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2014/2015 Bachelor of Engineering (Honours) in Electrical Engineering (41480)

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Bachelor of Engineering (Honours) in Electrical Engineering

Part-time

Programme Code : 41480

2014/2015

DEFINITIVE PROGRAMME DOCUMENT

Department of
Electrical Engineering
電機工程學系

BEng (Hons) in Electrical Engineering
2014 – 2015


Department of
Electrical Engineering
電機工程學系

Self-financed Part-time Bachelor of Engineering (Honours) in Electrical Engineering 2014-15

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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."

1 Preamble

1.1 A Brief History

The Department of Electrical Engineering launched its Part-time Bachelor of Engineering (Hons) in Electrical Engineering (PT-BEng (Hons) in EE) in 1992/93, modelled on the Full-time Bachelor programme. The PT-BEng (Hons) in EE was introduced as a 3-year programme with an intake comprising mainly graduates of the 2-year Higher Diploma Programme from the Polytechnic University. In view of the general recommendation from the Engineering Council conveyed to the University, the PT-BEng (Hons) in EE was subsequently converted into a 4-year programme, with Higher Certificate (HC) as the minimum entrance qualification, in 1993/94. Due to the increasing demand, the self-financed Part-time Degree programme (SF PT-BEng (Hons)) in EE was introduced in 2004/05. This SF PT-BEng (Hons) in EE has exactly the same curriculum and level as the UGC funded PT-BEng (Hons) in EE except the funding model. In 2005 all programmes offered by the University underwent a major revision with the introduction of outcome-based curriculum and criterion-referenced assessment. The total number of credits was changed from 72 to 66 in order to give a study effective programme. In 2007, a minor revision of the curriculum was made and the number of credits was reverted to 72. In 2008, the curriculum was fine-tuned to align with the revised programme outcomes. The programme and subject outcomes will be assessed in stages according to a Learning Outcomes Assessment Plan (LOAP) adopted by the Departmental Learning and Teaching Committee. In 2009, minor changes in the curriculum were made and new General Assessment Regulations of the University were adopted. In 2014, a major revision was made due to the change in education system of Hong Kong to 3-3-4 curriculum and change in General University Requirements in the University. The nominal credits required for graduation is 61.

1.2 Credit-Based Curriculum

The part-time programme is designed to produce electrical engineering graduates at the same academic standard, quality and classification levels as the full-time programme.

Same as its full-time counterpart, the programme is a credit-based structure, which enables students to determine their own pace of studies which are very much in line with modern educational philosophy. Students will be able to make up a specific programme to suit their personal aspirations within the framework of the PT-BEng (Hons) curriculum. To allow flexibility, there is no ‘year’ concept in a credit-based system and the subjects are offered at distinct levels. The subjects in Level 2 must be taken by all students. Electives are available in Levels 3 and 4. However, students must take a compulsory set of subjects which are designed to give vertical integration in electrical engineering studies. Elective subjects in Level 4 address the career aspirations of graduates and advances in technology.

The subjects are listed in Table 4.3.1 to 4.3.4, and a typical student progress pattern is illustrated in Table 4.4.1 to 4.4.4.

2 Aims and Rationale

2.1 Programme Philosophy

The programme aims to fulfil the needs of the majority of graduates who will look for his/her career path in Hong Kong industry engaged in operation, development, design, manufacture, marketing, maintenance, building services and management. Therefore, considerable thought and effort has been given to determine what industry expects of degree graduates. The programme also aims to address the development of the next generation of academic research workers, but this goal is of secondary importance.

Modern engineers are often required to undertake different activities and may face promotion or placement in the course of their career development. The programme thus aims to prepare graduates for their entire working life rather than only for their first jobs. Emphasis is therefore placed on the understanding of fundamental concepts which will always be applicable and valid. However, the teaching of particular techniques which have a shorter duration of applicability cannot be neglected either. Applications will change rapidly as technology develops but the underlying theories remain invariant. It is therefore important not to emphasise training at the expense of education.

It is our perception that industrial employers want engineers to have a broad-based education, but at the same time to have adequate specialist knowledge to undertake detailed technical work in design and production. Therefore, the programme is designed to produce graduates who have not only developed a thorough understanding of electrical engineering, including interdisciplinary aspects, but who have also acquired a broad and general appreciation of engineering activity outside the confines of electrical engineering. The students are guided to learn the interfaces between specialist engineering areas and to be prepared to work in a multidisciplinary work environment which usually includes colleagues with other engineering backgrounds.

At the same time the students must become aware that ‘a good engineering solution’ is one which fulfils economic and financial criteria as well as the engineering design specification. This necessitates the study of economics and management with particular reference to engineering activities, as well as the interrelation between engineering activities and society as a whole.

Engineers must be able to express themselves clearly, both in verbal and written communications, therefore the Department has adopted a teaching approach which involves seminars, discussions, in-class feedback, assessed presentations, demonstrations of project work and formal laboratory reports in all programmes offered.

The Undergraduate Programme Committee also recognises that it is important to train and educate our students not only in cognitive ability in technical areas but also in life skills. Hence students are exposed to situations where they are assisted to learn:

(i) to develop their intellectual abilities (creative thinking, critical/independent judgement making, ability to analyse and synthesise, and to cope with real-life conditions such as indeterminacy, lack of information and time pressure); and

(ii) to develop their social abilities (personal and public relations, team work, handling of responsibility/authority, etc).

In this undergraduate programme, the knowledge required to bridge between that of the Higher Diploma / Associate Degree holders to that of the first half of the Full-time BEng (Hons) programme is covered in Level 2, the core knowledge areas are covered in Level 3 and specialisms are introduced in Level 4. All the deferrable subjects must however be completed before any student can graduate and students must *not* be under the illusion that deferrable subjects are unimportant. The credit-based structure described in this booklet has been discussed extensively at both the Departmental level and Programme Committee level, and both committees reckoned that the students will benefit from such a structure as the subject materials could be disseminated better and in greater depth.

2.2 Programme Objectives

(i) To produce students with a broad base of knowledge in the fundamentals of electrical engineering and its current applications.

(ii) To prepare students for working life including the skills needed for critical thinking, effective communication, problem solving, and lifelong learning.

(iii) To produce engineers with the understanding of their obligations to society.

2.3 Programme Outcomes

Programme outcomes refer to the intellectual abilities, knowledge, skills and attributes that a graduate from this programme should possess. To attain the aim of developing all-round students with professional competence, the programme outcome statements are encompassed in the following two categories of learning outcomes.

Category A: Professional/academic knowledge and skills
Upon successful completion of the programme, students will be able to:

A1 Apply fundamental principles of mathematics, science and engineering to identify, formulate and solve practical problems in the areas of electrical engineering and related disciplines.
A2 Design and conduct experiments with appropriate techniques and tools; and interpret and analyse the data.
A3 Design a system, component or process according to given specifications and requirements in the areas of electrical engineering and related disciplines.
A4 Identify constraints, other than technical considerations, which may influence engineering problems, systems or projects.
A5 Keep abreast of developments in electrical engineering and related disciplines and be aware of the need of lifelong learning.
A6 Appreciate and understand the ethical, managerial and social responsibilities of a professional engineer.

Category B: Attributes for All-roundedness
Upon successful completion of the programme, students will be able to:

B1 Communicate effectively via graphic, numeric, verbal and written media with proficiency in both English and Chinese.
B2 Reason critically and develop alternative views or solutions.
B3 Work in multi-disciplinary teams with professional interpersonal skills.

The Programme Outcomes are in line with the Programme objectives and the mapping is shown in Table 2.3.1.

		Programme Objectives		
		(i)	(ii)	(iii)
Programme Outcomes	A1	√		
	A2	√		
	A3	√		
	A4	√	√	
	A5		√	
	A6		√	√
	B1	√		
	B2	√		
	B3		√	√

Table 2.3.1 Mapping between Programme Objectives and Programme Outcomes

The Subject Learning Outcomes are designed to be in alignment with the Programme Outcomes. The Subject Learning Outcomes are given in each subject and they can be found in the Subject Description Form (SDF) in Appendix I.

The programme and subject outcomes will be assessed in stages according to a Learning Outcomes Assessment Plan (LOAP) adopted by the Departmental Learning and Teaching Committee.

Relationship between Institutional Learning Outcomes and Intended Learning Outcomes (ILO) of the programme is shown in Table 2.3.2.

		Institutional Learning Outcomes					
		Professional Competence	Critical Thinker	Effective Communicator	Innovative Problem Solver	Lifelong Learner	Ethical Leader
Programme Outcomes	A1	√			√		
	A2	√	√				
	A3	√			√		
	A4	√	√				
	A5	√				√	
	A6	√					√
	B1			√			
	B2		√		√		
	B3	√		√			

Table 2 3.2 Relationship between Institutional Learning Outcomes and Intended Learning Outcomes (ILO) of the programme

3 General Information

3.1 Programme Title

Self-Financed Part-time Bachelor of Engineering (Honours) in Electrical Engineering

3.2 Duration and Mode of Attendance

Normally 4 years Part-time. The maximum period of registration is 8 years.

3.3 Final Award

Bachelor of Engineering (Honours) Degree in Electrical Engineering
電機工程學(榮譽)工學士學位

3.4 Implementation Dates

October 1992 (initial implementation for the three-year programme)
October 1993 (first major revision, changed to a four-year programme)
October 1995 (second major revision to convert the programme from modular to credit-based)
October 1997 (*phase in* alignment exercise to adjust the programme to conform to the PolyU norms)
October 2001 (minor revision to align with modifications in the full-time programme)
September 2004 (introduction of the self-financed funding model)
September 2005 (introduction of the re-vamped 66 credits curriculum)
September 2007 (introduction of the revised 72 credits curriculum)
September 2008 (revised outcome-based curriculum, inclusion of compulsory business and management subjects)
September 2009 (minor changes in curriculum; changes in General Assessment Regulations regarding retaking of subjects)
September 2013 (revised changes in program structure concerning GUR requirements)
September 2014 (major changes in curriculum, change in GUR requirements)

3.5 Minimum Entrance Requirements

A Higher Diploma in Electrical Engineering; OR

An Associate Degree in Engineering; OR

Equivalent qualification

3.6 Graduation Requirement

Minimum credit requirement for graduation: **61**

Students are required to successfully finish 9 credits subject to meet the Language and Communication Requirement (LCR), among which 6 credits (2 subjects) for English, and 3 credits (1 subject) for Chinese, in addition to the 61 credits required for graduation. Students would be considered for credit transfer based on their previous studies and their academic performance but subject to the approval from the Department. Students not meeting the

equivalent standard of the Undergraduate Degree LCR will be required to take the LCR subjects.

3.7 External Recognition

This part-time degree programme has evolved from the corresponding old version that has accredited by The Hong Kong Institution of Engineers (HKIE). Subject to the approval of the Accreditation Board, interim recognition will be granted to the program.

3.8 Summer Term Teaching

Usually, there will be no summer term teaching on engineering subjects.

3.9 Medium of instruction

English is the medium of instruction (the only exceptions are for a small number of programmes/subjects which have got special approval to be taught and examined in Chinese, due to the nature and objectives of the programmes/subjects concerned). Chinese could only be used in small group discussions/tutorials/practical sessions if and when necessary.

In the presence of non-Cantonese-speaking students, English should be used all the time.

4 Curriculum

4.1 University Graduation Requirements

All candidates qualifying for a Part-time Undergraduate Degree offered from 2014/15 onward must meet the University Graduation Requirements:

Summary of University Graduation Requirements

(i) Complete successfully a minimum of 60 credits[1];

(ii) Earn a cumulative GPA of 2.00 or above at graduation;

(iii) Satisfy the following General University Requirements (GUR) requirements:

(a) Language and Communication Requirements# # Not required if equivalent standard of Undergraduate Degree LCR is met	9 credits
(b) Service-Learning	3 credits
(c) Cluster Areas Requirement (CAR) (From different cluster areas)	6 credits
(d) China Studies Requirement	(3 of the 6 CAR credits)
	Total = 18 credits

(iv) Satisfy the residential requirement as stated in Section 20 above; and

(v) Satisfy any other requirements as specified in this Definite Programme Document.

4.2 General University Requirements (GUR)

(i) Language and Communication Requirements (LCR)

All students must successfully complete two 3-credit English language subjects and one 3-credit Chinese language as stipulated by the University.

However, students would be considered for credit transfer based on their academic performances of equivalent subjects as previous studied in AD/HD programmes. Students not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take the LCR subjects.

[1] This minimum only applies to students who are admitted through the normal route. Also, for passing a subject which is designed to fulfil the credit requirement of different types of subject, students will be regarded as having fulfilled the credit requirements of the particular types of subject concerned. Nevertheless, the subject itself will only be counted once in the student's total credit requirements, and the students will be required to make up the total credit requirement by taking another subject.

English

- Subject 1: English for University Studies (ELC1012/ELC1013), 3 credits
- Subject 2: Advanced English for University Studies (ELC1014), 3 credits

Chinese

- Fundamentals of Chinese Communication (CBS1101P), 3 credits

Students who are non-Chinese speakers (NCS), or whose Chinese standards are at junior secondary level or below, are also required to take one LCR-Chinese subject specially designed to suit their language background and entry standard (Table 4.2.1).

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

Table 4.2.1: Chinese LCR Subjects for non-Chinese speakers or students whose Chinese standards are at junior secondary level or below

Writing Requirement

In addition to the LCR in English and Chinese mentioned above, all students must also, among the Cluster Areas Requirement (CAR) subjects they take (see section (iii)), 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/

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

Note: In addition to the LCR in General University Requirements, students also have to complete 4 credits of Discipline-Specific Language Requirements (DSLR) (2 credits in English and 2 credits in Chinese) as specified in the curriculum requirements of their Major.

(ii) Service-Learning

All students must successfully complete one 3-credit subject designated to meet the service-learning requirement, in which they are required to (a) participate in substantial community service or civic engagement activities that will benefit the service users or the community at large in a meaningful way, (b) apply the knowledge and skills acquired from their Major or other learning experiences at the University to the community service activities, and (c) 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.

These subjects may take the form of:

- An open-to-all General University Requirements (GUR) service-learning subject
- A GUR service-learning subject targeted at a particular student group (e.g. a Broad Discipline), or
- A customised DSR subject (core or elective) with the Major (Minor with all the required features and components to meet the Service-Learning Requirement)

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

(iii) Cluster Areas Requirements (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 6-credit subjects selected from the four CAR areas as follows:

- Human Nature, Relations and Development (HRD)
- Community, Organisation and Globalisation (COG)
- History, Culture and World Views (HCW)
- Science, Technology and Environment (STE)

The students should not take more than 3 credits (1 subject) from the same cluster area. 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#_Cluster_Areas_Requirements

(iv) China Studies Requirement

Of the 6 credits of CAR described in section (iii) 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/

4.3 Curriculum for Various Levels

The time-tabled student hours for each subject and the type of activity (lecture [Lt], tutorial [Tu] and laboratory [Lab]) are given in the Tables 4.3.1 - 4.3.4. The abbreviations used in these tables are:

AF	Accounting and Finance
AP	Applied Physics
AMA	Applied Mathematics
APSS	Applied Social Sciences
BSE	Building Services Engineering
CBS	Chinese & Bilingual Studies
CEE	Civil and Environmental Engineering
EE	Electrical Engineering
ELC	English Language Centre
ENG	Engineering Faculty
IC	Industrial Centre
ISE	Industrial and Systems Engineering
MM	Management and Marketing

A normal student in the BEng (Hons) programme may complete 12, 15, 16 and 18 credits in Year 1, 2, 3 and 4, respectively, as shown in the indicative progression patterns in Tables 4.4.1 to 4.4.4. In other words, a student must complete a nominal number of at least 61 academic credits.

Subjects are referenced by a Departmental prefix (e.g. EE corresponds to Electrical Engineering) followed by a reference number. Each subject is also categorised as non-deferrable (Non-Def), deferrable (Def) or Elective. In the reference numbers, the first digit (i.e. 1, 2, 3 or 4) indicates the level of the subject.

'*Non-def*' are those subjects which form the backbone of the vertical integration must be taken by every student in the prescribed semester, unless prevented from doing so due to non-compliance with prerequisites.

'*Def*' are those subjects which must be satisfactorily completed before the student becomes eligible for an award but the timing of the subject is determined by the student.

'*Electives*' are those subjects which are optional. Electives give students choices in composing their study programme. All elective subjects are deferrable.

Tables in Section 4.4 show the times (semesters) in which these subjects are recommended to be taken if the programme are to be completed in the minimum time.

