in solving such problems.</p> <p data-bbox="443 1568 1469 1601">Examination will be conducted to assess students' learning on numerical methods.</p> |  |   |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |   | a | b | c | d | e       | 1. Test | 20% | √ | √ | √ | √        |   | 2. Assignment | 30% | √ | √ | √                      | √ | √ | 3. Examination | 50% |   | √ | √ |  |  | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
|  |   | a  | b | c | d | e |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 1. Test  | 20%   | √  | √ | √ | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 2. Assignment  | 30%   | √  | √ | √ | √ | √ |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 3. Examination   | 50%   |  | √ | √ |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Total  | 100%  |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |         |     |   |   |   |          |   |               |     |   |   |                        |   |   |                |     |   |   |   |  |  |       |      |  |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 33 Hrs.  |
|                                      | ▪ Tutorial   | 5 Hrs.   |
|                                      | ▪ Computational Workshop   | 1 Hr.    |
|                                      | Other student study effort:  |          |
|                                      | ▪ Performing assignment  | 40 Hrs.  |
|                                      | ▪ Applying computational software  | 12 Hrs.  |
|                                      | ▪ Private study  | 25 Hrs.  |
|                                      | Total student study effort   | 116 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. S.C. Chapra and R.R. Canale, Numerical Methods for Engineers, McGraw-Hill, latest edition.</li> <li>2. S.S. Rao, Applied Numerical Methods for Engineers and Scientists, Prentice-Hall, latest edition.</li> <li>3. S.C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill, latest edition.</li> <li>4. D.M. Etter, Engineering Problem Solving with Matlab, Prentice-Hall, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME46003   |
| <b>Subject Title</b>                                  | Numerical Fluid Mechanics and Heat Transfer   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ENG2002 Computer Programming, and<br>ME34003 Thermofluid Mechanics   |
| <b>Objectives</b>                                     | To equip students with numerical methods and computational techniques in analyzing fluid dynamics and heat transfer problems which are usually encountered in the design of thermofluid systems.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand and apply numerical differentiation method, and analyze the stability and errors involved.</li> <li>b. Apply knowledge of thermofluid science/engineering to formulate numerical equations for solving steady-state/transient fluid mechanics or heat transfer problems, and apply appropriate mathematics methods for their evaluation.</li> <li>c. Apply knowledge of mathematics and thermofluid science/engineering via computational approaches to analyze and predict the performance of thermofluid systems/products.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Introduction to Numerical Methods for Product Analysis</i></b> – Mathematical modeling for fluid mechanics and heat transfer systems. Numerical approximations of scientific equations. Direct and iterative methods for solving simultaneous equations. Stability and major errors involved in numerical methods.</p> <p><b><i>Numerical Differentiation</i></b> – Finite-differences for the first derivative and the second derivative. Finite-differences for partial differentiation. High-accuracy differentiation formulas.</p> <p><b><i>Finite-Difference Methods in Solving Heat Transfer Problems</i></b> – Governing equations for heat transfer. Boundary conditions in heat conduction and heat convection. Steady-state and transient heat transfer problems. Dimensionless differential equations. Discretization. Explicit scheme finite-difference. Implicit scheme finite-difference. Direct and iterative mathematics methods. Analysis on solution stability and estimation of errors.</p> |

|  | <p><b><i>Finite-Difference Methods in Solving Fluid Dynamics Problems</i></b> – Classification of partial differential equations for fluid dynamics. Navier-Stokes equations. Grid types. Explicit and implicit scheme finite-difference formulations. Introduction to turbulence and its modeling.</p> <p><b><i>Introduction to computational approach</i></b> – Introduction to commercial CFD software and their applications to solve fluid mechanics problems.</p>   |                                   |             |   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
|--|---|-----------------------------------|-------------|---|--|---|---|---|---------|--|-----|---|------------------------------|---|---------|-----|----------------------|---|---|--------------------------------|-----|---|---|---|-------|------|---|---|---|
| <p><b>Teaching/Learning Methodology</b></p>                                  | <ol style="list-style-type: none"> <li>The lectures are aimed at providing students with necessary background knowledge in related mathematical principles and computational approaches for analysis of thermofluid problems. (Outcomes a to c)</li> <li>The tutorials and in-class exercises are aimed at enhancing the students' skills in effectively using numerical and computational approaches to solve thermofluid problems. Thus, some tutorial classes will be held in the Computational Laboratory. (Outcomes a to c)</li> <li>The homework assignments are to get students engaged with learning activities continuously and to provide them with self-assessment opportunities on their progress of learning. (Outcomes a to c)</li> </ol> <table border="1" data-bbox="528 1055 1493 1339"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="3">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorials/In-class exercises</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Homework assignments</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcomes    |   |  | a | b | c | Lecture | √  | √   | √ | Tutorials/In-class exercises | √ | √       | √   | Homework assignments | √ | √ | √                              |     |   |   |   |       |      |   |   |   |
| Teaching/Learning Methodology  | Outcomes  |                                   |             |   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
|  | a   | b                                 | c           |   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| Lecture  | √   | √                                 | √           |   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| Tutorials/In-class exercises   | √   | √                                 | √           |   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| Homework assignments   | √   | √                                 | √           |   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| <p><b>Assessing Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="528 1447 1505 1861"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="3">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>1. Homework assignments/<br/>In-class exercises</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. End-of-semester Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |   | a | b | c       | 1. Homework assignments/<br>In-class exercises | 30% | √ | √                            | √ | 2. Test | 20% | √                    | √ | √ | 3. End-of-semester Examination | 50% | √ | √ | √ | Total | 100% | √ | √ | √ |
| Specific assessment methods/tasks  | % weighting   |                                   |             | Intended subject learning outcomes to be assessed |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
|  |   | a                                 | b           | c   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| 1. Homework assignments/<br>In-class exercises                               | 30%   | √                                 | √           | √   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| 2. Test  | 20%   | √                                 | √           | √   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| 3. End-of-semester Examination   | 50%   | √                                 | √           | √   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |
| Total  | 100%  | √                                 | √           | √   |  |   |   |   |         |  |     |   |                              |   |         |     |                      |   |   |                                |     |   |   |   |       |      |   |   |   |

|  |   |             |
|--|---|-------------|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment: <math>0.5 \times \text{Continuous Assessment} + 0.5 \times \text{Examination}</math>.</p> <ol style="list-style-type: none"> <li>Homework assignments and in-class exercises are aimed at evaluating students' progress in study, and assisting them in fulfilling the respective subject learning outcomes.<br/><br/>Homework assignments and in-class exercises should include analyses of thermofluid systems, case-study of problems encountered in thermofluid design, and applications of computational technique (including CFD software) to solve thermofluid problems.</li> <li>Test and end-of-semester examination will be used to assess the degree of achieving the subject learning outcomes by individual student. Their understanding of numerical methods and ability to apply them to critically analyze thermofluid problems will be evaluated.</li> </ol> |             |
| <b>Student Study Effort Expected</b>                                   | Class contact:  | <b>Time</b> |
|  | <ul style="list-style-type: none"> <li>▪ Lectures</li> </ul>  | 26 Hrs.     |
|  | <ul style="list-style-type: none"> <li>▪ Tutorials/In-class Exercises</li> </ul>  | 13 Hrs.     |
|  | Other student study effort:   | <b>Time</b> |
|  | <ul style="list-style-type: none"> <li>▪ Performing assignments including computational work</li> </ul>   | 50 Hrs.     |
|  | <ul style="list-style-type: none"> <li>▪ Self-study</li> </ul>  | 31 Hrs.     |
|  | Total student study effort  | 120 Hrs.    |
| <b>Reading List and References</b>                                     | <ol style="list-style-type: none"> <li>S.C. Chapra and R.R. Canale, Numerical Methods for Engineers, McGraw-Hill, latest edition</li> <li>S.S. Rao, applied Numerical Methods for Engineers and Scientists, Prentice-Hall, latest edition</li> <li>A. Cengel Yunus, and J. Ghajar Afshin, Heat and Mass Transfer-Fundamentals and Applications, 4th edition in SI units, McGraw-Hill, 2011.</li> <li>H. K. Versteeg and W. Malalasekera, An Introduction to Computational Fluid Dynamics, 2<sup>nd</sup> edition, Pearson Prentice Hall 2007.</li> </ol>  |             |

*Developed in March 2017*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME49001   |
| <b>Subject Title</b>                                  | Final Year Capstone Project   |
| <b>Credit Value</b>                                   | 6   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31001 Dynamics and Vibrations;<br>ME31002 Linear Systems and Control;<br>ME32001 Manufacturing Fundamentals;<br>ME33001 Mechanics of Materials;<br>ME34002 Engineering Thermodynamics; and<br>ME34004 Fluid Mechanics  |
| <b>Objectives</b>                                     | To provide students with an opportunity of integrating and applying knowledge from different disciplines of mechanical engineering to conduct an engineering project that is open-ended and requires team collaboration for its completion.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate the problem and suggest a practical solution to solve an open-ended real-world engineering problem.</li> <li>b. Utilize knowledge from different disciplines of engineering to solve problems encountered in conducting the team project.</li> <li>c. Design, plan and carry out scientific and engineering experiments (physical tests and/or computer numerical simulations) to prove the feasibility of their designed solutions.</li> <li>d. Design the test apparatus, rigs, assemblies or systems as required by the project.</li> <li>e. Apply appropriate engineering tool (analytical, experimental, and/or computational) for carrying out tasks in the development and implementation of a designed solution.</li> <li>f. Work in a professional manner and comply with all applicable standards and regulations in conducting the project.</li> <li>g. Select and employ the appropriate manufacturing methods in the production and fabrication of components and assemblies required by the project.</li> <li>h. Evaluate the potential impact of their designed solution on performance, safety, cost and environment.</li> <li>i. Participate and lead in a multi-functional team.</li> <li>j. Take into account of safety, legal, environmental protection considerations in an engineering project.</li> <li>k. Communicate their project work to sponsors (if any), supervisors, other peer teams, and even non-technical audience and articulate the results and findings with scientific and logical arguments.</li> <li>l. Conduct literature search including patents, books, archived publications and product catalogues, and to perform the state-of-the-art and benchmark studies.</li> </ol> |



| <b>Subject Synopsis/<br/>Indicative Syllabus</b>                                   | <p>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:</p> <ul style="list-style-type: none"> <li>• Problem identification</li> <li>• Literature review</li> <li>• Methodology of study</li> <li>• Project execution</li> <li>• Report writing</li> <li>• Project presentation</li> </ul>  |   |                |  |   |   |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
|--|---|---|----------------|--|---|---|---|---|---|---|---|---|---|--|---|---|---|---|---|---|---|---|---|---|---|---|--------------|--------------------------|-----|---|---|---|---|---|---|---|---|---|---|---|---|-------------------|-----|---|---|---|---|---|---|---|---|---|---|---|---|-----------------|-----|---|---|---|---|---|---|---|---|---|---|---|---|---------------------|-----|---|---|---|---|---|---|---|---|---|---|---|---|-------|------|--|--|--|--|--|--|--|--|--|--|--|--|
| <b>Teaching/Learning<br/>Methodology</b>   | <p>The subject is taught through guided studies. The students are given the project title, objectives and description. The students are guided by the project supervisor to go through the different stages of the project as shown in the Subject Synopsis/Indicative Syllabus. (Outcomes a – l)</p> <table border="1" data-bbox="440 801 1473 1014"> <thead> <tr> <th rowspan="2">Teaching/Learning<br/>Methodology</th> <th colspan="12">Outcomes</th> </tr> <tr> <th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th><th>g</th><th>h</th><th>i</th><th>j</th><th>k</th><th>l</th> </tr> </thead> <tbody> <tr> <td>Guided study</td> <td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td> </tr> </tbody> </table>  | Teaching/Learning<br>Methodology        | Outcomes       |  |   |   |   |   |   |   |   |   |   |  | a | b | c | d | e | f | g | h | i | j | k | l | Guided study | √                        | √   | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| Teaching/Learning<br>Methodology   | Outcomes  |   |                |  |   |   |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
|  | a   | b                                       | c              | d  | e | f | g | h | i | j | k | l |   |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| Guided study   | √   | √                                       | √              | √  | √ | √ | √ | √ | √ | √ | √ | √ |   |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>Assessment Methods<br/>in Alignment with<br/>Intended Learning<br/>Outcomes</b> | <table border="1" data-bbox="440 1066 1473 1615"> <thead> <tr> <th rowspan="2">Specific<br/>assessment<br/>methods/tasks</th> <th rowspan="2">%<br/>weighting</th> <th colspan="12">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th><th>g</th><th>h</th><th>i</th><th>j</th><th>k</th><th>l</th> </tr> </thead> <tbody> <tr> <td>1. Continuous monitoring</td> <td>15%</td> <td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td> </tr> <tr> <td>2. Interim report</td> <td>10%</td> <td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td> </tr> <tr> <td>3. Final report</td> <td>50%</td> <td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td> </tr> <tr> <td>4. Oral examination</td> <td>25%</td> <td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="12"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment: 1.0 × Continuous Assessment</p> <ol style="list-style-type: none"> <li>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).</li> <li>2. The continuous monitoring of a project group as a whole and that of each group</li> </ol> | Specific<br>assessment<br>methods/tasks | %<br>weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |   |   |   |   |   |  |   | a | b | c | d | e | f | g | h | i | j | k | l            | 1. Continuous monitoring | 15% | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | 2. Interim report | 10% | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | 3. Final report | 50% | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | 4. Oral examination | 25% | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | Total | 100% |  |  |  |  |  |  |  |  |  |  |  |  |
| Specific<br>assessment<br>methods/tasks  | %<br>weighting  |   |                | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
|  |   | a                                       | b              | c  | d | e | f | g | h | i | j | k | l |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Continuous monitoring   | 15%   | √                                       | √              | √  | √ | √ | √ | √ | √ | √ | √ | √ | √ |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Interim report  | 10%   | √                                       | √              | √  | √ | √ | √ | √ | √ | √ | √ | √ | √ |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Final report  | 50%   | √                                       | √              | √  | √ | √ | √ | √ | √ | √ | √ | √ | √ |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Oral examination  | 25%   | √                                       | √              | √  | √ | √ | √ | √ | √ | √ | √ | √ | √ |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |
| Total  | 100%  |   |                |  |   |   |   |   |   |   |   |   |   |  |   |   |   |   |   |   |   |   |   |   |   |   |              |                          |     |   |   |   |   |   |   |   |   |   |   |   |   |                   |     |   |   |   |   |   |   |   |   |   |   |   |   |                 |     |   |   |   |   |   |   |   |   |   |   |   |   |                     |     |   |   |   |   |   |   |   |   |   |   |   |   |       |      |  |  |  |  |  |  |  |  |  |  |  |  |

|                                       | <p>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.</p> <ol style="list-style-type: none"> <li>3. The supervisor monitors and assesses the overall and individual progresses through regular meetings. The interim report should be submitted to the independent assessor at around week 8 of the first semester. The final report submitted before the end-of-year examination is assessed by both the supervisor and the independent assessor. Due consideration of each student's individual contribution and performance will be taken into account.</li> <li>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.</li> <li>5. The assessment system is summarized as shown in the following table:</li> </ol> <table border="1" data-bbox="496 869 1453 1256"> <thead> <tr> <th rowspan="2">Assessor</th> <th colspan="5">Assessment Component (% of the total)</th> </tr> <tr> <th>Continuous Monitoring (15)</th> <th>Interim Report (10)</th> <th>Final Report (25)</th> <th>Final Report (25)</th> <th>Oral Examination (25)</th> </tr> </thead> <tbody> <tr> <td>Supervisor</td> <td>√</td> <td></td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Independent Assessor</td> <td></td> <td>√</td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>Examination Panel</td> <td></td> <td></td> <td></td> <td></td> <td>√</td> </tr> </tbody> </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 |  |  |  |  | √ |
|---------------------------------------|---|---------------------|---------------------------------------|-------------------|-----------------------|-----------------------------|--|----------------------------|---------------------|---------------------------------------|-------------------|----------------------------|------------|---|--|---|--|--|----------------------|--|---|--|---|--|-------------------|--|--|--|--|---|
| 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                     |   |                     |                                       |                   | √                     |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| <b>Student Study Effort Expected</b>  | <table border="1"> <tr> <td>Class contact:</td> <td></td> </tr> <tr> <td>▪ Guided study</td> <td>26 Hrs.</td> </tr> <tr> <td>Other student study effort:</td> <td></td> </tr> <tr> <td>▪ Conducting project</td> <td>154 Hrs.</td> </tr> <tr> <td>▪ Literature search and private study</td> <td>72 Hrs.</td> </tr> <tr> <td>Total student study effort</td> <td>252 Hrs.</td> </tr> </table>   | Class contact:      |                                       | ▪ Guided study    | 26 Hrs.               | Other student study effort: |  | ▪ Conducting project       | 154 Hrs.            | ▪ Literature search and private study | 72 Hrs.           | Total student study effort | 252 Hrs.   |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| Class contact:                        |   |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| ▪ Guided study                        | 26 Hrs.   |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| Other student study effort:           |   |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| ▪ Conducting project                  | 154 Hrs.  |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| ▪ Literature search and private study | 72 Hrs.   |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| Total student study effort            | 252 Hrs.  |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |
| <b>Reading List and References</b>    | To be advised by supervisor   |                     |                                       |                   |                       |                             |  |                            |                     |                                       |                   |                            |            |   |  |   |  |  |                      |  |   |  |   |  |                   |  |  |  |  |   |

Revised July 2014

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME49003   |
| <b>Subject Title</b>                                  | Capstone Project  |
| <b>Credit Value</b>                                   | 6   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31003 System Dynamics<br>ISE386 Integrated Design for Manufacture<br>ME33001 Mechanics of Materials<br>ME34003 Thermofluid Mechanics   |
| <b>Objectives</b>                                     | To provide students an opportunity to utilize and integrate their knowledge of engineering, design and marketing in completing a real-life product design engineering project.  |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Formulate a design problem addressing certain market needs and to develop design specifications with due consideration of industrial design.</li> <li>b. Generate alternative design concepts, and then evaluate each of these concepts by considering the impacts of various important factors including human factors, materials used, manufacturing processes, quality and environmental issues, health and safety on product design and development.</li> <li>c. Apply arts, mathematics, information technology and engineering sciences via analytical, computational and experimental approaches to realize a selected design concept.</li> <li>d. Work effectively and make contributions independently in a multi-disciplinary design project team, and apply project management technique to ensure successful competition of the design project.)</li> <li>e. Understand the importance of life-long learning and perform literature search to upkeep with the state-of-the-art product design technology.</li> <li>f. Present a design project via oral presentation and written report.</li> </ul> |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>In-depth Study of Substantial Design Tasks</i></b> - Marketing survey; Alternative conceptual design; Engineering design and analysis; Product safety and reliability; Product testing techniques; Prototyping and development technologies.</p> <p><b><i>Areas of Design Project</i></b> - Toys; Home appliances; Electronic and electrical appliances; Bio-medical equipment; Plastic and metallic products; Green products; Health products; Computer-aided technology for product development; Products for specialists.</p> <p><b><i>Knowledge and Skills Required for Performing Design Project</i></b> - Problem identification; Literature review; Methodology for data analysis; Engineering design and analysis; Design concept generation; Safety and risk analysis; Prototyping technology; Project management; Report writing and presentation skill.</p>   |

| <b>Teaching/Learning Methodology</b>                                   | <ol style="list-style-type: none"> <li>1. Guidance will be given to students during the whole design project. (Outcomes a to d)</li> <li>2. Regular group discussions with the supervisor (and the industrial supervisor for an industrial-based project) to ensure the correct direction and focus of the project. (Outcomes a to e)</li> <li>3. The interim report aims at ensuring the proper progress of the project.</li> <li>4. The final report aims at examining the completeness, quality, workability, practicability and engineering content of the product being designed and developed.</li> <li>5. Prototype and/or computer-aided simulation will be conducted to show the functionality and safety of the product being designed and developed. (Outcomes a to f)</li> <li>6. Oral examination will be conducted to examine the presentation skill, ability to provide prompt response to a question and understanding of the whole design project.</li> </ol> <table border="1" data-bbox="432 712 1457 969"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="6">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th>f</th> </tr> </thead> <tbody> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Group Discussion</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcomes    |  |   |   |   |  | a | b | c | d | e | f | Tutorial | √                        | √   | √ | √ |   |   | Group Discussion | √ | √                 | √   | √ | √ |   | Project | √ | √ | √               | √   | √ | √ |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
|--|---|-----------------------------------|-------------|--|---|---|---|--|---|---|---|---|---|---|----------|--------------------------|-----|---|---|---|---|------------------|---|-------------------|-----|---|---|---|---------|---|---|-----------------|-----|---|---|---|---|---|---|----------------------|-----|---|---|---|---|---|---|-------|------|--|--|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |                                   |             |  |   |   |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
|  | a   | b                                 | c           | d  | e | f |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| Tutorial   | √   | √                                 | √           | √  |   |   |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| Group Discussion   | √   | √                                 | √           | √  | √ |   |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| Project  | √   | √                                 | √           | √  | √ | √ |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="432 1043 1457 1581"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th>f</th> </tr> </thead> <tbody> <tr> <td>1. Continuous monitoring</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>2. Interim report</td> <td>10%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>3. Final report</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Oral presentation</td> <td>25%</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> </tbody> </table> <p data-bbox="491 1621 1465 1682">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p data-bbox="432 1722 863 1783">Overall Assessment:<br/>1.0 x Continuous Assessment.</p>   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |  |   | a | b | c | d | e | f        | 1. Continuous monitoring | 15% | √ | √ | √ | √ | √                |   | 2. Interim report | 10% | √ | √ | √ |         |   | √ | 3. Final report | 50% | √ | √ | √ | √ | √ | √ | 4. Oral presentation | 25% | √ | √ | √ | √ | √ | √ | Total | 100% |  |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
|  |   | a                                 | b           | c  | d | e | f |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| 1. Continuous monitoring   | 15%   | √                                 | √           | √  | √ | √ |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| 2. Interim report  | 10%   | √                                 | √           | √  |   |   | √ |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| 3. Final report  | 50%   | √                                 | √           | √  | √ | √ | √ |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| 4. Oral presentation   | 25%   | √                                 | √           | √  | √ | √ | √ |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |
| Total  | 100%  |                                   |             |  |   |   |   |  |   |   |   |   |   |   |          |                          |     |   |   |   |   |                  |   |                   |     |   |   |   |         |   |   |                 |     |   |   |   |   |   |   |                      |     |   |   |   |   |   |   |       |      |  |  |  |  |  |  |