The Hong Kong Polytechnic University Part-Time BEng (Hons) in Electrical Engineering Level 1		Curriculum					Assessment Methods	
		Teaching Department	Contact Hours		Credits	GPA Weight (W_i)		
Subject Code	Subject Title		Lt/Tu	Lab			Continuous Assessment	Examination
	Non-Def Subjects							
ELC1012/13	English for University Studies	ELC	39	-	3	0.2	100%	-
ELC1014	Advanced English for University Studies	ELC	39	-	3	0.2	100%	-
CBS1101P	Fundamentals of Chinese Communication	CBS	tbc	-	3	0.2	tbc	-
	Def Subjects							
depending on the subjects taken	Cluster Areas Requirement (CAR) subjects (subjects taken must conform to the University's Cluster Area Requirements specified in Section 4.2)	Various departments			3	0.2	depending on the subjects taken	depending on the subjects taken

Table 4.3.1

The Hong Kong Polytechnic University Part-Time BEng (Hons) in Electrical Engineering Level 2		Curriculum					Assessment Methods	
		Teaching Department	Contact Hours		Credits	GPA Weight (W_i)		
Subject Code	Subject Title		Lt/Tu	Lab			Continuous Assessment	Examination
	Non-Def Subjects							
EE2001D	Applied Electromagnetics	EE	33	12	3	0.2	40%	60%
ENG2001	Fundamentals of Materials Science and Engineering	EE	39	--	3	0.2	40%	60%

Table 4.3.2

The Hong Kong Polytechnic University Part-Time BEng (Hons) in Electrical Engineering Level 3		Curriculum					Assessment Methods	
		Teaching Department	Contact Hours		Credits	GPA Weight (W_i)		
Subject Code	Subject Title		Lt/Tu	Lab			Continuous Assessment	Examination
	Non-Def Subjects							
AF3625	Engineering Economics	EE	39	-	3	0.3	50%	50%
EE3001D	Analogue And Digital Circuits	EE	39	6	3	0.3	40%	60%
EE3004D	Power Transmission and Distribution	EE	33	12	3	0.3	40%	60%
EE3005D	Systems and Control	EE	30	9	3	0.3	40%	60%
	Def Subjects							
EE3006D	Analysis Methods for Engineers	EE	36	6	3	0.3	40%	60%
EE3007D	Computer Systems Principles	EE	35	8	3	0.3	40%	60%
EE3008D	Liner Systems and Signal Processing	EE	39	6	3	0.3	40%	60%
ENG3003	Engineering Management	ENG	39	-	3	0.3	40%	60%
ENG3004	Society and the Engineer	ENG	39	-	3	0.3	60%	40%
CBS3241P	Professional Communication in Chinese	CBS	tbc	-	2	0.3	tbc	tbc
ELC3521	Professional Communication in English	ELC	26	-	2	0.3	100%	-

Table 4.3.3

The Hong Kong Polytechnic University Part-Time BEng (Hons) in Electrical Engineering Levels 4 and 5		Curriculum					Assessment Methods	
		Teaching Department	Contact Hours		Credits	GPA Weight (W_i)		
Subject Code	Subject Title		Lt/Tu	Lab			Continuous Assessment	Examination
	Non-Def Subjects							
EE4003D	Electrical Machines	EE	33	12	3	0.3	40%	60%
EE4004D	Power Systems	EE	36	6	3	0.3	40%	60%
	Def Subjects							
EE4006D	Individual Project	EE	-	-	9	0.3	100%	-
	Specialist Elective (Def Subjects)							
BSE463	Design of Mechanical Systems in Buildings	BSE	27	6	3	0.3	40%	60%
EE4002D	Digital Control and Signal Processing	EE	33	6	3	0.3	40%	60%
EE4007D	Advanced Power Electronics	EE	36	6	3	0.3	40%	60%
EE4008D	Applied Digital Control	EE	33	6	3	0.3	40%	60%
EE4009D	Electric Traction and Drives	EE	33	6	3	0.3	40%	60%
EE4010D	Fibre Optics	EE	36	6	3	0.3	40%	60%
EE4011D	Industrial Computer Applications	EE	36	6	3	0.3	40%	60%
EE4012D	Intelligent Buildings	EE	39	-	3	0.3	40%	60%
EE4013D	Power System Protection	EE	36	6	3	0.3	40%	60%
EE4014D	Intelligent Systems Applications in Electrical Engineering	EE	33	12[+]	3	0.3	40%	60%
	MSc Subjects (Def Subjects) *Students must seek prior approval for enrolling on Level 5 subjects.*							
EE501D	Alternative Energy Technologies	EE	39[#]	-	3	0.3	40%	60%
EE502D	Modern Protection Methods	EE	33	12	3	0.3	40%	60%
EE505D	Power System Control and Operation	EE	39	-	3	0.3	40%	60%
EE509D	High Voltage Engineering	EE	39	-	3	0.3	40%	60%
EE510D	Electrical Traction Engineering	EE	39	-	3	0.3	40%	60%
EE512D	Electric Vehicles	EE	39	-	3	0.3	40%	60%
EE514D	Real Time Computing	EE	36	3	3	0.3	40%	60%
EE517D	Fibre Optic Components	EE	36	3	3	0.3	40%	60%
EE520D	Intelligent Motion Systems	EE	39	-	3	0.3	40%	60%
EE521D	Industrial Power Electronics	EE	36	6	3	0.3	40%	60%
EE522D	Optical Fibre Systems	EE	39	-	3	0.3	40%	60%
EE524D	Open Electricity Market Operation	EE	39	-	3	0.3	40%	60%
EE525D	Energy Policy and Restructuring of Electricity Supply Industry	EE	39	-	3	0.3	40%	60%
EE526D	Power System Analysis and Dynamics	EE	36	8	3	0.3	40%	60%
EE527D	Auto-tuning for Industrial Processes	EE	39	-	3	0.3	40%	60%
EE528D	System Modelling and Optimal Control	EE	30	9	3	0.3	40%	60%
EE529D	Power Electronics for Utility Applications	EE	39	-	3	0.3	40%	60%
EE530D	Electrical Energy-saving Systems	EE	39	-	3	0.3	40%	60%

Table 4.3.4

Note: The Department reserves the right of NOT offering all electives in each semester.
[+] Mini-project
[#] Lecture: 33 hours; plus Seminar: 6 hours

4.4 Indicative Progression Pattern

A student in the First Year is advised to take the following curriculum as indicated in Table 4.4.1 below and obtain a total of 18 credits.

	Semester One
	(Non-Def Subjects)
ENG2001	Fundamentals of Material Science and Engineering (3)
	Def Subjects
ELC1013	English for University Studies (3)
	One Cluster Area Requirement Subject (3)
	9 credits
	Semester Two
	(Non-Def Subjects)
EE2001D	Applied Electromagnetics (3)
	Def Subjects
CBS1101P	Fundamentals of Chinese Communication (3)
EE3006D	Analysis Methods for Engineers (3)
	9 credits

Table 4.4.1

Note: Students if not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take degree LCR subjects. More details are mentioned in section (i) of 4.2.

A student in the Second Year is advised to take the following curriculum as indicated in Table 4.4.2 below and obtain 18 credits.

	Semester One
	(Non-Def Subjects)
EE3004D	Power Transmission and Distribution (3)
	Def Subjects
AF3625	Engineering Economics (3)
	One Cluster Area Requirement Subject (3)
	9 credits
	Semester Two
	(Non-Def Subjects)
EE3005D	Systems and Control (3)
	Electives (Def Subjects) (3) #
EE3007D	Computer System Principles
EE3008D	Linear Systems and Signal Processing
	Def Subjects
ELC1014	Advanced English for University Studies (3)
	9 credits

Table 4.4.2

One of these two electives

A student in the Third Year is advised to take the following curriculum as indicated in Table 4.4.3 below and obtain 16 credits.

	Semester One **(Non-Def Subjects)**
EE4003D	Electrical Machines (3)
CBS3241P	Professional Communication in Chinese (2)
	Def Subjects
EE3001D	Analogue and Digital Circuits (3)
	8 credits
	Semester Two **(Non-Def Subjects)**
EE4004D	Power Systems (3)
ELC3521	Professional Communication in English (2)
	Def Subjects
ENG3003	Engineering Management (3)
EE4006D	Individual Project (continue in next year)
	8 credits

Table 4.4.3

A student is advised to take the following curriculum in the final year as indicated in Table 4.4.4 and obtain 18 credits. He/she must accumulate at least 61 academic credits to qualify for graduation.

	Semester One
EE4006D	Individual Project (continue from the previous year) (6)
	Electives (Def Subjects)
	One Elective (**) (3)
	9 credits
	Semester Two
	Def Subjects
ENG3004	Society and the Engineer (3)
	Service-Learning Subject / University Free Elective (3)
	Electives (Def Subjects)
	One Elective (**) (3)
	9 credits

Table 4.4.4

** Student must choose **TWO** subjects from either the Level 4 Specialist Electives, or the Level 5 MSc subjects offered by EE or other servicing departments as given in Table 4.3.4.

Note: The Department reserves the right of not offering all electives in each semester.

4.5 Subject Support to Programme Outcomes

Table 4.5 illustrates how the subjects support the Programme Outcomes through teaching activities, practice on the part of students, and measurements.

		PROGRAMME OUTCOMES								
		A1	A2	A3	A4	A5	A6	B1	B2	B3
SUBJECTS	AF3625				√	√	√	√	√	√
	BSE463	√		√	√	√			√	
	CBS1101P					√		√		
	CBS3241P					√		√		
	EE2001D	√		√		√		√		√
	EE3001D	√	√	√	√		√	√	√	
	EE3004D	√	√	√	√	√		√	√	
	EE3005D	√		√				√		
	EE3006D	√		√		√		√		√
	EE3007D	√	√	√				√		√
	EE3008D	√	√					√		
	EE4002D	√		√				√		
	EE4003D	√		√	√	√		√		√
	EE4004D	√	√					√	√	
	EE4006D		√	√	√	√	√	√	√	√
	EE4007D	√		√	√	√		√		√
	EE4008D	√		√				√		
	EE4009D	√		√	√	√	√	√	√	
	EE4010D	√	√	√	√				√	
	EE4011D	√		√		√		√		
	EE4012D	√		√				√	√	
	EE4013D	√	√		√			√	√	
	EE4014D	√	√					√	√	√
	EE501D	√		√	√		√	√		√
	EE502D	√				√				
	EE505D	√	√					√	√	
	EE509D	√	√	√	√	√		√	√	
	EE510D	√		√	√	√	√	√	√	
	EE512D	√		√		√		√	√	
	EE514D	√	√	√						
	EE517D	√		√		√		√	√	
	EE520D	√		√				√		
	EE521D	√		√	√	√		√		√
	EE522D	√	√	√	√				√	
	EE524D	√			√	√		√		
	EE525D	√			√	√		√		
	EE526D	√	√							
	EE527D	√		√				√		
	EE528D	√		√		√		√		√
	EE529D	√		√	√	√		√		√
	EE530D	√		√	√	√		√	√	√
	ELC1012/13					√		√		
	ELC1014					√		√		
	ELC3521					√		√		
	ENG2001	√			√				√	
	ENG3003				√	√	√		√	
	ENG3004				√	√	√	√		√
	CAR subjects						√	√		
	Service-Learning			√	√	√	√	√		√

Table 4.5 Support of programme outcomes by individual subjects

5. Management and Operation

The daily operation of the programme, such as general administration of admission, registrations, student records, preparation for Board-of-Examiners meetings and documentations, is overseen by the Programme Leader and the administrative team of the Department. All enquiries regarding registration and general administration from students on the programme should be made to the General Office as the first contact point.

The Departmental Undergraduate Programmes Committee, in which the Head of Department and the Programme Leaders of all programmes offered by the Department are members, discusses and reviews the programme structure, syllabi content, high-level integration and future directions of the programme. The Departmental Learning and Teaching Committee advises on matters related to teaching methods and learning quality and cultivates the positive mentality toward teaching and learning among teaching staff and students.

6 Academic Regulations on Admission, Registrations and Assessment

The admission, registration and assessment arrangements described below are in accordance with the University policies and regulations for credit-based programmes which lead to an award of the University, except where the Senate decides otherwise.

6.1 Admission/Registration

Students are normally admitted into the programme via the non-joint university programmes admission scheme (NON-JUPAS) on a yearly basis. Some students may be admitted in Semester Two to top up any vacancies from de-registration and/or drop-outs in Semester One.

6.2 Maximum duration for completion of a programme and the validity period of subject credits

The maximum period of registration on, and for completion of, a programme is normally twice the duration of the programme, and must not exceed 8 years. This 8 year maximum period shall apply to programmes whose specified duration is more than 4 years. This period shall exclude deferment granted for justifiable reasons such as illness or posting to work outside Hong Kong, but any semester in which the students are allowed to take zero subject will be counted towards the maximum period of registration.

A student's registration shall lapse if it is no longer possible for him to obtain an award within the maximum period of registration.

The validity period of subject credits earned is 8 years from the year of attainment, i.e. the year in which the subject is completed. Credits earned from previous study should remain valid at the time when the student applies for credit transfer.

6.3 Residential Requirement

In order to be considered for an award granted by the University, a student must complete at least 1/3 of the normal credit requirement for the award he is currently enrolled, unless the professional bodies concerned stipulate otherwise.

6.4 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. Applications must be submitted one month before the commencement of the examination period. 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 examination 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.

Students should study the definitive programme document, the subject pre-requisite, co-requisite and exclusion requirements and the specified progression pattern, if any, of the programme before subject registration. It is the student's responsibility to check if his/her subject registration will fulfil the graduation requirements.

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. The selection of additional subjects will be done during the add/drop period. Part-time students can only take extra subjects from within their programme curriculum. Tuition fees will be charged according to the number of credits taken.

6.5 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 this 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. For such cases, students should be reminded that the study load approved should not be taken as the grounds for academic appeal.

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.

6.6 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. Subject exemption is normally decided by 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.

6.7 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. Credit transfer normally will be done without the grade being carried over. Subject credit transfer is normally decided by the subject offering department. In such occasion that a credit transfer is accompanied with grade, the actual grade as approved will be used in calculating the GPA/WGPA. The validity period of credits previously earned, is 8 years after the year of attainment.

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.

6.8 Deferment of Study

Students may apply for deferment of study if they have a genuine need to do so such as illness. 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 or sandwich 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.

6.9 General Assessment Regulations

These General Assessment Regulations shall govern all credit-based programmes which lead to an award of the University, except where the Senate decides otherwise.

For credit-based programmes, students progress by credit accumulation, i.e. credits earned by passing individual subjects can be accumulated and counted towards the final award.

(i) Subject Level

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 following is the Subject Level code adopted by the University:

Level Code		***Explanation***
0	=	Pre-university level standard (and remedial subjects taken by new admittees to a 4-year degree programme, or some subjects offered to Higher Diploma students only)
1	=	Standard comparable to year 1 of a 4-year degree programme
2	=	Standard comparable to year 2 of a 4-year degree programme
3	=	Standard comparable to year 3 of a 4-year degree programme
4	=	Standard comparable to the final year of a 4-year degree programme
5	=	Master's degree level
6	=	Doctoral degree level

(ii) Language of assessment

The language of assessment for all programmes/subjects shall be English, unless approval is given for it to be otherwise.

6.10 Principles of Assessment

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

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

The ultimate authority in the University for the confirmation of academic decisions is the Senate, but for practical reasons, the Senate has delegated to the Faculty/School Boards the

authority to confirm the decisions of Boards of Examiners provided these are made within the framework of the General Assessment Regulations. Recommendations from Board of Examiners which fall outside these Regulations shall be ratified by the Academic Regulations Committee (ARC) and reported to the Senate.

6.11 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 Definite 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 teacher should inform students of the details of the methods of assessments to be used, within the assessment framework as specified in the definitive programme document.

6.12 Progression/Academic Probation/Deregistration

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

(a) eligible for progression towards an award; or

(b) eligible for an award; or

(c) 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.

(ii) A student will have 'progressing' status unless he falls within anyone of the following categories, which may be regarded as grounds for deregistration from the programme:

(a) the student has exceeded the maximum period of registration for that programme, as specified in the Definitive Programme Document; or

(b) 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

(c) the student's GPA is lower than 2.0 for three consecutive semesters.

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

A student may be de-registered from the programme enrolled before the time frame specified at (ii) or (iii) of (b) above 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.

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

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

6.13 Retaking of Subjects

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

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

6.14 Appeal Against Examination Results

A student may appeal against the decision of the Board of Examiners within 7 working days after the public announcement of the overall examination results. (This refers to the date when results are announced to students via the web.) Students appealing against the decision of a Subject Lecturer/ Subject Assessment Review Panel/Board of Examiners shall pay a fee. This fee shall be refunded if the appeal is upheld.

The appeal should be made to the Head of Department in writing. The appeal should be accompanied by a copy of the fee receipt, for inspection by the Department concerned. The student should give a complete account of the grounds for the appeal in the letter, and provide any supporting evidence. The person authorised to deal with the appeal will inform the student of the appeal results within 7 working days upon the receipt of all required information. Students may refer to the Student Handbook for more details on appeal procedures.

6.15 Absence from an assessment component

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

The student concerned is required to submit his/her application for late assessment in writing to the Head of Department offering the subject, within 5 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.

6.16 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.

6.17 Other Particular Circumstances

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

6.18 Grading

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

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

Codes	Interpretation	Remarks
I #	Assessment to be completed	An incomplete grade must be converted to a regular grade normally in the following academic year at the latest.
N	Assessment is not required	—
P	Pass an ungraded subject	This code applies to an ungraded subject, such as industrial training.
U	Fail an ungraded subject	This code applies to an ungraded subject, such as industrial training.
M	Pass with Merit	This code applies to all General Education subjects for intake cohorts before 2010/11. The adoption or otherwise of this code to other subjects adopting a "Pass/Fail" grading system would be subject to the decision of individual Departments. The grade "Pass with Merit" can be awarded when the student's work exceeds the subject learning outcomes in the majority of regards.
L	Subject to be continued in the following semester	This code applies to subjects like "Project" which may consist of more than 1 part (denoted by the same subject code) and for which continuous assessment is deemed appropriate.
S	Absent from assessment	—
W	Withdrawn from subject	Dropping of subjects after the add/drop period is normally not allowed. Requests for withdrawal from subjects after the add/drop period and prior to examination will only be considered under exceptional circumstances. This code is given when a student has obtained exceptional approval from Department to withdraw from a subject after the "add/drop" period and prior to examination; otherwise, a failure grade (grade F) should be awarded.
Z	Exempted	—
T	Transfer of credit	—

* Entry of grades/codes for subject components is optional.

\# For cases where students fail marginally in one of the components within a subject, the BoE can defer making a final decision until the students concerned have completed the necessary remedial work to the satisfaction of the subject examiner(s). The students can be assigned an ' I ' code in this circumstance.

Note: Subjects with the assigned codes I, N, P, U, M, L, W, Z and T (if the subject is without grade transferred) will be omitted in the calculation of the GPA. A subject assigned code S will be taken as zero in the calculation.

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[2]

(v) Subjects from which a student has been allowed to withdraw (i.e. those with the code '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.

In the event that grade is awarded to subject components, a grade point with the decimal value may be generated for the overall result of the subject. This grade point with decimal value will be converted to grade according to the conversion methodology for deriving the subject overall grades. The corresponding grade point for the subject overall grade, instead

[2] Subjects taken in the University or elsewhere and with grades assigned, and for which credit transfer has been approved, will be included in the GPA calculation.

of the actual grade points obtained by students, will be used for GPA calculation. This methodology for deriving subject overall grades only serves as an aid to subject assessors. As assessment should be a matter of judgement, not merely a result of computation, the subject lecturer will have the discretion to assign a grade which is considered to reflect more appropriately the overall performance of the student in a subject to override the grade derived by the computer.

6.19 Different types of GPA

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

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

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

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.

Types of GPA	Purpose	Rules for GPA calculation
GPA	Determine Progression/ Graduation	(1) All academic subjects taken by the student throughout his study, both inside and outside the programme curriculum, are included in the GPA calculation. (2) For training subjects, including WIE and Clinical/Field subjects, departments can decide whether to include them in the GPA calculation. (3) For retake subjects, only the last attempt will be taken in the GPA calculation. (4) Level weighting, if any, will be ignored.
Semester GPA	Determine Progression	Similar to the rules for GPA as described above, except that only subjects taken in that Semester, including retaken subjects, will be included in the calculation.
Weighted GPA*	To give an interim indication on the likely Award GPA	(1) Similar to the rules for GPA, except that only subjects inside the programme curriculum concerned will be included in the calculation. Subjects outside the programme curriculum will be excluded. (2) Departments can decide whether the training subjects are to be counted towards the Weighted GPA. (3) For retake subjects, only the last attempt will be taken in the Weighted GPA calculation. (4) The weighted GPA will be the same as the Award GPA unless a student has taken more subjects than required.

Types of GPA	Purpose	Rules for GPA calculation
Major/Minor GPA	For reference and determination of award classification	Major/Minor GPA (1) Only subjects inside the curriculum of the Major/Minor Programmes will be taken in the Major/Minor GPA calculation. (2) Departments can decide whether the training subjects, are to be counted towards the Major/Minor GPA. (3) For retake subjects, only the last attempt will be taken in the Major/Minor GPA calculation. Major GPA Level weighting will be included in the calculation of Major GPA. Minor GPA Level weighting will <u>not</u> be included in the calculation of Minor GPA.
Award GPA	For determination of award classification	If the student has not taken more subjects than required, the Award GPA will be as follows: (1) For single Major: Award GPA = Weighted GPA (2) For Major/Minor programmes: Award GPA = Major GPA

6.20 Guidelines for Award Classification

The Weighted GPA will be used as a guide to help determine award classifications, and the level weighting to different subjects of all disciplines and programmes will need to be specified in the Definitive Programme Document.

Weighted GPA will be computed as follows:

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

where Wi = weighting to be assigned according to the level of the subject (see note below)

n = number of all subjects counted in GPA calculation

Same as for GPA, Weighted GPA is capped at 4.0.

Any subjects passed after the graduation requirement has been met or subjects taken on top of the prescribed credit requirements for award will not be taken into account of in the grade point calculation for award classification (see Sections 6.18 and 6.21 above). However, if a student attempts more elective subjects (or optional subjects) than those required for graduation in or before the semester in which he becomes eligible for award, the elective subjects (or optional subjects) with a higher grade/contribution shall be included in the grade point calculation (i.e. the excessive subjects attempted with a lower grade/contribution, including failed subjects, will be excluded).

6.21 Classification of Awards

For Honours degree programmes, the awards will be classified as follows:

- First Class Honours
- Second Class Honours (Division 1)
- Second Class Honours (Division 2)
- Third Class Honours

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

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

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

The following is a set of indicators, for Boards of Examiners' reference, which can be used in helping to determine award classification:

Honours classification	Weighted GPA
1st	3.7^{+} - 4
2:i	3.2^{+} - 3.7^{-}
2:ii	2.3^{+} - 3.2^{-}
3rd	2.0 - 2.3^{-}

Note: "+" sign denotes 'equal to and more than'; "–" sign denotes 'less than'.

There is no requirement for Boards of Examiners to produce award lists which conform to the guidelines of the above table.

6.22 Examination result announcements, transcripts, testimonials and references

At the end of each semester, where appropriate, examination results are announced online for individual students' checking. It provides information on subjects taken and grades attained, the Grade Point Average (GPA) for all subjects, and the overall result for that semester. The announcement serves as an official notification of the student's academic performance.

A formal transcript of studies will be issued by the University, upon request, to any student registered on a programme offered by the University, and it will include the following information:

(i) name and student number;

(ii) title of the programme(s) on which enrolled, or from which graduated;

(iii) medium of instruction for the programme (applicable only to programmes which are delivered in Chinese and for which both Chinese and English versions are offered);

(iv) a full academic record, giving subjects taken and grades attained, and the Grade Point Average (GPA) for all subjects;

(v) credit requirement of the student if different from the normal credit requirement of the programme;

(vi) where relevant, the final award(s) granted, with classification and year of award; and

(vii) a statement indicating that the student has completed the Work-integrated Education (WIE) activities which is non-credit bearing.

Students may request for a testimonial which is a certification of their studies at the University, but without details on subjects and subject results. Students may also request for references direct from academic staff/members concerned.

Appendix I

Subject Description Forms

Content

Subjects

*The Subject Description Form for CBS1101P "Fundamentals of Chinese Communication" and CBS3241P "Professional Communication in Chinese" will be available for download from the Department Website in October 2014.

Subject Description Form

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
Continuous Assessment	50%			
1. In-class activities	15%	√	√	√
2. Written assignments	15%	√	√	√
3. Test	20%	√	√	√
Final Examination	50%	√	√	√
Total	100 %			

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

Student Study Effort Required		
	Class contact:	
	▪ Lecture	26 Hrs.
	▪ Tutorial	13 Hrs.
	Other student study effort:	
	▪ Study and self-learning	48 Hrs.
	▪ Written assignments	18 Hrs.
	Total student study effort	105 Hrs.

Reading List and References

Recommended Textbooks

Parkin and Bade, 2014, *Foundations of Microeconomics*, 6th Edition, Pearson.

Sullivan, Wicks and Koelling, 2014, *Engineering Economy,* 16th Edition, Pearson.

References

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

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

Subject Description Form

Subject Code	BSE463
Subject Title	Design of Mechanical Systems in Buildings
Credit Value	3
Level	4
Pre-requisite Co-requisite Exclusion	Pre-requisite: ENG2001 and EE3009
Objectives	(1) To provide students with a comprehensive understanding of air conditioning system, refrigeration and indoor environmental issues for different kinds of buildings common to Hong Kong; and (2) To provide students with a comprehensive understanding in formulating practical energy policies.
Intended Learning Outcomes	Upon successful completion of the subject, students are expected to: Professional / academic knowledge and skills (a) Be able to have basic knowledge of thermal systems in buildings. (b) Be able to undertake the thermodynamic and application analysis of vapour compression refrigeration systems. (c) Be able to select a proper method for estimating operation energy use for a given building air-conditioning system on the basis of understanding the energy analysis requirement, and the calculation principles of current major building energy analysis methods. (d) Be able to undertake the design and analysis of ventilation systems for general contaminants control on the basis of understanding the function and working principles of contaminants control, and able to undertake the ventilation measurements for evaluating the ventilation of contaminants control. Attributes for all roundedness (e) Be able to communicate to others in a clear and concise manner through written reports, drawings and oral presentation; and (f) Be able to develop the skills and abilities to undertake, independently, a major piece of investigation work in a specialist subject area.
Subject Synopsis/ Indicative Syllabus	This subject provides a basic understanding of air conditioning system, refrigeration and indoor environment issues for different kinds of buildings common to Hong Kong. The syllabus includes air conditioning fundamentals, loads estimation, fan and duct sizing, ventilation for acceptable air quality and refrigeration plant exclusively designed for non BSE students.
Teaching/Learning Methodology	Students are briefed in the first lecture for the expected subject outcomes. Teaching is conducted in the form of interactive lecture, supplemented by worked examples, case study and mini project. Handouts were distributed one week before the lecture session.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d	e	f
1. Group assignment	15%			√		√	√
2. Test	25%	√	√	√	√		
3. End-of-semester examination	60%	√	√	√	√		
Total	100 %						

Students are required to demonstrate presentation and communication abilities through different types of assessments, which include written report, drawings and written assessment.

Student Study Effort Required

Class contact:	
▪ Lectures	27 Hrs.
▪ Tutorials	6 Hrs.
Other student study effort:	
▪ Test & Examination	6 Hrs.
▪ Mini Project	11 Hrs.
▪ Self-study	80 Hrs.
Total student study effort	130 Hrs.

Reading List and References

Authors: Title: Publisher: PolyU Call Number:	Shan K Wang, Zalman Lavan & Paul Norton Air Conditioning and Refrigeration Engineering Boca Raton, Fla.: CRC Press, c2000 TH7687.W363 2000
Authors: Title: Publisher PolyU Call Number	A.F.E. Wise & J.A. Swaffield Water, Sanitary and Waste Services for Buildings 5th Edition, Oxford; Woburn, Mass: Butterworth – Heinemann, 2002 TD345.W5 2002
Authors: Title: Publisher: PolyU Call Number:	T.D. Eastop & A. McConkey Applied Engineering Thermodynamics for Technologists 5th Edition, Essex, England: Longman; New York: Wiley 1993 TJ265.E3 1993
Author: Title: Publisher: PolyU Call Number:	Hazim B. Awbi Ventilation of Buildings 2nd Edition, London; New York, N.Y.: Spon Press 2003 TH7653.A9 2003

Subject Description Form

Subject Code	EE2001D
Subject Title	Applied Electromagnetics
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce to students the physical laws that govern the electromagnetic phenomena commonly encountered in electrical engineering systems. 2. To familiarise students with the techniques for solving problems in electromagnetics. 3. To provide students the foundation of electromagnetic field theory required for pursuing the EE programme.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Understand that electromagnetism is based on Maxwell's equations. Interpret the physical meaning and phenomena behind Maxwell's equations. Know the meanings of physical quantities of electromagnetism and their basic relationships. 2. Be able to analyse electromagnetic phenomena related to electrical engineering systems by selecting the most appropriate laws/theorems/solution techniques. 3. Have had hands-on experience in electromagnetic measurements.
Subject Synopsis/ Indicative Syllabus	1. ***Static fields*:** Electrostatics: Electric fields, Coulomb's law, Gauss's law, potential, capacitance and energy storage. Magnetostatics: Biot-Savart law, magnetic fields, Ampere's circuital law. Force on a current-carrying conductor, Lorentz force. 2. ***Time-varying fields*:** Faraday's Law and Lenz's Law; self-inductance, mutual inductance and stored energy. 3. ***Mathematical preliminaries*:** Vectors analysis and coordinate systems. The operators grad, div and curl. Concept of line, surface and volume integrals. Stokes's and divergence theorems. 4. ***Maxwell's equations and EM waves*:** Maxwell's equations in integral form as a restatement of fundamentals. Differential form. The continuity equation. The displacement current. The wave equation, plane polarized wave, velocity of propagation and energy flows. 5. ***Material media*:** Dielectric material: dipole, polarisation, permittivity and capacitors. Ferromagnetism: magnetisation curve, permeability, hysteresis and saturation. Boundary conditions. Magnetic circuits: magneto-motive force, reluctance and permeance. 6. ***Solution of static field problems*:** Hand-mapping, method of images, numerical and computer-based methods. Estimation of conductance, inductance, capacitance and field quantities from field plots. **Laboratory Experiments:** Field plotting using resistance and impedance networks. Field plotting using the Electrolytic tank. Field plotting using the resistive paper.

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on analysis and practical applications are given through experiments and using software, in which the students are expected to solve problems with critical and analytical thinking. Experiments are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information. Software is used to help the students to understand the physical meanings of mathematical equations.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√		√	
Tutorials	√	√		
Experiments	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√		√	
2. Class Test	30%	√		√	
3. Laboratory performance & reports	10%	√		√	
Total	100 %				

It is a fundamental subject of electromagnetics. The outcomes on physical concepts and analysis are assessed by the usual means of examination and test whilst those on analytical skills and problem-solving techniques, as well as technical reporting and teamwork, are evaluated by experiments, software application and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Laboratory	12 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	105 Hrs.

Reading List and References

Reference books:

1. W.H. Hayt, and J.A. Buck, Engineering Electromagnetics, 7th Edition, Boston: McGraw Hill, 2006
2. J. E. Parton and S.J.T. Owen, Applied Electromagnetics, The MACMILLAN PRESS LTD.
3. Nannapaneni Naraynan Rao, Elements of Engineering Electromagnetics, 6th Edition, Pearson Education International, 2004.
4. Fawwaz T. Ulaby, Fundamentals of Applied Electromagnetics, 5th Edition, Pearson Education International, 2007.
5. Fawwaz T. Ulaby, Electromagnetics for Engineers, Pearson Education International, 2005.
6. Karl E. Lonngren, etc., Fundamentals of Electromagnetics with Matlab, Second Edition, Scitech Publishing, Inc., 2007.

Subject Description Form

Subject Code	EE3001D
Subject Title	Analogue and Digital Circuits
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To familiarise students with the characteristics and operation of analogue and digital circuits for analysis and design purposes. 2. To enable students to understand the common techniques used in circuit design for combinational and sequential logic circuits. 3. To provide an appreciation of advantages and limitations of different classes of power amplifiers. 4. To enable students to analyse the operation principles of different A/D and D/A approaches and match their properties to serve the purposes of different applications. 5. To enable students to appreciate the limitations of circuit design.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Design basic digital combinational and sequential circuits. b. Given the requirements of an application, justify the use of suitable A/D or D/A converters and elaborate on the advantages and limitations of the selection. c. Compare the characteristics and operation of different classes of power amplifiers. d. Analyse operation of digital circuits and diagnose faults with basic equipment in the laboratory. e. Write a technical report.
Subject Synopsis/ Indicative Syllabus	**Digital Circuits** 1. ***Digital system fundamentals*:** Boolean algebra, number systems and codes used in digital systems logic gates and their characteristics, truth tables. 2. ***Analysis and synthesis of combinational circuits*:** Simplification techniques, Don't care terms, Karnaugh maps. Implementation of large scale circuits. Static and dynamic hazards. 3. ***Digital integrated circuits*:** Digital IC families: TTL, CMOS, structure of basic logic gates, input and output V-I characteristics; transfer characteristics, switching thresholds, noise margins, power dissipation of logic gate, propagation delay, rise time, fall time. ***ential circuits*:** Typical structure, operation, design and applications of flip-flops. Design and analysis of synchronous sequential circuits; states and state variable: structures of registers, counters and memory units. Design of asynchronous circuits, state machines, flow tables, stable and unstable states. **Analogue Circuits** 5. ***Large-signal transistor circuits*:** Classification of power amplifiers; analysis of efficiency, power dissipation and distortion of class A, B, AB and C amplifiers. 6. ***Signal conversion*:** Voltage comparator. Sample & hold circuits. A/D and D/A converters: Weighted-resistor D/A converter; R-2R Ladder D/A converter; Parallel-comparator A/D converter; Dual slope A/D converter; Successive-approximation A/D converter;

	Laboratory Experiments: Logic circuits I – Combinational logic circuits. Logic circuits II –Sequential logic circuits.
Teaching/Learning Methodology	The main teaching methods used to convey the basic concepts and fundamental theories are lectures and tutorials. The laboratory sessions are used to help the students to have an in-depth understanding of the fundamentals of analogue and digital circuits and apply the fundamental theory and knowledge learned to practice.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lectures	√	√	√			
Tutorials	√	√	√			
Experiments	√		√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d	e	f
1. Examination	60%	√	√	√			
2. Class Test	25%	√	√	√			
3. Laboratory performance & reports	10%	√		√	√	√	√
4. Home work	5%	√	√	√			
Total	100%						

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

It is a fundamental circuit design subject. The outcomes on concepts, design and applications are assessed by the usual means of examination and test whilst those on analytical skills, problem-solving techniques and practical considerations of circuit design, as well as technical reporting, are evaluated by experiments, and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	39 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	102 Hrs.

Reading List and References

Textbooks:

1. Thomas L. Floyd, "Digital fundamentals", Prentice Hall, 2003

Reference books:

1. William Kleitz, "Digital Electronics", Prentice Hall, 2002
2. Roger Tokheim, "Digital Electronics, principles and applications", McGraw Hill, 2002
3. Alan B. Marcovitz, "Introduction to Logic Design", McGraw Hill, 2002
4. M.M. Mano, Digital Design, 4th Edition, Prentice Hall, 2007

Subject Description Form

Subject Code	EE3004D
Subject Title	Power Transmission and Distribution
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce students to the fundamental knowledge which is essential for all electrical power engineers. It leads to a deeper insight into the design, planning, operation, equipment characteristics and environmental impacts of modern electrical power systems.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: a. Have acquired the fundamental knowledge and analytical techniques on electrical power systems. b. Be able to identify, analyze, and solve technical problems to power system design, planning, and operation, making use of mathematics and engineering techniques. c. Be able to work in teams when conducting laboratory investigations. d. Be able to write a technical report and present the findings.
Subject Synopsis/ Indicative Syllabus	1. ***Reactive power and voltage control*:** Voltage drop and power loss calculation. Voltage control using tap-changing and booster transformer, regulator, series and shunt compensation. Reactive power flow. Power factor improvement and bulk tariff. 2. ***Surges*:** Travelling wave, surge impedance and standing voltage. Lightning and switching surges. Surge mitigation, reflection and refraction. Use of lattice diagram. Protection against overvoltage. 3. ***Fault analysis*:** Use of per unit notation. Balanced 3-phase fault calculation. Fault current limiting concepts. Unbalanced fault calculation by symmetrical components method including line-to-ground, line-to-line, and double-line-to-ground faults. Sequence current and voltage measurements. 4. ***Switchgear and protection*:** Construction and application of different types of switching devices. Arc extinction and transient recovery voltages. AC and DC current interruption, current chopping. Role and component of protection systems. Coordination, selection and zoning of protection. Overcurrent relays. Differential and distance protection schemes. 5. ***Tariffs:*** Concepts of tariff design. Tariff structures. Conventional and new tariffs in different utilities. Dynamic tariff, marginal methods and load management concepts. **Laboratory Experiment:** Voltage regulation and reactive power compensation for short and medium length transmission lines. Static and electromechanical current measuring relays. Studies of surges on transmission lines. Symmetric and Asymmetric fault using interactive package "Powerworld". Symmetrical components. Effects of different earthing methods in distribution system. Grading of overcurrent relays.

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through experiments, in which the students are expected to solve the power system design, planning, and operation problems with practical constraints and to attain pragmatic solutions with critical and analytical thinking. Experiments are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√		
Tutorials	√	√		
Experiments			√	√

Assessment Methods, its alignment of Intended Subject Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√		
2. Class Test	25%	√	√		
3. Laboratory Performance & Report	15%			√	√
Total	100%				

The outcomes on concepts, design and applications are assessed by the usual means of examination and test Experiments and written reports assess those on analytical skills, problem-solving techniques and practical considerations of power system design, as well as technical reporting and teamwork.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Laboratory	12 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	102 Hrs.