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

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

*Revised July 2014*

## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                            | SD3401  |
| <b>Subject Title</b>                           | Designing for Humanities  |
| <b>Credit Value</b>                            | 3   |
| <b>Level</b>                                   | 3   |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | Nil   |
| <b>Objectives</b>                              | <p>There are three sections in the subject: Human Factors in Design, Designing for Disabilities, and the introduction of “Universal Design”.</p> <ol style="list-style-type: none"> <li>1. To introduce to students the fundamentals of human requirements that are essential to the success of user-related design. Well-designed visuals, products, systems and environments involve the appreciation and thorough consideration of the human aspects of design. Such aspects include the physiological, psychological and sociological factors.</li> <li>2. Students will devise more appropriate solutions to design problems in the acknowledgement of the people they design for.</li> <li>3. This subject intensifies at a later stage. It guides students to the appreciation of higher levels and more complex human requirements that relate to the success of user-interface design.</li> <li>4. The subject addresses particularly the interface issues, which will contribute to future design studies (projects). The issue of designing for special group of users such as the disabled and the ageing populations will be investigated. The “Universal Design” principles will be discussed.</li> </ol> |
| <b>Intended Learning Outcomes</b>              | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate a design problem addressing to certain market needs and by fully considering impacts of human factors, product safety and environmental issues.</li> <li>b. Fully consider the physiological, psychological, cultural and sociological factors in generating and evaluating alternative design concepts in product design.</li> <li>c. Present a design project via oral presentation and/or written report.</li> </ol>  |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <p><b><i>Human Factors in Design -</i></b></p> <ol style="list-style-type: none"> <li>1. Understanding people’s activities at work, rest &amp; in play. The basic principles of human factors are introduced. The significance and relevance of the subject to design tasks are explained.</li> <li>2. The appreciation and application of data in the physiological, psychological cultural and sociological aspects of people are presented. This section will start with anthropometry (body measurements).</li> <li>3. The evaluation of designs for people use: This includes people’s abilities and limitations in relation to the tasks &amp; environments, and thereby the designs. Methods of approaching human aspects for design projects are discussed.</li> </ol>  |

|   | <p>Students are expected to be able to identify user-interface issues, plan and carry out related tests and experiments needed to support design works, and to evaluate the design results.</p> <p>4. The goal is to enhance <i>effectiveness, efficiency, comfort and safety</i> by improving the user/design interface.</p> <p><b><i>User-related Design and Designing for Disabilities -</i></b></p> <ol style="list-style-type: none"> <li>1. User in normal conditions and environments.</li> <li>2. User in extreme conditions and environments.</li> <li>3. Designing for the elderly and the disability.</li> <li>4. User testing methods: Heuristic evaluation (quick and inexpensive method made in early phases of design to evaluate the most significant usability problems); Pluralistic usability (evaluation performed by user interface specialists, designers and real users).</li> <li>5. Usability test: A design evaluation in the usability that can be performed during the development of a product or system to reveal problems. This may result in re-design or modification, or for product/system comparison (compared against competitor's design).</li> <li>6. Universal Design Principles.</li> </ol> |                                   |             |  |   |   |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |
|---|--|-----------------------------------|-------------|--|---|---|--|--|--|---|---|---|---|---|--|--|----|---|---|--|--|--|--|--|----|--|--|---|--|--|--|-------|-------|--|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>The teaching and learning approaches as stated in Section E are justified as below:</p> <ol style="list-style-type: none"> <li>1. The teaching and learning methods include lectures, tutorials, case studies, seminars, and assignment (design exercise).</li> <li>2. The lectures are aimed at providing students with an integrated knowledge required for understanding and analyzing Human Factors and related issues in Design.</li> <li>3. The design exercise is aimed at allowing hands-on experience in team-work to appreciate the lectures. The students are required to participate in the mini-project through literature survey, information search, discussions, report writing and presentation of results. Innovative thinking is encouraged.</li> <li>4. The tutorials are aimed at helping students to go through the exercise smoothly, and to guide the students to solve real-world problems using the knowledge they acquired in the class.</li> <li>5. Case studies are there to reinforce the lectures and to encourage discussions.</li> </ol>   |                                   |             |  |   |   |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th></th> </tr> </thead> <tbody> <tr> <td>Design exercise assignment, presentation</td> <td>90</td> <td>v</td> <td>v</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Motivation (participation in team, attendance)</td> <td>10</td> <td></td> <td></td> <td>v</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td colspan="6"></td> </tr> </tbody> </table>   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |  |  | a | b | c | d | e |  | Design exercise assignment, presentation | 90 | v | v |  |  |  |  | Motivation (participation in team, attendance) | 10 |  |  | v |  |  |  | Total | 100 % |  |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |
|   |  | a                                 | b           | c  | d | e |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |
| Design exercise assignment, presentation                                      | 90   | v                                 | v           |  |   |   |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |
| Motivation (participation in team, attendance)                                | 10   |                                   |             | v  |   |   |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |
| Total   | 100 %  |                                   |             |  |   |   |  |  |  |   |   |   |   |   |  |  |    |   |   |  |  |  |  |  |    |  |  |   |  |  |  |       |       |  |  |  |  |  |  |



|   |   |                |
|---|---|----------------|
|   | <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p><i>The assessment methods are justified as below:</i></p> <ol style="list-style-type: none"> <li>1. The Design Exercise assessment is in an “open-book” format to encourage continuous effort throughout the whole period of assignment.</li> <li>2. The presentation allows student to learn about and experiencing in presenting one’s view, opinion and argument in open critique, by thorough preparation.</li> <li>3. The grade for motivation encourages students to work positively, energetically, in private and in group. It can be checked also by class-attendance.</li> </ol> <p>Minimum condition to consider a grade, would require the student to satisfactorily complete and submit the assignment, and present it as indicated. A pass grade or above will depend on how well the student has achieved in the learning outcomes. In addition, the following points should be taken into consideration:</p> <ol style="list-style-type: none"> <li>1. A minimum grade “D” should be obtained in assignment.</li> <li>2. Assignment may require both “group effort” and “individual effort”.</li> <li>3. Copy right must be strictly respected. If a copy is detected, a zero score will be assigned regardless of whom/which group did the assignment.</li> <li>4. Attendance of class is very important. If a student anticipates being absent from class for any reason, please notify the course instructor ahead of time. In the event of absence, it is the student’s responsibility to catch up on any work missed.</li> </ol> |                |
| <p><b>Student Study Effort Expected</b></p> | <p>Class contact:</p>   |                |
|   | <ul style="list-style-type: none"> <li>▪ Lecture</li> </ul>   | <p>6 Hrs.</p>  |
|   | <ul style="list-style-type: none"> <li>▪ Tutorial, Seminar</li> </ul>   | <p>16 Hrs.</p> |
|   | <ul style="list-style-type: none"> <li>▪ Case Studies and Design Exercise</li> </ul>  | <p>17 Hrs</p>  |
|   | <p>Other student study effort:</p>  |                |
|   | <ul style="list-style-type: none"> <li>▪ Research, preparation of design exercise and presentation</li> </ul>   | <p>41 Hrs.</p> |
|   | <p>Total student study effort</p>   | <p>80 Hrs.</p> |
| <p><b>Reading List and References</b></p>   | <ol style="list-style-type: none"> <li>1. Barbacetto, G. <i>Design interface: How man and machine communicate</i>. Arcadia Edizioni, 1992.</li> <li>2. Chan, L. H.. <i>Successful aging: from the perspective of Hong Kong elderly: a qualitative approach</i>. Hong Kong: School of Nursing, The Hong Kong Polytechnic University. 2003.</li> <li>3. Cox, K., Walker, D. <i>User interface design</i>. New York: Prentice Hall, 1993.</li> <li>4. Dul, J. et al. <i>Ergonomics for beginners - A quick reference guide</i>. London: Taylor &amp; Francis, 1993</li> <li>5. Fernandes, T. <i>Global Interface Design: A guide to Designing International User Interfaces</i>. Boston: AP Professional, 1995.</li> <li>6. Gary, D. et al. <i>Designing and using assistive technology: The human perspective</i>. London: Paul H. Brookes, 1998.</li> <li>7. Grandjean, E. <i>Fitting the task to the man</i>. London: Taylor &amp; Francis, 1998.</li> <li>8. Green, W. S., Jordon, P. W. <i>Human factors in product design: Current practice and future trends</i>. London: Taylor and Francis. 1999.</li> <li>9. Karwowski, W., Soares, M. M., Stanton, N. A. <i>Human factors and ergonomics in consumer product design</i>. Boca Raton: Taylor &amp; Francis Group. 2011.</li> </ol>   |                |

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

**Websites:**

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

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | SD348  |
| <b>Subject Title</b>                                  | Introduction to Industrial Design  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 3  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Nil  |
| <b>Objectives</b>                                     | <p>This subject gives an introduction to the field of industrial design as a creative discipline, a discipline which synthesises knowledge from fields as diverse as arts, sciences and engineering. Industrial design is known for its capacity to innovate and to add value to products and services. Industrial designers solve problems centred on user needs with the intent to improve the quality of people's lives. The design process incorporates unique problem solving methods and creativity process. Industrial design intends to work with technological and ecological parameters in an appropriate way. The development and use of state of the art tools and technologies puts industrial design in a significant position socially and economically.</p> <p>The subject aims to equip students with knowledge and experience of industrial design to appreciate the profession, relate to its practitioners in different work situations, employ the design process appropriately for problem identification, solving and innovation, and to realise the importance of a user centred approach to the creation of new products and services.</p> <p>The subject is project-oriented that the students are expected to learn through a design project. The subject does not include any engineering skill, such as software application. The students are expected to apply the technological and engineering knowledge, skills and experience obtained from other subjects to tackle the project.</p> |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to basic knowledge to:</p> <ol style="list-style-type: none"> <li>a. Appreciate the industrial/product design profession, relate to its practitioners in different work situations.</li> <li>b. Employ the design process appropriately for problem solving and innovation.</li> <li>c. Realise the importance of a user centered approach to the creation of new products and services.</li> <li>d. Apply visualisation skill in project presentation.</li> <li>e. Understand objectives of industrial/product design, and apply knowledge and experience in other related subjects and future career.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p>The field of industrial design is introduced through a series of lectures featuring a review of milestones of design achievements internationally and locally. The relationships between design, culture and society are highlighted through a look at topics like cultural identity in product design, user centred design, employment of technologies, and design and sustainability.</p>   |

|  | <p>Further lectures and seminars cover two major parts of industrial design and its professional practice:</p> <ol style="list-style-type: none"> <li>The essentially theoretical foundation of the industrial design process and methodology covering topics such as: <ul style="list-style-type: none"> <li>Design and culture</li> <li>Form, aesthetics and semantics</li> <li>Human factors and ergonomics in design</li> <li>Research and problem identification</li> <li>Design requirements and design brief</li> <li>Design development and specifications</li> <li>Design evaluation and concept selection</li> </ul> </li> <li>The essentially practical aspects of the industrial design process covering topics such as: <ul style="list-style-type: none"> <li>Design visualisation, presentation and communication</li> <li>Product prototyping and user testing</li> <li>Manufacturer and marketing relations</li> </ul> </li> </ol>   |  |   |   |   |   |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
|--|---|--|---|---|---|---|----------------|--|-----------------------------------|-------------|--|--|--|--|--|--|---|---|---|---|---|--|---|----|---|---|---|---|---|--|--|----|--|---|---|--|---|--|--|----|---|---|---|---|---|--|---|----|--|--|--|---|---|--|--------------|--------------|--|--|--|--|--|--|
| <b>Teaching/Learning Methodology</b>                                   | <p>Emphasis in the practical learning activities is placed on students' creativity in relation to designing. Students explore different approaches to problems and experience methods of problem solving with the designer's tools.</p>   |  |   |   |   |   |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="483 1003 1427 1728"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Design project: Understanding design process</td> <td>10</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>2. Design project: investigation and application in design</td> <td>30</td> <td></td> <td>✓</td> <td>✓</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>3. Design project: development of design ideas</td> <td>45</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>4. Design project: presentation of design ideas</td> <td>15</td> <td></td> <td></td> <td></td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td><b>Total</b></td> <td><b>100 %</b></td> <td colspan="6"></td> </tr> </tbody> </table> <p>Project and continuous assessment approaches are adopted in the subject.</p> |  |   |   |   |   |                |  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |  |  | a | b | c | d | e |  | 1. Design project: Understanding design process | 10 | ✓ | ✓ | ✓ | ✓ | ✓ |  | 2. Design project: investigation and application in design | 30 |  | ✓ | ✓ |  | ✓ |  | 3. Design project: development of design ideas | 45 | ✓ | ✓ | ✓ | ✓ | ✓ |  | 4. Design project: presentation of design ideas | 15 |  |  |  | ✓ | ✓ |  | <b>Total</b> | <b>100 %</b> |  |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |   |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
|  |   | a  | b | c | d | e |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| 1. Design project: Understanding design process                        | 10  | ✓  | ✓ | ✓ | ✓ | ✓ |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| 2. Design project: investigation and application in design             | 30  |  | ✓ | ✓ |   | ✓ |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| 3. Design project: development of design ideas                         | 45  | ✓  | ✓ | ✓ | ✓ | ✓ |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| 4. Design project: presentation of design ideas                        | 15  |  |   |   | ✓ | ✓ |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| <b>Total</b>   | <b>100 %</b>  |  |   |   |   |   |                |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |
| <b>Student Study Effort Required</b>                                   | <p>Class contact:</p> <ul style="list-style-type: none"> <li>Lectures and seminars</li> </ul>   |  |   |   |   |   | <p>26 Hrs.</p> |  |                                   |             |  |  |  |  |  |  |   |   |   |   |   |  |   |    |   |   |   |   |   |  |  |    |  |   |   |  |   |  |  |    |   |   |   |   |   |  |   |    |  |  |  |   |   |  |              |              |  |  |  |  |  |  |

|                                    |  |         |
|------------------------------------|--|---------|
|                                    | <ul style="list-style-type: none"> <li>▪ Tutorials and exercises</li> </ul>  | 13 Hrs. |
|                                    | Other student study effort:  |         |
|                                    | <ul style="list-style-type: none"> <li>▪ Research and design</li> </ul>  | 31 Hrs. |
|                                    | <ul style="list-style-type: none"> <li>▪ Preparation of presentation</li> </ul>  | 10 Hrs. |
|                                    | Total student study effort   | 80 Hrs. |
| <b>Reading List and References</b> | <ol style="list-style-type: none"> <li>1. <i>Design Issues. The MIT Press. (Journal)</i></li> <li>2. <i>Design Management Journal. The Design Management Institute. (Journal)</i></li> <li>3. <i>Design Studies. Elsevier Science. (Journal)</i></li> <li>4. <i>International Journal of Design (Journal)</i></li> <li>5. <i>The Design Journal (Journal)</i></li> <li>6. <i>Forest, D. (Ed.) (2014). The art of things: Product design since 1945. New York: Abbeville Press Publishers.</i></li> <li>7. <i>Fung, A., Lo, A., &amp; Rao, M. N. (2005). Creative tools. Hong Kong: School of Design, The Hong Kong Polytechnic University.</i></li> <li>8. <i>Graedel, T. E. (2003). Industrial ecology (2nd ed.). Upper Saddle River, NJ: Prentice Hall.</i></li> <li>9. <i>Jordan, P. W. (1997). Putting the pleasure into products. IEE Review, Nov. 1997, 249-252.</i></li> <li>10. <i>Koos, E. (2014). Sketching product design presentation. Amsterdam, The Netherlands: BIS.</i></li> <li>11. <i>Leung, T. P. (Ed.) (2004). Hong Kong: Better by design. Hong Kong: The Hong Kong Polytechnic University.</i></li> <li>12. <i>Mackenzie, D. (1997). Green design: Design for the environment (2nd ed.). London: Laurence King.</i></li> <li>13. <i>Monika, H. (2013). Branding and product design: An integrated perspective. Surrey, England: Gower Publishing Limited.</i></li> <li>14. <i>Norman, D. A. (1998). The invisible computer: Why good products can fail, the personal computer is so complex and information appliances are the solution. Cambridge, Mass., London: The MIT Press.</i></li> <li>15. <i>Norman, D. A. (1998). The design of everyday things. London: The MIT Press.</i></li> <li>16. <i>Richard, M. (2016). The fundamentals of product design (2nd ed.). London: Fairchild Books.</i></li> <li>17. <i>Rodgers, P. (2011). Product design. London: Laurence King.</i></li> <li>18. <i>Roqueta, H. (2002). Product design. London: Te Neues.</i></li> <li>19. <i>Rowe, P. G. (1987). Design thinking. Cambridge, Mass.: The MIT Press.</i></li> <li>20. <i>Siu, K. W. M. (Ed.) (2009). New era of product design: Theory and practice (Chinese ed.) Beijing: Beijing Institute of Technology Press. 邵健偉 編著 (2009) : 《產品設計新紀元：理論與實踐》。北京：北京理工大學出版社。</i></li> <li>21. <i>Stanton, N. (Ed.) (1998). Human factors in consumer products. London: Taylor &amp; Francis.</i></li> <li>22. <i>Ulrich, K. T. (2004). Product design and development (3rd ed.). New York, NY: McGraw-Hill/Irwin.</i></li> <li>23. <i>Wang, S. Z. (1995). A history of modern design 1864-1996. Guangzhou: Xin Shi Ji Chu Ban She.</i></li> <li>24. <i>Whiteley, N. (1993). Design for society. London: Reaktion Books.</i></li> </ol> |         |

**Intended Blank**

## **Elective Subjects**





## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                              | ENG4001   |
| <b>Subject Title</b>                             | Project Management  |
| <b>Credit Value</b>                              | 3   |
| <b>Level</b>                                     | 4   |
| <b>Pre-requisite/Co-requisite/Exclusion</b>      | Nil   |
| <b>Objectives</b>                                | <p>This subject provides students with knowledge in:</p> <ol style="list-style-type: none"> <li>1. project management tools in business organizations, taking into account the time-cost relationships, resources, processes, risks, the project life cycle, organization, and management principles;</li> <li>2. project management methodologies and their application;</li> <li>3. choosing project variables for effective project management; and</li> <li>4. various developments of project management.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. demonstrate good understanding of definition of a project, the characteristics and project life cycle;</li> <li>b. identify appropriate project variables and practices that are applicable to engineering projects;</li> <li>c. perform project planning, cost/resources estimation, evaluate and monitor of project progress; and</li> <li>d. propose project management solutions, taking into consideration the project objectives and constraints.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. <u>Project Overview, Management Principles, and the Systems Approach</u><br/>Characteristics of projects and project management. Management principles. Project organization. Team development. Systems concepts and principles. Conflict management.</li> <li>2. <u>Project Methodologies and Planning Techniques</u><br/>Constraints: time, cost, and technical performance. Work breakdown structure. Management of scope. Scheduling tools: Gantt charts, network analysis techniques, time-phased networks, CPA, PERT, and resource smoothing.</li> <li>3. <u>Cost Estimation and Cost Control for Projects</u><br/>Types of estimates. Budgeting project costs. Experience curve. Cost schedules and forecasts. Cost control systems.</li> <li>4. <u>Evaluation and Control of Projects</u><br/>Earned value measurement system. Managing project risks. Status reporting. Project closeout and termination.</li> </ol> |

| <b>Teaching/Learning Methodology</b>  | <p>A mixture of lectures, tutorial exercises, case studies, and laboratory work are used to deliver the various topics in this subject. Some material is covered using a problem-based format where this advances the learning objectives. Other material is covered through directed study to enhance the students' "learning to learn" ability. Some case studies are from best practices of projects, based on a literature review. They are used to integrate the topics and demonstrate to students how the various techniques are interrelated and applied in real-life situations.</p>   |   |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
|---|---|---|----------|---|---|-----------------------------------|-------------|---|--|--|--|---|---|---|---|--|-----|--|---|---|--|------------------|-----|---|---|---|--|------------------------|-----|---|---|---|---|-------|------|--|--|--|--|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>  | <table border="1" data-bbox="443 539 1401 1032"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Tutorial exercises/<br/>written report</td> <td>20%</td> <td></td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>2. Mid Term Test</td> <td>20%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>3. Written examination</td> <td>60%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="4"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Continuous assessment (1) &amp; (2): Test, written reports and tutorial exercises are used to assess students' understanding and application of the knowledge that they have learnt relative to learning outcomes (a), (b) and (c).</p> <p>Written examination: questions are designed to assess learning outcomes (a), (b), (c), and (d).</p> |   |          |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |  | a | b | c | d | 1. Tutorial exercises/<br>written report | 20% |  | ✓ | ✓ |  | 2. Mid Term Test | 20% | ✓ | ✓ | ✓ |  | 3. Written examination | 60% | ✓ | ✓ | ✓ | ✓ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting   | Intended subject learning outcomes to be assessed |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
|   |   | a   | b        | c | d |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| 1. Tutorial exercises/<br>written report  | 20%   |   | ✓        | ✓ |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| 2. Mid Term Test  | 20%   | ✓   | ✓        | ✓ |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| 3. Written examination  | 60%   | ✓   | ✓        | ✓ | ✓ |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| Total   | 100%  |   |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| <b>Student Study Effort Expected</b>  | Class contact:  |   |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| <ul style="list-style-type: none"> <li>▪ Lectures</li> </ul>  | 3 hours/week for 9 weeks  |   | 27 Hrs.  |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| <ul style="list-style-type: none"> <li>▪ Tutorials / Case studies</li> </ul>  | 3 hours/week for 4 weeks  |   | 12 Hrs.  |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
|   |   |   | 39 Hrs.  |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
|   |   |   |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| Other student study effort:   |   |   |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| <ul style="list-style-type: none"> <li>▪ Preparation for assignments, short tests, and the written examination</li> </ul> |   |   | 79 Hrs.  |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| Total student study effort  |   |   | 118 Hrs. |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |
| <b>Reading List and References</b>  | <ol style="list-style-type: none"> <li>1. Meredith JR and Mantel SJ, 2010, <i>Project Management: a Managerial Approach</i>, Wiley, Hoboken NJ</li> <li>2. Kerzner, H 2009, <i>Project Management: a Systems Approach to Planning, Scheduling, and Controlling</i>, John Wiley, New York</li> <li>3. Smith, NJ (ed.) 2008, <i>Engineering Project Management</i>, Blackwell, Oxford</li> </ol>  |   |          |   |   |                                   |             |   |  |  |  |   |   |   |   |  |     |  |   |   |  |                  |     |   |   |   |  |                        |     |   |   |   |   |       |      |  |  |  |  |

(Revised) July 2015

## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>                              | ISE376   |
| <b>Subject Title</b>                             | Entrepreneurship and Innovation  |
| <b>Credit Value</b>                              | 3  |
| <b>Level</b>                                     | 3  |
| <b>Pre-requisite/Co-requisite/Exclusion</b>      | Nil  |
| <b>Objectives</b>                                | <p>The objectives of the subject are to enable the students to</p> <ol style="list-style-type: none"> <li>1. gain an overview of the concept of entrepreneurship and entrepreneurship strategies;</li> <li>2. develop an awareness of the sources/processes of innovation;</li> <li>3. develop the ability to analyze innovative business.</li> </ol>  |
| <b>Intended Learning Outcomes</b>                | <p>Upon completion of the subject, students will be able to</p> <ol style="list-style-type: none"> <li>a. understand entrepreneurship strategies in which innovation is an important part of business and corporate strategy;</li> <li>b. recognize various types of innovations and their processes;</li> <li>c. apply the techniques involved in assessing corporate ventures;</li> <li>d. evaluate the management of innovative business development or processes from a strategic and contemporary viewpoint.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <p>Entrepreneurship and Industry Analysis</p> <ol style="list-style-type: none"> <li>1. <u>Overview of Entrepreneurship</u><br/>This provides the fundamental concept of entrepreneurship and relevant issues.</li> <li>2. <u>Understanding Industry Context and Entrepreneurship Strategies</u><br/>This details the approaches to justify the industry context.<br/>This introduces the various strategies involved in the business development process.</li> </ol> <p>Innovation and Business Development</p> <ol style="list-style-type: none"> <li>3. <u>Introduction of Innovation Types</u><br/>Innovation styles and approaches are discussed.</li> <li>4. <u>Implementation of Innovation</u><br/>This discusses the approaches to integrate innovation in entrepreneurship.</li> </ol> |
| <b>Teaching/Learning Methodology</b>             | <p>The teaching/learning approach combines lectures, cases, and in-class activities. Each session includes a number of readings (required/optional) pertaining to the theme of the session.</p>  |

|  | <p>Lectures: Lectures are conducted to give students an overview of the fundamental concepts and theories.</p> <p>Case studies are given to students to facilitate the application of learned knowledge and interactive knowledge sharing.</p> <p>In-class activities include seminars by industrialists and projects involving hands-on experience on the subject.</p>  |             |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|--|--|-------------|---|---|---|---|----------|-----------------------------------|-------------|---|--|--|--|--|--|---|---|---|---|--|--|--|------|---|---|--|--|--|--|------------|------|--|--|---|---|--|--|---------------|------|--|--|--|---|--|--|-------|------|--|--|--|--|--|--|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>1. Ind. Assessments, in-class activities and Test(s)</td> <td>50 %</td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2. Project</td> <td>30 %</td> <td></td> <td></td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>3. Reflection</td> <td>20 %</td> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="6"></td> </tr> </tbody> </table> <p>The various forms of assessments/assignments allow students not only to understand the learned topics but also to reflect on the topics.</p> <ul style="list-style-type: none"> <li>Assessment methods 1: Assignments and tests are used to assess students' understanding of the basic concepts of the subject, students are also required to participate in in-class activities and</li> <li>Assessment methods 2 &amp; 3: Project and individual reflections are used to assess the students' ability in applying learned knowledge, that is, the techniques in assessing corporate ventures and the management of innovative entrepreneurship.</li> </ul> |             |   |   |   |   |          | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |  |  |  | a | b | c | d |  |  | 1. Ind. Assessments, in-class activities and Test(s) | 50 % | ✓ | ✓ |  |  |  |  | 2. Project | 30 % |  |  | ✓ | ✓ |  |  | 3. Reflection | 20 % |  |  |  | ✓ |  |  | Total | 100% |  |  |  |  |  |  |
|  | Specific assessment methods/tasks  | % weighting | Intended subject learning outcomes to be assessed |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  |  |             | a   | b | c | d |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | 1. Ind. Assessments, in-class activities and Test(s)   | 50 %        | ✓   | ✓ |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | 2. Project   | 30 %        |   |   | ✓ | ✓ |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | 3. Reflection  | 20 %        |   |   |   | ✓ |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
| Total  | 100%   |             |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
| <b>Student Study Effort Expected</b>                                   | Class contact  |             |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>Lectures / Test(s)<br/>3 hours/week x 6 weeks</li> </ul>  | 18 Hrs.     |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>Case studies/Workshops/Guided project/ Reflection 3 hours x 7 weeks</li> </ul>  | 21 Hrs.     |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | Other student study efforts  |             |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>Individual reading and assignments</li> </ul>   | 42 Hrs.     |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>Project</li> </ul>  | 42 Hrs.     |   |   |   |   |          |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |
|  | Total student study effort   |             |   |   |   |   | 123 Hrs. |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |  |      |   |   |  |  |  |  |            |      |  |  |   |   |  |  |               |      |  |  |  |   |  |  |       |      |  |  |  |  |  |  |