Reading List and References

Textbooks:

1. C.R. Bayliss and B.J. Hardy, Transmission and Distribution Electrical Engineering, Kindle, 3rd Edition, 2007
2. W.D. Stevenson, Elements of Power System Analysis, McGraw Hill, 4th Edition or later, 1982 or later
3. B.M. Weedy, Electric Power Systems, Wiley, 3rd Edition or later, 1988 or later

Reference Books:

1. L. Grigsby, Electric Power Generation, Transmission and Distribution, Electric Power Engineering Handbook, 2nd Edition, CRC Press, 2007
2. A.R. Bergen and V. Vittal, Power System Analysis, Prentice Hakk, 2nd Edition, 2000
3. T. Gönen, Modern Power System Analysis, Wiley, 1988 or later

Subject Description Form

Subject Code	EE3005D
Subject Title	Systems and Control
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the principles and techniques used in the analysis and design of feedback control systems. 2. To provide the foundation for the later subjects in the areas of power systems, drives and control.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Analyse the stability, transient response and steady-state response of continuous time systems. b. Design compensators and controllers for control systems. c. Model systems using block diagram and signal flow graph and evaluate the properties of the overall systems. d. Write technical reports and present the findings.
Subject Synopsis/ Indicative Syllabus	1. ***Introduction to control system analysis*:** Open-loop control systems, Closed-loop control systems, Effects of feedback, Examples of control systems. 2. ***Mathematical modelling of dynamic systems*:** Electrical and electro-mechanical system components, Transducers and actuators, Laplace transform, Transfer functions. 3. ***System diagrams and simulations*:** Block diagram, Signal flow graphs, Mason's formula, Simulation of continuous systems using Matlab. 4. ***Time domain analysis of linear systems*:** First-order systems, Second-order systems, Transient response, Steady-state response, Routh-Hurwitz stability criterion. 5. ***Frequency domain analysis of linear systems*:** Frequency response, Bode Diagrams, Gain margin and phase margin, Polar plots, Nyquist stability criterion, Nichols plots. 6. ***Compensators and PID controllers:*** Compensators, PID controllers, Controller tuning. 7. ***State-space analysis*:** State-space models, Transfer matrix, State transition matrixt. **Laboratory Experiment:** Three-term controller Open-loop frequency response Modular position control system

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiments are designed to supplement the lecturing materials. The students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Tutorials	√	√	√	
Experiments	√	√		√

Assessment Methods, its alignment of Intended Subject Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	
2. Class tests	30%	√	√	√	
3. Laboratory reports	10%	√	√		√
Total	100%				

The outcomes on analysis and design are assessed by the usual means of examination and tests whilst those on technical reporting and presentation are evaluated by the experiments and reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Laboratory	9 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	49 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. K. Ogata, Modern Control Engineering, 5th Edition, Prentice-Hall, 2010
2. B.C. Kuo, Automatic Control Systems, 8th Edition, Prentice-Hall, 2002
3. R.C. Dorf and R.H. Bishop, Modern Control Systems, 12th Edition, Prentice-Hall, 2010
4. M. Gopal, Control Systems: Principles and Design, 3rd Edition, McGraw-Hill, 2008

Subject Description Form

Subject Code	EE3006D
Subject Title	Analysis Methods for Engineers
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To familiarise students with the essential numerical techniques and operations research methods which are applicable in most engineering problems. 2. To enable students to analyse the advantages and limitations of the commonly adopted numerical techniques and operations research methods. 3. To prepare students for tackling practical engineering problems, with a combination of strong theoretical background and sound engineering sense.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Match the numerical techniques and operations research techniques with the corresponding mathematical theories and compare their advantages and limitations. b. Given an engineering problem, justify the application of an appropriate technique, formulate the solution process and evaluate the results. c. Analyse essential features of different statistical problems in engineering. d. Apply computer software to develop iterative numerical algorithms. e. Write technical reports and present the findings in logical and organised manner.
Subject Synopsis/ Indicative Syllabus	1. ***Basics*****:** Error propagation, numerical stability, solutions by iterations, Newton's method, finite difference and interpolation, Lagrange interpolation; solution of non-linear simultaneous equation; numerical differentiation and integration. 2. ***Differential equations*****:** Numerical solutions of ordinary differential equations, Euler and Runge-Kutta methods, convergence and stability; finite difference methods for partial differential equations, boundary value problems. 4. ***Operations research*****:** Linear programming, simple Simplex algorithms, sensitivity analysis, shortest path and maximum flow problems, integer programming, combinatorial optimisation problems, applications in power systems and transportation. 5. ***Optimisations***: Direct search and simple gradient methods; optimisations with constraints. 6. ***Probability & statistics:*** Random variables, probability distributions, sample distributions and means, Central Limit Theorem, significance and hypothesis testing, stochastic processes. **Laboratory Experiments:** • Numerical analysis and algorithm implementation through Matlab • Numerical evaluation of partial differential equations of voltage or heat distribution • Optimization and sensitivity analysis in electrical systems

Teaching/Learning Methodology	Basic concepts and theories are taught in lectures and tutorials. When conducting the experiments, the students are expected to solve practical problems with critical and analytical thinking. Interactive assignments and on-the-spot discussions are conducted in both lectures and laboratory sessions. Experiments are designed so that the students should use the references in the instruction sheets to look for the supplementary information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials	√	√	√	√	
Experiments			√	√	√

Assessment Methods, its alignment of Intended Subject Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√		
2. Tests	20%	√	√	√		
3. Assignments & class works	10%	√	√	√	√	
4. Laboratory performance & reports	10%			√	√	√
Total	100%					

The outcomes on concepts, design and applications are assessed by the usual means of examination and tests. The outcomes on analytical skills, problem-solving techniques, technical reporting and teamwork, are evaluated by experiments and the reports.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	36 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	12 Hrs.
▪ Self-study and assignments	46 Hrs.
Total student study effort	100 Hrs.

Reading List and References

Textbooks:

1. S.C. Chapra, Applied numerical methods with MATLAB for engineers and scientists, McGraw Hill, 2008
2. F.S. Hillier, Introduction to operations research, McGraw Hill, 2005
3. R.E. Walpole, R.H. Myers, S.L. Myers and K.Y. Ye, Probabilities and Statistics for Engineers and Scientists, Prentice Hall, 2002

Reference books:

1. J.H. Mathews, Numerical methods using MATLAB, Pearson Prentice Hall, 2004
2. A.V. Balakrishnan, Introduction to random processes in engineering, John Wiley & Sons, 2005

Subject Description Form

Subject Code	EE3007D
Subject Title	Computer System Principles
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to establish a broad knowledge of the organization and components included in a small computer system. 2. To enable students to understand and apply assembly language programming. 3. To enable students to develop a simple embedded computer system
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Given specifications of an application and the instruction set of the microprocessor, design an assembly program to carry out the necessary operations. b. Appreciate advanced features of the latest microprocessors and understand functions of basic computer peripherals. c. Given a set of conditions, design a basic computer system. d. Think logically and be able to analyze data as well as present results in writing.
Subject Synopsis/ Indicative Syllabus	**Computer Systems Hardware and Operations** 1. ***Processor operation and internal architecture*:** Operations of data registers, buses and data path, operations of ALU, arithmetic hardware, and general pipeline architecture. Introduction to structure and operation of a modern microprocessor. 2. ***Memory organization*:** Characteristics of current memory technologies. Memory hierarchies and memory decoding mechanism. 3. ***Input and output systems*:** Direct I/O system and memory mapped I/O, interrupt and polling mechanisms. Protocol for serial data communications. 4. ***Microprocessor hardware and interfacing*:** System bus organization and interfacing techniques, CPU bus timing, system bus structure, design of input/output system. **Assembly Language Programming** 5. ***Memory addressing space and data representation*:** Internal registers of 8086, Addressing modes in 8086 soft-ware model. 6. ***Assembly language program*:** Basic elements of an assembly language program, instruction mnemonics and directives, arithmetic operations and logical operations. 7. ***Programming techniques*:** Arithmetic manipulations, elementary programming constructs, parameter passing, data initialization. 8. ***Coding and debugging*:** Conversion of source programs to machine codes, use of software debugging monitor, Compilation of assembly source program, linking of object files. **Laboratory Experiment:** Perform basic input/output operations of a microcontroller by assembly language programming. Control of different types of motors using a microcontroller and assembly language programming.

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on design, practical applications and programming are given through experiments, in which the students are expected to solve design problems with real-life constraints and to attain feasible solutions with critical and analytical thinking. Interactive laboratory sessions are introduced to encourage better preparation and hence understanding of the experiments. On-the-spot assessments are conducted in the laboratory to provide additional incentives for student learning. Experiments are designed to supplement the lecturing materials, especially in assembly language programming, so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Tutorials	√	√	√	
Experiments	√			√

Assessment Methods, its alignment of Intended Subject Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	
2. Mid-term quiz	15%	√	√		
3. Laboratory performance & report	15%	√			√
4. Assignments and in-class activities	10%	√		√	√
Total	100%				

It is a fundamental computer architecture subject. The outcomes on concepts, design and applications are assessed by the usual means of examination and test whilst those on analytical skills, problem-solving techniques and practical considerations of programming, as well as technical reporting are evaluated by experiments, and the report.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	35 Hrs.
	▪ Laboratory	8 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	11 Hrs.
	▪ Self-study	50 Hrs.
	Total student study effort	100 Hrs.

Reading List and References	**Textbooks:** 1. C. Hamacher, Z. Vranesic, S. Zaky, and N. Manjikian, Computer Organization and Embedded Systems, 6th Edition, McGraw-Hill, 2012 2. J.L. Hennessy and D.A. Patterson, Computer Architecture: A Quantitative Approach, 5th Edition, Elsevier, 2012 3. B. B. Brey, The Intel Microprocessors Architecture, Programming, and Interfacing. 8th

	Edition, Prentice Hall, 2008 **Reference books:** 1. A.K. Ray, Advanced Microprocessors & Peripherals, McGraw-Hill, 2006 2. K.R. Irvine, Assembly Language for Intel-Based Computers, 5th Edition, Prentice Hall, 2006

Subject Description Form

Subject Code	EE3008D
Subject Title	Linear Systems and Signal Processing
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide a broad treatment of the fundamentals of telecommunication systems.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the fundamentals of signals and linear systems. b. Undersatnd and analyze problems in different disciplines of engineering (with an emphasis on communication systems) under the framework of signals and linear systems c. Understand the characteristics, operating principles, performance metrics and limitations of typical tele-communication systems.
Subject Synopsis/ Indicative Syllabus	1. ***Signal representation and analysis:*** Mathematical representation of a signal; time-domain representation. Classification of signal and systems; Special functions. Linear and Time-Invariant Systems; Convolution; 2. ***Fourier series and Fourier Transforms:*** Complex exponentials; Frequency domain representation of signals; Fourier Series; Fourier transform; Fourier Transform pairs; Fourier Transform properties; Parsavel's theorem; Transfer functions; filters. Applications to music and electromagnetic radiation; 3. ***Sinusoidal carrier modulation:*** Amplitude and frequency modulation; Operating principle; Double side-band suppressed carrier, Conventional (Standard) AM, single side-band; Frequency division multiplexing; generation and detection circuitry; Modulation system performance comparison. 4. ***Pulse modulation:*** Sampling theorem. Pulse amplitude modulation. Timedivision-multiplexing. Pulse code modulation: quantization, encoding. Quantization noise. Differential pulse code modulation. Delta modulation. Pulse amplitude modulation; Pulse width modulation; 5. ***Digital communications:*** Digital transmission. Intersymbol interference; Eye diagram. Coding (source, error control, line). Digital carrier modulation; Pulse shaping; modulation format and spectral efficiency; probability and random variables; bit error ratio (BER) characterization and system performance 6. ***Introductions to copper-wire, wireless and optical fiber communications:*** Historical developments; channel characterizations; Electromagnetic radiation in wireless systems; multi-path interference; Light sources in optical communication systems. Light transmission in optical fibers. Light detection. Communication networks; **Laboratory Experiments:** Amplitude modulation (AM) System Pulse code modulation (PCM)

Teaching/Learning Methodology	The main teaching methods used to convey the basic concepts and fundamental theories are lectures and tutorials. The laboratory sessions are used to help the students to have an in-depth understanding of the fundamentals of telecommunication systems and apply the theory learned to practice.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lectures	√	√	
Tutorials	√	√	
Experiments	√		√

Assessment Methods, its alignment of Intended Subject Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Examination	60%	√	√	
2. Class test	24%	√	√	
3. Laboratory	10%	√		√
4. Home work or in-class exercises	6%	√	√	
Total	100%			

The outcomes on understanding the fundamentals of telecommunication systems and their characteristics are mainly assessed by examination, test and exercises, whilst the capability of applying theory to practice is evaluated through the laboratory work.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	39 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	6Hrs.
▪ Self-study	49 Hrs.
Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. A.V. Oppenheim and A. S. Willsky, "Signals and systems," Prentice Hall
2. B.P. Lathi, Modern Digital and Analogue Communication Systems, Oxford University Express, 2009
3. J.M. Senior, Optical Fiber Communications: Principle and Practice, 3rd Edition, Prentice Hall, 2009
4. J. G. Proakis and M. Salehi, "Digital Communications," 5th edition, McGraw-Hill

Subject Description Form

Subject Code	EE4002D
Subject Title	Digital Control and Signal Processing
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE3005D / EE3051
Objectives	1. To introduce the fundamentals and design techniques in digital control, filtering and signal processing. The analysis and design of these digital systems will be described with the aid of practical examples and CAD packages.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Analyse the stability, transient response and steady-state response of sampled-data systems. b. Design digital controllers for sampled-data systems. c. Analyse discrete-time signals and extract features using different digital signal processing techniques. d. Design a range of FIR and IIR filters. e. Write technical reports and present the findings.
Subject Synopsis/ Indicative Syllabus	1. ***Stability and transient analysis*:** Sampling and z-transform, Sampled-data systems, Stability of closed-loop systems, Transient and steady state responses. 2. ***Digital control design*:** Translation of analogue design to digital design, Designs based on frequency response methods, Analytical design method. 3. ***Design in state space*:** Controllability, Observability, Pole placement, State observer, Output feedback, Servo problem. 4. ***Digital filters*:** Forms of realization, Design of nonrecursive and recursive filters, Finite word length effect. 5. ***Spectrum analysis*:** DFT, FFT, Power spectrum, Windowing. Computation of convolution and correlation, Estimation of signal in noise. **Laboratory Experiment:** Digital controllers Digital signal analysis and filter design
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiments are designed to supplement the lecturing materials. The students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials	√	√	√	√	
Experiments	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes	The outcomes on analysis and design are assessed by the usual means of examination and tests whilst those on technical reporting and presentation are evaluated by the experiments and reports.

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√	√	
2. Class tests	30%	√	√	√	√	
3. Laboratory reports	10%	√	√	√	√	√
Total	100%					

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	49 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. G.F. Franklin, J.D. Powell and M.L. Workman, Digital Control of Dynamic Systems, 3rd Edition, Addison-Wesley, 1997
2. B.C. Kuo, Digital Control Systems, 2nd Edition, Oxford University Press, 1995
3. K. Ogata, Discrete-time Control Systems, 2nd Edition, Prentice Hall, 1995
4. E. Ifeachor and B. Jervis, Digital Signal Processing: A Practical Approach, 2nd Edition, Addison-Wesley, 2002
5. R. Kuc, Introduction to Digital Signal Processing, McGraw Hill, 1988
6. J. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1989

Subject Description Form

Subject Code	EE4003D
Subject Title	Electrical Machines
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. After completing an elementary subject on electromechanical energy conversion, the students are exposed to the more challenging topics such as electrical machine design, transient and unbalanced operations of electrical machines in this course. 2. This course is designed to ensure the students developing an in-depth understanding of various drive systems in the local industry. 3. To give the knowledge various electrical machines such as AC, DC and power electronic driven.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: 1. Have acquired a good understanding of the basic design methods of electric machines. 2. Have had experience in synchronous machines including load characteristics, oscillations equations, and displacement stability. 3. Be able to analyse the unbalanced and dynamic operation, condition monitoring and temperature-rise for the single and 3-phase induction machines. 4. Be able to understand the drives for induction machines and their harmonics analysis for drives. Be aware of various switched-mode driven machines. 5. Be capable to understand the control method for induction machines including closed loop and vector control.
Subject Synopsis/ Indicative Syllabus	1. ***Winding parameters and transformation*:** Inductance parameters. Winding Transformation. Circuit equations, conversion process, torque, equation of motion. 2. ***Appreciation of machine design*:** Appreciation of the economic and basic technological factors. Winding design. 3. ***Synchronous machines*:** Load characteristics of isolated generator. Linearized equations of small oscillations. Natural frequency. Transient and sub-transient reactance, field transient. 4. ***Induction machines*:** Performance analysis of single- and three-phase induction machines. Unbalanced operation. Dynamic Operation. Temperature-rise tests. Condition monitoring. 5. ***Drives for induction machines*:** Induction motor drives fed from stepped wave/PWM inverters. Harmonics analysis for drives. 6. ***Control of machines*:** Open loop and closed loop control. Concept of vector control, torque control. 7. ***Switched mode driven machines*:** Power electronics interfacing to machines, switched reluctance machines, DC brushless machines. **Laboratory/Mini-project Experiments:** The students are required to team up to work on laboratory session or mini-project. The mini-project is problem-based learning type and they are required to research for information, and do the design and analysis on the topics selected.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on analysis, control, design and practical applications are given through mini-projects, in which the students are expected to solve control and design problems with real-life constraints and to attain pragmatic solutions with critical and analytical thinking. The mini-projects are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	√
Tutorials	√				
Mini-projects	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√		√		
2. Class Test	24%	√		√		
3. Mini-project & report	16%	√	√	√	√	√
Total	100%					

It is a subject of the specific topics of electrical machines. The outcomes on concepts, design and applications are assessed by the usual means of examination and test whilst those on analytical skills, problem-solving techniques and practical considerations of electrical machine control and design, as well as technical reporting and teamwork, are evaluated by mini-project and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Laboratory/Mini-project	12 Hrs.
	Other student study effort:	
	▪ Mini-project/report	12 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	105 Hrs.

Reading List and References

Reference books:

1. G.K. Dubey, Power Semiconductor Controlled Drives, Prentice Hall, 1989
2. B.K. Bose, Power Electronics and AC Drives, Prentice-Hall, 2002
3. P. Vas, Vector control of AC machines, Clarendon Press: Oxford University Press, 1990
4. D. Hanselman, Brushless Permanent Magnet Motor Design, The Writers' Collective, 2003
5. R. Krishnan, Switched Reluctance Motors Drives: Modeling, Simulation, Analysis, Design, and Applications, CRC Press, 2001.

Subject Description Form

Subject Code	EE4004D
Subject Title	Power Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE3004D
Objectives	1. To provide students with a sound knowledge of modern power systems that is essential for the understanding of the operation and control of power systems. 2. To provide a continuation of study of power systems in level 3 subject EE3004A "Power Transmission and Distribution" and lead to more advanced topics of power systems study in final year electives.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: a. Have acquired in-depth understanding of power system analysis, stability and operation. b. Have acquired skills in identification, formulation and solution of power system analysis, operation and control problems. c. Have acquired ability to evaluate the design and operational performance of basic power systems. d. Have acquired skills in presentation and interpretation of experimental results and communication with others in a team environment.
Subject Synopsis/ Indicative Syllabus	1. ***Power flow analysis*:** Load flow concepts and formulation. Solution methods, including Gauss-Seidal, Newton-Raphson and Fast Decoupled Methods. Applications of load flow study to system operation. 2. ***Economic operation*:** Generation costs. Equal incremental cost. B coefficients. Penalty factor. Multi-area coordination. Unit commitment. AGC and coordination. 3. ***Power system control*:** Generator control systems. Speed governor systems. Load sharing. Load frequency control. Interconnected area system control. Voltage control loop. Automatic voltage regulator. AVR models and response. 4. ***Power system stability*:** Steady state and transient stability. Equal area criterion. Time domain solution of swing curves. Multi-machine stability. Stability improvement. Excitation and governor control effects. Dynamic equivalents. 5. ***Power system operation*:** Power system control functions. Security concepts. Scheduling and coordination. Supervisory control and data acquisition. Computer control, communication and monitoring systems. Man-machine interface. Load forecasting. Energy management systems. **Laboratory Experiment:** Power system load flow and security operation simulation. Transient stability assessment of power system.

Teaching/Learning Methodology	Lectures are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through experiments and mini-projects, in which students are required to solve the power system planning, operation and control problems with practical constraints and to attain pragmatic solutions with critical and analytical thinking. Experiments and mini-projects are designed to supplement the lecturing materials and encourage students to take extra readings and practice specialty software tools for power system planning, operation and control.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Mini-projects	√	√	√	√
Experiments			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	
2. Class tests	20%	√	√	√	
3. Lab performance and report	10%			√	√
4. Mini-project and report	10%	√	√	√	√
Total	100%				

This comprises an examination, class tests, written assignment in the form of laboratory report and mini-project report. Examination and tests assess the technical competence of students in power system analysis methods and methods of power system operation and control whilst written reports assess the students' ability to apply the theories learned in class to practical experiments, to interpret the experimental results obtained and to communicate in written form.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture	36 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Laboratory preparation / report	12 Hrs.
	▪ Mini-project / self-study	46 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference Books:

1. J. Grainger, W. D. Stevenson, Power System Analysis, McGraw-Hill, 1994
2. B. M. Weedy, B. J. Cory, N. Jenkins, J. B. Ekanayake, G. Strbac, Electric Power Systems, 5th Edition, Wiley, 2012
3. H. Saadat, Power System Analysis, 3nd Edition, McGraw Hill, 2010
4. A. J. Wood, B. F. Wollenberg, G. B. Sheble, Power Generation, Operation and Control, 3rd Edition, Wiley, 2014
5. A. Gomez-Exposito, A. J. Conejo, C. Canizares, Electric Energy Systems: Analysis and Operation , CRC Press, 2009

Subject Description Form

Subject Code	EE4006D
Subject Title	Individual Project
Credit Value	9
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide an opportunity for students: 1. to apply specialized professional engineering knowledge independently in the creative design, implementation, monitoring and evaluation of an engineering project, and 2. to achieve this goal, students are required to identify key engineering problems, to solve them and to communicate the findings in oral and written report format.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able: a. To apply specialized knowledge independently. b. To identify key engineering problems, to solve them and to communicate what is achieved orally and in a written report. c. To develop a project which is creative, rich in intellectual content and sufficiently challenging. d. To monitor the progress of project from concept to final implementation and testing, through problem definition and the selection of alternative solutions. e. To synthesize and apply their knowledge and analytical skills gained in various engineering domains. f. To build self confidence, demonstrate independence, and develop professionalism by successfully completing the project in a competent manner.
Subject Synopsis/ Indicative Syllabus	**Choice of Project** Projects are expected to be proposed by the students. They may also be proposed by academic members of staff, or jointly by student and staff. Industrial experience and staff research and consultancy activities are fertile ground for ideas. Project proposals must include an objective, describe the method of approach, describe any innovative features, and provide an estimate of cost. The suitability of a proposal may be judged by factors such as its intellectual level, relevance to the aims of the Programme, practicality in terms of time, funding and availability of resources. **Project Plan** At the beginning of the project, students are required to submit a clear project plan (formal project proposal). The plan should not be too long but should cover such matters as: – problem statement – brief literature research – initial problem identification – preliminary suggestion on methodology – division outline of hardware and software – preliminary time schedule – cost estimate

	Interim Report At the middle of the project period, each student has to submit an Interim Report to summarise their progress to date. This gives the supervisor a more formal opportunity than at discussions to indicate his assessment of student progress and to eliminate discrepancies if necessary. Problem cases are brought to the notice of the subject coordinator by supervisors. **Final Project Report** A good project schedule includes adequate time for preparing a report of the appropriate standard. The final report should be submitted, before the examination period, and will be given to the Assessment Panel (see Assessment below) for understanding of the student's work and for assessment purposed. To ensure that the project reports are prepared properly and of appropriate standard, students must first submit a draft of the report to the supervisor for comments before final submission. At the end of the project period, each project is assessed by an Assessment Panel of three members, including a Chairman, an independent examiner and the project Supervisor. The Chairman and the independent examiner should have sufficient knowledge of the subject area, so as to form an independent opinion of the technical merit of the project and to independently assess achievements. The Project Supervisor will provide information on student's progress, originality, initiative and ability to work independently. The Supervisor will also be in a position to contribute views on the student's technical achievement. All members of the Assessment Panel will read the project report before the assessment meeting. The Assessment Panel will reach their decision after: – listening to the student's presentation (can be a video clip), – examining him orally on his work, and – seeing a demonstration of the project's outcome (can be a video clip). **Assessment** In assessing the project, the panel will typically consider the following aspects: a. Intellectual achievement; b. Depth of understanding of the topic and the relevant allied topics; c. Quantity and quality of work done, including design and construction of equipment, experimentation, mathematical models, program writing, verification; d. Presentation including the written report, seminar presentation and response to questions. The Chairman will ensure that all aspects of the study are thoroughly discussed by the Panel before arriving at a consensus on an overall grade to be awarded to the project. In arriving at their decision, the Panel will bear in mind their experiences in respect of the achievements in other projects in the Department in the current and previous years. If no consensus arises as to the overall grade to be awarded to the project, each panel member (i.e. the Chairman, the project supervisor and the independent examiner) will independently award grades to the project on an assessment form with written justification for their grades. A grade from the Assessment Panel will then be derived by averaging (with the same weight) the conversion marks for the grades given by the three academics constituting the Assessment Panel. **Method of Assessment: 100% continuous assessment** **(I) Formal Project Proposal** Students are required to submit a formal project proposal when the project is started. **This will contribute to 5% of the final grade.**

	The contents of the proposal should include: A. Aims of the project B. Proposed specifications of the product (no matter it is a hardware or software project) C. Summary of the literature search done up-to-date. D. Proposed approach/methodology to be used E. Some brief descriptions on the theory of the approach/methodology F. Time table / schedule of your work of the entire project If a student decides to carry the project which he/she developed in subject EE3111 (for Prog. 41070) or EE3141 (for Prog. 41080), he/she should give details on updated materials in every section in this formal project proposal, as compared with his previously submitted work in EE3111 or EE3141. **Assessment Criteria** *1. Literature research.* *2. Problem definition.* *3. Writing quality.* **(II) The Interim Progress Report** Students are also required to submit an interim report at about the middle of project duration. **This will contribute to 15% of the final grade.** The contents of the progress report should include: A. Aims of the project (especially any change from the original aims). B. Brief outline of the theory. C. Work that has been carried out up to the date. D. The system design and the block diagram of the system, plus some brief descriptions on the theory. E. Difficulties encountered and the measures taken to solve them. F. Proposed time table / schedule for the rest of the work up to the end of the project. G. Difficulties expected in the coming period. **Assessment Criteria** *1. Method: innovation and feasibility.* *2. Design / Implementation / Results.* *3. Project management.* *4. Writing quality.* **(III) The Final Report** The final project report should contain all the work carried out by the student in the project. The students are advised to form a framework for the report first, then proceed to the formation of the titles of the chapters. The titles and structure of the sections within each chapter are then decided. Continuing the process, each section may be further expanded into appropriate sub-sections, divisions and sub-divisions etc., until a complete framework is formed. ***The final report will contribute to 50% of the final grade.*** The content of the final report includes: A. Aims of the project (especially any change from the original aims). B. The motivation behind the project and a brief outline of the project work. C. A summary of work done or developed in the project (not work done by others). D. The system design and the block diagram of the system, plus some brief descriptions on the theory. E. Testing and simulation results. F. Comments on results obtained. G. Difficulties encountered and the measures taken to solve them.

	H. The achievement of the project, the conclusions from the work and suggestions for further work. I. Materials which are closely related to the contents of the report, and which are themselves self-contained, may be included in the report as appendixes. J. A list of the references referred to the source of information in the report. This is compulsory. **Assessment Criteria** *1. Literature research* *2. Technical concept/knowledge/application, intellectual level* *3. Problem identification, initiative and progress* *4. Organization and writing quality* **(IV) The Presentation and Demonstration** The student should keep the presentation concise and interesting through good use of visual aids and multimedia, logic flow of ideas, and appropriate control of the pace. Show good mastering of topics and avoid undue pauses. The student should be able to elaborate on technical details in answering questions. Good pronunciation and intonation are desirable. Be courteous during the presentation. Hardware must be neatly built and laid out and there is good engineering sense in hardware implementation. Circuits /software should function properly, and experiments should be able to support fulfillment of project objectives. The student should show good mastering of topics during the question session of the presentation by providing satisfactory answers to questions. **The presentation and demonstration will contribute to 30% of the final grade.** **Assessment Criteria** *1. Technical concept/knowledge/application* *2. Intellectual level, response to questions* *3. Demonstration and engineering accomplishment* *4. Presentation skill and language competence.* **Note 1:** Each student has to submit/carry out all the above four components before he/she is considered to complete the FYP. **Note 2:** The final grade for the FYP will be calculated by taking the weighted average of the grades from the above four components.
Teaching/Learning Methodology	As the nature of the subject implies, there will not be many formal lectures in the subject, other than a few of hours of briefings on general information, some official procedures in administration of the project and some techniques on information/components searching. Students learn the technical contents by a substantial number of individual discussions with their project supervisors and a large number of hours of self-learning. The planning of the project will be carried under the direction of the supervisor. Through the execution of the project plan with guidance from the supervisor, the student should be able to achieve the learning outcomes.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Discussion with the project Supervisor	√		√			
Wiring of the project proposal	√	√	√		√	
Writing of the interim report	√	√	√	√	√	
Writing of the final report	√	√	√	√	√	√
Presentation and demonstration		√				√

<table>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>1. Formal project proposal</td><td>5%</td><td></td><td>√</td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>2. Interim progress report</td><td>15%</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. Presentation and demonstration</td><td>30%</td><td>√</td><td>√</td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="6"></td></tr>
</table>
Assessment criteria for each of the above assessment methods are as listed in one of above sections.
</td></tr>
<tr><td rowspan="6">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>▪ Briefings</td><td>3 Hrs.</td></tr>
<tr><td>▪ Individual discussions with supervisor</td><td>17 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Information search, self study, execution of the project, report writing, preparation of presentation</td><td>190 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>210 Hrs.</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Nil</td></tr>
</table>

Subject Description Form

Subject Code	EE4007D
Subject Title	Advanced Power Electronics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide the students with the knowledge of advanced power electronic conversion. 2. To ensure the students having an in-depth understanding of the design and control of various power electronics converters. 3. To give the knowledge of AC switched-mode conversion. 4. To provide a concept of impact of power electronics on power quality.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: a. Have acquired a good understanding of basic switched-mode DC/DC topologies, operation, performance and modelling. b. Have acquired a basic understanding of resonant converter and its method of loss reduction. c. Be able to apply the switched mode techniques to inverters. d. Be able to perform study on power electronics circuit simulation. e. Be aware of the impact of electromagnetic interference (EMI) and the reduction of EMI using power electronics techniques. f. Be able to present results of study in the form of simulation, design equation and basic model and work independently and in teams when conducting laboratory investigations and power electronics circuit design.
Subject Synopsis/ Indicative Syllabus	1. ***Pulse-Width-Modulated DC/DC converters*:** Basic topologies and higher order converters, transformer-isolated topologies, snubbers, discontinuous conduction modes of operation, ripple analysis. 2. ***Resonant-Mode DC/DC converters*:** Classification, zero-current switching and zero-voltage switching techniques, quasi-resonant converters, resonant transition converters. 3. **Control and *CAD for power electronics:*** Small-signal model and control, analog and digital circuit simulation for power electronics, simulation techniques. 4. ***Switched-Mode inverters*:** Single-phase and three-phase voltage-source inverters, AC-AC conversion, Resonant inverters. 5. ***Electromagnetic interference*:** Generation of EMI, power factor, switched-mode EMI filter, International Standards, Reduction of EMI. **Laboratory Experiments:** Switched-mode power converters with parasitic components and snubbers. Resonant converters Mixed-mode circuit simulation

Teaching/Learning Methodology	Lectures and tutorials are effective teaching methods: 1. To provide an overview or outline of recent development of power electronics. 2. To introduce new concepts and knowledge in advantage power electronic converter design, soft switching technique, control method and electromagnetic interference (EMI) aspect. 3. To explain difficult ideas and concepts. 4. To provide students feedback in relation to their learning. 5. To encourage students responsibility for their learning by extra reference books reading and computer-based circuit simulations. Laboratory works is an essential ingredient of this subject: 1. To supplement the lecturing materials. 2. To provide power converter design experience for the students. 3. To provide deep understanding of various power converter design aspects. 4. To enable students to organise principle and challenge ideas.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lectures	√	√	√		√	
Tutorials	√	√	√		√	
Experiments	√	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d	e	f
1. Examination	60%	√	√	√		√	
2. Class tests	20%	√	√	√		√	
3. Laboratory reports & assignments	20%	√	√	√	√	√	√
Total	100%						

The understanding on theoretical principle and practical considerations, analytical skills and problem solving technique will be evaluated. Examination, class tests, laboratory sections and reports are an integrated approach to validly assess students' performance with respect to the intended subject learning outcomes.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	36 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	46 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Textbooks:

1. Ned. Mohan, Tore M. Undeland, William P. Robins, Power Electronics: Converters, Applications & Design, 3rd Edition, Wiley, 2003
2. K.W.E.Cheng, Classical Switched Mode and Resonant Power Converters, The Hong Kong Polytechnic University, 2002

	Reference books: 1. N. Mohan, Power Electronics: A First Course, John Wiley & Sons, 2012. 2. A.M. Trzynadlowski, Introduction bto Modern Power Electronics, John Wiley & Sons, 2010.

Subject Description Form

Subject Code	EE4008D
Subject Title	Applied Digital Control
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE3005D / EE3051
Objectives	1. To facilitate a working knowledge of principles of reduced-order modelling, digital control algorithms, system identification, and adaptive control. 2. To enable students designing industrial control systems for applications in different engineering areas.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the concepts of reduced-order modelling, deadbeat control algorithm, system identification and adaptive control. b. Understand the notions of offline and online system identification. c. Design conventional and adaptive controllers based on user specifications. d. Use CAD package for design and simulation. e. Effectively communicate experimental results in written and oral reports.
Subject Synopsis/ Indicative Syllabus	1. ***Process control*:** Process modelling, Performance Specification, Industrial controller, Ziegler & Nichols tuning, Advanced process control, Reduced order modelling. 2. ***Direct digital control algorithms*:** Modified z-transform, PID algorithm, Cascade control, Finite-settling time control, Dead-time compensation, Internal model control. 3. ***Computer control methods*:** Hierarchical control configurations, Distributed approach, Description of representative systems, Programmable logic controllers (PLC). 4. ***System identification*:** Discrete-time and continuous-time systems, identification by correlation, principle of least squares, Recursive least squares. 5. ***Self-tuning control*:** Introduction to adaptive control, Self-tuning controller. **Laboratory Experiment:** There will be three laboratory experiments on the topics of reduced order modeling, digital control design and system identification by least-squares technique. **Case study:** Individual assignment related to above methods. Students will write a report and present their finding to the class.

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiments and case study are designed to supplement the lecturing materials. The students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√		
Tutorials	√	√	√		
Experiments and case study			√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√		
2. Class test	20%	√	√	√		
3. Laboratory and case study reports	20%			√	√	√
Total	100%					

The outcomes on concepts, analysis and design are assessed by the usual means of examination and tests whilst those on technical reporting and presentation are evaluated by the case study and experiments.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Case study preparation/report	14 Hrs.
	▪ Self-study	35 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. D.E. Seborg, Process Dynamics and Control, Hoboken, N.J.: Wiley, 2011
2. C.A. Smith, Automated Continuous Process Control, New York, John Wiley & Soncs, 2002
3. J.R. Leigh, Applied Digital Control: Theory, Design, and Implementation, New York, Prentice-Hall, 1992
4. P.E. Wellstead and W. Zarrop, Self-tuning Systems: Control and Signal Processing, Cichester, England: New York, Wiley, 1991
5. R. Isermann, Adaptive Control Systems, New York, Prentice Hall, 1992

Subject Description Form

Subject Code	EE4009D
Subject Title	Electric Traction and Drives
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE4003D
Objectives	1. To enable students to develop a sound understanding of operation of modern electrified railway systems. 2. To provide an appreciation of the design and application of electric drives and operation principles of railway signalling. 3. To enable students to understand the implications of design of traction and signalling systems on railway operations and traffic control. 4. To introduce to students the vital problems of electromagnetic interference and hardware design of enhanced electromagnetic compatibility. 5. To enhance students' awareness on the use of computer simulation in railway planning and operation, as well as the future technologies in railway systems.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Outline the operation principles of the sub-systems and their components in an electrified railway system and compare their advantages and limitations with reference to practical railway lines. b. Elaborate on the impacts of the performance and properties of the sub-systems to the overall system safety and reliability. c. Engage in self-learning on latest technologies on railway systems at this advanced level of study.
Subject Synopsis/ Indicative Syllabus	1. ***Introduction*:** The trends of modernisation of railway systems. Technical and design aspects of railway electrification. Fundamentals of design and construction of rolling stock. Power supply systems: rectifier substations, distance and load sharing between substations, reduction of supply unbalance in single-phase traction. 2. ***D.C. drives*:** Single-phase dual-converter drives; Three-phase full-converter drives. Chopper drives: line filter design, chopping frequency selection; principles of powering and regenerative braking. Multiphase chopper, automatic variable field chopper. Case studies on local traction industry. 3. ***A.C. drives*:** Performance characteristics of induction motors: VVVF control, PWM control: mode transition, pulse dropping; CVVF control; Vector Control. 4. ***Railway signalling*:** Basic functions. Fixed and moving block signalling schemes. Route and cab signalling. Principles of headway and block length. Factors affecting signal layout. Track circuits: principles, operation and function. Interlocking. Traffic control. Automatic train control. 5. ***Train movement and simulation*:** Train operation modes. Factors determining train movement: resistance, speed restriction, gradient and curvature of tracks. Movement control: Precise stopping at stations and inter-station runs. Computer simulation: time-based and event-based models, simulation levels, applications. 6. ***Electromagnetic compatibility*:** Track circuit interference. Substation harmonics. Hardware designs with enhanced electromagnetic compatibility.