**Reading List and References**

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

## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>                              | ISE4006  |
| <b>Subject Title</b>                             | Integrative Studies in Enterprise Systems and Management   |
| <b>Credit Value</b>                              | 3  |
| <b>Level</b>                                     | 4  |
| <b>Pre-requisite/Co-requisite/Exclusion</b>      | Nil  |
| <b>Objectives</b>                                | <p>This subject will provide students with</p> <ol style="list-style-type: none"> <li>1. the ability to work at their own pace, in groups as well as individually;</li> <li>2. the understanding of the importance of teamwork and the complexity of a modern enterprise;</li> <li>3. the knowledge to develop business plans/proposals in implementing an enterprise project;</li> <li>4. the skills to design, develop and evaluate a prototype of enterprise portal.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                | <p>Upon completion of the subject, students will be able to</p> <ol style="list-style-type: none"> <li>a. learn various skills and practical knowledge at their own pace;</li> <li>b. start-up of a business with entrepreneurial business skills;</li> <li>c. build an enterprise portal with needed features to show the business idea;</li> <li>d. assess and critique the quality of work of their peer group.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. <u>Company Formation</u><br/>Company registration, role play to be company secretary and directors,</li> <li>2. <u>Business Plan Development</u><br/>Apply brainstorming techniques to develop innovative business ideas, formulate company strategies using SWOT analysis, analyse market and competitive environments using PEST and Porter's Five Forces analysis, formulate marketing strategies according to different stage of product life cycle, designing marketing program, and financial and operation plans, financial and risk analyses.</li> <li>3. <u>Business Plan Write-up and Competition</u><br/>Business plan writing, application prototype, portal development, design, plan and control of an enterprise, business plan competition and interview.</li> </ol> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Throughout the duration of the project, the project tutors provide guidance and monitor the progress of the business projects. The project-based learning approach is recommended for adoption. It is a systematic teaching method engaging students to learn the essential knowledge and life-enhancing skills through extended and student-influenced inquiry process, which are structured around complex and real problems.</p> <p>Before commencing this project, students are required to form a company with 5 to 7 students and do the company registration, attend briefing and seminar sessions to ensure its smooth running. In particular, one of these will include business plan writing and portal development. This will contain topics that will assist students to plan, schedule and control the various activities involved so as to effectively complete their work within the time frame allowed. In addition, other topic areas will be covered including, the awareness of various engineering options, strategic management skills, creativity and idea generation, and the use of the IT skills that they will have learnt in Year 1 of the programme.</p>  |   |   |   |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
|--|--|---|---|---|---|--|--|-----------------------------------|-------------|---|--|--|--|--|--|---|---|---|---|--|--|------------------|-----|--|---|---|--|--|--|---------------------------------------|-----|---|---|---|---|--|--|----------------|-----|---|---|---|--|--|--|-----------|-----|--|---|---|--|--|--|--------------|-------------|--|--|--|--|--|--|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="440 887 1466 1532"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="6">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td>Progress meeting</td> <td>10%</td> <td></td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Presentation and portal demonstration</td> <td>40%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>Report writing</td> <td>30%</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Interview</td> <td>20%</td> <td></td> <td>✓</td> <td>✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td><b>Total</b></td> <td><b>100%</b></td> <td colspan="6"></td> </tr> </tbody> </table> <p>a. Students have to attend various seminars and progress meeting in order to develop their own knowledge in a business environment.</p> <p>b. In conducting the business project, students have to execute how to develop their own business by writing a business plan and developing a company portal.</p> <p>c. Students have to present their business to a panel in form of a competition and attend an interview individually for assessment.</p> <p>d. Students have to compare their peer groups and to assess the quality of their work.</p> |   |   |   |   |  |  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |  |  |  | a | b | c | d |  |  | Progress meeting | 10% |  | ✓ | ✓ |  |  |  | Presentation and portal demonstration | 40% | ✓ | ✓ | ✓ | ✓ |  |  | Report writing | 30% | ✓ | ✓ | ✓ |  |  |  | Interview | 20% |  | ✓ | ✓ |  |  |  | <b>Total</b> | <b>100%</b> |  |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting  | Intended subject learning outcomes to be assessed |   |   |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
|  |  | a   | b | c | d |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
| Progress meeting   | 10%  |   | ✓ | ✓ |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
| Presentation and portal demonstration                                  | 40%  | ✓   | ✓ | ✓ | ✓ |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
| Report writing   | 30%  | ✓   | ✓ | ✓ |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
| Interview  | 20%  |   | ✓ | ✓ |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
| <b>Total</b>   | <b>100%</b>  |   |   |   |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |
| <b>Student Study</b>   | Class contact:   |   |   |   |   |  |  |                                   |             |   |  |  |  |  |  |   |   |   |   |  |  |                  |     |  |   |   |  |  |  |                                       |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |           |     |  |   |   |  |  |  |              |             |  |  |  |  |  |  |

|                                    |   |          |
|------------------------------------|---|----------|
| <b>Effort Expected</b>             | ▪ Business Plan briefing and seminars   | 9 Hrs.   |
|                                    | ▪ Progress meeting 1hour/week for 9 weeks   | 9 Hrs.   |
|                                    | ▪ Presentation  | 8 Hrs.   |
|                                    | ▪ Interview   | 1 Hrs.   |
|                                    | Other student study effort:   |          |
|                                    | ▪ Research and preparation  | 30 Hrs.  |
|                                    | ▪ Report writing  | 40 Hrs.  |
|                                    | ▪ Preparation for presentation and interview  | 30 Hrs.  |
|                                    | Total student study effort  | 127 Hrs. |
| <b>Reading List and References</b> | <ol style="list-style-type: none"> <li>1. Knowles, Ronald A. 2007, <i>Small Business – An Entrepreneur’s Plan</i>, Toronto, Ont. Thomson Nelson</li> <li>2. Truitt Wesley B. 2002, <i>Business Planning: A Comprehensive Framework and Process</i>, Quorum Books</li> <li>3. Capezio Peter 2010, <i>Manager’s Guide for Business Planning</i>, McGraw Hill</li> <li>4. Applegate Jane 2011, <i>201 Great Ideas for Your Small Business</i>, Bloomberg Press</li> <li>5. Finch Brian 2013, <i>How to Write a Business Plan</i>, Kogan Page Limited</li> <li>6. InfoSci-Books 2011, <i>Global Business Concepts, Methodologies, Tools and Applications</i>, Business Science Reference</li> </ol> |          |



## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                          | ISE430  |
| <b>Subject Title</b>                         | New Product Planning and Development  |
| <b>Credit Value</b>                          | 3   |
| <b>Level</b>                                 | 4   |
| <b>Pre-requisite/Co-requisite/Exclusion</b>  | Exclusion: MM484 Managing New Product Development   |
| <b>Objectives</b>                            | <p>This subject will enable students to</p> <ol style="list-style-type: none"> <li>1. understand the new product development process and strategic features of new product development;</li> <li>2. develop strategic thinking and planning abilities throughout the early product design stage;</li> <li>3. understand various techniques for new product planning.</li> </ol>   |
| <b>Intended Learning Outcomes</b>            | <p>Upon completion of the subject, students will be able to</p> <ol style="list-style-type: none"> <li>a. appreciate the generation of product concepts that satisfy the needs of customers;</li> <li>b. explore and analyze market needs and appreciate their direct relationship with new products;</li> <li>c. identify new product opportunities;</li> <li>d. introduce financial, environmental, social, and cultural considerations with regard to design decisions.</li> </ol>   |
| <b>Subject Synopsis/ Indicative Syllabus</b> | <ol style="list-style-type: none"> <li>1. <u>Introduction to New Product Planning and Development</u><br/>           New product planning and development process, Types of new products, Drivers of new product development, Success and failure factors, New product development strategy, Analysis of business and completion environments for new product development</li> <li>2. <u>Issues of Strategic Planning for New Products</u><br/>           Modular product design, Product architecture, Product family design, Product line design, Product Portfolio planning, Customized products versus mass products, Technology roadmapping</li> <li>3. <u>Customer Needs and Value</u><br/>           Acquisition, organization and analysis of customer needs, Customer value and its measurement</li> </ol> |

|   | <p>4. <u>Segmentation, Targeting, and Positioning</u></p> <p>Market and benefit segmentation and its techniques, Product positioning, Perceptual mapping, Value mapping</p> <p>5. <u>Opportunity Specification and Justification</u></p> <p>Needs analysis, Ethnography, Scenario analysis, Product innovation charter</p> <p>6. <u>Defining Design Specification</u></p> <p>Conjoint analysis, QFD-based techniques</p> <p>7. <u>Concept Test</u></p> <p>Concept statements, Considerations, Formats</p> <p>8. <u>Sales Forecasting and Financial Analysis</u></p> <p>Sales forecasting models, Choice modeling, Pricing techniques for new products, Examples of financial plans</p>  |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
|---|---|-----------------------------------|-------------|---|---|--|--|--|--|---|---|---|---|--|--|-----------------|-----|---|---|---|---|--|--|----------------|-----|---|---|---|--|--|--|---------|-----|---|---|---|---|--|--|-------|------|--|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Teaching and learning activities include lectures, tutorials, case studies, a group project, and a laboratory exercise. The lectures are aimed at providing students with the basic understanding of new product development process, as well as common techniques and methods used in new product planning. In tutorial classes, small group discussions are facilitated for students to enhance their understanding of the subject matter. Through a number of minor exercises in tutorial classes, students not only have better understanding of the subject matter, but teachers are also allowed to monitor their learning progress. All the case studies are related to real-life successful and failed cases of new product development. Through the case studies, students can appreciate various issues and factors leading to the success and failure of new product development. Laboratory exercises provide students with hands-on experience on the segmentation and generation of perceptual maps.</p> |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
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| Specific assessment methods/tasks   | % weighting   |                                   |             | Intended subject learning outcomes to be assessed |   |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
|   |   | a                                 | b           | c   | d |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| 1. Case studies   | 25%   | ✓                                 | ✓           | ✓   | ✓ |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| 2. Assignments  | 45%   | ✓                                 | ✓           | ✓   |   |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| 3. Test   | 30%   | ✓                                 | ✓           | ✓   | ✓ |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |
| Total   | 100%  |                                   |             |   |   |  |  |  |  |   |   |   |   |  |  |                 |     |   |   |   |   |  |  |                |     |   |   |   |  |  |  |         |     |   |   |   |   |  |  |       |      |  |  |  |  |  |  |

|                                      |   |          |
|--------------------------------------|---|----------|
|                                      | The case studies are aimed at assessing all the ILOs of students. The assignments of this subject contain in-class assignments and take-home assignments which are used to assess the ILOs a, b and c of students. A test is normally conducted by the end of the semester and is aimed at assessing all the ILOs of students.  |          |
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lectures  | 24 Hrs.  |
|                                      | ▪ Tutorials   | 11 Hrs.  |
|                                      | ▪ Laboratory exercise   | 2 Hrs.   |
|                                      | ▪ Test  | 2 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Case studies  | 25 Hrs.  |
|                                      | ▪ Preparation for test  | 28 Hrs.  |
|                                      | ▪ Take-home assignments   | 30 Hrs.  |
|                                      | Total student study effort  | 122 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Crawford, C.M., and Di Benedetto, C.A., <i>New Products Management</i>, McGraw Hill</li> <li>2. Glen, L. 1993, <i>Design and Marketing of New Products</i>, Prentice Hall</li> <li>3. Lilien, G.L. and Rangaswamy, A. 2003, <i>Marketing Engineering – Computer Assisted Marketing Analysis and Planning</i>, Prentice Hall</li> <li>4. Baxter, M. 1995, <i>Product Design – Practical Methods for Systematic Development of New Products</i>, Chapman &amp; Hall</li> <li>5. Ulrich, K.T. and Eppinger, S.D., <i>Product Design and Development</i>, McGraw-Hill</li> <li>6. <i>Design Management Journal</i>, Design Management Institute Press</li> <li>7. <i>The Journal of Product Innovation Management</i>, Elsevier Science Inc.</li> </ol> |          |

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME41001  |
| <b>Subject Title</b>                                  | Automatic Control Systems  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31002 Linear Systems and Control  |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of controller design for automatic control systems.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate and solve problems relating to modeling of linear mechanical systems, analysis of system relative stabilities; determining specifications for open- or closed-loop control systems and designing controllers or compensators for mechanical systems.</li> <li>b. Complete a given task such as a project in system modeling or controller design by applying knowledge acquired in the subject and information obtained through literature search.</li> <li>c. Analyze and interpret data obtained from experiments in system modeling, stability analysis or frequency-domain analysis of mechanical systems.</li> <li>d. Present effectively in completing written reports of laboratory work and the given task.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Time Domain Controller Design</i></b> - Multi-mode controllers; Optimum controller settings; Ratio, cascade and feedforward control.</p> <p><b><i>Frequency Domain Compensator Design</i></b> - Nyquist criterion; Phase and gain margins; Multiple design constraints; Characteristics of lead, lag and lag-lead elements; Compensator design via Bode plots.</p> <p><b><i>State-Space Representation of Dynamic Systems</i></b> - 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.</p> <p><b><i>Control System Analysis Using State Variable Method</i></b> - Direct numerical solution of state equation; Solution using state transition matrix; System stability; Controllability and observability.</p> <p><b><i>Control System Design Using State Variable Method</i></b> - 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.</p> <p><b>Laboratory Experiment</b></p> |

|   | <p>There are two 2-hour laboratory sessions.</p> <p>Typical Experiments:</p> <ol style="list-style-type: none"> <li>1. Twin-rotor control</li> <li>2. Inverted pendulum control</li> <li>3. DC servo control</li> </ol>  |                                   |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
|---|--|-----------------------------------|-------------|--|---|--|---|---|---|---|---------|----------------|-----|---|---|----------|---|---------|-----|---|------------|--|--|---------------|-----|---|---|--|--|----------------------|-----|--|--|---|---|-------|------|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures aim at providing students with an integrated knowledge required for understanding controller or compensator design, analyzing and designing state-space control systems (Outcomes a and b).</p> <p>Tutorials aim at enhancing the analytical skills of the students. Examples on time-domain controller design, frequency domain compensator design, state-space system representation, analysis and controller design are used to illustrate the application of integrated knowledge to solve real-world problems (Outcomes a and b).</p> <p>Experiments will provide the students with experience on the use of simulation tools for the computer-aided analysis and controller design of typical state-space dynamic systems. It also trains students in the measurement and instrumentation, the analysis and presentation of experimental data (Outcomes c and d).</p> <table border="1" data-bbox="443 909 1347 1171"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table>         | Teaching/Learning Methodology     | Outcomes    |  |   |  | a | b | c | d | Lecture | √              | √   |   |   | Tutorial | √ | √       |     |   | Experiment |  |  | √             | √   |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes   |                                   |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
|   | a  | b                                 | c           | d  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| Lecture   | √  | √                                 |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| Tutorial  | √  | √                                 |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| Experiment  |  |                                   | √           | √  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1238 1431 1635"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Test</td> <td>25%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Assignment</td> <td>15%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>4. Laboratory report</td> <td>10%</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   | a | b | c | d       | 1. Examination | 50% | √ | √ |          |   | 2. Test | 25% | √ | √          |  |  | 3. Assignment | 15% | √ | √ |  |  | 4. Laboratory report | 10% |  |  | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
|   |  | a                                 | b           | c  | d |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| 1. Examination  | 50%  | √                                 | √           |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| 2. Test   | 25%  | √                                 | √           |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| 3. Assignment   | 15%  | √                                 | √           |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| 4. Laboratory report  | 10%  |                                   |             | √  | √ |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |
| Total   | 100%   |                                   |             |  |   |  |   |   |   |   |         |                |     |   |   |          |   |         |     |   |            |  |  |               |     |   |   |  |  |                      |     |  |  |   |   |       |      |  |  |  |  |

|                                      |   |          |
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| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 31 Hrs.  |
|                                      | ▪ Tutorial/Laboratory   | 8 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Course work   | 26 Hrs.  |
|                                      | ▪ Self-study  | 45 Hrs.  |
|                                      | Total student study effort  | 110 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. M. Gopal, Control Systems, Principles and Design, McGraw-Hill, latest edition.</li> <li>2. N.S. Nise, Control Systems Engineering, Wiley, latest edition.</li> <li>3. K. Ogata, Modern Control Engineering, Prentice Hall, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME41002   |
| <b>Subject Title</b>                                  | Noise Abatement and Control   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics; and<br>ME34004 Fluid Mechanics   |
| <b>Objectives</b>                                     | To provide students with fundamental concept and knowledge of sound generation mechanism and noise abatement technology.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the sound generation mechanisms, and the method to identify and analyze the type of noise source.</li> <li>b. Formulate and solve the noise problem by using sound reflection, sound absorption and active noise control by applying knowledge of sound wave propagation.</li> <li>c. Understand the importance and usage of the noise assessment criterion for a given problem in duct or room noise applications.</li> <li>d. Apply the state-of-the-art noise abatement technology and design elementary reactive and absorptive noise control device, analyze and interpret its performance from measurement.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Noise Sources and Control Strategy</b> - 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.</p> <p><b>Sound Reflection</b> - 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.</p> <p><b>Sound Absorption</b> - Characteristics of sound propagation in porous materials, empirical formulas and numerical modelling of sound absorption materials, grazing incident sound, and performance of duct lining.</p> <p><b>Active Noise Control</b> - Destructive interference, sensors, actuators and controllers, concept of feedback and feedforward control.</p> <p><b>Room Acoustic Control</b> - Basic concepts of room acoustics and room modes, noise control and sound transmission in buildings.</p> <p><b>Mini Project</b> - This involves the use of numerical and/or experimental methods for noise abatement in a realistic application.</p> <p><b>Laboratory Experiment</b></p> |

|  |  |             |  |   |   |   |
|--|--|-------------|--|---|---|---|
|  | <p>There is one 1-hour laboratory session.<br/> Typical experiment:<br/> 1. Helmholtz resonator<br/> 2. Expansion chamber</p>  |             |  |   |   |   |
| <b>Teaching/Learning Methodology</b>   | <p>Lectures are aimed at providing students with the knowledge of acoustics and noise control for achieving the subject outcomes. (Outcomes a to d)</p> <p>Tutorials are aimed at enhancing students' skills necessary for analyzing and designing the noise control method. (Outcomes a, b and d)</p> <p>Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems, to develop the students' interest and curiosity in the design of noise control method. (Outcomes b to d)</p> |             |  |   |   |   |
|  | Teaching/Learning Methodology  |             | Outcomes   |   |   |   |
|  |  |             | a  | b | c | d |
|  | Lecture  |             | √  | √ | √ | √ |
|  | Tutorial   |             | √  | √ |   | √ |
| Experiment   |  |             | √  | √ | √ |   |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>   | Specific assessment methods/tasks  | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |
|  |  |             | a  | b | c | d |
|  | 1. Class test  | 20%         | √  | √ | √ | √ |
|  | 2. Homework  | 20%         | √  | √ |   | √ |
|  | 3. Lab report  | 10%         |  | √ | √ | √ |
|  | 4. Examination   | 50%         | √  | √ | √ | √ |
|  | Total  | 100%        |  |   |   |   |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |             |  |   |   |   |



|                                      |  |         |
|--------------------------------------|--|---------|
| <b>Student Study Effort Expected</b> | Class contact:   |         |
|                                      | ▪ Lecture  | 31 Hrs. |
|                                      | ▪ Tutorial/Laboratory  | 8 Hrs.  |
|                                      | Other student study effort:  |         |
|                                      | ▪ Reading and review   | 40 Hrs. |
|                                      | ▪ Homework assignment  | 11 Hrs. |
|                                      | ▪ Laboratory report  | 8 Hrs.  |
| Total student study effort           | 98 Hrs.  |         |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. A.D. Pierce, Acoustics: an Introduction to its Physical Principles and Applications, Acoustical Society of America, Woodbury, N.Y., latest edition.</li> <li>2. A.P. Dowling and J.E. Ffowes Williams, Sound and Sources of Sound, Chichester: E. Horwood, latest edition.</li> <li>3. L.L. Beranek, Noise and Vibration Control Engineering: Principles and Applications, Wiley, latest edition.</li> <li>4. D.A. Bies and C.H. Hansen, Engineering Noise Control: Theory and Practice, E &amp; FN Spon, latest edition.</li> </ol> |         |

*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME41003   |
| <b>Subject Title</b>                                  | Principles of Sound and Vibration   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics   |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of generation and measurement of sound and vibration and the sound propagation.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the physics of the vibration of simple structure and sound propagation in the acoustic medium, in duct and in room.</li> <li>b. Formulate and solve the sound and vibration problem relating to vibration of string, beam and plate, sound radiation from the source, sound reflection and transmission through a junction and a flat interface of acoustic media by applying knowledge in noise mitigation method.</li> <li>c. Understand the mechanisms of basic measurement devices for sound and vibration, analyze and interpret the measured data from the experiments of noise and vibration.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Fundamentals of Sound</i></b> - 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.</p> <p><b><i>Vibration of Continuous Systems</i></b> - Vibration of string, rod, beams and plates; energy transmission through structures, natural modes, free and forced vibrations.</p> <p><b><i>Sources of Sound</i></b> - Radiation of sound by pistons (1D, 2D), impedance, radiation efficiency, monopole and dipole, critical frequency, sound radiation by 2D structures.</p> <p><b><i>Sound Propagation</i></b> - Single travelling wave and properties of standing wave, reflection of sound at pipe junctions and at interface of two media.</p> <p><b><i>Sound and Vibration Measurement</i></b> - 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.</p> <p><b>Laboratory Measurement</b></p> <ol style="list-style-type: none"> <li>1. Sound propagation in anechoic chamber</li> <li>2. Impedance tube measurement</li> <li>3. Experimental modal analysis of a vibrating beam</li> <li>4. Traffic noise measurement</li> </ol> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are aimed at providing students with the knowledge of acoustics and vibration. (Outcomes a to c).</p> <p>Tutorials are aimed at enhancing students' skills necessary for analyzing the physics of sound and vibration system (Outcomes a and b).</p> <p>Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems (Outcomes b and c).</p> <table border="1" data-bbox="443 477 1465 734"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="3">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Experiment</td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |  |   |   | Teaching/Learning Methodology     | Outcomes    |  |  | a         | b | c       | Lecture | √                     | √   | √      | Tutorial | √                           | √           |     | Experiment |                      | √ | √                    |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
|--|---|--|---|---|-----------------------------------|-------------|--|--|-----------|---|---------|---------|-----------------------|-----|--------|----------|-----------------------------|-------------|-----|------------|----------------------|---|----------------------|-----|-----------------------|---|---------|----------------|---------------------|---|---------|---|----------------------------|------|----------|--|--|
| Teaching/Learning Methodology  | Outcomes  |  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
|  | a   | b  | c |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| Lecture  | √   | √  | √ |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| Tutorial   | √   | √  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| Experiment   |   | √  | √ |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 779 1465 1182"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Homework</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Laboratory report</td> <td>10%</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |           | a | b       | c       | 1. Class test         | 20% | √      | √        | √                           | 2. Homework | 20% | √          | √                    | √ | 3. Laboratory report | 10% |                       | √ | √       | 4. Examination | 50%                 | √ | √       | √ | Total                      | 100% |          |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
|  |   | a  | b | c |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| 1. Class test  | 20%   | √  | √ | √ |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| 2. Homework  | 20%   | √  | √ | √ |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| 3. Laboratory report   | 10%   |  | √ | √ |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| 4. Examination   | 50%   | √  | √ | √ |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| Total  | 100%  |  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| <b>Student Study Effort Expected</b>                                   | <table border="1" data-bbox="443 1536 1485 1980"> <tbody> <tr> <td colspan="2">Class contact:</td> <td colspan="2"></td> </tr> <tr> <td>▪ Lecture</td> <td></td> <td colspan="2">32 Hrs.</td> </tr> <tr> <td>▪ Tutorial/Laboratory</td> <td></td> <td colspan="2">7 Hrs.</td> </tr> <tr> <td colspan="2">Other student study effort:</td> <td colspan="2"></td> </tr> <tr> <td>▪ Reading and review</td> <td></td> <td colspan="2">43 Hrs.</td> </tr> <tr> <td>▪ Homework assignment</td> <td></td> <td colspan="2">10 Hrs.</td> </tr> <tr> <td>▪ Laboratory report</td> <td></td> <td colspan="2">10 Hrs.</td> </tr> <tr> <td colspan="2">Total student study effort</td> <td colspan="2">102 Hrs.</td> </tr> </tbody> </table>  |  |   |   | Class contact:                    |             |  |  | ▪ Lecture |   | 32 Hrs. |         | ▪ Tutorial/Laboratory |     | 7 Hrs. |          | Other student study effort: |             |     |            | ▪ Reading and review |   | 43 Hrs.              |     | ▪ Homework assignment |   | 10 Hrs. |                | ▪ Laboratory report |   | 10 Hrs. |   | Total student study effort |      | 102 Hrs. |  |  |
| Class contact:   |   |  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| ▪ Lecture  |   | 32 Hrs.  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| ▪ Tutorial/Laboratory  |   | 7 Hrs.   |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| Other student study effort:  |   |  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| ▪ Reading and review   |   | 43 Hrs.  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| ▪ Homework assignment  |   | 10 Hrs.  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| ▪ Laboratory report  |   | 10 Hrs.  |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |
| Total student study effort   |   | 102 Hrs.   |   |   |                                   |             |  |  |           |   |         |         |                       |     |        |          |                             |             |     |            |                      |   |                      |     |                       |   |         |                |                     |   |         |   |                            |      |          |  |  |

|                                    |  |
|------------------------------------|--|
| <b>Reading List and References</b> | <ol style="list-style-type: none"><li>1. L.E. Kinsler, et al., Fundamentals of Acoustics, Wiley, latest edition.</li><li>2. M.P. Norton, Fundamentals of Noise and Vibration Analysis for Engineers, Cambridge University Press, latest edition.</li><li>3. H. Benaroya, Mechanical Vibration: Analysis, Uncertainties and Control, Prentice-Hall, latest edition.</li><li>4. A.P. Dowling and J.E. Ffowcs Williams, Sound and Sources of Sound, Chichester: E. Horwood, latest edition.</li><li>5. L.L. Beranek, Noise and Vibration Control Engineering: Principles and Applications, Wiley, latest edition.</li></ol> |
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*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME42001   |
| <b>Subject Title</b>                                  | Artificial Intelligence in Products   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31002 Linear Systems and Control ; or<br>ME41004 Mechatronics and Control  |
| <b>Objectives</b>                                     | To provide students with basic knowledge on expert and fuzzy inference systems for product design and development.  |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Apply knowledge of mathematics, expert systems and fuzzy inference systems to analyze a product design via analytical and computational approaches.</li> <li>b. Understand the applications of AI in high-tech product design and development.</li> <li>c. Work effectively as a member to tackle a multi-disciplinary design project involving the application of AI.</li> <li>d. Appreciate the state-of-the-art applications of AI in product design and present a design project via written report.</li> </ul>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Expert Systems for Products</i></b> - Principles of expert systems; Knowledge representations; Knowledge acquisition; Inference mechanisms; Learning and heuristics; Application of expert systems to product design and product data management; Understanding expert system shells, such as Prolog or Lisp; Building expert systems using Prolog or available software packages. [Case study 1: Apply expert system in product design]</p> <p><b><i>Fuzzy Inference Systems in Product Design and Development</i></b> - Fuzzy sets and crisp sets; Membership functions; Properties of fuzzy sets; Operations on fuzzy sets; Operations on fuzzy relations; Fuzzy if-then statements; Inference rules; Developing fuzzy inference systems using Matlab or available software packages. [Case study 2: Apply fuzzy inference Systems in product design]</p> |