	7. ***Future trends of transit systems*:** Guided vehicles under computer control. Magnetic levitation and suspension techniques. Advanced automatic train control of registers, counters and memory units. Design of asynchronous circuits, flow tables, stable and unstable states. **Laboratory Experiments:** Traction power load flow simulation **Case Study:** HK MTR systems
Teaching/Learning Methodology	Video clips together with computer animations are used to supplement conventional lectures. Case studies will be used extensively to highlight the practicality of the subject materials being covered. Practitioners are also invited to have experience sharing sessions with the class. A group project is to be carried out to demonstrate and integrate the knowledge learned. Teaching/Learning Methodology × Outcomes: Lectures: a √, b √ Tutorials: a √, c √ Experiments: c √ Mini-Projects: a √, b √, c √
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks × % weighting × Intended subject learning outcomes to be assessed: 1. Mini-project (group project) — 20% — c 2. Tests — 20% — a, b 3. Examination — 60% — a, b Total — 100% This is an advanced and yet appreciation subject for students who are interested in railway engineering. The subject encompasses all the important elements in a typical railway and a number of case studies are used to supplement the analytical discussions. The outcomes are assessed through a mini-project (which aims to integrate the various aspects learnt), tests and written examinations.
Student Study Effort Expected	Class contact: ▪ Lecture/Tutorial — 33 Hrs. ▪ Seminar — 6 Hrs. Other student study effort: ▪ Assignment and self-studies — 65 Hrs.
	Total student study effort — 104 Hrs.
Reading List and References	**Textbooks:** 1. M.H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd Edition, Prentice Hall 2004 2. Managing railway operations & maintenance: best practices from KCRC / edited by Robin Hirsch ; technical co-editors, Felix Schmid, Michael Hamlyn. A & N Harris ; Birmingham :

	University of Birmingham Press, 2007 **Reference books/journals:** 1. J. Pachl, Railway Operation and Control. VTD Rail Publishing, Mountlake Terrace (USA) 2004. 2. Bonnett, Clifford F. Practical railway engineering, London : Imperial College Press, 2005. 3. O.S. Lock, Railway Signalling, 3rd Edition, A & C Black, 1993 4. Selected papers from IEE Proceedings – Electric Power Applications

Subject Description Form

Subject Code	EE4010D
Subject Title	Fibre Optics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE3008D
Objectives	1. To introduce to students the physical laws that govern the behaviour of fibre-optics components. 2. To give students an understanding of the principles of fibre-optic sensing and optical fibre communications. 3. To equip students with the knowledge to design simple fibre-optics sensor systems.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the attenuation and dispersion of optical fibres and their physical meaning and phenomena behind mathematical equations and computed results. b. Understand the most appropriate passive and active fibre-optic components for fibre-optic sensor systems and communication links. c. Use the appropriate fibre-optic equipment/instrument to perform optical power and spectrum measurements and have had hands-on experience in the use fusion splicer to make low-loss fibre joints. d. Apply fibre optic sensors for temperature and strain measurement in pratical engineering applications. e. Appreciate recent developments and the importance of fibre optics technologies for communications and fibre-optic sensors.
Subject Synopsis/ Indicative Syllabus	1. ***Optical fibres*****:** Propagation theory. Wave-guiding. Fibre types. Optical loss. Fibre dispersion. Mechanical properties. Special fibres. Fibre-optic cables and cable design examples. 2. ***Fibre optic connections and test methods*****:** Coupling losses. Splices. Connectors. Coupling devices and techniques. Distribution systems. Devices for wavelength-division-multiplexing. Power measurements. Fibre loss and dispersion measurements. Optical time-domain reflectometry. Reliability. 3. ***Optical fibre sensors*****:** Extrinsic, evanescent, intrinsic sensors. Optical components for fibre sensor systems. Power transmission, actuation and safety aspects of design. Applications. 4. ***Optical sources*****:** Wavelength considerations. Emitter materials. Light-emitting-diodes. Laser diodes. Emitter lifetime. Modulation of LED and laser diodes. Drive circuits. Formats for digital modulation. Direct and coherent transmission systems. Noise and error mechanisms. Receiver sensitivity and circuit design. 5. ***Optical detectors*****:** Photo-detectors: noise, response time, materials. PIN and avalanche photodiodes. Receivers. 6. ***Fibre optic systems design*****:** Fibre optic communication system design considerations. Attenuation and dispersion budgets. Digital system design. 7. ***Applications of fibre optics in electrical engineering*****:** Optical groundwire. Enhancing power system telecommunications and control with overhead and underground fibre optic cables. Fibre optic sensors for measuring voltage, current, temperature. Location of cable faults by using optical fibre sensing. **Laboratory Experiments/Demonstrations:** • Insertion loss measurement of optical fibres using optical power meters and optical spectrum analyzers • Optical spectrum analyzer for spectral measurements of light sources • Fibre Bragg grating sensors
Teaching/Learning Methodology	Lectures, quizzes, tests, laboratory experiments, mini-projects, and examination.

Teaching/Learning Methodology	Outcomes									
	a	b	c	d	e	f	g	h	i	j
Lectures	√	√	√	√	√			√	√	√
Tutorials			√		√					√
Experiments/Demonstration						√	√	√		√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed									
		a	b	c	d	e	f	g	h	i	j
1. Quizzes	2%	√	√	√		√				√	
2. Tests	28%	√	√	√	√	√	√		√		√
3. Laboratory experiment report	5%			√	√	√	√	√	√		√
4. Mini-projects	5%	√	√		√	√	√	√		√	
5. Examination	60%		√	√	√				√		√
Total	100%										

This subject introduces the physical laws that govern the behaviour of optical fibres, semiconductor light sources and detectors, and how to employ them to design simple fibre-optics sensor systems. The outcomes are assessed by quizzes, tests, mini-projects, laboratory experiments and examination.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	36 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Mini-projects	20 Hrs.
	▪ Self-study	38 hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. J.M. Senior, Optical Fiber Communications-Principles and Practice, 3nd Edition, Prentice Hall, 2008
2. J.C. Palais, Fiber Optic Communications, 5th Edition, Prentice Hall, 2005
3. G. Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill, 2000
4. G.P. Agrawal, Fiber-optic Communication Systems, 3rd ed., Wiley, 2002.
5. J. Hecht, Understanding Fiber Optics, 5th edn., Prentice Hall, 2006

Subject Description Form

Subject Code	EE4011D
Subject Title	Industrial Computer Applications
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce the applications of computing techniques in solving industrial problems and the following topics are included: Computer process control; Industrial instrumentation and systems; Image processing; Multimedia concepts.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Design and develop digital controllers. b. Understand the use of industrial networks on process data acquisition and control. c. Apply image processing techniques in industrial automation. d. Understand the mobile communication techniques and the Android development applications.
Subject Synopsis/ Indicative Syllabus	1. ***Computer process control*:** Modelling of the computer process control system, practical approaches to digital control implementation, PLC and microcomputer-based control systems. 2. ***Intelligent instrumentation and systems*:** Embedded microcontrollers, industrial process controllers, applications of distributed digital control algorithms, industrial networks and SCADA system. 3. ***Image processing*:** Digital image fundamentals, image representation, image enhancement, image segmentation, application of image processing in industrial automation. 4. ***Multimedia concepts and applications*:** Multimedia fundamentals, image compression, video compression, hardware peripherals and software tools. **Mini-project Experiment:** PC based digital controller for temperature control Power failure monitoring using embedded controller Automatic meter reading using computer vision Jelly Bean IDE and the Andriod Devloper Tools (ADT)
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on design and practical applications are given through mini-projects, in which the students are expected to solve design problems with real-life constraints and to attain pragmatic solutions with critical and analytical thinking.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	√
Tutorials	√	√	√	√
Experiment	√	√		

Assessment Methods in Alignment with Intended Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	√
2. In-class Test (x2)	20%	√	√	√	√
3. Mini-project Report	10%	√	√		
4. Mini-project Demo/Presentation	10%	√	√		
Total	100%				

One end-of-semester written examination; one mid-semester-test; one end-of-semester test; a mini-project on a small micro-processor based application; and a report/demonstration/presentation to accompany the mini-project.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	36 Hrs.
	▪ Laboratory (mini-project)	6 Hrs.
	Other student study effort:	
	▪ Mini-project report and preparation	12 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	99 Hrs.

Reading List and References

Reference books:

1. J.A. Rehg and G.J. Sartori, Industrial Electronics, Pearson Prentice Hall, 2006
2. A.V. Deshmukh, Microcontrollers: Theory and Applications, Tata McGraw-Hill, 2006
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, 3rd Edition, Prentice Hall, 2008
4. T. Vaughan, Multimedia: Making It Work, 7th Edition, McGraw-Hill, 2008

Subject Description Form

Subject Code	EE4012D
Subject Title	Intelligent Buildings
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to establish a broad knowledge on the concepts of intelligent buildings. 2. To enable students to understand that intelligence of a building can be achieved by integration and optimization of building structure, services systems, information technology, management and valued-added services. 3. To enable students to understand basic features of an intelligent building and the required services system to support these features. 4. To enable students to understand the operation principle and characteristics of various service systems/technologies of an intelligent buildings; such as the building automation system, intelligent vertical transportation systems, communications, structured cabling and etc. 5. To enable student to understand the impacts these services systems/ technologies on the building and people.
Subject Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify benefits, impacts and driving forces of intelligent buildings, and its subsystems. b. Describe design philosophy at system level, system configurations, system sub-modules of vertical modern vertical transportation systems and building automation systems, including the out-stations, etc. c. Describe general design concept and principles of communication systems in intelligent building, such as voice communication system, video communication systems, LAN, wireless LAN, mobile phone system, data networks, office automation systems, etc. d. Describe the general principle, concepts and system configurations of structure cabling, including the features, characteristics and applications of different categories of cables. e. Given a technical topic, carry out literature search and present the findings in a technical report.
Subject Synopsis/ Indicative Syllabus	1. ***Intelligent building characteristics*:** Features and benefits of intelligent buildings. The anatomy of intelligent buildings. Environmental aspect. The marketplace and other driving forces behind the emergence of intelligent buildings. (6 hours) 2. ***Building automation systems & controls*:** Philosophy, system configuration, system modules, distributed systems, communication protocol and on-line measurements. Fire protection, security and energy management. Control objectives. Sensors, controllers and actuators. Control system schematics system design. Microprocessor based controllers & digital controls. Examples of sub-systems such as: Digital Addressable Lighting Interface (DALI) (9 hours) 3. ***Modern intelligent vertical transportation systems:*** Sky lobby, double-deck lifts, twin lifts, advanced call registration systems, large scale monitoring systems, applications of artificial intelligence in supervisory control, energy saving measures related to lift systems/escalator systems, other modern vertical transportation systems, such as: gondola systems, materials handling systems, etc. (6 hours) 4. ***Communication system*:** Voice communication systems, local area network, wireless LAN, public address, Digital TV, CCTV, teleconferencing, cellular phone system, radio paging and CABD. SMATV. Data networking. Short- and long-haul networks. Wideband network. Office automations. Public Address/Sound reinforcement systems (10 hours) 5. ***Structured cabling systems*:** Characteristics and benefits. Standards, configurations and physical media. EMI/EMC issues, grounding problems. System design. Different Categories of cables. (6 hours) 6. ***Integrating the technologies and systems*:** The impact of information technology on buildings and people. Shared tenant services. Interaction and integration between building structure, systems, services, management, control and information technology. Application & design software packages. (5 hours) **Case study:** International Financial Centre II, International Commerce Centre, Central Plaza and similar buildings
Teaching/Learning Methodology	Lectures and tutorials are effective teaching methods: 1. To provide an overview or outline of the subject. 2. To introduce new concepts and knowledge to the students. 3. To explain difficult ideas and concepts of the subject. 4. To motivate and stimulate students interest. 5. To provide students feedback in relation to their learning. Mini-project works/Assignments are essential ingredients of this subject: 1. To supplement the lecturing materials. 2. To add real experience for the students. 3. To provide deep understanding of the subject. 4. To enable students to organise principle and challenge ideas.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials	√	√	√	√	
Mini-project					√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√	√	
2. Class tests	20%		√	√	√	
3. Mini-project/Assignments	20%	√				√
Total	100%					

The understanding on theoretical principle and practical considerations, analytical skills and problem solving technique will be evaluated. Examination, class tests and mini-project report are an integrated approach to validly assess students' performance with respect to the intended subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	39 Hrs.
	Other student study effort:	
	▪ Mini-project/Assignments	20 Hrs.
	▪ Self-study	41 Hrs.
	Total student study effort	100 Hrs.
Reading List and References	**Reference books:** 1. Clements-Croome, Derek, Intelligent Buildings: An introduction, Routledge, 20142. Shengwei Wang, Intellgient Buildings and Building Automation, Spon Press, 2010 3. Jim Sinopoli, Smart Building Systems for Architectures, Owners and Builders, Elsevier, 2010 4. P. Manolescue, Integrating Security into Intelligent Buildings, Cheltenharn, 2003 5. B.L. Capehart, Information Technology for Energy Mangers, Fairmont Press, 2004 6. L. Chow, The Intelligent Building Index: (IBI) manual: version 3.0, Hong Kong: Asian Institute of Intelligent Buildings, 2004 7. B.L. Capehart and L. C. Capehart, "Web based enterprise energy and building automation systems", Fairmont Press ; Boca Raton : CRC Press 2007 8. Robert Shimonski, Network Cabling Illuminated, Jones and Barlett, 2006	

Subject Description Form

Subject Code	EE4013D
Subject Title	Power System Protection
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE3004D / EE3041
Objectives	1. To introduce students the modern knowledge of power system protection. 2. To enable students to understand the design philosophy and working principle of different protective schemes, and how they are applied to power systems.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: a. Have acquired a good understanding of knowledge, techniques and skills of power system protection. b. Have the ability to apply and adapt applications of mathematics, engineering skills in the analysis, comparison, and interpretation of various power system protection schemes. c. Be able to interpret nameplate data and able to select the most appropriate transducers for various protection schemes. d. Be able to carry out tests and analyse the performance of transducers and protection relays. e. Be able to present technical results in the form of a technical report.
Subject Synopsis/ Indicative Syllabus	1. ***Philosophy of protection*:** General considerations. Components of protection. Structure of protective relays. Trend of protection development. 2. ***Transducers*:** Input sources for protection system. Current and voltage transformers; sources of error; their performance under normal and abnormal conditions. 3. ***Non-unit protection*:** Non-unit protection for distribution networks – overcurrent and directional protection, techniques used to analyze their performances. Non-unit protection for transmission networks – distance relays, distance protection schemes, protection characteristics and impedance seen by distance relays. 4. ***Unit protection*:** Principles of unit protection. High impedance and low impedance differential protection and their applications. Bias differential protection and its application to transformers. 5. ***Digital protection*:** Principles of digital relaying. Digital relay architecture. Recent development of digital relaying techniques. **Laboratory Experiment:** Current Transformer Saturation. Directional Overcurrent Protection. Low Impedance and High Impedance Busbar Protection. Fault Simulation and Simulation of Digital Relay in EHV Transmission Line. **Case study:** 1. Explain how source impedance and fault location affect the performance of protective relays. 2. What do you understand about the terms reliability and stability of protective relays? 3. How protective relays achieve selectivity? Give examples and explain. 4. Explain the meaning of sensitivity of protective relays. How to decide a suitable sensitivity for protective relays? 5. What factors will affect CT accuracy and how to control them? 6. How to choose a suitable CT for protective relays? 7 Describe the voltage measurement methods in different voltage levels in a power network. 8. Pros and cons of using Capacitive Voltage Transformer (CVT). 9. How to achieve discrimination between overcurrent relays installed in radial feed feeders in distribution system? 10. When we grade overcurrent relays of different time / current characteristics, what precautions should we take? Give examples. 11. What are directional relay schemes? Explain how the relays are connected and how they are used. 12. Will directional relays mal-operate? Give one example. 13. What is the effect of load on distance relay operation? 14. What will affect the accuracy of measurement on distance protection relays? 15. Describe the communication methods used for protective relays in a power network. 16. What is the effect of power swing on distance protection relays? 17. How differential protection is applied in feeders, busbars, and transformers? 18. What is the difference between low impedance and high impedance differential protection? How can we achieve through fault stability in both protection systems? 19. How the inrush current on power transformer is formed and what is its effect on transformer protection? 20. Why bias is required in transformer differential protection? What is its effect on the range of windings to be protected? 21. Explain the working principle of harmonic bias used in transformer differential protection. 22. What is restricted earth fault protection and what is unrestricted earth fault protection? Why are they needed? What is the range of winding they can protect comparing to the bias differential protection? 23. Why digital relay is different from conventional protective relays? What additional features a digital relay can offer? 24. Compare the performance of the two basic digital relay algorithms, the sample and derivative algorithm, and the differential equation algorithm. What is the problem when they are applied in a power system? 25. Explain the working principle of the Fourier algorithm in digital relay technology. Why it has better performance than other algorithm? What is its drawback?
Teaching/Learning Methodology	Both the fundamental understanding and practical problem-solving methods would be emphasized in lectures. Students shall take initiative to learn through the process of engagement and participation in lectures. Practical protection schemes used in industry, where appropriate, are discussed interactively in class. In laboratory classes, experiments are planned to let students design and carry-out an experimental strategy, record and critically analyze their results, reach conclusions about the interpretation and performance of power system protective schemes. Students would have to make preparations such as information gathering before laboratory classes. Mini-Projects are used to enhance students learning experiences and practical applications. They provide students with the opportunity to develop independent design/planning and technical report writing skills pertinent to the field of power system protection.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√		
Experiments	√			√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√		
2. Class Test/Quiz	20%	√	√	√		
3. Laboratory performance & reports	10%	√	√		√	√
4. Mini-project & report	10%	√	√	√		√
Total	100%					