| <b>Teaching/Learning Methodology</b>                                   | <ol style="list-style-type: none"> <li>The lectures are aimed at providing fundamental knowledge on product expert system and fuzzy inference systems for product design and development. (Outcomes a and b)</li> <li>The tutorials are aimed at enhancing applicable skills of the students. Examples on the expert systems and fuzzy inference systems in commercial products will be involved. (Outcomes a and b)</li> <li>The project is aimed at integrating the knowledge that will be applied through a team project on product design and development with expert systems and fuzzy inference systems. (Outcomes a - d)</li> </ol> <table border="1" data-bbox="497 526 1358 784"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  | Teaching/Learning Methodology     | Outcomes    |  |   |  | a | b | c | d | Lecture | √             | √   |   |   | Tutorial | √ | √           |     |   | Project | √ | √ | √                | √   |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
|--|--|-----------------------------------|-------------|--|---|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|-------------|-----|---|---------|---|---|------------------|-----|---|---|---|---|----------------|-----|---|---|--|--|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes   |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
|  | a  | b                                 | c           | d  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Lecture  | √  | √                                 |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Tutorial   | √  | √                                 |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Project  | √  | √                                 | √           | √  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 835 1358 1377"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Class Test</td> <td>25%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Homework</td> <td>10%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Group Project</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math>.</p> <p>The weighting of 50% on continuous assessment is meant to allow students to consolidate their learning through continuous effort such as assignments and project work. The group project will be assigned to students at early stage of the subject study which enables students to link the knowledge they learnt with the project step by step. Report and the presentation will be major outcomes of the project work that will show how the students are able to design expert systems and fuzzy inference systems for products. The examination is used to assess the knowledge acquired by the students for understanding expert systems and fuzzy inference systems of the products.</p> | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   | a | b | c | d       | 1. Class Test | 25% | √ | √ |          |   | 2. Homework | 10% | √ | √       |   |   | 3. Group Project | 15% | √ | √ | √ | √ | 4. Examination | 50% | √ | √ |  |  | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting  |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
|  |  | a                                 | b           | c  | d |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 1. Class Test  | 25%  | √                                 | √           |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 2. Homework  | 10%  | √                                 | √           |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 3. Group Project   | 15%  | √                                 | √           | √  | √ |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| 4. Examination   | 50%  | √                                 | √           |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |
| Total  | 100%   |                                   |             |  |   |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |         |   |   |                  |     |   |   |   |   |                |     |   |   |  |  |       |      |  |  |  |  |

|                                      |   |          |
|--------------------------------------|---|----------|
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Laboratory / project / tutorial   | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Reading and review  | 20 Hrs.  |
|                                      | ▪ Homework assignment   | 28 Hrs.  |
|                                      | ▪ Project / Laboratory report   | 18 Hrs.  |
|                                      | Total student study effort  | 105 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Luger, G.F., and Stubblefield, W.A., Artificial Intelligence and the Design of Expert Systems, The Benjamin/Cummings Publishing Co., latest edition.</li> <li>2. Clocksin, W. F., Programming in Prolog, Berlin; New York: Springer-Verlag, latest edition.</li> <li>3. Boca Raton, FL, A first course in fuzzy and neural control, Chapman &amp; Hall/CRC Press, latest edition.</li> <li>4. Ross, Timothy J., Fuzzy logic with engineering applications, Chichester; Hoboken, NJ: Wiley, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME42004  |
| <b>Subject Title</b>                                  | Development of Green Products  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: CEE370 Environmental Science I; or<br>ME22002 Integrated Product Development Fundamentals; or<br>ME32001 Manufacturing Fundamentals; or<br>ME32003 Design and Manufacturing; or<br>ISE386 Integrated Design for Manufacture   |
| <b>Objectives</b>                                     | To enhance students' awareness of environmental issues and provide them with necessary knowledge in green product development.   |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Appreciate the environmental impact of product manufacturing, distribution, use and disposal.</li> <li>b. Critically evaluate the environmental impacts of products during their life cycle and suggest appropriate actions to minimize/mitigate the impacts.</li> <li>c. Apply green design concepts in designing/re-designing products to fulfill the needs of green product market.</li> <li>d. Evaluate existing products/processes/technologies in terms of their environmental performance, and present the findings via oral presentation and written report.</li> </ul>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Environmental Issues of Concern</i></b> - Depletion and degradation of natural resources, environmental pollution and history of responses to pollution, waste and waste disposal issues, global warming, ozone layer depletion, acid rains, desertification, climate change, consumerism and its effect on global environment , individual and social preference for green living.</p> <p><b><i>Environmental Impact of Products</i></b> - Life-cycle of a product, environmental impact of products over its life-cycle, environmental impact of packaging, strategies for minimizing environmental impact, drivers for green product design</p> <p><b><i>Green and Sustainable Product Development Process</i></b> - Concept of green and sustainable product development: product design, planning and innovation for environment, concept of eco-design, eco-labelling and energy-labelling, international environmental management standards.</p> <p><b><i>Material Selection and Procurement for Green Product Development</i></b> – Material selection for green design: Material selection process steps for green design, material selection methods, and material assessments.<br/>Green Procurement: Benefits of green procurement, green procurement process steps, evaluation of suppliers, green procurement programmes.</p> |



|   | <p><b><i>Environmental Assessment of Green Products</i></b> - Criteria on the global warming, stratospheric ozone depletion, photochemical ozone formation, acidification, nutrient enrichment, ecotoxicity, human toxicity, resource consumption and working environment. Normalisation and weighting in the environmental assessment of products, life-cycle impact assessment (LCA) of products.</p> <p><b><i>The Green Future</i></b> - Green consumerism, opportunities from green technologies, green taxes and their effect on product development and marketing.</p>  |                               |          |   |  |  |   |   |   |   |                  |   |   |   |  |                                    |  |  |   |   |                                   |   |   |  |   |
|---|---|-------------------------------|----------|---|--|--|---|---|---|---|------------------|---|---|---|--|------------------------------------|--|--|---|---|-----------------------------------|---|---|--|---|
| <p><b>Teaching/Learning Methodology</b></p> | <ol style="list-style-type: none"> <li>1. The lectures are aimed at providing students with an integrated knowledge required for understanding the need for a green design approach, developing green products, assessing environmental impact of products and highlighting the opportunities arising from green consumerism. They provide a necessary framework for subsequent self-learning and group-learning activities. (Outcomes a to c)</li> <li>2. The tutorials are aimed at enhancing the students' skills necessary for analyzing the environmental impact of existing products and packaging solutions using various tools and develop solution strategies to minimize impact. Therefore, students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to c)</li> <li>3. The mini-project is aimed at enhancing the written and oral communication skills and teamwork spirit of the students. The students are expected to utilize the knowledge acquired in class to analyze the environmental impact of a selected existing product and systematically redesign it to enhance its green attributes in order to strategically place the product in rapidly developing green market. (Outcomes c and d)</li> <li>4. The assignments and case studies are aimed at providing students with learning opportunities to study the practical implementations of green product and process assessments and developments. (Outcomes a, b and d)</li> </ol> <table border="1" data-bbox="443 1346 1369 1608"> <thead> <tr> <th data-bbox="443 1346 970 1397" rowspan="2">Teaching/Learning Methodology</th> <th colspan="4" data-bbox="978 1346 1369 1397">Outcomes</th> </tr> <tr> <th data-bbox="978 1397 1066 1449">a</th> <th data-bbox="1074 1397 1161 1449">b</th> <th data-bbox="1169 1397 1257 1449">c</th> <th data-bbox="1265 1397 1369 1449">d</th> </tr> </thead> <tbody> <tr> <td data-bbox="443 1449 970 1500">Lecture/Tutorial</td> <td data-bbox="978 1449 1066 1500">√</td> <td data-bbox="1074 1449 1161 1500">√</td> <td data-bbox="1169 1449 1257 1500">√</td> <td data-bbox="1265 1449 1369 1500"></td> </tr> <tr> <td data-bbox="443 1500 970 1552">Mini-project report &amp; presentation</td> <td data-bbox="978 1500 1066 1552"></td> <td data-bbox="1074 1500 1161 1552"></td> <td data-bbox="1169 1500 1257 1552">√</td> <td data-bbox="1265 1500 1369 1552">√</td> </tr> <tr> <td data-bbox="443 1552 970 1608">Homework assignments/Case studies</td> <td data-bbox="978 1552 1066 1608">√</td> <td data-bbox="1074 1552 1161 1608">√</td> <td data-bbox="1169 1552 1257 1608"></td> <td data-bbox="1265 1552 1369 1608">√</td> </tr> </tbody> </table> | Teaching/Learning Methodology | Outcomes |   |  |  | a | b | c | d | Lecture/Tutorial | √ | √ | √ |  | Mini-project report & presentation |  |  | √ | √ | Homework assignments/Case studies | √ | √ |  | √ |
| Teaching/Learning Methodology               | Outcomes  |                               |          |   |  |  |   |   |   |   |                  |   |   |   |  |                                    |  |  |   |   |                                   |   |   |  |   |
|   | a   | b                             | c        | d |  |  |   |   |   |   |                  |   |   |   |  |                                    |  |  |   |   |                                   |   |   |  |   |
| Lecture/Tutorial                            | √   | √                             | √        |   |  |  |   |   |   |   |                  |   |   |   |  |                                    |  |  |   |   |                                   |   |   |  |   |
| Mini-project report & presentation          |   |                               | √        | √ |  |  |   |   |   |   |                  |   |   |   |  |                                    |  |  |   |   |                                   |   |   |  |   |
| Homework assignments/Case studies           | √   | √                             |          | √ |  |  |   |   |   |   |                  |   |   |   |  |                                    |  |  |   |   |                                   |   |   |  |   |

| Assessment Methods in Alignment with Intended Learning Outcomes  | Specific assessment methods/tasks   | % weighting | Intended subject learning outcomes to be assessed |   |   |   |
|--|---|-------------|---|---|---|---|
|  |   |             | a   | b | c | d |
|  | 1. Homework assignments/ Case studies   | 10%         | √   | √ |   | √ |
|  | 2. Test   | 20%         | √   | √ | √ |   |
|  | 3. Mini-project report & presentation   | 20%         |   |   | √ | √ |
|  | 4. Examination  | 50%         | √   | √ | √ |   |
|  | Total   | 100%        |   |   |   |   |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}.</math></p> <p>1. The continuous assessment will comprise three components: homework assignments &amp; case studies (10%), test (20%) and mini-project report &amp; presentation (20%). The homework assignments and test are aimed at evaluating the progress of students study and assisting them in fulfilling the respective subject learning outcomes. The mini-project and case studies are to assess students learning outcomes while providing them with opportunities to apply their learnt knowledge, enhance written &amp; oral communication skills and team-work spirit.</p> <p>2. The examination (50%) will be used to assess the knowledge acquired by students independently in understanding and analysing related problems critically and to determine the degree of achieving the subject learning outcomes.</p> |   |             |   |   |   |   |
| Student Study Effort Expected  | Class contact:  |             |   |   |   |   |
|  | ▪ Lecture   |             | 33 Hrs.   |   |   |   |
|  | ▪ Tutorial/Mini-project discussion & presentation   |             | 6 Hrs.  |   |   |   |
|  | Other student study effort:   |             |   |   |   |   |
|  | ▪ Self study/coursework   |             | 43 Hrs.   |   |   |   |
|  | ▪ Mini-project report preparation and presentation  |             | 24 Hrs.   |   |   |   |
| Total student study effort   |   |             | 106 Hrs.  |   |   |   |
| Reading List and References  | <ol style="list-style-type: none"> <li>1. Azapagic A., Perdan S., Clift R. and Surrey G., Sustainable Development in Practice, John Wiley &amp; Sons, Ltd., latest edition.</li> <li>2. Burall P., Product Development and the Environment, The Design Council, latest edition.</li> <li>3. Fuad-Luke A., EcoDesign: The Sourcebook, Chronicle Books, latest edition.</li> <li>4. Ottman J.A. Green Marketing, NTC Business Books, latest edition.</li> <li>5. William McDonough &amp; Michael Braungart, Cradle to Cradle: Remaking the Way We Make Things, latest edition.</li> <li>6. Ulrich, K.T. and Eppinger, S.D., Product Design and Development, McGraw-Hill, latest edition.</li> </ol> |             |   |   |   |   |

Revised July 2016

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME42008  |
| <b>Subject Title</b>                                  | Computer-Aided Technology for Design   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME32001 Manufacturing Fundamentals; or<br>ME32003 Design and Manufacturing  |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To provide students advanced knowledge on the computer-aided related technologies for product design and development.</li> <li>2. To provide students advanced knowledge on the principles and applications of computer-aided modelling and analysis.</li> <li>3. To provide students advanced knowledge on the use of computer-aided techniques and software to solve structural, stress, heat transfer and dynamic problems.</li> </ol>  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Use the computer-aided techniques to facilitate the process of product design and development.</li> <li>b. Understand the interface among CAD, CAE and CAM during the product design process by using up-to-date software.</li> <li>c. Identify a set of design variables and the governing equations to analyze a conceptual design.</li> <li>d. Optimize the mesh size and type and apply appropriate types of boundary constraints in the CAE process.</li> <li>e. Analyze and optimize a design with the aid of modern CAE software.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Computer-aided Modelling</i></b></p> <ul style="list-style-type: none"> <li>- Geometric Models of Products</li> <li>- Mathematical Modelling <ul style="list-style-type: none"> <li>• Curve Modelling</li> <li>• Surface Modelling</li> <li>• Solid Modelling</li> </ul> </li> <li>- 3-D Product Analysis</li> <li>- Modelling and Simulations</li> <li>- Product Animation</li> </ul> <p><b><i>Design Analysis and Evaluation</i></b></p> <ul style="list-style-type: none"> <li>- Finite Element Modelling and Analysis <ul style="list-style-type: none"> <li>• Modelling Techniques</li> <li>• Mesh Types</li> <li>• Boundary Constraints</li> <li>• Material and Property Types</li> </ul> </li> </ul> |

|   | <ul style="list-style-type: none"> <li>- Mathematical Modelling</li> <li>- Mechanical and Thermal Stress Analyses</li> <li>- Dynamic Response</li> <li>- Product Optimizations (Size and Shape)</li> <li>- Non-linear Stress Analysis</li> </ul> <p><b>CAD/CAE/CAM Integration</b></p> <ul style="list-style-type: none"> <li>- Interface between CAD/CAE/CAM</li> <li>- Applications of CAD/CAE/CAM</li> </ul>  |                                   |             |  |   |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
|---|--|-----------------------------------|-------------|--|---|---|--|---|---|---|---|---|---------|---------------|------|---|---|---|----------|---|--------------------------------|------|---|---|------------|---|---|---------------|------|---|--------------|---|---|---|-------------------------------------|------|---|---|---|---|---|----------------|------|---|--|---|---|--|-------|-------|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures will be given to explain the theories behind CAD, CAE and CAM.</p> <p>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.</p> <p>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.</p> <table border="1" data-bbox="440 943 1453 1272"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Case study</td> <td></td> <td></td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Mini-project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcomes    |  |   |   |  | a | b | c | d | e | Lecture |               | √    | √ | √ |   | Tutorial | √ |                                | √    | √ | √ | Case study |   |   | √             |      | √ | Mini-project | √ | √ | √ | √                                   | √    |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes   |                                   |             |  |   |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
|   | a  | b                                 | c           | d  | e |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
| Lecture   |  | √                                 | √           | √  |   |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
| Tutorial  | √  |                                   | √           | √  | √ |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
| Case study  |  |                                   | √           |  | √ |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
| Mini-project  | √  | √                                 | √           | √  | √ |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="440 1301 1453 1834"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>20 %</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Written/computer assignment</td> <td>10 %</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Case study</td> <td>10 %</td> <td></td> <td></td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>4. Mini-project report/presentation</td> <td>10 %</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>5. Examination</td> <td>50 %</td> <td>√</td> <td></td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Total</td> <td>100 %</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:</p>   | 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 % |  |  |  |  |  |
| 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 %  |                                   |             |  |   |   |  |   |   |   |   |   |         |               |      |   |   |   |          |   |                                |      |   |   |            |   |   |               |      |   |              |   |   |   |                                     |      |   |   |   |   |   |                |      |   |  |   |   |  |       |       |  |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
|                                      | <p style="text-align: center;"><math>0.5 \times \text{End of Subject Examination} + 0.5 \times \text{Continuous Assessment}</math></p> <p>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.</p> <p>Mini-project report and presentation assess the students' ability to assimilate the learnt knowledge for solving a more realistic, open-ended design problem systematically.</p> |          |
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 29 Hrs.  |
|                                      | ▪ Tutorial   | 4 Hrs.   |
|                                      | ▪ Guided study of CAD/CAE  | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Performing CAD/CAE in design (tutorial problems)   | 23 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. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Michael E. Mortenson, Geometric Modeling, John Wiley &amp; Sons, latest edition.</li> <li>2. Kunwoo Lee, Principles of CAD/CAM/CAE System, Addison-Wesley Longman, latest edition.</li> <li>3. Vince Adams and Abraham Askenazi, Building Better Products with Finite Element Analysis, Onword Press, latest edition.</li> </ol>   |          |

Revised July 2016

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME42010  |
| <b>Subject Title</b>                                  | Industrial Automation  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31002 Linear Systems and Control<br><br>Exclusion: ME4217 Industrial Automation   |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To teach students mechanisms of sensors, and available techniques for sensor interfacing and circuit protection in automation system.</li> <li>2. To teach students principle of analog-to-digital conversion and importance of anti-alias filtering.</li> <li>3. To teach students the mechanics and control of industrial robots used in flexible automation.</li> <li>4. To teach students principle of industrial logic control systems used in manufacturing automation.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the major components of mechatronic systems used in automation such as sensors, and techniques for sensor interfacing and circuit protection.</li> <li>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.</li> <li>c. Understand the mechanisms of actuators and method used to select sensors and actuators for practical mechatronic systems.</li> <li>d. Understand various types of robots for industrial applications.</li> <li>e. Understand industrial control logic design using ladder diagram and programmable logic controller.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Sensors and Actuators</b> - Generic components for mechatronic systems in automation: sensors and transducers such as displacement sensors, force sensors, ultrasonic sensors, fibre optic devices, <i>etc</i>; actuators such as dc motors, stepper motors, piezoelectric actuators, <i>etc</i>.</p> <p><b>Interfacing</b> - Sensor protection circuits; Signal transmission and noise suppression; Analog-to-digital and digital-to-analog conversion; Sampling frequency; Anti-alias filtering.</p> <p><b>Industrial Robotics</b> – Robot geometry; Basic forward and inverse kinematics; Robot drives; Motion control; Robot Tooling; Robot applications; Economic justifications; Robot implementation.</p> <p><b>Discrete Control Using PLCs</b> - 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.</p> |

|   | <p><b>Laboratory Experiment:</b><br/>         There are two 2-hour laboratory sessions.<br/>         Typical Experiments:<br/>         1. Sequential control using PLC.<br/>         2. Programming and control of gantry robot.<br/>         3. Motor control systems.</p>   |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|---|---|--|---|---|---|---|-----------------------------------|-------------|--|--|--|--|---|---|---|---|---|---------|---------------|-----|---|---|---|----------|---|-------------|-----|---|---|------------|---|---|---------------|-----|---|------------|---|---|---|-------------------------------------|-----|---|---|---|---|---|----------------|-----|---|---|---|---|---|-------|------|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures aim at providing students with an integrated knowledge required for the design and implementation of industrial automation systems.</p> <p>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.</p> <p>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).</p> <p>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.</p> <table border="1" data-bbox="443 965 1473 1283"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Case study</td> <td></td> <td></td> <td>√</td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td></td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table> |  |   |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  |  | a | b | c | d | e | Lecture | √             | √   | √ | √ | √ | Tutorial | √ | √           |     | √ | √ | Case study |   |   | √             |     | √ | Experiment |   |   | √ | √                                   | √   |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes  |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|   | a   | b  | c | d | e |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Lecture   | √   | √  | √ | √ | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Tutorial  | √   | √  |   | √ | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Case study  |   |  | √ |   | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Experiment  |   |  | √ | √ | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 1317 1473 1805"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Homework</td> <td>10%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Laboratory</td> <td>10%</td> <td></td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Case study report / presentation</td> <td>10%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>5. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.5 \times \text{End of Subject Examination} + 0.5 \times \text{Continuous Assessment}</math></p>   |  |   |   |   |   | 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% |  |  |  |  |  |
| 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%  |  |   |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |             |     |   |   |            |   |   |               |     |   |            |   |   |   |                                     |     |   |   |   |   |   |                |     |   |   |   |   |   |       |      |  |  |  |  |  |

|                                      |   |          |
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|                                      | 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.  |          |
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Laboratory/Tutorial   | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Reading and revision  | 39 Hrs.  |
|                                      | ▪ Homework assignment   | 20 Hrs.  |
|                                      | ▪ Laboratory report   | 6 Hrs.   |
|                                      | ▪ Case study report   | 10 Hrs.  |
|                                      | Total student study effort  | 114 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. D. Shetty, and R.A. Kolk, Mechatronics System Design, PWS Publishing Company, latest edition.</li> <li>2. D.M. Auslander and C.J. Kempf, Mechatronics - Mechanical System Interfacing, Prentice-Hall, Inc., latest edition.</li> <li>3. W. Kleitz, Microprocessor and Microcontroller Fundamentals, Prentice-Hall, Inc., latest edition.</li> <li>4. M.P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, Prentice Hall, latest edition.</li> </ol> |          |

May 2016



## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME42011  |
| <b>Subject Title</b>                                  | Fundamentals of Robotics   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME31002 Linear systems and control; or<br>ME41004 Mechatronics and Control  |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To provide students with the concepts and techniques for the design, modeling, analysis of robot manipulators.</li> <li>2. To provide students with the fundamental knowledge of machine vision for robot guidance and automation.</li> </ol>  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Identify different types of robots and their applications in the industry.</li> <li>b. Construct the kinematics and dynamics equations of robot manipulators for motion analysis.</li> <li>c. Apply trajectory planning algorithms to generate the path for robot manipulators.</li> <li>d. Apply different machine vision and image processing algorithms to automate robot manipulators.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Robot Manipulators</b> - degrees of freedom, coordinate frame and homogeneous transformation, Denavit-Hartenberg (DH) convention, forward and inverse kinematics, Jacobian matrix, singularity, Lagrange's equation kinetic and potential energy, trajectory planning and obstacle avoidance.</p> <p><b>Computer Vision</b> - Image formation, acquisition, histogram, edge and line detections, image enhancement, filtering, object recognition, stereo vision, camera modeling and calibration.</p> <p><b>Laboratory Work</b><br/>There is at least 1 2-hour laboratory session or an equivalent project. Typical Experiments are:</p> <ol style="list-style-type: none"> <li>1. Object manipulation through a robot manipulator.</li> <li>2. Programming and control of gantry robot.</li> <li>3. Path planning of mobile robots for collision avoidance.</li> </ol> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures aim at providing students with an integrated knowledge required for understanding and analyzing different robots, including system modeling, trajectory planning and image processing (Outcomes a to d)</p> <p>Tutorials aim at enhancing students’ analytical and problem solving skills on robotics. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to d)</p> <p>The project/experiments aims to have hand-on experience to automation of a robot system with vision or other functions. (Outcomes a to d)</p> <table border="1" data-bbox="443 555 1417 869"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Lectures</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Tutorials</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Homework assignments</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Project or experiments</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>   |   |   |   |   | Teaching/Learning Methodology     | Outcomes    |   |  |  | a | b | c | d | 1. Lectures | √              | √   | √ | √ | 2. Tutorials |   | √             | √   | √ | 3. Homework assignments |   | √ | √   | √   | 4. Project or experiments | √ | √ | √ | √     |      |  |  |  |  |
|--|---|---|---|---|---|-----------------------------------|-------------|---|--|--|---|---|---|---|-------------|----------------|-----|---|---|--------------|---|---------------|-----|---|-------------------------|---|---|---|-----|---------------------------|---|---|---|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |   |   |   |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
|  | a   | b   | c | d |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 1. Lectures  | √   | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 2. Tutorials   |   | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 3. Homework assignments  |   | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 4. Project or experiments  | √   | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 913 1426 1290"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Class Test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Coursework including Project/Experimental Work</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <ol style="list-style-type: none"> <li>The assessment is comprised of 50% continuous assessment and 50% examination.</li> <li>The continuous assessment consists of three components: homework assignments, test, and experiments/projects. They are aimed at evaluating the progress of students’ study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.</li> <li>The examination is used to assess the knowledge acquired by the students for understanding and analyse the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.</li> </ol> |   |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |   | a | b | c | d           | 1. Examination | 50% | √ | √ | √            | √ | 2. Class Test | 20% | √ | √                       | √ | √ | 3. Coursework including Project/Experimental Work | 30% | √                         | √ | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed |   |   |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
|  |   | a   | b | c | d |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 1. Examination   | 50%   | √   | √ | √ | √ |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 2. Class Test  | 20%   | √   | √ | √ | √ |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| 3. Coursework including Project/Experimental Work                      | 30%   | √   | √ | √ | √ |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |
| Total  | 100%  |   |   |   |   |                                   |             |   |  |  |   |   |   |   |             |                |     |   |   |              |   |               |     |   |                         |   |   |   |     |                           |   |   |   |       |      |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 33 Hrs.  |
|                                      | ▪ Tutorial/Laboratory  | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Reading and review   | 36 Hrs.  |
|                                      | ▪ Coursework (assignments, project)  | 40 Hrs.  |
|                                      | Total student study effort   | 115 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. S. B. Niku, Introduction to robotics : analysis, control, applications, Wiley, latest edition.</li> <li>2. M. W. Spong S. Hutchinson, and M. Vidyasagar, Robot Modeling and Control, Wiley, latest edition.</li> <li>3. C. Bishop, Pattern Recognition and Machine Learning, Springer, latest edition.</li> <li>4. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Prentice Hall, latest edition.</li> </ol> |          |