The subject outcomes on concepts understanding, interpretation, analysis and applications of power system protection schemes are assessed by means of examination, quizzes and tests. The outcomes on engineering skills and applications, performance testing and analysis, as well as technical writing techniques, are evaluated by experiments, mini-project and reports.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	36 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	12 Hrs.
▪ Self-study	46 Hrs.
Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. Network Protection and Automation Guide, Edition May 2011, Alstom Grid, 2011
2. P.M. Anderson (Editor in Chief), Power System Protection, McGraw Hill 1st Edition, 1999
3. W.A. Elmore, Protective Relaying Theory and Applications, Marcel Dekker, 2nd Edition, 2004
4. A.T. Johns & S.K. Salman, Digital Protection for Power Systems, IEE Power Series, 1995
5. Power System Protection, Vol. 1, 2, & 3, The Electricity Training Association, 1995

Subject Description Form

Subject Code	EE4014D
Subject Title	Intelligent Systems Applications in Electrical Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce students to the fundamentals of intelligent systems and their applications in Electrical Engineering including electrical power systems, control and utilization.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: a. Have acquired a good understanding of the fundamental concepts and characteristics and methodologies of intelligent systems. b. Be able to appreciate the power and usefulness of intelligent techniques. c. Be able to know the design of artificial intelligence systems, evolutionary computation algorithms, uncertainty representation and reasoning mechanisms. d. Be able to integrate the intelligent system approaches in real-life electrical power engineering problems and control problems. e. Have acquired skills in presentation and interpretation of mini-project results and communicate in written form
Subject Synopsis/ Indicative Syllabus	1. ***Knowledge-based intelligent systems*:** Concepts and theory. Knowledge representation techniques. Structure of a rule-based expert system. Forward and backward chaining inference techniques. 2. ***Fuzzy systems*:** Concepts of Fuzzy reasoning. Membership Functions and Fuzzy sets. Fuzzy rules. Defuzzification methods. Fuzzy inference. Building a fuzzy expert system. 3. ***Artificial neural networks*:** Concepts of ANN. Neuron and perception. Multilayer neural networks. Forward and Backward Propagation. Neural Network Training. Hopfield network. 4. ***Evolutionary computation*:** Concepts of Evolutionary computing. Genetic algorithms. Chromosomes, fitness function, cross-over and mutation. Evolutionary Programming. 5. ***Hybrid algorithms*:** Simulated Annealing. Combined Genetic Algorithm and Simulated Annealing. Fuzzy Neural Systems. Fuzzy Genetic Algorithm. 6. ***Applications in power system problems in planning, operation and control*:** Applications in Control and Utilization – Intelligent process control. Intelligent robot control and Utilization. **Mini-project:** Performance of Genetic Algorithm **Case study:** To study the performance of genetic algorithm on solving different functions such as De Jong problems and Colville problems. To investigate the effects of parameter setting on the performance of genetic algorithm. To investigate the effect of solution acceleration technique on the performance of genetic algorithm.

	To apply genetic algorithm to different Electrical Engineering problems.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through mini-projects, in which the students are expected to solve the electrical engineering problems using intelligent techniques with critical and analytical thinking. Mini-projects are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials	√	√	√	√	
Mini-projects		√			√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√		
2. Class Test	20%	√	√	√		
3. Mini-project Report and Presentation	20%	√			√	√
Total	100%					

The outcomes on concepts, design and applications are assessed by the usual means of examination and test Min-projects and written reports assess those on analytical skills, problem-solving techniques and practical considerations of intelligent technique applications, as well as technical reporting, teamwork and presentation skill.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Mini-project	12 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	102 Hrs.

Reading List and References

Reference books:

1. K.Y. Lee and M.A. El-Sharkawi, Modern Heuristic Optimization Techniques: Theory and Applications to Power Systems, Wiley-IEEE Press, 2008
2. M. Negnevitsky, Artificial Intelligence-A Guide to Intelligent Systems, Addison-Wesley, 2002
3. K. Warwick, A. Ekwue and R. Aggarwal, Artificial Intelligence Techniques in Power Systems, IEE Power Engineering Series 22, UK, IEE Press, 1997
4. L.L. Lai, Intelligent System Applications in Power Engineering, Wiley, 1998
5. T.S. Dillon and M.A. Laughton, Expert System Applications in Power Systems, Prentice Hall, 1990
6. Selected reference papers in IEEE Transactions and IEE Proceedings

Subject Description Form

Subject Code	EE501D
Subject Title	Alternative Energy Technologies
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to establish a broad concept on alternative energy techniques in engineering. 2. To provide an in-depth knowledge on selected topics of alternative energy systems in engineering. 3. To enable students to understand typical alternative energy technologies, its associated issues of application and related technical considerations. 4. To enable students to understand the potential of alternative energy and characteristics & performance of various types of alternative energy systems. 5. To enable students to understand various techniques and systems for control and monitoring of alternative energy technologies, as well as the related communication protocol and interfacing requirements.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Describe the operation principle & control strategy of various alternative energy systems and topologies of these systems. b. Identify benefits & impacts of the applications of these alternative energy systems; such as their effects on environment and utility energy efficiencies. c. Describe the operation principle, characteristics and performance of various alternative energy devices/systems. d. Identify different alternative energy technologies for industrial & commercial plants and multi-storey buildings, including giving examples. e. Able to carry out literature search and report the findings in a presentation, when given a technical topic.
Subject Synopsis/ Indicative Syllabus	1. ***Energy resources and types*:** Renewable and non-renewable energy resources. World potential and trends. Environmental effects. Alternative energy types and present developments. Role and importance of alternative energy. 2. ***Wind and solar energy*:** Wind characteristics. Extraction characteristics. Windmill aerodynamics. Design and materials of windmills. Wind turbines. Types of wind turbines and connection. Siting and designs. Wind farms. Case study. On-shore and off-shore wind farms. Solar characteristics. Solar cells and solar thermal power. Photovoltaic conversion systems. Case study. Design and monitoring techniques. New developments. 3. ***Wave and tidal energy*:** Wave and tide characteristics for energy extraction. Tidal schemes. Tidal sites. Single and multiple basin schemes. Case study. Wave energy schemes. Case study. Ocean energy conversion. 4. ***Geothermal energy and fuel cells*:** Geothermal energy sources and methods. Characteristics. Hot dry rock technology. Case study. Fuel cells types and principles. Biomass energy types and case study. Future potentials. 5. ***Co-generation and combine-cycle plants*:** New technologies for co-generation and CCGT. Efficiency and environmental benefits. Case study examples. Future development potentials. 6. ***Better utilization of energy resources*:** Pollution reduction techniques. Clean coal technologies. Nuclear power. Environmental impacts of better utilization of energy. **Case study:** Selections of practical alternative energy systems in Hong Kong and overseas.
Teaching/Learning Methodology	Lectures and tutorials are effective teaching methods: 1. To provide an overview or outline of the subject contents. 2. To introduce new concepts and knowledge to the students. 3. To explain difficult ideas and concepts of the subject. 4. To allow students to feedback on aspects related to their learning. Mini-project works/Assignments are essential ingredients of this subject: 1. To supplement the lecturing materials. 2. To add real experience for the students. 3. To provide deeper understanding of the subject. 4. To enable students to organise principles and challenge ideas. Case studies: 1. To give real example for some of the concept presented in the lectures. 2. To explain some practical considerations when applying technologies in real projects 3. To motivate and stimulate students interest. Seminars from industrial experts may also be arranged, this will give student up-to-date status of the development in alternative energy area, as well as market trends.
Assessment Methods in Alignment with Intended Learning Outcomes	

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√		
Tutorials	√	√	√		
Case studies			√	√	√
Mini-project/Assignments/Presentations				√	√

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Class tests	20%	√	√	√		
2. Mini-project/Assignments/ Presentations	20%				√	√
3. Examination	60%	√	√	√	√	
Total	100%					

The understanding on theoretical principle and practical considerations, analytical skills and problem solving technique will be evaluated. Examination, class tests, assignments, presentations and mini-project report are an integrated approach to validly assess students' performance with respect to the intended subject learning outcomes.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Seminar/Case studies	6 Hrs.
	Other student study effort:	
	▪ Mini-project/Assignments	18 Hrs.
	▪ Self-study	42 Hrs.
	Total student study effort	99 Hrs.
Reading List and References	**Reference books:** 1. J. Twidell, Renewable Energy Sources, E&F N Spon 2. G. Boyle, Renewable Energy, Oxford, 2004 2. L.L. Freris, Wind Energy Conversion Systems, Prentice Hall 3. Diamant, Total Energy, Pergamon Press 5. W. Avery and C. Wu, Renewable Energy From the Ocean, A Guide to OTEC , Oxford University Press, 1994 6. CDM Consultancy Stage 1 Report, Study on the Potential Applications of Renewable Energy in Hong Kong, 2003 (from website of EMSD-EEO of HKSAR Government). 7. R. Messenger, Photovoltaic Systems Engineering, CRC Press, 2004 8. G.N. Tiwari, Solar Energy: Fundamental, Design, Modelling and Applications, CRC Press 2002 9. Biofuels for Transport: an International Perspective, International Energy Agency, 2004 10. Geothermal Energy Resources for Developing Countries, A.A. Balkema Publishers, 2002 11. M. Stiebler, Wind Energy Systems for Electric Power Generation, Springer 2008 12. J. Cruz, Ocean Wave Energy: Current Status and Future Perspectives, Springer-Verlag 2008	

Subject Description Form

Subject Code	EE502D
Subject Title	Modern Protection Methods
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the concept of modern power system protection to students. 2. To integrate theory and practical knowledge of power system protection. 3. To understanding the working principle of power system protection. 4. To master the analytical techniques. 5. To apply protective relaying in power systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Be able to master the concept and philosophy on power system protection. b. Apply and adapt applications of mathematics, engineering skills in the analysis, comparison, interpretation of various protection schemes in the power system. c. Integrate and justify techniques to be used in the planning and operation of power system protection. d. Be able to solve technical problems for power system protection.
Subject Synopsis/ Indicative Syllabus	1. ***Overview of protection systems and its development*:** General considerations. Components of protection. Structure of protective relays. Trend of protection development. 2. ***Fault and transient in power systems*:** Fault transient behaviour of power system. The use of Electro-Magnetic Transient Program (EMTP) and MATLAB software to simulate the transient behaviour of power system. 3. ***Current and voltage transducers*:** Requirement of transducers for measurement and protection. Their features and characteristics under steady state and transient conditions. 4. ***Protection systems for distribution networks*:** Protection criteria for distribution system. Features of directional and non-directional protection schemes for distribution system. 5. ***Protection systems for transmission networks*:** Distance protection system and characteristics. Differential line protection. Phase comparison line protection. Use of line carrier and communication for protection systems. 6. ***Busbar, transformer and generator protection systems*:** High impedance and low impedance differential protection schemes. Protection schemes for busbar, transformer, and generator. 7. ***Digital protection relaying technique*:** Features of digital protection relay. Digital relay architecture. Digital relaying algorithms. Adaptive and intelligent relays. Recent development.

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Knowledge on system analysis, design and practical applications are given through case studies in the assignments, in which the students are expected to integrate and justify modern techniques to be used in the planning and operation of power system protection with critical and analytical thinking. Case studies are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√		√
Tutorials	√	√		√
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. Examination	60%	√	√	√	√
2. Class Test	25%	√	√	√	√
3. Assignments	15%			√	
Total	100%				

The examination and tests assess the technical competence of students in power system protection analysis methods and methods of protection design, planning, and operation. Case studies and written reports assess those on analytical skills, problem-solving techniques and practical considerations of protection design, as well as technical reporting.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	33 Hrs.
	▪ Laboratory	12 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	42 Hrs.
	Total student study effort	99 Hrs.

Reading List and References

Reference books:

1. L. Hewitson, M. Brown and R. Balakrishnan, Practical Power System Protection, Newnes, 2005
2. Network Protection and Automation Guide, AREVA T & D Ltd., 2002
3. P.M. Anderson, Power System Protection, IEEE Press or McGraw Hill, 1999
4. A.E. Walter, Protective Relaying Theory and Applications, ABB Power T & D Co. Inc., Dekker, 1994
5. A.T. Johns and S.K. Salman, Digital Protection for Power Systems, IEE Power Series, 1995
6. Microprocessor Relays and Protection Systems – IEEE Tutorial Course, Publication No. 88EH0269-1-PWR, 1987
7. Advancements in Microprocessor Based Protection and Communication – IEEE Tutorial Course, Publication No. 97TP120-0, 1997
8. Power System Protection, Vol. 1, 2, & 3, The Electricity Council, Peter Peregrinus, 1981

Subject Description Form

Subject Code	EE505D
Subject Title	Power System Control and Operation
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the concept of modern power system control & operation to students; 2. To integrate theory and practical knowledge of power system control & operation; 3. To understand the working principle of power system control and operation; 4. To apply the theory in power system control & operation; and 5. To understand the industrial practice and tools used in power system control and operations
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Ability to analyse power system security control & operation; b. Ability to analyse interconnected power system interchange and economic operation. c. Ability to analyse power system computer control and applications; d. Understand the functionalities and able to use to appropriate level of competence of selected specialty software for power system control and operation purpose; e. To be aware of new technologies development trends and environmental impacts of modern power system control and operation techniques; and f. Ability to write technical reports and present the findings through individual effort as well as team work
Subject Synopsis/ Indicative Syllabus	1. ***Power system operational security and dispatch*:** Power system security concepts. Contingency analysis. Static and dynamic security. States of operation. Prevention of blackouts. Power system state estimation concepts. Application of state estimation. 2. ***Frequency control & AGC*:** Frequency control and voltage control concepts. Control loops and analysis. Automatic generation control methodology and implementation. 3. ***Interconnected systems operation*:** System interconnection merits and problems. Economic interchange and control. Multi-area operation. 4. ***Unit commitment and economic dispatch*:** Priority lists. Methodologies for large system economic dispatch and unit commitment. Programming methods. 5. ***Energy management and real-time control*:** Energy management systems. Software systems. Computer hardware resources and configurations. Data management. Communication and distributed computing. Load forecasting. Contingency and security assessment. System restoration and emergency control concepts. **Case Study:** 1. Local system control centre arrangement. 2. Case study of past system blackout in overseas countries. 3. AGC and voltage control case studies. 4. Power system developments in HK and China as well as overseas countries. 5. Applications of computer technology in power system control and monitoring

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on real world cases and associated analysis are given through case studies, in which the students are expected to power system control and operation problems with real-life constraints and to attain pragmatic solutions with critical and analytical thinking. Guest lecture / industrial seminars will be given to provide hands-on experience and knowledge on this subject from industry practice. Mini-project is designed to supplement the lecturing materials so that the students are encouraged to take extra readings and practice specialty software tools for power system operation and control.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lectures	√	√	√	√		
Tutorials	√	√	√	√		
Report	√	√	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d	e	f
1. Exam	60%	√	√	√		√	
2. Class test	20%	√	√	√		√	
3. Mini project and report	20%	√	√	√	√	√	√
Total	100%						

The assessment methods include an examination, a class test, and written assignment in the form of mini-project report. The examination and class test assess the technical competence of students in power system analysis methods and methods of power system operation and control. The written reports assess the students' ability to apply the theories learned in class to practical project, and to communicate in written form.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	39 Hrs.
	Other student study effort:	
	▪ Mini-project preparation/report	10 Hrs.
	▪ Self-study	50 Hrs.
	Total student study effort	99 Hrs.

Reading List and References

Reference books:

1. W.D. Stevenson, Elements of Power System Analysis, McGraw Hill
2. Wood & Wollenberg, Power Generation, Operation and Control, J. Wiley.
3. Weedy and Cory, Electric Power Systems, 4th Edition, Wiley
4. Grainger & Stevenson, Power System Analysis, McGraw Hill
5. H. Saadat, Power System Analysis, McGraw Hill
6. Antonio Gomez-Exposito, Antonio J. Conejo, and Claudio Canizares, Electric Energy Systems: Analysis and Operation, CRC Press, 2009

Subject Description Form

Subject Code	EE509D
Subject Title	High Voltage Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with knowledge to understand the techniques of analysis and design pertaining to high voltage engineering including causes and manner of insulation failure and problems encountered in practice.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Describe the insulation breakdown mechanisms so as to identify the failure phenomena of different insulation systems. b. Be aware the design features of high voltage equipment so as to understand the application of common high voltage practices in the industry.
Subject Synopsis/ Indicative Syllabus	1. ***Introduction to electrical insulation*:** Electric fields; dielectric breakdown; electrical insulating materials; industrial applications of electrical insulating materials. 2. ***Breakdown of gaseous insulation*:** Ionization processes; Townsend breakdown mechanism; breakdown in electronegative gases; streamer breakdown mechanism; Paschen's law; corona discharges; breakdown in non-uniform fields; post-breakdown phenomena and applications; vacuum insulation and breakdown. 3. ***Breakdown of liquid insulation*:** Breakdown in pure liquids; breakdown in commercial liquids; purification and breakdown test. 4. ***Breakdown of solid insulation*:** Breakdown due to treeing; breakdown due to surface flashover; breakdown due to surface tracking; breakdown in composite insulation. 5. ***Partial discharges*:** Classification of partial discharges by origin; partial discharge measurements. 6. ***High-voltage equipment*:** Applications of the above sections to the design of bushings, transformers, overhead lines, cables and circuit breakers. 7. ***Generation of high voltages*:** Cascade and series resonant methods for alternating voltages; doubler and multistage rectifiers for direct voltages; single-stage and Marx generators for impulse voltages. 8. ***High-voltage measurements*:** Measurement of leakage current; hv voltmeters; measurement of impulse voltages (peak voltage and wave-shape); Schering bridge. 9. ***High-voltage Applications Outside of T&D*:** Electrostatic hazards (such as dust explosions, oil-tanker explosions, integrated-circuit damage); applications such as in electrostatic precipitator, paint spraying (and powder coating), ore separation; lightning protection of buildings.