*Revised March 2017*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME43001  |
| <b>Subject Title</b>                                  | Advanced Materials for Design and Technology   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME33001 Mechanics of Materials<br>Exclusion: ME45006 Aircraft Structure and Engineering Composite   |
| <b>Objectives</b>                                     | To provide advanced knowledge on the design, development, processing, applications and structural evaluations of advanced materials and structures, including smart materials and aircraft and aerospace structures.   |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Apply the mechanics of composites and smart materials in the product design process.</li> <li>b. Design innovative products/structures by applying knowledge in advanced materials and technology including smart materials and intelligent technology.</li> <li>c. Identify the limitations and constraints by using advanced materials at different environments.</li> <li>d. Consider environmental factors during the product design process.</li> </ul>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Advanced Composite Materials</i></b> - 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.</p> <p><b><i>Smart Materials and Structures and Integrated Systems</i></b> - 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.</p> <p><b><i>Nano-structural Materials</i></b> - Carbon nanotubes and their composite structures; Nanoclay/polymer composites; Superhard particles for wear resistance; Micro-electro-mechanical (MEMs) and Nano-electro-mechanical (NEMs) devices.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to advanced materials. (Outcomes a, b and c)</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations. (Outcomes a, b and c)</p> <p>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)</p> <p>Experiments are used to relate the concepts to practical applications and students are exposed to hand-on experience, proper use of equipment and application of analytical skills on interpreting experimental results. (Outcomes a and c)</p> <table border="1" data-bbox="443 622 1430 931"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Project/case study</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Experiment</td> <td>√</td> <td></td> <td>√</td> <td></td> </tr> </tbody> </table>  |  |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  | a | b | c | d | Lecture | √              | √   | √ |   | Tutorial | √ | √             | √   |   | Project/case study | √ | √ | √                                      | √   | Experiment | √ |   | √ |                      |    |   |  |   |  |       |      |  |  |  |  |
|--|--|--|---|---|---|-----------------------------------|-------------|--|--|--|---|---|---|---|---------|----------------|-----|---|---|----------|---|---------------|-----|---|--------------------|---|---|--|-----|------------|---|---|---|----------------------|----|---|--|---|--|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes   |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |
|  | a  | b  | c | d |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |
| Lecture  | √  | √  | √ |   |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |
| Tutorial   | √  | √  | √ |   |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |
| Project/case study   | √  | √  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |
| Experiment   | √  |  | √ |   |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 987 1430 1447"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Assignment</td> <td>25%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Project / case study / Presentation</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Laboratory report</td> <td>5%</td> <td>√</td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |   |   |   | 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% |  |  |  |  |
| 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%   |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |                |     |   |   |          |   |               |     |   |                    |   |   |  |     |            |   |   |   |                      |    |   |  |   |  |       |      |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 33 Hrs.  |
|                                      | ▪ Tutorial/Laboratory  | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Assignment   | 21 Hrs.  |
|                                      | ▪ Self-study   | 40 Hrs.  |
|                                      | Total student study effort   | 100 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>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.</li> <li>2. Smart Materials, edited by Mel Schwartz, CRC Press/Taylor &amp; Francis, latest edition.</li> <li>3. Progress in Smart Materials and Structures, Peter L. Reece, editor, New York, Nova Science Publishers, latest edition.</li> <li>4. Smart Structures -Analysis and Design, A. V. Srinivasan and D. M. McFarland, Cambridge University Press, latest edition.</li> <li>5. Shape Memory Materials, K. Otsuka &amp; C. M. Wayman, Cambridge University Press, latest edition.</li> <li>6. Zafer Gurdal, Raphael T. Haftka and Prabhat Hajela, Design and Optimization of Laminated Composite Materials, John Wiley &amp; Sons, latest edition.</li> <li>7. Sergey Edward Lyshevski, MEMS and NEMS: Systems, Devices, and Structures, Boca Raton, Fla.: CRC Press, latest edition.</li> <li>8. Facing up to the Recycling Challenge, Reinforced Plastics, Elsevier, Monthly Periodical, latest edition.</li> <li>9. Principles of Composite Material Mechanics, Ronald F. Gibson, CRC Press, Taylor &amp; Francis Group, latest edition.</li> <li>10. Materials Science and Engineering an Introduction, William D. Callister, David G. Rethwisch, John Wiley &amp; Sons, latest edition.</li> </ol> |          |

*Revised March 2015*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME43003  |
| <b>Subject Title</b>                                  | Product Testing Technology   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME33001Mechanics of Materials   |
| <b>Objectives</b>                                     | To equip students with basic knowledge and universal standards of common product testing and examination technologies.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Apply knowledge of mathematics, engineering sciences and computing simulation to analyze and test a product design via analytical, experimental and computational approaches.</li> <li>b. Understand and explain the effects of various important factors including materials, manufacturing processes, environmental and health issues, reliability and safety issues on product design and development.</li> <li>c. Work effectively as a member and apply project management technique in the capacity of a team leader to complete a multi-disciplinary product testing project.</li> <li>d. Appreciate the state-of-the-art product testing technologies and present a design project via written report.</li> <li>e. Recognize the need to develop the ability of life-long learning.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Purpose and Classification of Product Testing and Examination</i></b> - Damage and degradation of products, environmental attack, crack initiation, aging, fault in manufacturing process; classification of testing and examination methods.</p> <p><b><i>Destructive Testing</i></b> - Tensile and shear strength tests; Drop tests for home appliances and toys; Impact and fracture toughness tests for plastics and metallic materials; Scratch and wear tests of surface coatings; Harness test; Creep and durability tests for static and dynamic products.</p> <p><b><i>Non-destructive Testing (NDT)</i></b> - Damage detection in products; embedded sensor technology; Wireless sensing technique; Ultrasonic spectroscopy and detection technique; Vibration and acoustic emission technique; Acousto-ultrasonic reproducibility; C-scan of composite products; Thermal wave imaging and full-field NDE; Microwave evaluation; Eddy current and Magnetic flux techniques.</p> <p><b><i>Product Examination Techniques</i></b> - Surface morphology examination using optical technique, scanning electron microscopy (SEM) and atomic force microscopy (AFM); Chemical analysis using EDX and XRF; Structure examination using XRD.</p> <p><b><i>Standards and Data Handling</i></b> - Design for inspection; Testing codes and standards; Data collection and analysis techniques.</p> <p><b><i>Virtual Testing</i></b> - Product drop test simulations using CAE technique.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <ol style="list-style-type: none"> <li>The lectures are aimed at providing students with an integrated knowledge required for understanding and analyzing product testing technology and methodology. (Outcomes a and b).</li> <li>The tutorials are aimed at enhancing the analytical skills of the students. Examples on the analysis of testing methods and testing results will be involved. So the students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a, b and e).</li> <li>The experiments will provide the students with hands-on experience on the instrumentation and measurement. It also trains students in the analysis and presentation of experimental data. (Outcomes a and b).</li> <li>The mini-project is aimed at enhancing the written and oral communication skills and team-work spirit of the students. The students are expected to apply the knowledge learnt in product testing technologies. The students are required to participate in the mini-project through literature survey, information search, discussions, report writing and presentation of results. Innovative thinking is encouraged. (Outcomes a, b, c, d and e).</li> </ol> <table border="1" data-bbox="443 786 1466 1093"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Mini-project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcomes    |   |   |   |  | a | b | c | d | e | Lecture | √       | √   |   |   |  | Tutorial | √ | √             |     |   | √ | Experiment | √ | √ |            |     |   | Mini-project | √ | √ | √ | √              | √   |   |   |  |  |  |       |      |  |  |  |  |  |
|--|--|-----------------------------------|-------------|---|---|---|--|---|---|---|---|---|---------|---------|-----|---|---|--|----------|---|---------------|-----|---|---|------------|---|---|------------|-----|---|--------------|---|---|---|----------------|-----|---|---|--|--|--|-------|------|--|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes   |                                   |             |   |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
|  | a  | b                                 | c           | d   | e |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| Lecture  | √  | √                                 |             |   |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| Tutorial   | √  | √                                 |             |   | √ |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| Experiment   | √  | √                                 |             |   |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| Mini-project   | √  | √                                 | √           | √   | √ |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 1193 1466 1686"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Test</td> <td>20%</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2. Assignment</td> <td>10%</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>3. Project</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p data-bbox="443 1720 1466 1787">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p data-bbox="443 1821 1466 1888">Overall Assessment:<br/>0.50 x End of Subject Examination + 0.50 x Continuous Assessment.</p>   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |   |   |  |   | a | b | c | d | e       | 1. Test | 20% | √ | √ |  |          |   | 2. Assignment | 10% | √ | √ |            |   | √ | 3. Project | 20% | √ | √            | √ | √ | √ | 4. Examination | 50% | √ | √ |  |  |  | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting  |                                   |             | Intended subject learning outcomes to be assessed |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
|  |  | a                                 | b           | c   | d | e |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| 1. Test  | 20%  | √                                 | √           |   |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| 2. Assignment  | 10%  | √                                 | √           |   |   | √ |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| 3. Project   | 20%  | √                                 | √           | √   | √ | √ |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| 4. Examination   | 50%  | √                                 | √           |   |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |
| Total  | 100%   |                                   |             |   |   |   |  |   |   |   |   |   |         |         |     |   |   |  |          |   |               |     |   |   |            |   |   |            |     |   |              |   |   |   |                |     |   |   |  |  |  |       |      |  |  |  |  |  |



|                                      |  |          |
|--------------------------------------|--|----------|
|                                      | <ol style="list-style-type: none"> <li>1. The continuous assessment will comprise of four components: one test (20%), assignments (10%), project reports (10%) and oral presentation (10%). The test is aimed at assessing the interim knowledge gained by the student. The assignments are aimed at assisting the students in preparation for the tests and checking the progress of their study. The project report is aimed at assessing the capability of the student in analyzing and reporting experimental data, self-learning and problem-solving skills, and English writing capability. The oral presentation is aimed at assessing the student's communication and presentation skills.</li> <li>2. The examination will be used to assess the knowledge acquired by the students for understanding and analyzing the product problems related to property testing and defect/motion detecting technologies.</li> </ol> |          |
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 30 Hrs.  |
|                                      | ▪ Laboratory / Tutorial  | 9 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Reviewing and Reading  | 26 Hrs.  |
|                                      | ▪ Assignment / Laboratory Report   | 40 Hrs.  |
|                                      | Total student study effort   | 105 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Mechanical Testing, ASM International, ASM Handbook Volume 8, latest edition.</li> <li>2. Sampling and analysis, Upper Saddle River, N.J.: Prentice Hall, latest edition.</li> <li>3. Nondestructive testing of materials, Amsterdam; Washington, D.C.: IOS Press; Tokyo: Ohmsa, latest edition.</li> <li>4. Practical non-destructive testing, Raj Baldev, New Delhi: Narosa Pub. House; Materials Park, Ohio: Distribution in North America only by ASM International, latest edition.</li> <li>5. Encyclopedia of Materials Characterization, TA418.7.B73, latest edition.</li> </ol>   |          |

Revised July 2014

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME44001  |
| <b>Subject Title</b>                                  | Air Conditioning for Indoor Thermal and Environmental Quality  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics or<br>ME34003 Thermofluid Mechanics  |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of air conditioning for indoor thermal and environmental quality.   |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Appreciate and understand the concepts and components of air conditioning and refrigeration systems and applications.</li> <li>b. Applied the general knowledge of indoor thermal comfort and environmental health.</li> <li>c. Applied the knowledge of moist air properties and conditioning processes.</li> <li>d. Apply the knowledge of heating and cooling load required for a building.</li> <li>e. Applied the knowledge of refrigeration systems and cycles.</li> </ul>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Introduction of Air Conditioning and Refrigeration Systems and Applications</i></b> - 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.</p> <p><b><i>Moist Air Properties and Conditioning Processes</i></b> - Moist air and standard atmosphere. Fundamental parameters. Adiabatic saturation. Wet bulb temperature and the Psychrometric chart. Space air conditioning- design and off-design conditions.</p> <p><b><i>Space Heating and Cooling Loads</i></b> - Outdoor and Indoor design conditions. Heat transmission in building structures. Infiltration. Heat losses from air ducts. Auxiliary heat sources. Supply air for space heating. Source media for space heating. Heat gain, cooling load and heat extraction rate. Solar radiation. Outside and interior surface heat balance. Zone air heat balance. Implementation of the heat balance method.</p> <p><b><i>Refrigeration</i></b> - Refrigerants. Mechanical vapour-compression refrigeration cycles. Modifications to basic cycles. Reciprocating compressors. Cooling towers.</p> <p><b><i>Indoor Thermal Comfort</i></b> - Physiological considerations. Thermal comfort indices and conditions. Hot and humid, and extreme cold environments.</p> <p><b><i>Indoor Environmental Health</i></b> - 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.</p> |

| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>1. The subject intends to equip students with fundamental knowledge of air conditioning for indoor thermal and environmental quality. Systematic lectures are required to achieve such foundation building coupled with assignments (outcomes a, b, c, d and e).</p> <p>2. Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a, b, c, d and e).</p> <p>It is intended to make use of these teaching/learning methodologies to achieve the intended subject learning outcomes as indicated in the following table:</p> <table border="1" data-bbox="440 521 1404 734"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |  |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  |  | a | b | c | d | e | Lecture | √             | √   | √ | √ | √ | Tutorial | √ | √       | √   | √ | √ |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|---|---|--|---|---|---|-----------------------------------|-------------|--|--|--|--|---|---|---|---|---|---------|---------------|-----|---|---|---|----------|---|---------|-----|---|---|---|--|--|----------------|-----|---|---|---|---|---|-------|------|--|--|--|--|--|
| Teaching/Learning Methodology   | Outcomes  |  |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|   | a   | b  | c | d | e |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Lecture   | √   | √  | √ | √ | √ |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Tutorial  | √   | √  | √ | √ | √ |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="440 779 1423 1131"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>1. The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test which covers the first half of the subject material provides useful feedback to both lecturer and students on the learnt topics.</p> <p>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.</p> |  |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |   | a | b | c | d | e       | 1. Assignment | 30% | √ | √ | √ | √        | √ | 2. Test | 20% | √ | √ | √ |  |  | 3. Examination | 50% | √ | √ | √ | √ | √ | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|   |   | a  | b | c | d | e                                 |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 1. Assignment   | 30%   | √  | √ | √ | √ | √                                 |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 2. Test   | 20%   | √  | √ | √ |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 3. Examination  | 50%   | √  | √ | √ | √ | √                                 |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Total   | 100%  |  |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |         |               |     |   |   |   |          |   |         |     |   |   |   |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |

|                                      |   |          |
|--------------------------------------|---|----------|
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Tutorial  | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Coursework  | 33 Hrs.  |
|                                      | ▪ Self-study/   | 33 Hrs.  |
|                                      | Total student study effort  | 105 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. ASHRAE Handbooks on HVAC Systems and Equipment, Fundamentals, Refrigeration, and HVAC Applications, latest edition.</li> <li>2. F.C. McQuiston, J.D. Parker and J.D. Spitler, Heating, Ventilating and Air Conditioning- Analysis and Design, John Wiley &amp; Sons, Inc., latest edition.</li> <li>3. W.T. Grondzik W.T.; J.S. Reynolds ; B. Stein; A.G. Kwok Mechanical and Electrical Equipment for Buildings, John Wiley &amp; Sons, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME44002   |
| <b>Subject Title</b>                                  | Engine Technology   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics   |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of engine technology, and its combustion-related emissions.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand and evaluate physical parameters of engine design and operating characteristics.</li> <li>b. Apply the fundamental knowledge of solving air-standard and real air-fuel engine cycles.</li> <li>c. Apply the fundamental knowledge of thermochemistry and fuels.</li> <li>d. Understand the general principles of engine combustion, emissions controls and standards.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Introduction</b> - Historical perspective of engines. Engine classifications. Terminology and abbreviations. Engine components. Basic engine cycles.</p> <p><b>Engine Design and Operating Characteristics</b> - 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.</p> <p><b>Engine Cycles</b> - Air-standard cycles. Otto Cycle. Diesel cycle. Dual cycle. Comparison of Otto, Diesel and Dual cycles. Real air-fuel engine cycles.</p> <p><b>Thermochemistry and Fuels</b> - Thermochemistry. Gasoline, diesel and alternative fuels.</p> <p><b>Engine Combustion and Emissions</b> - Spark ignition engine combustion, ignition and burning rate analysis. Compression ignition engine combustion, fuel injection, ignition delay. Engine emissions controls and standards.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to internal combustion engines (outcomes a to d).</p> <p>Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments (outcomes a to d).</p> <table border="1" data-bbox="440 371 1425 584"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Assignment/Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |  |   |   |   |  | Teaching/Learning Methodology     | Outcomes    |  |  |  | a | b         | c       | d | Lecture | √             | √   | √          | √      | Assignment/Tutorial | √ | √       | √   | √                           |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
|--|---|--|---|---|---|--|-----------------------------------|-------------|--|--|--|---|-----------|---------|---|---------|---------------|-----|------------|--------|---------------------|---|---------|-----|-----------------------------|--|---|--|----------------|-----|-------------------------|---------|---|---|-------|------|----------------------------|----------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
|  | a   | b  | c | d |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| Lecture  | √   | √  | √ | √ |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| Assignment/Tutorial  | √   | √  | √ | √ |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="440 636 1425 983"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>3. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <ol style="list-style-type: none"> <li>The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students' studies, assisting them in fulfilling the respective intended subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test(s) covers the first half of the subject material and provides useful feedback to both the lecturer and students on the learnt topics.</li> <li>The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the intended subject learning outcomes.</li> </ol> |  |   |   |   |  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |   | a         | b       | c | d       | 1. Assignment | 30% | √          | √      | √                   | √ | 2. Test | 20% | √                           |  | √ |  | 3. Examination | 50% | √                       | √       | √ | √ | Total | 100% |                            |          |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
|  |   | a  | b | c | d |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| 1. Assignment  | 30%   | √  | √ | √ | √ |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| 2. Test  | 20%   | √  |   | √ |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| 3. Examination   | 50%   | √  | √ | √ | √ |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| Total  | 100%  |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| <b>Student Study Effort Expected</b>                                   | <table border="1" data-bbox="440 1626 1474 1957"> <tbody> <tr> <td>Class contact:</td> <td colspan="5"></td> </tr> <tr> <td>▪ Lecture</td> <td colspan="5">33 Hrs.</td> </tr> <tr> <td>▪ Tutorial</td> <td colspan="5">6 Hrs.</td> </tr> <tr> <td>Other student study effort:</td> <td colspan="5"></td> </tr> <tr> <td>▪ Self-study/Coursework</td> <td colspan="5">67 Hrs.</td> </tr> <tr> <td>Total student study effort</td> <td colspan="5">106 Hrs.</td> </tr> </tbody> </table>  |  |   |   |   |  | Class contact:                    |             |  |  |  |   | ▪ Lecture | 33 Hrs. |   |         |               |     | ▪ Tutorial | 6 Hrs. |                     |   |         |     | Other student study effort: |  |   |  |                |     | ▪ Self-study/Coursework | 67 Hrs. |   |   |       |      | Total student study effort | 106 Hrs. |  |  |  |  |
| Class contact:   |   |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| ▪ Lecture  | 33 Hrs.   |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| ▪ Tutorial   | 6 Hrs.  |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| Other student study effort:  |   |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| ▪ Self-study/Coursework  | 67 Hrs.   |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |
| Total student study effort   | 106 Hrs.  |  |   |   |   |  |                                   |             |  |  |  |   |           |         |   |         |               |     |            |        |                     |   |         |     |                             |  |   |  |                |     |                         |         |   |   |       |      |                            |          |  |  |  |  |

|                                    |   |
|------------------------------------|---|
| <b>Reading List and References</b> | <ol style="list-style-type: none"><li>1. C.R. Ferguson and A.T. Kirkpatrick, Internal Combustion Engines, John Wiley &amp; Sons Inc., latest edition</li><li>2. W.W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall, latest edition.</li><li>3. J.C. Guibet, Fuels and Engines- Technology, Energy and Environment, Vol. 1 &amp; 2, Technip, Paris, latest edition.</li></ol> |
|------------------------------------|---|



*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME44003   |
| <b>Subject Title</b>                                  | Combustion and Pollution Control  |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics   |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of combustion phenomena, and formation and control of combustion-generated air pollutants.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Apply the fundamental knowledge of thermodynamics and chemical kinetics of combustion.</li> <li>b. Apply the general principles of combustion of fuels.</li> <li>c. Understand the formation mechanisms of combustion-generated air pollutants, and fuel emissions.</li> <li>d. Understand and determine appropriate methods for air pollution measurement and control.</li> <li>e. Determine the air pollutant concentration and dispersion from source(s).</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Thermodynamics and Chemical Kinetics of Combustion</i></b> - 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.</p> <p><b><i>Combustion of Gaseous and Vaporised Fuels</i></b> - Laminar and turbulent premixed flames. Diffusion flames. Mechanisms of flame stabilisation. Explosion limits. Mechanisms of quenching, flammability and ignition.</p> <p><b><i>Combustion of Liquid Fuels</i></b> - Spray formation. Size distribution. Fuel injectors. Spray dynamics. Vaporisation of single droplet.</p> <p><b><i>Air Pollutants and Their Formation</i></b> - Formation of carbon monoxide, nitrogen oxides, unburnt hydrocarbon, soot and particulates. Measurement techniques and quantification of air pollutants.</p> <p><b><i>Fuels and Emissions</i></b> - Gasoline and diesel fuels. LPG, natural gas and biodiesel as alternative fuels. Oxygenated fuels. Effect of sulphur contents on diesel emissions.</p> <p><b><i>Aftertreatment for Motor Vehicle and Power Plant Emissions</i></b> - Two and three way catalysts. Cyclones, precipitators, filters and traps, evaluation of capturing efficiency. Scrubbers for flue gas desulphurisation. NO<sub>x</sub> reduction. Advanced aftertreatment devices/systems.</p> |



|  | <b>Introduction to Air Pollutant Dispersion</b> - Chimneys, inversions and the atmosphere. Air pollutant concentration and dispersion from motor vehicles and chimneys. Street canyon effect.   |  |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|--|---|--|---|---|---|-----------------------------------|-------------|--|--|--|--|---|---|---|---|---|------------|---------------|-----|---|---|---|------------------------|---|---------|-----|---|---|--|--|--|----------------|-----|---|---|---|---|---|-------|------|--|--|--|--|--|
| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to combustion and pollution control (outcomes a to e).</p> <p>Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments (outcomes a to e).</p> <table border="1" data-bbox="443 562 1473 770"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Assignment/Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |  |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  |  | a | b | c | d | e | 1. Lecture | √             | √   | √ | √ | √ | 2. Assignment/Tutorial | √ | √       | √   | √ | √ |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Teaching/Learning Methodology  | Outcomes  |  |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|  | a   | b  | c | d | e |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 1. Lecture   | √   | √  | √ | √ | √ |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 2. Assignment/Tutorial   | √   | √  | √ | √ | √ |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 831 1473 1182"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Test</td> <td>20%</td> <td>√</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <ol style="list-style-type: none"> <li>The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test(s) covers the first half of the subject material and provides useful feedback to both the lecturer and students on the learnt topics.</li> <li>The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the intended subject learning outcomes.</li> </ol> |  |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |   | a | b | c | d | e          | 1. Assignment | 30% | √ | √ | √ | √                      | √ | 2. Test | 20% | √ |   |  |  |  | 3. Examination | 50% | √ | √ | √ | √ | √ | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
|  |   | a  | b | c | d | e                                 |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 1. Assignment  | 30%   | √  | √ | √ | √ | √                                 |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 2. Test  | 20%   | √  |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| 3. Examination   | 50%   | √  | √ | √ | √ | √                                 |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |
| Total  | 100%  |  |   |   |   |                                   |             |  |  |  |  |   |   |   |   |   |            |               |     |   |   |   |                        |   |         |     |   |   |  |  |  |                |     |   |   |   |   |   |       |      |  |  |  |  |  |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 33 Hrs.  |
|                                      | ▪ Tutorial   | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Self-study/coursework  | 67 Hrs.  |
|                                      | Total student study effort   | 106 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. G.L. Borman and K.W. Ragland, Combustion Engineering, McGraw-Hill, latest edition.</li> <li>2. R.J. Heinsohn and R.L. Kabel, Sources and Control of Air Pollution, Prentice Hall, latest edition.</li> <li>3. N.D. Nevers, Air Pollution Control Engineering, McGraw-Hill, latest edition.</li> <li>4. S.R. Turns, An Introduction to Combustion- Concepts and Applications, McGraw-Hill, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME44004  |
| <b>Subject Title</b>                                  | Heat and Mass Transfer   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics; and<br>ME34004 Fluid Mechanics  |
| <b>Objectives</b>                                     | To provide students with the fundamental knowledge of heat and mass transfer.  |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Apply the fundamental knowledge of heat transfer mechanisms, namely conduction, convection and radiation.</li> <li>b. Evaluate different types of heat exchangers.</li> <li>c. Apply the numerical techniques in heat transfer applications.</li> <li>d. Apply the fundamental knowledge of mass transfer.</li> </ul>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Introduction</b> - Conduction, convection and radiation. Fourier's law. Newton's law of cooling.</p> <p><b>Conduction</b> - 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.</p> <p><b>Forced and Free Convection</b> - 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.</p> <p><b>Numerical Simulation</b> - 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.</p> <p><b>Heat Exchanger</b> - 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.</p> <p><b>Radiation</b> - Black body and grey body. Absorptivity and emissivity. View factors. Irradiation and radiosity. Radiation exchange between surfaces and its network approach.</p> <p><b>Mass Transfer</b> - Basic equations in mass transfer. Analogy between heat and mass transfer. Mass diffusion. Boundary conditions. Steady mass diffusion through a wall.</p> |

|   |  |      |             |   |  |   |
|---|--|------|-------------|---|--|---|
|   | Water vapour migration in buildings. Simultaneous heat and mass transfer.  |      |             |   |  |   |
| <b>Teaching/Learning Methodology</b>  | Lectures are used to deliver the fundamental knowledge in relation to heat transfer and mass transfer (outcomes a to d). |      |             |   |  |   |
|   | Tutorials will be conducted to facilitate discussions of typical examples and coursework assignments (outcomes a to d).  |      |             |   |  |   |
|   | Teaching/Learning Methodology  |      | Outcomes    |   |  |   |
|   |  | a    | b           | c | d  |   |
| Lecture   |  | √    | √           | √ | √  |   |
| Assignment/Tutorial   |  | √    | √           | √ | √  |   |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>  | Specific assessment methods/tasks  |      | % weighting |   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |
|   |  |      | a           | b | c  | d |
|   | 1. Assignment  | 30%  | √           | √ | √  | √ |
|   | 2. Test  | 20%  | √           | √ |  |   |
|   | 3. Examination   | 50%  | √           | √ | √  | √ |
|   | Total  | 100% |             |   |  |   |
| Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:   |  |      |             |   |  |   |
| Overall Assessment:<br>$0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}$   |  |      |             |   |  |   |
| <ol style="list-style-type: none"> <li>The continuous assessment will comprise two components: assignments (30%) and tests (20%). The assignments are aimed at evaluating the progress of students study, assisting them in fulfilling the respective intended subject learning outcomes, and enhancing the integration of their knowledge learnt. The mid-term test(s) covers the first half of the subject material and provides useful feedback to both the lecturer and students on the learnt topics.</li> <li>The examination (50%) will be used to assess the knowledge acquired by the students for understanding and analyzing the problems critically and independently; as well as to determine the degree of achieving the intended subject learning outcomes.</li> </ol> |  |      |             |   |  |   |

|                                      |  |          |
|--------------------------------------|--|----------|
| <b>Student Study Effort Expected</b> | Class contact:   |          |
|                                      | ▪ Lecture  | 33 Hrs.  |
|                                      | ▪ Tutorial   | 6 Hrs.   |
|                                      | Other student study effort:  |          |
|                                      | ▪ Self-study/Coursework  | 67 Hrs.  |
|                                      | Total student study effort   | 106 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Y.A. Cengel and A.J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications, McGraw-Hill, latest edition.</li> <li>2. J.P. Holman, Heat Transfer, McGraw Hill, latest edition.</li> <li>3. F.P. Incropera, D.P. Dewitt, T.L. Bergman and A.S. Lavine, Principles of Heat and Mass Transfer, John Wiley &amp; Sons, Inc., latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                            | ME44005   |
| <b>Subject Title</b>                           | Alternative Fuels   |
| <b>Credit Value</b>                            | 3   |
| <b>Level</b>                                   | 4   |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics   |
| <b>Objectives</b>                              | To provide students with the knowledge on the properties, applications, limitations and environmental impacts of different fuels  |
| <b>Intended Learning Outcomes</b>              | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Solve renewable energy related problems with knowledge in fossil fuels and alternative fuels.</li> <li>b. Demonstrate knowledge in production methods of different alternative fuels.</li> <li>c. Select from different alternative fuels available for specific potential applications.</li> <li>d. Understand the socio-economic, environmental impacts, limitations and applications of alternative fuels.</li> </ol>   |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <p><b>Fuels</b> - Fossil fuel and alternative fuels; Hydrogen, biomass and biofuels; Environmental benefits of alternative fuels.</p> <p><b>Biomass</b> - Composition of biomass; Biomass combustion; Application of biomass combustion; Exergy analysis.</p> <p><b>Biodiesel</b> - Production of biodiesel from plant oil, animal oil and waste cooking oil; Application of biodiesel to diesel engines.</p> <p><b>Hydrogen</b> - Production and storage of hydrogen; Application of hydrogen to fuel cells and motor vehicles.</p> <p><b>Other Biofuels, Their Production and Applications</b> - Bioethanol; Fischer-Tropsch Diesel; Biofuels from Microalgae and Seaweeds; Methane Biogas; Biomethanol and Biomethane</p> <p><b>Limitations of Biofuels</b> - Economic, social and environmental impact of biofuels, Life cycle analysis of biofuels</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge on alternative fuels (Outcomes a to d).</p> <p>Tutorials are used to illustrate the application of alternative fuels. (Outcomes a to d)</p> <table border="1" data-bbox="443 338 1369 551"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>   |  |   |   |          | Teaching/Learning Methodology     | Outcomes    |  |  |  | a | b | c       | d | Lecture | √              | √       | √ | √        | Tutorial | √ | √        | √      | √                           |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
|--|--|--|---|---|----------|-----------------------------------|-------------|--|--|--|---|---|---------|---|---------|----------------|---------|---|----------|----------|---|----------|--------|-----------------------------|---|---|---|----------------|-----|---|-------------|---|---|-------|---------|---|------------|--|--|--|---------|----------------------------|--|--|--|--|----------|
| Teaching/Learning Methodology  | Outcomes   |  |   |   |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
|  | a  | b  | c | d |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| Lecture  | √  | √  | √ | √ |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| Tutorial   | √  | √  | √ | √ |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 622 1422 1032"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Tests</td> <td>35%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Assignments</td> <td>15%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/>0.5 x End of Subject Examination + 0.5 x Continuous Assessment</p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by tests and assignments which provide timely feedback to both lecturers and students on various topics of the syllabus.</p> |  |   |   |          | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |   | a | b       | c | d       | 1. Examination | 50%     | √ | √        | √        | √ | 2. Tests | 35%    | √                           | √ | √ | √ | 3. Assignments | 15% | √ | √           | √ | √ | Total | 100%    |   |            |  |  |  |         |                            |  |  |  |  |          |
| Specific assessment methods/tasks                                      | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
|  |  | a  | b | c | d        |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| 1. Examination   | 50%  | √  | √ | √ | √        |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| 2. Tests   | 35%  | √  | √ | √ | √        |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| 3. Assignments   | 15%  | √  | √ | √ | √        |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| Total  | 100%   |  |   |   |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| <b>Student Study Effort Expected</b>                                   | <table border="1" data-bbox="443 1424 1439 1872"> <tr> <td colspan="2">Class contact:</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>▪</td> <td>Lecture</td> <td></td> <td></td> <td></td> <td>33 Hrs.</td> </tr> <tr> <td>▪</td> <td>Tutorial</td> <td></td> <td></td> <td></td> <td>6 Hrs.</td> </tr> <tr> <td colspan="2">Other student study effort:</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>▪</td> <td>Course work</td> <td></td> <td></td> <td></td> <td>39 Hrs.</td> </tr> <tr> <td>▪</td> <td>Self-study</td> <td></td> <td></td> <td></td> <td>39 Hrs.</td> </tr> <tr> <td colspan="2">Total student study effort</td> <td></td> <td></td> <td></td> <td>117 Hrs.</td> </tr> </table>  |  |   |   |          | Class contact:                    |             |  |  |  |   | ▪ | Lecture |   |         |                | 33 Hrs. | ▪ | Tutorial |          |   |          | 6 Hrs. | Other student study effort: |   |   |   |                |     | ▪ | Course work |   |   |       | 39 Hrs. | ▪ | Self-study |  |  |  | 39 Hrs. | Total student study effort |  |  |  |  | 117 Hrs. |
| Class contact:   |  |  |   |   |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| ▪  | Lecture  |  |   |   | 33 Hrs.  |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| ▪  | Tutorial   |  |   |   | 6 Hrs.   |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| Other student study effort:  |  |  |   |   |          |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| ▪  | Course work  |  |   |   | 39 Hrs.  |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| ▪  | Self-study   |  |   |   | 39 Hrs.  |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |
| Total student study effort   |  |  |   |   | 117 Hrs. |                                   |             |  |  |  |   |   |         |   |         |                |         |   |          |          |   |          |        |                             |   |   |   |                |     |   |             |   |   |       |         |   |            |  |  |  |         |                            |  |  |  |  |          |

**Reading List and References**Reference Books

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

Reference Journals

1. International journal of hydrogen energy
2. Biofuels, bioproducts and biorefining - Biofpr
3. Bioresource technology
4. Biomass & bioengineering

*Revised April 2015*



## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME44007  |
| <b>Subject Title</b>                                  | Fluids Engineering   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34004 Fluid Mechanics   |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To teach students the principle of rotodynamic machines applied to fan design.</li> <li>2. To teach students to the phenomena of flows around cylinders and the applications in flow-induced vibrations</li> <li>3. To teach students to the phenomena of flows around spherical particles and the applications in environmental engineering.</li> <li>4. To teach students the basic theory and applications of computational fluid dynamics (CFD).</li> </ol>  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the principle of rotodynamic machines applied to fan design.</li> <li>b. Understand the characteristics and performance of different type of centrifugal fans and axial flow fans.</li> <li>c. Design centrifugal fans and axial flow fans for different applications.</li> <li>d. Understand the phenomena of flows around cylinders and spheres for different Reynolds number and the resulting force characteristics.</li> <li>e. Apply the knowledge in flow around cylinders and sphere in flow induced vibration and environmental protection devices.</li> <li>f. Understand basic theory in computational fluid dynamics.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b>Fluid Machinery</b> - Classification. Pumps, fans, compressors and turbines. Energy equation. Euler equation.</p> <p><b>Centrifugal Fans</b> - 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 &amp; forward bladed fans. Fan laws. Design of impeller and volute. Case study.</p> <p><b>Axial Flow Fans</b> - 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.</p> |

|   | <p><b>Flows around Cylinders</b> - Effect of Reynolds numbers. Flow separations. Vortex shedding. Pressure coefficients. Mean &amp; 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.</p> <p><b>Flows around Spheres</b> - 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.</p> <p><b>Introduction to CFD</b> - 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.</p> <p><b>Laboratory Experiments:</b><br/> There are 2 two-hour laboratory sessions:<br/> Typical experiments:<br/> 1. Performance of centrifugal fans.<br/> 2. Fluidization and Cyclone experiments.</p> |                               |          |   |   |   |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |
|---|---|-------------------------------|----------|---|---|---|--|--|---|---|---|---|---|---|---------|---|---|---|---|---|---|----------|---|---|---|---|---|---|----------------------|--|--|--|--|--|---|------------|--|---|--|---|--|--|
| <p><b>Teaching/Learning Methodology</b></p> | <p>Lectures are used to deliver the fundamental knowledge in relation to fans, flows around cylinders and spheres, CFD (outcomes a to f).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to f).</p> <p>Project or case study is used to allow students to deepen their knowledge and software applications on CFD such as FLUENT (outcome f).</p> <p>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).</p> <table border="1" data-bbox="440 1447 1465 1765"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="6">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> <th>f</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Project / Case study</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td></td> <td>√</td> <td></td> <td>√</td> <td></td> <td></td> </tr> </tbody> </table>  | Teaching/Learning Methodology | Outcomes |   |   |   |  |  | a | b | c | d | e | f | Lecture | √ | √ | √ | √ | √ | √ | Tutorial | √ | √ | √ | √ | √ | √ | Project / Case study |  |  |  |  |  | √ | Experiment |  | √ |  | √ |  |  |
| Teaching/Learning Methodology               | Outcomes  |                               |          |   |   |   |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |
|   | a   | b                             | c        | d | e | f |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |
| Lecture                                     | √   | √                             | √        | √ | √ | √ |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |
| Tutorial                                    | √   | √                             | √        | √ | √ | √ |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |
| Project / Case study                        |   |                               |          |   |   | √ |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |
| Experiment                                  |   | √                             |          | √ |   |   |  |  |   |   |   |   |   |   |         |   |   |   |   |   |   |          |   |   |   |   |   |   |                      |  |  |  |  |  |   |            |  |   |  |   |  |  |

|   |  |             |  |   |   |   |   |   |
|---|--|-------------|--|---|---|---|---|---|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b>  | 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 %       |  |   |   |   |   |   |
| <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.5 \times \text{End of Subject Examination} + 0.5 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |             |  |   |   |   |   |   |
| <b>Student Study Effort Expected</b>  | Class contact:   |             |  |   |   |   |   |   |
|   | ▪ Lecture  |             | 33 Hrs.  |   |   |   |   |   |
|   | ▪ Laboratory/Tutorial  |             | 6 Hrs.   |   |   |   |   |   |
|   | Other student study effort:  |             |  |   |   |   |   |   |
|   | ▪ Assignment, Laboratory report, Mini-project  |             | 20 Hrs.  |   |   |   |   |   |
|   | ▪ Self-study   |             | 43 Hrs.  |   |   |   |   |   |
|   | Total student study effort   |             | 102 Hrs.   |   |   |   |   |   |
| <b>Reading List and References</b>  | 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 2015

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME45001  |
| <b>Subject Title</b>                                  | Aerodynamics   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34004 Fluid Mechanics   |
| <b>Objectives</b>                                     | To equip students with necessary knowledge of flow physics, analytical and numerical techniques for the prediction of forces acting on and performance analysis of aerodynamic bodies.   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Formulate and solve problems relating to low-speed flow past two-dimensional airfoils and aerodynamic bodies by applying inviscid and incompressible flow theories.</li> <li>b. Formulate and solve problems relating to downwash and induced drag phenomena for finite wings by applying the techniques derived from laws of vortex motion.</li> <li>c. Formulate and solve problems relating to compressible flow through nozzles/diffusers and supersonic flow past aerodynamic bodies by applying one-dimensional compressible flow equations and knowledge of flow compressibility and wave phenomena in aerodynamics.</li> <li>d. Analyze and interpret data obtained from experiments in incompressible and compressible aerodynamics.</li> <li>e. Present effectively in completing written reports of laboratory work and the given task.</li> </ol>                       |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Fundamental Principles and Equations</i></b> - Control volume concept for fluid. Continuity equation. Momentum equation. Energy equation. Substantial derivative. Angular velocity, vorticity and strain. Dimensional analysis.</p> <p><b><i>Inviscid and Incompressible Flow</i></b> - Stream function and velocity potential. Potential flow. Laplace's equation and its elementary solutions.</p> <p><b><i>Incompressible Flow over Two-Dimensional Airfoils</i></b> - Airfoil nomenclature and characteristics. The Kutta condition. Circulation and lift. Kelvin's circulation theorem and starting vortex. General thin airfoil theory. Symmetric and cambered airfoils. Aerodynamic Center. Panel method for arbitrary lifting bodies. Viscous airfoil drag.</p> <p><b><i>Finite Wings</i></b> - Downwash and induced drag. Vortex system on finite wing. Law of vortex motion. Prandtl's lifting line theory. Lifting-surface theory and vortex lattice numerical method.</p> |

|   | <p><b><i>Inviscid and Compressible Flow</i></b> - Definition of compressibility and total conditions. Governing equations. One-dimensional flow: weak waves and plane normal shock waves. Two-dimensional supersonic flow: oblique shock and expansion waves. Flow through nozzles and diffusers.</p> <p><b><i>Compressible Flow over Airfoils</i></b> - Velocity potential equation and its linearized form. Prandtl-Glauert compressibility correction. Critical Mach number. The sound barrier. Supersonic pressure coefficients. Application to supersonic airfoils.</p>  |                                   |             |  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
|---|---|-----------------------------------|-------------|--|---|---|--|---|---|---|---|---|---------|---------------|-----|---|---|---|----------|---|------------------------------|-----|--|---|--------------------|---|---|---------|-----|---|------------|---|--|--|----------------|-----|---|---|---|--|--|-------|------|--|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are used to deliver the fundamental principles and equations of aerodynamics as well as solution techniques (outcomes a to d).</p> <p>Tutorials are used to illustrate the application of fundamental principles to practical engineering situations (outcomes a to c).</p> <p>Projects, in the form of design problems or case studies, are used to allow students to deepen their knowledge on a selected topic through search of information, analysis of data and report writing (outcomes a, b and e).</p> <p>Experiment(s) on evaluating the effects of configurations of an airfoil on its flow field and aerodynamic characteristics, either in laboratory or numerical setup, is (are) provided for bridging the knowledge of fluid mechanics with current subject. Students are exposed to proper use of knowledge taught and analysis skills on evaluating their experimental results (outcomes a, d and e).</p> <table border="1" data-bbox="486 996 1422 1301"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Project/Laboratory</td> <td>√</td> <td>√</td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>Experiment</td> <td>√</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> </tbody> </table> | Teaching/Learning Methodology     | Outcomes    |  |   |   |  | a | b | c | d | e | Lecture | √             | √   | √ | √ |   | Tutorial | √ | √                            | √   |  |   | Project/Laboratory | √ | √ |         |     | √ | Experiment | √ |  |  | √              | √   |   |   |   |  |  |       |      |  |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes  |                                   |             |  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
|   | a   | b                                 | c           | d  | e |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Lecture   | √   | √                                 | √           | √  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Tutorial  | √   | √                                 | √           |  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Project/Laboratory  | √   | √                                 |             |  | √ |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Experiment  | √   |                                   |             | √  | √ |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="440 1373 1382 1832"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Assignment</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>2. Project/Laboratory report</td> <td>15%</td> <td></td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Test</td> <td>15%</td> <td>√</td> <td>√</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p>  | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |   | a | b | c | d | e       | 1. Assignment | 20% | √ | √ | √ |          |   | 2. Project/Laboratory report | 15% |  | √ | √                  | √ | √ | 3. Test | 15% | √ | √          |   |  |  | 4. Examination | 50% | √ | √ | √ |  |  | Total | 100% |  |  |  |  |  |
| Specific assessment methods/tasks   | % weighting   |                                   |             | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
|   |   | a                                 | b           | c  | d | e |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 1. Assignment   | 20%   | √                                 | √           | √  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 2. Project/Laboratory report  | 15%   |                                   | √           | √  | √ | √ |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 3. Test   | 15%   | √                                 | √           |  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| 4. Examination  | 50%   | √                                 | √           | √  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |
| Total   | 100%  |                                   |             |  |   |   |  |   |   |   |   |   |         |               |     |   |   |   |          |   |                              |     |  |   |                    |   |   |         |     |   |            |   |  |  |                |     |   |   |   |  |  |       |      |  |  |  |  |  |

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|                                      | Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments projects and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Assigned homework and test are designed to enhance the students' learning of fundamental principles in aerodynamics. The projects provide students an opportunity to capitalize on the knowledge they learn for tackling practical aerodynamic problems arising from real practice. Written report and oral presentation on a specific project or case study is used to assess the students' knowledge in contemporary aircraft maintenance engineering. |          |
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Tutorial  | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Self-study  | 45 Hrs.  |
|                                      | ▪ Homework assignment   | 12 Hrs.  |
|                                      | ▪ Project/case study  | 12 Hrs.  |
|                                      | Total student study effort  | 108 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Anderson Jr., J. D., Fundamentals of Aerodynamics, McGraw-Hill, latest edition.</li> <li>2. Houghton, E. L., and Carpenter, P. W., Aerodynamics for Engineering Students, Butterworth &amp; Heinemann, latest edition.</li> <li>3. Bertin, J. J. and Cummings, R. M., Aerodynamics for Engineers, Pearson Prentice-Hall, latest edition.</li> <li>4. Anderson Jr., J. D., Aircraft Performance and Design, McGraw-Hill, latest edition.</li> </ol>  |          |

Revised July 2014

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME45002   |
| <b>Subject Title</b>                                  | Aircraft Systems  |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34004 Fluid Mechanics  |
| <b>Objectives</b>                                     | To develop students' fundamental knowledge and basic concepts on components and operating principles of essential mechanical and electrical systems in civil transport aircraft.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Demonstrate good understanding of the principles of flight control and various systems in civil transport aircraft; and formulate and solve problems relating to aircraft systems.</li> <li>b. Identify the flight control and utility functions to be considered in the design of an aircraft hydraulic system.</li> <li>c. Explain major electrical loads and the characteristics of modern aircraft electrical system.</li> <li>d. Explain the need for cabin and avionics conditioning and outline recent advances in aircraft environmental control system design.</li> <li>e. Explain the design philosophy and objectives of aircraft emergency systems.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Flight Control Systems</i></b> - Principles of flight control. Primary and secondary flight controls. Flight phases.</p> <p><b><i>Power Plant</i></b> - Fuel efficiency. Effect of specific thrust. Specific fuel consumption and flight speed. Engine cycle and performance.</p> <p><b><i>Fuel Systems</i></b> - Characteristics of aircraft fuel systems. Fuel system components. Aircraft mass and payload.</p> <p><b><i>Hydraulic Systems</i></b> - Flight control and utility functions. Emergency power sources. Landing-gear system. Braking and anti-skid.</p> <p><b><i>Electrical systems</i></b> - Characteristics of civil aircraft electrical system. Electrical loads. Emergency power generation.</p> <p><b><i>Pneumatic systems</i></b> - Pitot-static systems. Use of engine bleed air. Bleed air control. Thrust reversers.</p> <p><b><i>Environmental Control Systems</i></b> - The need for cabin and equipment conditioning. Environmental control system design. Air distribution systems. Cabin pressurization.</p> <p><b><i>Emergency Systems</i></b> - Warning systems. Fire detection and suppression. Emergency oxygen. Explosion suppression. Passenger evacuation.</p> |

| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to various aircraft systems (outcomes a to e).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to e).</p> <p>Industrial visits and special seminars delivered by invited industrial professionals are used to relate the concepts learnt on class to engineering practices. Students are expected to achieve better understanding of aircraft systems through these activities (outcomes a to e).</p> <table border="1" data-bbox="443 544 1469 801"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="5">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Industrial field visit and special seminar</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>   |  |   |   |   | Teaching/Learning Methodology      | Outcomes    |  |  |  |  | a | b | c | d | e | Lecture | √              | √   | √ | √ | √ | Tutorial | √ | √                      | √   | √ | √ | Industrial field visit and special seminar | √ | √ | √   | √   | √ |  |  |  |   |       |      |  |  |  |  |  |
|---|--|--|---|---|---|------------------------------------|-------------|--|--|--|--|---|---|---|---|---|---------|----------------|-----|---|---|---|----------|---|------------------------|-----|---|---|--|---|---|---|-----|---|--|--|--|---|-------|------|--|--|--|--|--|
| Teaching/Learning Methodology   | Outcomes   |  |   |   |   |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
|   | a  | b  | c | d | e |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| Lecture   | √  | √  | √ | √ | √ |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| Tutorial  | √  | √  | √ | √ | √ |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| Industrial field visit and special seminar                                    | √  | √  | √ | √ | √ |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="443 887 1469 1328"> <thead> <tr> <th rowspan="2">Specific assessment methods/ tasks</th> <th rowspan="2">% weighting</th> <th colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> <th>e</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Assignment and test</td> <td>40%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Industrial field visit and visit report, report for special seminars</td> <td>10%</td> <td></td> <td></td> <td></td> <td></td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="5"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments, closed-book tests, industrial visits and special seminars. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.</p> |  |   |   |   | Specific assessment methods/ tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |  |   | a | b | c | d | e       | 1. Examination | 50% | √ | √ | √ | √        | √ | 2. Assignment and test | 40% | √ | √ | √  | √ | √ | 3. Industrial field visit and visit report, report for special seminars | 10% |   |  |  |  | √ | Total | 100% |  |  |  |  |  |
| Specific assessment methods/ tasks  | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
|   |  | a  | b | c | d | e                                  |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| 1. Examination  | 50%  | √  | √ | √ | √ | √                                  |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| 2. Assignment and test  | 40%  | √  | √ | √ | √ | √                                  |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| 3. Industrial field visit and visit report, report for special seminars       | 10%  |  |   |   |   | √                                  |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |
| Total   | 100%   |  |   |   |   |                                    |             |  |  |  |  |   |   |   |   |   |         |                |     |   |   |   |          |   |                        |     |   |   |  |   |   |   |     |   |  |  |  |   |       |      |  |  |  |  |  |



|                                      |   |          |
|--------------------------------------|---|----------|
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Tutorial  | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Course work   | 20 Hrs.  |
|                                      | ▪ Self-study  | 45 Hrs.  |
|                                      | Total student study effort  | 104 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. The Rolls-Royce Book of the Jet Engine, latest edition, Rolls-Royce Ltd, latest edition.</li> <li>2. SAE Aerospace Information Report 5005, Aerospace – Commercial Aircraft Hydraulic Systems, latest edition.</li> <li>3. I. Moir and A.G. Seabridge, Design and Development of Aircraft Systems – An Introduction, First Edition, AIAA Education Series, latest edition.</li> </ol> |          |

*Revised July 2014*

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME45006   |
| <b>Subject Title</b>                                  | Aircraft Structure and Engineering Composites   |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME33001 Mechanics of Materials<br>Exclusion: ME43001 Advanced Materials for Design and Technology  |
| <b>Objectives</b>                                     | To provide students fundamental knowledge relevant to the structures and composite materials used in modern aircraft, and broad knowledge of all aspects of the technology related to aircraft structural applications.   |
| <b>Intended Learning Outcomes</b>                     | Upon completion of the subject, students will be able to: <ul style="list-style-type: none"> <li>a. Demonstrate an understanding of key aspects of aircraft structures.</li> <li>b. Formulate, analyze, design and optimize an aircraft structure subject to a combined loading using stress analysis tools.</li> <li>c. Formulate and solve problems involving compression/tension, bending, torsion and buckling in aircraft structures.</li> <li>d. Understand mechanical behaviors and manufacturing of composites used in aircraft.</li> <li>e. Gain appreciation of the wide design flexibility composites in modern aircraft.</li> </ul>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Fundamentals of Aircraft Structures and Materials</i></b> – Aircraft structures. Wing, fuselage, tail and landing gear. Aircraft materials.</p> <p><b><i>Elasticity</i></b> – Equations of equilibrium in a non-uniform stress field. Linear stress-strain relations.</p> <p>Loads Applied on Aircraft Structures – Torsion of wing and fuselage. Bending and Flexural shear of wing and fuselage. Closed single-cell thin-walled fuselage. Transverse shear stress due to transverse force in symmetric sections of fuselage.</p> <p><b><i>Flexural Shear Flow in Fuselage</i></b> – Flexural shear flow in open thin-walled section. Shear centre in open sections. Closed thin-walled sections and combined flexural and torsional shear flow.</p> <p><b><i>Failure Criteria</i></b> – Ductile and brittle materials. Fracture mechanics. Stress intensity factor. Fatigue. Failure criteria.</p> <p><b><i>Elastic Instability</i></b> – Eccentrically loaded beam-column. Elastic buckling of landing gear. Torsional-flexural buckling of thin-walled bars.</p> <p><b><i>Analysis of Lamina and Laminates in Aircraft</i></b> – Plane stress equations for composite lamina. Off-axis loading. Stacking sequence in laminates. Symmetric laminate under in-plane loading. Effective moduli for symmetric laminates. Laminar stresses.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to aircraft structures and composites (outcomes a to e).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to e).</p>  |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
|--|---|--|---|---|---|-----------------------------------|-------------|--|--------|---------------|---------|--------------|----------------|----------------------------|----------|---|---|----------|---|------------------------|-----|---|---|---|---|---|-------|------|---|---|---|---|---|
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1"> <thead> <tr> <th data-bbox="440 353 943 456">Teaching/Learning Methodology</th> <th colspan="5" data-bbox="943 353 1453 405">Outcomes</th> </tr> <tr> <td data-bbox="440 456 943 508">Lecture</td> <td data-bbox="943 405 1062 456">a</td> <td data-bbox="1062 405 1158 456">b</td> <td data-bbox="1158 405 1254 456">c</td> <td data-bbox="1254 405 1350 456">d</td> <td data-bbox="1350 405 1453 456">e</td> </tr> </thead> <tbody> <tr> <td data-bbox="440 508 943 562">Tutorial</td> <td data-bbox="943 456 1062 508">√</td> <td data-bbox="1062 456 1158 508">√</td> <td data-bbox="1158 456 1254 508">√</td> <td data-bbox="1254 456 1350 508">√</td> <td data-bbox="1350 456 1453 508">√</td> </tr> </tbody> </table>   |  |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |        |               |         | Lecture      | a              | b                          | c        | d | e | Tutorial | √ | √                      | √   | √ | √ |   |   |   |       |      |   |   |   |   |   |
| Teaching/Learning Methodology  | Outcomes  |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| Lecture  | a   | b  | c | d | e |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| Tutorial   | √   | √  | √ | √ | √ |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| <b>Student Study Effort Expected</b>                                   | <table border="1"> <thead> <tr> <th data-bbox="440 633 799 768">Specific assessment methods/tasks</th> <th data-bbox="799 633 943 768">% weighting</th> <th colspan="5" data-bbox="943 633 1453 719">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <td data-bbox="440 768 799 819">1. Examination</td> <td data-bbox="799 768 943 819">50%</td> <td data-bbox="943 719 1062 768">a</td> <td data-bbox="1062 719 1158 768">b</td> <td data-bbox="1158 719 1254 768">c</td> <td data-bbox="1254 719 1350 768">d</td> <td data-bbox="1350 719 1453 768">e</td> </tr> </thead> <tbody> <tr> <td data-bbox="440 819 799 871">2. Assignment and test</td> <td data-bbox="799 819 943 871">50%</td> <td data-bbox="943 768 1062 819">√</td> <td data-bbox="1062 768 1158 819">√</td> <td data-bbox="1158 768 1254 819">√</td> <td data-bbox="1254 768 1350 819">√</td> <td data-bbox="1350 768 1453 819">√</td> </tr> <tr> <td data-bbox="440 871 799 925">Total</td> <td data-bbox="799 871 943 925">100%</td> <td data-bbox="943 819 1062 871">√</td> <td data-bbox="1062 819 1158 871">√</td> <td data-bbox="1158 819 1254 871">√</td> <td data-bbox="1254 819 1350 871">√</td> <td data-bbox="1350 819 1453 871">√</td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments and closed-book tests. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus.</p> |  |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |        |               |         |              | 1. Examination | 50%                        | a        | b | c | d        | e | 2. Assignment and test | 50% | √ | √ | √ | √ | √ | Total | 100% | √ | √ | √ | √ | √ |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| 1. Examination   | 50%   | a  | b | c | d | e                                 |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| 2. Assignment and test   | 50%   | √  | √ | √ | √ | √                                 |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| Total  | 100%  | √  | √ | √ | √ | √                                 |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| <b>Reading List and References</b>                                     | <p>Class contact:</p> <table border="1"> <tr> <td data-bbox="440 1373 1110 1424">▪ Lecture</td> <td data-bbox="1110 1373 1481 1424">33 Hrs.</td> </tr> <tr> <td data-bbox="440 1424 1110 1476">▪ Tutorial</td> <td data-bbox="1110 1424 1481 1476">6 Hrs.</td> </tr> </table> <p>Other student study effort:</p> <table border="1"> <tr> <td data-bbox="440 1543 1110 1594">▪ Course work</td> <td data-bbox="1110 1543 1481 1594">20 Hrs.</td> </tr> <tr> <td data-bbox="440 1594 1110 1646">▪ Self-study</td> <td data-bbox="1110 1594 1481 1646">45 Hrs.</td> </tr> <tr> <td data-bbox="440 1646 1110 1697">Total student study effort</td> <td data-bbox="1110 1646 1481 1697">104 Hrs.</td> </tr> </table> <p>1. C.T. Sun, Mechanics of Aircraft Structures, John Wiley &amp; Sons, latest edition.<br/> 2. R.F. Gibson, Principles of Composite Material Mechanics, McGraw-Hill International Editions, latest edition.</p>   |  |   |   |   | ▪ Lecture                         | 33 Hrs.     | ▪ Tutorial   | 6 Hrs. | ▪ Course work | 20 Hrs. | ▪ Self-study | 45 Hrs.        | Total student study effort | 104 Hrs. |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| ▪ Lecture  | 33 Hrs.   |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| ▪ Tutorial   | 6 Hrs.  |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| ▪ Course work  | 20 Hrs.   |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| ▪ Self-study   | 45 Hrs.   |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |
| Total student study effort   | 104 Hrs.  |  |   |   |   |                                   |             |  |        |               |         |              |                |                            |          |   |   |          |   |                        |     |   |   |   |   |   |       |      |   |   |   |   |   |

Revised March 2015

## Subject Description Form

|  |   |
|--|---|
| <b>Subject Code</b>                            | ME47005   |
| <b>Subject Title</b>                           | Aircraft Performance and Flight Management  |
| <b>Credit Value</b>                            | 3   |
| <b>Level</b>                                   | 3   |
| <b>Pre-requisite / Co-requisite/ Exclusion</b> | Nil   |
| <b>Objectives</b>                              | To teach students the fundamental aerodynamic principles and performance analyses for the management of aircraft flight in atmosphere.  |
| <b>Intended Learning Outcomes</b>              | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Demonstrate a good understanding of the aircraft wing aerodynamic forces and their management in cruising flight;</li> <li>b. Define the combinations of aircraft aerodynamic features and propulsion methods for different cruising requirements;</li> <li>c. Describe the relationships between the performance prescriptions and the power and thrust requirements for steady flight;</li> <li>d. Evaluate the aircraft manoeuvre stability for managing flying qualities.</li> </ol>   |
| <b>Subject Synopsis/ Indicative Syllabus</b>   | <p><b><i>Aircraft Wing Aerodynamics</i></b> – Airfoil lift, drag and moments. Airfoil data. Compressibility correction. Finite wing aerodynamics. Induced drag. High-lift mechanisms.</p> <p><b><i>Aircraft Performance</i></b> – Concept of drag polar. Propulsion characteristics. Tradeoff between thrust availability and performance efficiency. Thrust and power requirements for cruising flight. Altitude effects. Climb and descent performance. Gliding flight. Takeoff and landing. Level turn, pull-up and pull-down.</p> <p><b><i>Manoeuvre Management</i></b> – Flying qualities. Elementary concepts of stability and control. Tail surfaces. Pitching moments of airfoil. Static and dynamic stability. Longitudinal and lateral stability. Stalling and spinning. Flight management and guidance computers (FMGC).</p> |

| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to various aspects of aerodynamic characteristics for aircraft as well as their influence in determining the aircraft performance and manouvre management for atmospheric flight (Outcomes a to d).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical flight situations (Outcomes c and d).</p> <p>Experiment on evaluating the effects on aircraft wing profile on aerodynamic force characteristics, either in laboratory or numerical setup, is provided for bridging the knowledge of aerodynamics with flight performance. Students are exposed to proper use of knowledge taught and analysis skills on evaluating their experimental results (Outcomes a and c).</p> <table border="1" data-bbox="453 607 1457 887"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Homework assignments</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Test</td> <td></td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>Examination</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |   |   |   |   | Teaching/Learning Methodology     | Outcomes    |   |  |  | a | b | c | d | Lectures | √                       | √   | √ | √ | Homework assignments |   | √             | √   | √ | Test |  | √ | √       |     | Examination | √ | √ | √ | √              |     |   |   |   |   |       |      |  |  |  |  |
|---|--|---|---|---|---|-----------------------------------|-------------|---|--|--|---|---|---|---|----------|-------------------------|-----|---|---|----------------------|---|---------------|-----|---|------|--|---|---------|-----|-------------|---|---|---|----------------|-----|---|---|---|---|-------|------|--|--|--|--|
| Teaching/Learning Methodology   | Outcomes   |   |   |   |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|   | a  | b   | c | d |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Lectures  | √  | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Homework assignments  |  | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Test  |  | √   | √ |   |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Examination   | √  | √   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="448 965 1461 1357"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Homework assignments</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Experiment</td> <td>15%</td> <td></td> <td>√</td> <td></td> <td></td> </tr> <tr> <td>3. Test</td> <td>15%</td> <td></td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>4. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td colspan="4"></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments projects and test(s), which provide timely feedback to both lecturers and students on various topics of the syllabus. Assigned homework and test are designed to enhance the students' learning of fundamental flight mechanics of an aircraft. The experiment provides students an opportunity to capitalize on the knowledge they learn for tackling practical aircraft flight performance problems. Written report and oral presentation on a specific project or case study is used to assess the students' knowledge in contemporary aeronautical engineering practice.</p> |   |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |   | a | b | c | d        | 1. Homework assignments | 20% | √ | √ | √                    | √ | 2. Experiment | 15% |   | √    |  |   | 3. Test | 15% |             | √ | √ |   | 4. Examination | 50% | √ | √ | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  | Intended subject learning outcomes to be assessed |   |   |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|   |  | a   | b | c | d |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 1. Homework assignments   | 20%  | √   | √ | √ | √ |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 2. Experiment   | 15%  |   | √ |   |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 3. Test   | 15%  |   | √ | √ |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 4. Examination  | 50%  | √   | √ | √ | √ |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Total   | 100%   |   |   |   |   |                                   |             |   |  |  |   |   |   |   |          |                         |     |   |   |                      |   |               |     |   |      |  |   |         |     |             |   |   |   |                |     |   |   |   |   |       |      |  |  |  |  |

|                                      |   |          |
|--------------------------------------|---|----------|
| <b>Student Study Effort Expected</b> | Class contact:  |          |
|                                      | ▪ Lecture   | 33 Hrs.  |
|                                      | ▪ Tutorials   | 6 Hrs.   |
|                                      | Other student study effort:   |          |
|                                      | ▪ Self Study  | 42 Hrs.  |
|                                      | ▪ Homework assignments  | 12 Hrs.  |
|                                      | ▪ Project/Case study  | 12 Hrs.  |
|                                      | Total student study effort  | 105 Hrs. |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. Kermondes, A. C., Mechanics of Flight, Prentice Hall, latest edition.</li> <li>2. Anderson Jr., J. D., Introduction to Flight, McGraw-Hill, latest edition.</li> <li>3. Torenbeek, E., and Wittenberg, H., Flight Physics, Springer, latest edition.</li> <li>4. Hull, D. G., Fundamentals of Airplane Flight Mechanics, Springer, latest edition.</li> </ol> |          |

March 2014

## Subject Description Form

|   |   |
|---|---|
| <b>Subject Code</b>                                   | ME47007   |
| <b>Subject Title</b>                                  | Aircraft and Spacecraft Propulsion  |
| <b>Credit Value</b>                                   | 3   |
| <b>Level</b>  | 4   |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics; and<br>ME34004 Fluid Mechanics   |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To provide students with the basic knowledge relevant to propulsion systems of aircraft and spacecraft.</li> <li>2. To provide students with knowledge and applications of thermodynamic cycles in propulsion systems of aircraft and spacecraft and the chemistry and thermodynamics of combustion.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand basic knowledge of modern propulsion systems used in today's aircraft and spacecraft, such as turbojet, turbofan and rocket propulsion.</li> <li>b. Obtain state-of-the-art knowledge in the area of advanced aerodynamics and thermodynamics related to modern propulsion systems in aircraft and spacecraft.</li> <li>c. Apply their knowledge, skills and hand-on experience to the design and analysis of propulsion systems in aircraft and spacecraft.</li> <li>d. Extend their knowledge of mechanical engineering to different situations of engineering context and professional practice in turbomachinery.</li> </ol>  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Basic Knowledge of Compressible Flows and Thermodynamics</i></b> - Conservation laws including continuity equation, momentum equation and energy equation. Brief review of thermodynamics. Isentropic and polytropic processes, stagnation concept. Speed of sound and Mach number. Quasi-one-dimensional flows, including compressible flows with friction and heat and nozzle flows.</p> <p><b><i>Introduction to Propulsion Systems of Aircraft</i></b> - Thrust and drag. Engine stall. Ramjet, turbojet, turbofan, turboprop, turbo-shaft engines, and new types of engines. Engine maintenance. Engine airworthiness.</p> <p><b><i>Basic Components of Aircraft Gas-turbine Engine</i></b> - Inlets. Compressor. Combustion chambers and afterburners. Turbine and nozzles.</p> <p><b><i>Cycle Analysis and Performance</i></b> - Thrust equations. Engine performance parameters. Thermal and propulsion efficiencies. Fuel consumption rate and specific thrust. Basic considerations in the analysis of jet propulsion. Inter-cooling. Reheating. Regeneration. Cycle analysis. Modifications to turbojet engines. Gas turbine design.</p> <p><b><i>Turbomachinery</i></b> - Basics of compressors and turbines.</p> <p><b><i>Introduction to Propulsion Systems of Spacecraft</i></b> - Chemical rockets. Spacecraft propulsion. Electric propulsion. Rocket thrust. High-speed Airbreathing engines. Hypersonic propulsion.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to propulsion systems of aircraft and spacecraft (outcomes a to d).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to d).</p> <table border="1" data-bbox="424 315 1450 517"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td></td> <td>√</td> <td></td> </tr> <tr> <td>Experiment</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |   |          |   |   | Teaching/Learning Methodology     | Outcomes    |   |  |  | a | b | c | d | Lecture | √              | √   | √ | √ | Tutorial | √ |                                | √   |   | Experiment |   | √ | √             | √   |   |   |   |   |       |      |  |  |  |  |
|--|---|---|----------|---|---|-----------------------------------|-------------|---|--|--|---|---|---|---|---------|----------------|-----|---|---|----------|---|--------------------------------|-----|---|------------|---|---|---------------|-----|---|---|---|---|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes  |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | a   | b   | c        | d |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| Lecture  | √   | √   | √        | √ |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| Tutorial   | √   |   | √        |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| Experiment   |   | √   | √        | √ |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="424 584 1450 898"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Assignments including Tests</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Experiment</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments, closed-book tests and group experiment. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Continuous assessment will also be used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English so as to fulfill the requirements of being space engineers.</p> <p>All assigned homework inclusive of any computer problems should be worked independently. It is the students' responsibilities to work out the problems individually and to ask questions on those problems they have difficulty with. Unless stated otherwise, no group submission or copies are permitted. If a copy is detected, a zero score will be assigned.</p> |   |          |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |   | a | b | c | d       | 1. Examination | 50% | √ | √ | √        | √ | 2. Assignments including Tests | 30% | √ | √          | √ | √ | 3. Experiment | 20% | √ | √ | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting   | Intended subject learning outcomes to be assessed |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  |   | a   | b        | c | d |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| 1. Examination   | 50%   | √   | √        | √ | √ |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| 2. Assignments including Tests   | 30%   | √   | √        | √ | √ |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| 3. Experiment  | 20%   | √   | √        | √ | √ |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| Total  | 100%  |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| <b>Student Study Effort Expected</b>                                   | Class contact:  |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | ▪ Lecture   | 33 Hrs.   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | ▪ Tutorial/Lab.   | 6 Hrs.  |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | Other student study effort:   |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | ▪ Assignments   | 36 Hrs.   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | ▪ Self-study  | 40 Hrs.   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
|  | Total student study effort  |   | 115 Hrs. |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |
| <b>Reading List and References</b>                                     | <ol style="list-style-type: none"> <li>S. Farokhi. Aircraft Propulsion, Wiley, latest edition.</li> <li>Hill P. and Peterson C., <i>Mechanics and Thermodynamics of Propulsion</i>. Addison Wesley, latest edition.</li> <li>Sutton G. P., Biblarz O., <i>Rocket Propulsion Elements</i>, John Wiley &amp; Sons, Inc., latest edition.</li> <li>P. Fortescue, <i>et al.</i> Spacecraft Systems Engineering, Wiley, latest edition.</li> </ol>   |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                                |     |   |            |   |   |               |     |   |   |   |   |       |      |  |  |  |  |



## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME47008  |
| <b>Subject Title</b>                                  | Fundamentals of Aircraft and Spacecraft Design   |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME32002 Engineering Design Fundamentals   |
| <b>Objectives</b>                                     | <ol style="list-style-type: none"> <li>1. To provide students with the key knowledge relevant to design of aircraft and spacecraft.</li> <li>2. To furnish students with key aspects to be considered when design aircraft and spacecraft.</li> <li>3. To equip students with the capacity to formulate the design requirements for aircraft and spacecraft using modern engineering tools.</li> </ol>   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand key concepts in a process of aircraft and spacecraft design.</li> <li>b. Understand key components in aircraft and spacecraft.</li> <li>c. Identify key design features from aerodynamic point of view.</li> <li>d. Understand launching procedure and vehicles for spacecraft.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Introduction to Aircraft Design</i></b> - Design method and requirements. Evolution of aircraft design. Overview of aircraft design cycle and process.</p> <p><b><i>Aerodynamic Consideration for Aircraft Design</i></b> - Fundamentals of aerodynamics. Flow separation. Friction and pressure drag. Airfoils. Finite wings. Drag and lift. Lift-to-drag ratio. Flapped airfoils. End effects of wing tips. Induced drag.</p> <p><b><i>Aircraft Configuration</i></b> - Conventional and alternative configurations. Wing design. Fuselage design.</p> <p><b><i>Sizing and Costing</i></b> - Internal layout. Structures and weight. Geometry constraints. Sizing equation. Weight fraction method. Weight and balance. Cost analysis. Elements of life-cycle cost. Cost-estimating methods. Operations and maintenance costs. Cost measures of merit.</p> <p><b><i>Airworthiness in Aircraft Design</i></b> - Airworthiness requirements. Airframe loads. Designing against fatigue. Prediction of aircraft fatigue life.</p> <p><b><i>Introduction to Spacecraft Design</i></b> - Fundamentals of space structures. Payloads and missions. Spacecraft environment and its effect on spacecraft design.</p> <p><b><i>Dynamics of Spacecraft</i></b> - Trajectory dynamics. General attitude dynamics. Attitude motion of specific types of spacecraft.</p> <p><b><i>Launch Vehicles</i></b> - Basic launch vehicle performance and operation. Spacecraft launch phases and mission planning. Crewed launch systems. Small launchers and reusable vehicles. Re-entry into Earth's atmosphere.</p> |

| <b>Teaching/Learning Methodology</b>                                   | <p>Lectures are used to deliver the fundamental knowledge in relation to aircraft and spacecraft design (outcomes a to d).</p> <p>Tutorials are used to illustrate the application of fundamental knowledge to practical situations (outcomes a to d).</p> <table border="1" data-bbox="443 369 1476 577"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Mini-project</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>   |   |          |   |   | Teaching/Learning Methodology     | Outcomes    |   |  |  | a | b | c | d | Lecture | √              | √   | √ | √ | Tutorial | √ | √              | √   | √ | Mini-project | √ | √ | √               | √   |   |   |   |   |       |      |  |  |  |  |
|--|--|---|----------|---|---|-----------------------------------|-------------|---|--|--|---|---|---|---|---------|----------------|-----|---|---|----------|---|----------------|-----|---|--------------|---|---|-----------------|-----|---|---|---|---|-------|------|--|--|--|--|
| Teaching/Learning Methodology  | Outcomes   |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | a  | b   | c        | d |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| Lecture  | √  | √   | √        | √ |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| Tutorial   | √  | √   | √        | √ |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| Mini-project   | √  | √   | √        | √ |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1" data-bbox="443 645 1476 929"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>2. Assignments</td> <td>30%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>3. Mini-project</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>Examination is adopted to assess students on the overall understanding and the ability of applying the concepts. It is supplemented by continuous assessment including assignments and closed-book tests. The continuous assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. Continuous assessment will also be used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English so as to fulfill the requirements of being aircraft design engineers. The mini-project concerns design and analysis of a new aerial vehicle.</p> <p>All assigned homework inclusive of any computer problems should be worked independently. It is the students' responsibilities to work out the problems individually and to ask questions on those problems they have difficulty with. Unless stated otherwise, no group submission or copies are permitted. If a copy is detected, a zero score will be assigned.</p> |   |          |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed |  |  |   | a | b | c | d       | 1. Examination | 50% | √ | √ | √        | √ | 2. Assignments | 30% | √ | √            | √ | √ | 3. Mini-project | 20% | √ | √ | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks                                      | % weighting  | Intended subject learning outcomes to be assessed |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  |  | a   | b        | c | d |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| 1. Examination   | 50%  | √   | √        | √ | √ |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| 2. Assignments   | 30%  | √   | √        | √ | √ |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| 3. Mini-project  | 20%  | √   | √        | √ | √ |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| Total  | 100%   |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
| <b>Student Study Effort Expected</b>                                   | Class contact:   |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Lecture</li> </ul>  |   | 26 Hrs.  |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Tutorial</li> </ul>   |   | 13 Hrs.  |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | Other student study effort:  |   |          |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Course work including project</li> </ul>  |   | 52 Hrs.  |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | <ul style="list-style-type: none"> <li>▪ Self-study</li> </ul>   |   | 26 Hrs.  |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |
|  | Total student study effort   |   | 117 Hrs. |   |   |                                   |             |   |  |  |   |   |   |   |         |                |     |   |   |          |   |                |     |   |              |   |   |                 |     |   |   |   |   |       |      |  |  |  |  |

|                                    |   |
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| <b>Reading List and References</b> | <ol style="list-style-type: none"><li>1. S.A. Brandt, <i>et al.</i>, Introduction to Aeronautics: A Design Perspective, American Institute of Aeronautics and Astronautics Inc., latest edition.</li><li>2. D.P. Raymer, Aircraft Design: A Conceptual Approach, American Institute of Aeronautics and Astronautics Inc., latest edition.</li><li>3. P. Fortescue, <i>et al.</i> Spacecraft Systems Engineering, Wiley, latest edition.</li></ol> |
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May 2016

## Subject Description Form

|   |  |
|---|--|
| <b>Subject Code</b>                                   | ME49002  |
| <b>Subject Title</b>                                  | Environmental Noise  |
| <b>Credit Value</b>                                   | 3  |
| <b>Level</b>  | 4  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Pre-requisite: ME34002 Engineering Thermodynamics  |
| <b>Objectives</b>                                     | To teach students the practical aspects in environmental noise; the techniques for the measurement, assessment and prediction of transportation and industrial noise.  |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a. Understand the simple sound fields and identify the noise sources and their respective mitigation measures for road traffic noise.</li> <li>b. Understand basic concept of room acoustics.</li> <li>c. Elucidate the various terms and factors involved in the evaluation of environmental and occupational noise.</li> <li>d. Understand the noise assessment methodology which correlate with human perception in the context of legal requirements and comply with local noise regulations.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>      | <p><b><i>Fundamentals of Noise</i></b> - Sound Pressure Levels and Sound Power Levels; <math>L_{eq}</math> and Sound Exposure Level of Noise Events; Prediction and Measurement of a Simple Noise Source; Directivity effects.</p> <p>Basic Concepts of Sound Propagation Outdoors: Refraction, Scattering, Diffraction, and Absorption of Sound in Air; Attenuation of Sound over Ground; Noise Reduction by Barriers.</p> <p>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 ingress and emission from buildings.</p> <p><b><i>Transportation Noise</i></b> - 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.</p> <p><b><i>Noise Assessment</i></b> - 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.</p> |

|   | <p><b>Laboratory Experiment</b><br/> There are two 2-hour laboratory sessions.<br/> Typical Experiments:<br/> 1. Outdoor traffic noise measurement<br/> 2. Classroom reverberation time measurement</p>  |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|---|--|--|---|---|---|-----------------------------------|-------------|--|--|--|---|---|---|---|---------|---------------|-----|---|---|----------|---|-------------|-----|---|--------------------|---|--|---------------|-----|------------|---|---|---|-------------------|-----|--|--|---|---|----------------|-----|---|---|---|---|-------|------|--|--|--|--|
| <p><b>Teaching/Learning Methodology</b></p>                                   | <p>Lectures are aimed at providing students with the knowledge of environmental noise and transportation noise for achieving the subject outcomes. (Outcomes a, b, c and d)</p> <p>Tutorials are aimed at enhancing students' skills necessary for analyzing noise assessment method and legal requirement in Hong Kong. (Outcomes a, b, c and d)</p> <p>Experiments, Project/Case Study are conducted to improve students' ability to apply their knowledge to implement real engineering systems. (Outcomes b, c and d)</p> <table border="1" data-bbox="456 678 1453 992"> <thead> <tr> <th rowspan="2">Teaching/Learning Methodology</th> <th colspan="4">Outcomes</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>Lecture</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Tutorial</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Project/Case Study</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>Experiment</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> </tbody> </table>  |  |   |   |   | Teaching/Learning Methodology     | Outcomes    |  |  |  | a | b | c | d | Lecture | √             | √   | √ | √ | Tutorial | √ | √           | √   | √ | Project/Case Study |   |  | √             | √   | Experiment |   | √ | √ | √                 |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Teaching/Learning Methodology   | Outcomes   |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|   | a  | b  | c | d |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Lecture   | √  | √  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Tutorial  | √  | √  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Project/Case Study  |  |  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Experiment  |  | √  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| <p><b>Assessment Methods in Alignment with Intended Learning Outcomes</b></p> | <table border="1" data-bbox="456 1070 1453 1512"> <thead> <tr> <th rowspan="2">Specific assessment methods/tasks</th> <th rowspan="2">% weighting</th> <th colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Class test</td> <td>20%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>2. Homework</td> <td>10%</td> <td>√</td> <td>√</td> <td>√</td> <td></td> </tr> <tr> <td>3. Lab report</td> <td>10%</td> <td></td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>4. Project report</td> <td>10%</td> <td></td> <td></td> <td>√</td> <td>√</td> </tr> <tr> <td>5. Examination</td> <td>50%</td> <td>√</td> <td>√</td> <td>√</td> <td>√</td> </tr> <tr> <td>Total</td> <td>100%</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</p> <p>Overall Assessment:<br/> <math>0.50 \times \text{End of Subject Examination} + 0.50 \times \text{Continuous Assessment}</math></p> <p>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.</p> |  |   |   |   | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed (Please tick as appropriate) |  |  |   | a | b | c | d       | 1. Class test | 20% | √ | √ | √        |   | 2. Homework | 10% | √ | √                  | √ |  | 3. Lab report | 10% |            | √ | √ | √ | 4. Project report | 10% |  |  | √ | √ | 5. Examination | 50% | √ | √ | √ | √ | Total | 100% |  |  |  |  |
| Specific assessment methods/tasks   | % weighting  | Intended subject learning outcomes to be assessed (Please tick as appropriate) |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
|   |  | a  | b | c | d |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 1. Class test   | 20%  | √  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 2. Homework   | 10%  | √  | √ | √ |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 3. Lab report   | 10%  |  | √ | √ | √ |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 4. Project report   | 10%  |  |   | √ | √ |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| 5. Examination  | 50%  | √  | √ | √ | √ |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |
| Total   | 100%   |  |   |   |   |                                   |             |  |  |  |   |   |   |   |         |               |     |   |   |          |   |             |     |   |                    |   |  |               |     |            |   |   |   |                   |     |  |  |   |   |                |     |   |   |   |   |       |      |  |  |  |  |

|                                      |   |         |
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| <b>Student Study Effort Expected</b> | Class contact:  |         |
|                                      | ▪ Lecture   | 33 Hrs. |
|                                      | ▪ Tutorial/Laboratory   | 6 Hrs.  |
|                                      | Other student study effort:   |         |
|                                      | ▪ Reading and review  | 40 Hrs. |
|                                      | ▪ Homework assignment   | 15 Hrs. |
|                                      | ▪ Laboratory report/ Project Report   | 22 Hrs. |
| Total student study effort           | 116 Hrs.  |         |
| <b>Reading List and References</b>   | <ol style="list-style-type: none"> <li>1. M.J. Crocker, (Ed.), Handbook of Acoustics, John Wiley &amp; Sons, latest edition.</li> <li>2. P.M. Nelson, (Ed.), Transportation Noise Reference Book, Butterworths, latest edition.</li> <li>3. The Open University Press, Unit 11-13, T234 Environmental Control and Public Health, The Open University, latest edition.</li> <li>4. The Open University Press, Noise Block, T334 Environmental Monitoring and Control, The Open University, latest edition.</li> <li>5. Engineering noise control: theory and practice, Spon Press/Taylor &amp; Francis, latest edition.</li> <li>6. Calculation of road traffic noise, Harlow, England: Addison Wesley Longman, latest edition.</li> <li>7. <a href="http://www.epd.gov.hk/epd/noise_education/web/ENG_EPD_HTML/m3/ordinance_7.html">http://www.epd.gov.hk/epd/noise_education/web/ENG_EPD_HTML/m3/ordinance_7.html</a></li> </ol> |         |

*Revised July 2014*

# **Training Subjects**





## Subject Description Form

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| <b>Subject Code</b>                                   | IC2105   |
| <b>Subject Title</b>                                  | Engineering Communication and Fundamentals   |
| <b>Credit Value</b>                                   | 4 Training Credits   |
| <b>Level</b>  | 2  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b> | Nil  |
| <b>Objectives</b>                                     | <p>This subject offers a wide spectrum of fundamental engineering practice that are essential for a professional engineer. This subject includes Engineering Drawing and CAD, Industrial Safety and Electronic Product Safety Test and Practice, Basic Mechatronic Practice and Basic Scientific Computing with MATLAB that aims at providing fundamental and necessary technical skills to all year 1 students interested in engineering.</p>   |
| <b>Intended Learning Outcomes</b>                     | <p>Upon completion of the subject, students will be able to:</p> <ul style="list-style-type: none"><li>a) Describe the principles and conventional representation of engineering drawings according to engineering standards and be able to use it as a medium in technical communication and documentation with CAD application, modelling and practice with application in mechanical, industrial systems and electrical engineering;</li><li>b) Interpret basic occupational health and industrial safety requirements for engineering practice;</li><li>c) Explain common electronic product safety tests;</li><li>d) Design and implement simple mechatronic systems with programmable controller, software, actuation devices, sensing devices and mechanism; and</li><li>e) Apply scientific computing software for computing in science and engineering including visualization and programming;</li></ul> |

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| <p><b>Subject Synopsis/<br/>Indicative Syllabus</b></p> | <p><b>Syllabus:</b></p> <ol style="list-style-type: none"> <li>1. <u>(TM8059) Engineering Drawing and CAD</u> <ol style="list-style-type: none"> <li>1.1. Fundamentals of Engineering Drawing and CAD<br/>Principles of orthographic projection; sectioning; dimensioning; sketching; general tolerances; conventional representation of screw threads and fasteners; types of drawings including part drawing and assembly drawing.<br/><br/>Introduction to CAD; features of 2D CAD system (layer; draw; modify; block &amp; attributes; standard library); techniques for the creation of titleblock; setup of 2D plotting; general concepts on 3D computer modeling; parametric feature based solid modeling; construction and detailing of solid features; solid model modification and its limitations; concepts of assembly modeling including bottom up and top down approaches for the generation of parts, subassemblies, and final assembly; virtual validation and simulation, generation of 2D drawings from 3D parts and assemblies; drawing annotation including dimensioning, tolerancing, and part list.</li> <li>1.2. Electrical Drawing<br/>Wiring diagram and wiring table for electronic and electrical installation, functional representation of circuit, system block diagram, electrical and electronic device symbols and layout, architectural wiring diagram with reference to the architectural symbols for electrical drawings in Hong Kong and international standards.</li> </ol> </li> <li>2. <u>(TM2009) Industrial Safety</u> <ol style="list-style-type: none"> <li>2.1. Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures.</li> <li>2.2. Safety Law: F&amp;IU Ordinance and principal regulations, OSH Ordinance and principal regulations.</li> <li>2.3. Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling.</li> <li>2.4. Safety Technology: Mechanical lifting, fire prevention, dangerous substances and chemical safety, machinery hazards and guarding, electrical safety, first aid, job safety analysis, fault tree analysis, personal protective equipment.</li> </ol> </li> <li>3. <u>(TM1116) Electronic Product Safety Test and Practice</u> <ol style="list-style-type: none"> <li>3.1 Use of basic electronic test instruments, current and voltage measurements, waveform measurement, power supply and signal</li> </ol> </li> </ol> |
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|                                    |  |
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|                                    | <p>sources;</p> <p>3.2 Electronic product safety test method; High Voltage Isolation Test, Insulation Resistance Test, Continuity Test, Leakage Current Measurement, Electrostatic Discharge (ESD) Test.</p> <p>4. <u>(TM0510) Basic Mechatronic Practice</u></p> <p>4.1. Definitions of mechatronics; design and operation of typical mechatronic systems; appreciation of measurement system, actuator system, motor drives, mechanical drives, gear train and linkage, pneumatic and hydraulic systems, signal conditioning, and human-machine interfaces.</p> <p>4.2. Integration of system components using appropriate controller hardware and software such as PLC, PAC, and Microcontroller system; use of simulation software packages for pneumatic and hydraulic circuit design.</p> <p>5. <u>(TM3014) Basic Scientific Computing with MATLAB</u></p> <p>5.1. Overview to scientific computing; introduction to MATLAB; interactive calculations, random number generators, variables, vectors, matrices and string; mathematical operations, polynomial operation, data analysis and curve fitting, file I/O functions. Basic 2D and 3D plots.</p> <p>5.2. M-file programming &amp; debugging; scripts, functions, logic operations, flow control, introduction to graphical user interface.</p> |
| <p><b>Learning Methodology</b></p> | <p>The teaching and learning methods include lectures, workshop tutorials, and practical works. The lectures are aimed at providing students with an overall and concrete background knowledge required for understanding key issues in engineering communication, use of standard engineering components and systems, and importance of industrial safety. The workshop tutorials are aimed at enhancing students' in-depth knowledge and ability in applying the knowledge and skills to complete specific tasks. The practical works aim at facilitating students to review the diverse topics covered in this course and perform active learning with research, practice, questioning, and problem solving in a unified activity.</p>  |

| Assessment Methods in Alignment with Intended Learning Outcomes | Assessment Methods   | Weighting (%) | Intended Learning Outcomes Assessed |         |         |        |   |
|---|--|---------------|-------------------------------------|---------|---------|--------|---|
|   |  |               | a                                   | b       | c       | d      | e |
|   | Continuous Assessment  |               |                                     |         |         |        |   |
| 1. Assignment / Project   | Refer to individual Module Description Form  | ✓             | ✓                                   | ✓       | ✓       | ✓      |   |
| 2. Test   |  |               | ✓                                   |         | ✓       | ✓      |   |
| 3. Report / Logbook   |  |               |                                     | ✓       | ✓       |        |   |
| Total   | 100  |               |                                     |         |         |        |   |
| Assessment Methods  | Remarks  |               |                                     |         |         |        |   |
| 1. Assignment / Project   | The project is designed to facilitate students to reflect and apply the knowledge periodically throughout the training.                                |               |                                     |         |         |        |   |
| 2. Test   | Test is designed to facilitate students to review the breadth and depth of their understanding on specific topics.                                     |               |                                     |         |         |        |   |
| 3. Report / Logbook   | Report / Logbook is designed to facilitate students to acquire deep understanding on the topics of the training and to present those concepts clearly. |               |                                     |         |         |        |   |
| Student Study Effort Expected                                   | Class Contact  | TM8059        | TM2009                              | TM1116  | TM0510  | TM3014 |   |
| ▪ Mini-lecture  | 11 Hrs.  | 7 Hrs.        | 2 Hrs.                              | 6 Hrs.  | 6 Hrs.  |        |   |
| ▪ In-class Assignment/ Hands-on Practice                        | 40 Hrs.  | 8 Hrs.        | 4 Hrs.                              | 21 Hrs. | 15 Hrs. |        |   |
| Other Study Effort  |  |               |                                     |         |         |        |   |
| ▪ Nil   |  |               |                                     |         |         |        |   |
| <b>Total Study Effort</b>                                       | <b>120 Hrs.</b>  |               |                                     |         |         |        |   |

|   |  |
|---|--|
| <p><b>Reading List and References</b></p> | <p><b>Reference Software List:</b></p> <ol style="list-style-type: none"> <li>1. AutoCAD from Autodesk Inc.</li> <li>2. SolidWorks from Dassault Systèmes Solidworks Corp.</li> <li>3. MATLAB from The Mathworks Inc.</li> </ol> <p><b>Reference Standards and Handbooks:</b></p> <ol style="list-style-type: none"> <li>1. BS8888 Technical Product Specification (TPS) Specification.</li> <li>2. Cecil H. Jensen, et al, Engineering Drawing and Design, McGraw-Hill, 2008.</li> <li>3. Warrendale, SAE fastener standards manual, Society of Automotive Engineers, 1997.</li> <li>4. Timothy H Wentzell, et al, Machine Design, Delmar Learning, 2004.</li> <li>5. Czernik, Daniel, Gaskets: Design, Selection, and Testing, McGraw-Hill, 1995.</li> <li>6. Michael M. Khonsari, E. Richard Booser, Applied Tribology: Bearing Design and Lubrication, Wiley-Interscience, 2001.</li> <li>7. IEEE Standard 315 / ANSI Y32.2 / CSA Z99 Graphic Symbols for Electrical and Electronics Diagrams.</li> <li>8. IEC 61082 Preparation of Documents used in Electrotechnology.</li> </ol> <p><b>Reference Books:</b></p> <p>Training material, manual and articles published by Industrial Centre.</p> |
|---|--|

## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>                              | IC348  |
| <b>Subject Title</b>                             | Appreciation of Manufacturing Processes  |
| <b>Credit Value</b>                              | 3 Training Credits   |
| <b>Level</b>                                     | 3  |
| <b>Pre-requisite</b>                             | IC2105   |
| <b>Objectives</b>                                | <p>This subject aims at developing students' understanding on:</p> <ul style="list-style-type: none"> <li>• the principles and operations of common manufacturing processes, and</li> <li>• the properties and application of different materials.</li> </ul>  |
| <b>Intended Learning Outcomes</b>                | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a) demonstrate a holistic understanding on the working principle, capability and operation of common manufacturing processes.</li> <li>b) justify appropriate manufacturing processes for specific product requirements.</li> <li>c) select and use various common engineering materials for specific purpose. and</li> <li>d) collaboratively complete an application oriented project through group work and discussions / and discuss current industrial practices and technologies.</li> </ol>   |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b> | <p><b>Outline Syllabus:</b></p> <ol style="list-style-type: none"> <li>1) Properties and uses of common materials including ferrous metal, non-ferrous metals, and polymers.</li> <li>2) Working principles and operation of metal removal processes including turning, milling, CNC machining, and electro-discharge machining.</li> <li>3) Working principles and operation of common production processes including casting methods for metal parts, and plastic injection moulding.</li> <li>4) Working principles and operation of arc welding and gas welding.</li> <li>5) Working principles and operation of common sheet metal parts manufacturing processes including blanking, forming, and turret pressing.</li> <li>6) Working principles, operation, and comparison of surface-finish processes including electro-plating, and aluminium anodising.</li> </ol> |

|  | 7) Application of dimensional and geometrical measuring tools.  |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
|--|---|----------------------|---------------|--|---------|---------------------------|--------|---------------------------|----------------|---|---|---------------------------|----|---|---|---|--|---------------------|----|--|--|--|---|----------------------|----|---|---|---|---|-------|-----|--|--|--|--|
| <b>Learning Methodology</b>  | <p>Min-lectures aim at providing students an understanding of the principles and application of common manufacturing technologies, properties and selection of common engineering materials.</p> <p>Hands-on activities will be used for students to appreciate the working principles, capability and operation procedures of common manufacturing processes.</p> <p>Group product assembly will be used to enable students to apply acquired practical knowledge and skills to produce a functional product, and to facilitate students in performing group collaboration and problem solving skills learning.</p>  |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | <table border="1"> <thead> <tr> <th rowspan="2">Assessment Methods</th> <th rowspan="2">Weighting (%)</th> <th colspan="4">Intended Learning Outcomes Assessed</th> </tr> <tr> <th>a</th> <th>b</th> <th>c</th> <th>d</th> </tr> </thead> <tbody> <tr> <td>1. Individual Assignments</td> <td>60</td> <td>✓</td> <td>✓</td> <td>✓</td> <td></td> </tr> <tr> <td>2. Product Assembly</td> <td>10</td> <td></td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>3. Individual Report</td> <td>30</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>Total</td> <td>100</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>The Individual Assignments are aimed at assessing student's practical ability in using various processes to produce the components for the product.</p> <p>The Product Assembly is aimed at assessing student's group collaboration, organization, time management and problem solving capability.</p> <p>The individual Report is aimed at assessing student's appreciation, understanding, and application of all the processes involved in the product.</p> | Assessment Methods   | Weighting (%) | Intended Learning Outcomes Assessed                              |         |                           |        | a                         | b              | c | d | 1. Individual Assignments | 60 | ✓ | ✓ | ✓ |  | 2. Product Assembly | 10 |  |  |  | ✓ | 3. Individual Report | 30 | ✓ | ✓ | ✓ | ✓ | Total | 100 |  |  |  |  |
| Assessment Methods   | Weighting (%)   |                      |               | Intended Learning Outcomes Assessed                              |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
|  |   | a                    | b             | c  | d       |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| 1. Individual Assignments  | 60  | ✓                    | ✓             | ✓  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| 2. Product Assembly  | 10  |                      |               |  | ✓       |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| 3. Individual Report   | 30  | ✓                    | ✓             | ✓  | ✓       |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| Total  | 100   |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| <b>Student Study Effort Required</b>                                   | <table border="1"> <tr> <td colspan="2"><b>Class Contact</b></td> </tr> <tr> <td>Min-lecture /Hands-on Practice/ Product Assembly /Report Writing</td> <td>90 Hrs.</td> </tr> <tr> <td><b>Other Study Effort</b></td> <td>0 Hrs.</td> </tr> <tr> <td><b>Total Study Effort</b></td> <td><b>90 Hrs.</b></td> </tr> </table>  | <b>Class Contact</b> |               | Min-lecture /Hands-on Practice/ Product Assembly /Report Writing | 90 Hrs. | <b>Other Study Effort</b> | 0 Hrs. | <b>Total Study Effort</b> | <b>90 Hrs.</b> |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| <b>Class Contact</b>   |   |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| Min-lecture /Hands-on Practice/ Product Assembly /Report Writing       | 90 Hrs.   |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| <b>Other Study Effort</b>  | 0 Hrs.  |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |
| <b>Total Study Effort</b>  | <b>90 Hrs.</b>  |                      |               |  |         |                           |        |                           |                |   |   |                           |    |   |   |   |  |                     |    |  |  |  |   |                      |    |   |   |   |   |       |     |  |  |  |  |

**Reading List and References**

Reading Materials published by the Industrial Centre :

1. Marking Out, Measurement, Fitting & Assembly
2. Metal Cutting Processes 1-Turning
3. Metal Cutting Processes 2 - Milling
4. Computer Numerical Control (CNC)
5. Foundry Processing
6. Plastics Technology Practice
7. Sheet Metal Fabrication
8. Welding Practice
9. Photo-Chemical Machining (PCM)
10. Surface Finishing



## Subject Description Form

|  |  |
|--|--|
| <b>Subject Code</b>  | IC382  |
| <b>Subject Title</b>   | Multidisciplinary Manufacturing Project  |
| <b>Credit Value</b>  | 3 Training Credits   |
| <b>Level</b>   | 3  |
| <b>Pre-requisite</b>   | IC348 or IC2114 or IC381   |
| <b>Objectives</b>  | <p>The subject provides opportunity for students to work in a multidisciplinary project team to accomplish realistic engineering goals. Through the project, students will apply and integrate the engineering knowledge and practical skills acquired from prior engineering subjects and industrial trainings.</p> <p>Students will also be able to analyse engineering problems from multiple perspectives, and synthesize a solution from ideas contributed by teammates of multiple disciplines.</p>  |
| <b>Intended Learning Outcomes</b>  | <p>Upon completion of the subject, students will be able to:</p> <ol style="list-style-type: none"> <li>a) apply engineering knowledge in carrying out an industrial project starting from problem definition, design, manufacturing, down to assembly, testing and evaluation;</li> <li>b) select and use appropriate technology building blocks, components and manufacturing processes to develop a solution to meet given specifications and constraints;</li> <li>c) Work collaboratively and effectively in a multidisciplinary team to accomplish mutual project goals; and</li> <li>d) Communicate effectively in a multidisciplinary project team.</li> </ol> |
| <b>Contribution of the Subject to the Attainment of Outcomes of EIE Programmes</b> | <p><u>Category A: Professional/academic knowledge and skills</u></p> <ul style="list-style-type: none"> <li>• Design systems, components and processes to meet given specifications and constraints.</li> <li>• Use modern engineering/IT tools appropriate to EIE practice.</li> </ul> <p><u>Category B: Attributes for all-roundedness</u></p> <ul style="list-style-type: none"> <li>• Work with others collaboratively in a multi-disciplinary team and have a knowledge of leadership</li> </ul>  |
| <b>Subject Synopsis/ Indicative Syllabus</b>                                       | <p>Students will be divided into groups to design and manufacture an engineering product that satisfy an existing demand in IC or a certain customer from the industry. Throughout the project, students will encounter situations that reinforce the following skills:</p> <ol style="list-style-type: none"> <li>1) <b>Project specification:</b> Identification of client needs and wants; Identification of resource constraints such as time, manpower, equipment, budget; Formulation of project plan.</li> <li>2) <b>Engineering design:</b> Selection of design methodology; collaborative</li> </ol>  |

|                                    |  |
|------------------------------------|--|
|                                    | <p>design; Make-or-buy decisions; Design prototyping; Testing and simulation.</p> <p>3) <b>Product manufacturing:</b> Material procurement; Component machining; PCB fabrication; Programming; Assembly and fine-tuning.</p> <p>4) <b>Project collaboration:</b> Determination of project stages and milestones; CAD and PDM; Leadership and Collaborative decision making; Tolerances and fits; Project documentations.</p>   |
| <p><b>Learning Methodology</b></p> | <p>Students will be divided into groups of 5-8 to design and manufacture an engineering product. Each project group will be formed by students from two or more engineering streams.</p> <p>The project topics will be provided by the subject supervisor team. Topics will be either initiated by supervisors or by commercial clients. All topics shall demand two or more skillsets including Mechanics, Electronics, and IT. Typical topics include: automated production equipment, mobility products, robotic toys, airframe structures, cabin installations, aircraft maintenance tools, jigs and gauges, <i>etc.</i></p> <p>The subject is divided into two stages:</p> <ul style="list-style-type: none"> <li>• Design Stage <p>During this period, the project team, under the guidance of the supervisors and clients, have to discover, understand and analyze the requirement of the project; and apply their knowledge to design a solution. Furthermore, students are required to search and track down parts and components with suppliers to obtain materials for the following manufacturing stage.</p> </li> <li>• Manufacturing stage <p>During this period, the project team will fabricate, test, and debug the product they designed. The supervisors will guide and monitor the groups on personal commitment, cooperation and coordination among team members.</p> </li> </ul> <p>Regular group tutorials in the form of student-centred project meeting will be arranged between project group and respective supervisors.</p> |

| Assessment Methods in Alignment with Intended Learning Outcomes | Assessment Methods   | Weighting (%) | Intended Learning Outcomes Assessed |   |         |   |
|---|--|---------------|-------------------------------------|---|---------|---|
|   |  |               | a                                   | b | c       | d |
|   | 1. Quality of final product  | 30            | ✓                                   | ✓ |         |   |
|   | 2. Report  | 20            | ✓                                   | ✓ | ✓       | ✓ |
|   | 3. Presentation and demonstration  | 20            |                                     |   | ✓       | ✓ |
|   | 4. Reflective Journal  | 30            | ✓                                   | ✓ | ✓       | ✓ |
|   | Total  | 100           |                                     |   |         |   |
|   | <p><b><u>Group assessment components</u></b></p> <p>Quality of final product will be assessed by the supervisor team during demonstration. The assessment is to determine how well the group's solution meets with client's requirement in terms of completeness and functionality. The assessment also determines how well the group has carried out the manufacturing in terms of accuracy and craftsmanship. This addresses the intended learning outcomes (a) &amp; (b).</p> <p>Report submitted at the end of project will be summative evidence of how well the group applied knowledge and made decisions collectively. Compulsory report chapters include: Technical description of final design; Justification of technology building blocks used; Critical review on project execution; and Record of internal communications. This addresses the intended learning outcomes (a), (b), (c) &amp; (d).</p> <p><b><u>Individual assessment components</u></b></p> <p>Oral presentation and demonstration in an exhibition booth setting allow individual members to demonstrate their ability in presenting engineering contents clearly and logically. Through Q&amp;A session supervisors can also determine the effectiveness of individual members' effort toward the final product outcomes. This addresses the intended learning outcomes (c) &amp; (d).</p> <p>Individual reflective journal serves as summative evidence of how well the student has functioned in the group and embrace the multidisciplinary collaboration concept. Compulsory journal contents include: Technical description of design and manufacturing tasks performed; Critical review of technical ideas proposed and adapted; Critical review on personal performance in the project execution and the collaboration experience. This addresses the intended learning outcomes (a), (b), (c) &amp; (d).</p> |               |                                     |   |         |   |
| Student Study Effort Required                                   | <b>Class Contact</b>   |               |                                     |   |         |   |
|   | ▪ Project works  |               |                                     |   | 78 Hrs. |   |
|   | ▪ Tutorial   |               |                                     |   | 12 Hrs. |   |

|                                    |  |                |
|------------------------------------|--|----------------|
|                                    | <b>Other Study Effort</b>  | <b>0 Hrs.</b>  |
|                                    | <b>Total Study Effort</b>  | <b>90 Hrs.</b> |
| <b>Reading List and References</b> | <ol style="list-style-type: none"> <li>1. <u>E. Tebeaux and S. Dragga, 'Chapter.9 Proposals and Progress Reports', in <i>The Essentials of Technical Communication</i>, 3rd ed., New York: Oxford, 2012</u></li> <li>2. <u>J. Abarca et al, 'Teamwork and Working in Teams', in <i>Introductory Engineering Design: A Projects-Based Approach</i>, 3rd ed., University of Colorado at Boulder, 2000.</u></li> <li>3. <u>J. Tropman, <i>Effective meetings</i>. Thousand Oaks, Calif.: Sage Publications, 3<sup>rd</sup> ED. 2014.</u></li> <li>4. <u>P. Harpum, 'Design Management', in <i>Engineering Project Management</i>, 3rd ed., N. Smith, Ed. Oxford: Blackwell, 2008, pp. 234-254.</u></li> </ol> |                |

## Subject Description Form

|  |   |             |  |  |
|--|---|-------------|--|--|
| <b>Subject Code</b>  | ME29001   |             |  |  |
| <b>Subject Title</b>   | Continuous Professional Development   |             |  |  |
| <b>Credit Value</b>  | Non-credit bearing  |             |  |  |
| <b>Level</b>   | 2   |             |  |  |
| <b>Pre-requisite/<br/>Co-requisite/<br/>Exclusion</b>                  | Nil   |             |  |  |
| <b>Objectives</b>  | To encourage students' participation in industrial visits organized by the Department. This will help students to relate what they learn in class to the real world situation and nurture their interest in Mechanical Engineering. |             |  |  |
| <b>Intended Learning Outcomes</b>                                      | Upon completion of the subject, students will be able to:<br>a. Appreciate and understand the roles of different sectors of our community including government, industry and utility in engineering discipline.                     |             |  |  |
| <b>Subject Synopsis/<br/>Indicative Syllabus</b>                       | Not applicable.   |             |  |  |
| <b>Teaching/Learning Methodology</b>                                   | Students are required to attend a minimum of 4 industrial visits (2 for senior year students). The industrial visits enable students to learn how mechanical engineering knowledge is put into practice.                            |             |  |  |
|  | Teaching/Learning Methodology   | Outcome     |  |  |
|  |   | a           |  |  |
|  | Industrial Visit  | √           |  |  |
| <b>Assessment Methods in Alignment with Intended Learning Outcomes</b> | Specific assessment methods/tasks   | % weighting | Intended subject learning outcome to be assessed |  |
|  |   |             | a  |  |
|  | 1. Attendance of industrial visit   | 100%        | √  |  |
|  | Total   | 100%        |  |  |
|  | The subject is neither credit-bearing nor graded. The students will be awarded a "Pass" grade if they meet the minimum attendance requirement.  |             |  |  |
| <b>Student Study Effort Expected</b>                                   | Class contact:  |             |  |  |
|  | ▪ Attendance of industrial visits   |             | 16 Hrs.  |  |
|  | Total student study effort  |             | 16 Hrs.  |  |
| <b>Reading List and References</b>                                     | Not applicable  |             |  |  |

Revised July 2016