Teaching/Learning Methodology	Lectures are the primary means of conveying the fundamental knowledge to understand the techniques of analysis and design pertaining to high voltage engineering. Experiences on design and practical applications are given and demonstrated, and the students are expected to solve design problems with real-life constraints and to attain pragmatic solutions with critical and analytical thinking. Students will be required to form groups to work through cases covering practice on high voltage engineering applications and learn through active participation in the presentation of their findings.

Teaching/Learning Methodology	Outcomes	
	a	b
Lectures	√	√
Case study		√
Demonstration	√	

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed	
		a	b
1. Examination	60%	√	√
2. Continuous assessment	30%	√	√
3. Case study	10%		√
Total	100%		

The assessment methods include end of subject examination (60 %), continuous assessment (30 %) and case study (10 %). Examination and continuous assessment cover intended subject learning outcomes 1 and 2, while case study involves intended subject learning outcome 2. Examination is in form of three-hour, closed book examination; continuous assessment contains classwork, homework, class test, etc.; and case study provides practice on high voltage engineering applications.

Student Study Effort Expected	
Class contact:	
▪ Lecture/Case study/Demonstration	39 Hrs.
Other student study effort:	
▪ Case study	12 Hrs.
▪ Self-study	51 Hrs.
Total student study effort	102 Hrs.

Reading List and References

Reference Books:

1. M. S. Naidu and V. Kamaraju, High Voltage Engineering, 3rd Edition, Tata McGraw-Hill, 2004
2. V. IA Ushakov, Insulation of High-Voltage Equipment, Springer, 2004
3. E. Kuffel, W. S. Zaengl and J. Kuffel, High Voltage Engineering: Fundamentals, 2nd Edition, Newnes, 2000
4. C. L. Wadhwa, High Voltage Engineering, 3rd Edition, New Age Science, 2010
5. A. Ravindra and M. Wolfgang, High Voltage and Electrical Insulation Engineering, Wiley: IEEE Press, 2011
6. F. H. Kreuger, Partial Discharge Detection in High-Voltage Equipment, Butterworths, 1989
7. IET Digital Library, Lightning Protection, Edited by C. Vernon, Institution of Engineering and Technology, 2010

Subject Description Form

Subject Code	EE510D
Subject Title	Electrical Traction Engineering
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE4003D Exclusion: EE4251
Objectives	1. To provide students with a comprehensive understanding of traction systems from a systems engineering viewpoint. 2. To provide an appreciation of the current state-of-the-art design and applications of electric drives and railway signalling systems. 3. To enable students to understand the implications of design of traction and signalling systems on railway operations and traffic control. 4. To introduce the quality indicators of railway operations and their relationships with the performance of traction drives, power supply and signalling systems. 5. To identify the necessary future technologies to improve the service quality in railway systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Analyse the operation principles of the sub-systems in an electrified railway system in the state-of-the-art approaches and criticise their advantages and limitations with reference to practical railway lines. b. Identify the railway service quality parameters and evaluate the impact of the performance of the sub-systems to the overall system reliability, availability, safety and maintainability. c. Recognise the importance to engage in self-learning on latest technologies on railway systems at this advanced level of study.
Subject Synopsis/ Indicative Syllabus	1. ***General aspects of traction system*:** Technical and design aspects of railway electrification. Train dynamics and speed-time characteristics. AC and DC railways, power supplies and interference. Supply system requirements: performance under normal and emergency feeding conditions. 2. ***Traction drives and railway signalling*:** Single-phase drives; chopper drives; inverter drives. Requirement of Inverter substations. Principles of powering and regenerative braking; blended regenerative and rheostatic brake control. Induction motor control: VVVF control, PWM control and CVVF control. Philosophy of railway signalling; route capacity; track circuits; principles and equipment; layout of signals and track circuits; interlocking and control; train description; train protection and control. 3. ***Computer-aided design and operation of traction systems*:** Elements of design and analysis of traction systems: cost/benefit analysis; digital simulation of AC/DC power converter drives and traction equipment; computer-based design of block layouts and track circuits; power-factor, control, maximum-demand and energy-efficient operation; digital simulation of train performance for optimum headway, schedule speed and energy consumption; use of expert systems for system control and train scheduling. Computer modeling of non-linear source and traction load. Power quality issues of single phase AC traction: imbalance, harmonics and voltage dip; impact to traction system and public. Corrective measures and filter design. 4. ***Maglev and linear drives*:** Principle and limitations of electromagnetic techniques of suspension and levitation. Levitation using permanent magnet, superconducting magnets and eddy currents induced by mains frequency excitation. Suspension using controlled DC electromagnets. Operation of single-sided linear induction motors. Application of linear drives in high speed transit systems. **Laboratory Experiment:** Load-flow analysis in traction power system **Case Study:** 1. Traction drive systems 2. Feeding systems in AC traction 3. Signalling system installation
Teaching/Learning Methodology	Video clips together with computer animations are used to supplement conventional lectures. Case studies will be used extensively to highlight the practicality of the subject materials being covered. Practitioners are also invited to have experience sharing sessions with the class. A group project is to be carried out to demonstrate and integrate the knowledge learned. Teaching/Learning Methodology: Outcomes a / b / c Lectures: √ / √ / Tutorials: / √ / √ Project Work: √ / √ / √
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks: % weighting: Intended subject learning outcomes to be assessed (a / b / c) 1. Mini-project (group project): 20%: / / √ 2. Tests: 20%: √ / √ / 3. Examination: 60%: √ / √ / Total: 100% This is an advanced and yet introductory subject for students, particularly practicing engineers in the railway industry. The subject encompasses all the important elements in a typical railway and a number of case studies are used to supplement the analytical discussions. The outcomes are assessed through a mini-project (which aims to integrate the various aspects learnt), tests and written examinations.
Student Study Effort Expected	Class contact: ▪ Lecture/Tutorial: 36 Hrs. ▪ Invited lecture: 3 Hrs. Other student study effort: ▪ Assignment and self-studies: 65 Hrs. Total student study effort: 104 Hrs.
Reading List and References	**Textbooks:** 1. M.H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd Edition, Prentice Hall 2004 2. Managing railway operations & maintenance: best practices from KCRC / edited by Robin Hirsch: technical co-editors, Felix Schmid, Michael Hamlyn. A & N Harris; Birmingham: University of Birmingham Press, 2007

	Reference books/journals: 1. J. Pachl, Railway Operation and Control. VTD Rail Publishing, Mountlake Terrace (USA) 2004. 2. Bonnett, Clifford F. Practical railway engineering, London: Imperial College Press, 2005. 3. Petros A. Ioannou, Intelligent Freight Transportation (Automation and Control Engineering), CRC Press, Taylor and Francis Group, 2008 4. O.S. Lock, Railway Signalling, 3rd Edition, A & C Black, 1993 5. M.E. Leach, Railway Control System, 2nd Edition, A & C Black, 1993 6. Selected papers from IEE Proceedings – Electric Power Applications

Subject Description Form

Subject Code	EE512D
Subject Title	Electric Vehicles
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Exclusion: EE543
Objectives	1. To acquire a broad knowledge on modern electric vehicles (EVs). 2. To understand the development of EVs from technological, environmental, and societal perspectives.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the importance of EVs for environment, energy sustainability and climate change. b. Understand various underpinning technologies for modern EVs, including electric motor drives, energy storage, batteries, charging methods, infrastructure and auxiliary systems. c. Explain the emerging technologies such as hybrid electric vehicles (HEVs), fuel cell electric vehicles (FEV) and energy storage methods.
Subject Synopsis/ Indicative Syllabus	1. ***Introduction to electric vehicles (EVs)*****:** Historical perspective. EV advantages and impacts. EV market and promotion: infrastructure needs, legislation and regulation, standardization. 2. ***Electric vehicle (EV) design options*****:** EV configurations: fixed vs. variable gearing, single- vs. multiple-motor drive, in-wheel drives. EV parameters, driving cycles and performance specifications. Choice of system voltage levels: electrical safety and protection. 3. V***ehicle dynamics and motor drives*****:** Road load: vehicle kinetics; effect of velocity, acceleration and grade. EV drivetrain and components. EV motor drive systems: DC drives, induction motor drives, permanent-magnet synchronous motor drives, switched reluctance motor drives. Control strategies. 4. ***Batteries*****:** Battery parameters. Types and characteristics of EV batteries. Battery testing and maintenance; charging schemes. Battery monitoring techniques. Open-circuit voltage and ampere-hour estimation. Battery load levelling. 5. ***Auxiliaries*****:** On-board and off-board battery chargers. Energy management units. Battery state-of-charge indicators. Temperature control units. Power steering. 6. ***Emerging EV technologies*****:** Hybrid electric vehicles (HEVs): types, operating modes, torque coordination and control, generator/motor requirements. Fuel cell electric vehicles (FEVs): fuel cell characteristics, hydrogen storage systems, reformers. Alternative sources of power: super- and ultra-capacitors, flywheels.

Teaching/Learning Methodology	Delivery of the subject is mainly through formal lectures, complemented by tutorials and worked examples. Self-learning on the part of students is strongly encouraged and extensive use of web resources will be made. A term paper and a related presentation enable students to develop skills in literature survey and writing. Oral presentation sessions develop students' skills in spoken communication and peer evaluation.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lectures	√	√	√
Tutorials	√	√	√
Assignment and oral presentation	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Examination	60%	√	√	√
2. Test	30%	√	√	√
3. Term paper	5%	√	√	√
4. Oral presentation	5%	√	√	√
Total	100%			

It is an advanced elective on electric vehicles. The outcomes on electric vehicle technology and its impacts are assessed by the usual means of test and examination, and partly by the term paper. The outcomes on technical communication and presentation skills are evaluated by the term paper and a related oral presentation.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Presentation/Tests	9 Hrs.
	Other student study effort:	
	▪ Self-study and revision	44 Hrs.
	▪ Report – Case Study	15 Hrs.
	Total student study effort	98 Hrs.

Reading List and References

Reference books:

1. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, London: Oxford University Press, 2001
2. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, New York: RC Press, 2003
3. M. Ehsani, Y. Gao, S.E. Gay and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004
4. Selected papers from relevant journals and conference proceedings, such as EVS

Subject Description Form

Subject Code	EE514D
Subject Title	Real Time Computing
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To understand the properties of real time languages, operating systems, associated hardware. 2. To apply real time system software in engineering applications. 3. To test and verify real time systems and software.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate the important issues in real time computing systems, and their relations in engineering applications. b. Identify and understand the real time issues in a computing OS system, and their mechanism of overcoming these obstacles. c. Communicate effectively during discussions and presentations. d. Equip individual the ability to analyse related issues and identify the proper solution in a real-time computing design.
Subject Synopsis/ Indicative Syllabus	1. ***Real time computing systems concepts*:** Characteristics of Real Time Computing. Properties and Speed Requirements of Real Time Systems. Synchronous Real Time Systems: Polled, Main Polled Loop with Interrupts, Cyclic Schedulers. Multi-Processors Real Time Systems: Multi-Processor Structures, Process Dispatch Latency, Inter CPU Communication, Hierarchical Approach to Real Time Systems. Process Scheduling Architecture of Cloud Computing. Example: a Real Time Control System in Coal-Fired Power Plant. 2. ***Real time systems design issues*:** Time Handling: Representation of Time, Time constraints, Time Service and Synchronization, the Master-Slave algorithm and the Time Distributed Clock algorithm. Real Time System Life Cycle: Requirement Specification,. Structured Design Approaches: Event Based Model, Process-Based Model.. Real Time System Modelling Example: Autonomous Robot Control. 3. ***Real time software*:** Real Time Programming Discipline, Asynchronous and Synchronous Real Time Language. Verification and Validation of Real Time Software: Testing Real Time Properties, Simulation as a Verification Tool, Testing Control and Data flow. Languages for real-time systems; real-time software analysis and design. Properties of Real Time Operating Systems; Allocation and Scheduling, Inter-process and Inter-processor communication; Distributed and Fault Tolerance Systems, Case Study: Real Time Linux. 4. ***Real time system applications*:** System supervision in Power System Process Operation. Implementation of Cloud technology to resolve the real-time system operation issues. Integration of high-speed communication network in favourable of speed performance in system operation. **Laboratory Experiment:** Appreciation of real time Linux and its application in Motor Control **Case study:**

	Real time power system simulation and data logging/queuing theory investigation in multi-servers system application.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on design and practical applications are given through a practical case study, in which the students are expected to understand design problems with real-life constraints and to attain pragmatic solutions.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Tutorials	√	√	√	
Experiments	√		√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√		
2. Tests (x2)	20%	√	√		
3. Assignment/Presentation	10%	√	√	√	
4. Laboratory experiments/Mini project/Report	10%	√	√		√
Total	100%				

The outcomes on concepts, design and applications of real-time systems are assessed by the usual means of examination and test whilst those on analytical skills, problem-solving techniques and practical considerations, as well as technical reporting and teamwork, are evaluated by experiments, mini-project and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Seminar	36 Hrs.
	▪ Laboratory demo	3 Hrs.
	Other student study effort:	
	▪ Case Study	15 Hrs.
	▪ Self-study	45 Hrs.
	Total student study effort	99 Hrs.

Reading List and References

Textbooks:

1. P. Laplante, Real-Time Systems Design and Analysis - An Engineer's Handbook, IEEE Computer Society Press, 1993

Reference books/materials:

1. S.T. Levi and A.K. Agrawala, Real Time System Design, McGraw-Hill, 1990
2. J.E. Cooling, Software Design for Real-time Systems, Chapman & Hall, 1991
3. J.A. Stankovic and K. Ramamritham, Advances in Real-Time Systems, IEEE Computer & Society Press, 1993
4. Selected papers from Proceedings of Real-time Systems Symnposium (IEEE)
5. Chris Moyer, Building Applications in the Cloud, Pearson Education, 2011

Subject Description Form

Subject Code	EE517D
Subject Title	Fibre Optic Components
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to understand the fundamentals of light emission, detection, amplification, and light propagation in optical fibres. 2. To learn the operation principles of key fibre components and apply the knowledge learned to design fibre components and devices.. 3. To appreciate the applications of fibre components in communication and sensing systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate the importance of optic fibre development from a historical perspective; understand the important role of advanced fibre components in enhancing the performance of modern fibre systems. b. Understand the operating principle of various fibre components and analyze/characterize the performance of fiber components. c. Understand the same function may be achieved by using different technology (e.g., electro-optic and acoustic modulation) and understand the advantage and limitations of each technology. d. Select the most appropriate principles/techniques to design a fibre optic component with required specification, read the data sheet of various fibre optic components.
Subject Synopsis/ Indicative Syllabus	1. ***Review of optics*****:** Wave/quantum nature of light. Polarization, index of refraction, reflection and refraction. 2. ***Optical fibres and cables*****:** Propagation of light in optical fibres. Different types of fibres. Fibre attenuation and dispersion. Optical fibre measurement. 3. ***Modulation of light*****:** Phase modulation, frequency modulation, intensity modulation. Birefringence and polarization modulation. Electro-optic, magneto-optic and acousto-optic effects. 4. ***Optical sources*****:** Emission and absorption of radiation. Population inversion. Optical feedback. Threshold condition. Laser modes. Light emitting diodes, semiconductor lasers, tunable lasers. 5. ***Optical amplifiers*****:** Rare-earth doped fibres, optical fibre amplifiers, semiconductor amplifiers. 6. ***Photo-detectors*****:** Photomultipliers, photoconductive detectors, junction detectors (p-i-n diode, avalanche photodiode). 7. ***Passive devices*****:** Fused bi-conical taper couplers. Thin-film multilayer interference filters. Wavelength division multiplexing (DWDM) devices. Fiber Bragg gratings and their fabrication techniques. Tunable Fabry-Perot filters. Optical isolators and circulators. Integrated optic devices. **Laboratory Demonstration:** Observation of fibre modal patterns Characterization of single mode fibres: loss, dispersion, polarization dependent loss Measurement of source (LED, multi and single mode diode lasers) spectrums and power-current relations

	Group-project Topics: To choose from a list of 15 topics and write a study report and give a presentation
Teaching/Learning Methodology	Lectures are the primary means of teaching the basic concepts and theories. The understanding of basic principle is further enhanced through tutorials and laboratory demonstrations. Experiences and knowledge on design and applications of various integrated/fiber optic components, and on the use of alternative technologies to realise similar functionalities are gained through the use of examples during lectures and discussions during tutorials, and through assignments and group-study projects.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Tutorials		√	√	√
Experiments		√		√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	
2. Tests and assignments	25%	√	√	√	√
3. Lab report	5%		√		
4. Group-project & report	10%		√	√	√
Total	100%				

The outcomes on concepts, design and applications are assessed by examinations, test and assignments whilst those on practical considerations of optical components and systems design, as well as team work and technical report writing abilities are evaluated by group projects and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	36 Hrs.
	▪ Laboratory demo	3 Hrs.
	Other student study effort:	
	▪ Self study and assignments	50 Hrs.
	▪ Group project and Report	10 Hrs.
	Total student study effort	99 Hrs.

Reading List and References

Reference books:

1. E. Hecht, Optics, 4th Edition, Addison-Wesley, 2002
2. G. Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill, 2000
3. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, 2nd Edition, Wiley Interscience, 2007
4. D.K. Mynbaev and L.L. Scheiner, Fiber-Optic Communications Technology, Prentice-H 2001
5. Selected papers from relevant journals

Subject Description Form

Subject Code	EE520D
Subject Title	Intelligent Motion Systems
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To describe an in depth knowledge on the design and operation of intelligent motion systems. 2. To relate and compare numerous application examples, which ranges from CD players and hard disc drives to robots and component insertion machines. 3. To enable the students to have the ability to design motion control systems for industry and domestic purposes.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Be able to contrast and compare different motion control system configurations, and select the most appropriate one for the task. To comprehend and understand numerous motion control examples for domestic and industrial applications. b. Understand the in-depth knowledge of motion drive and sensing techniques, and the ability to use them in real engineering applications. c. Have a broad understanding of motion control platform hardware and a visionary perspective on the future developments of computing/control hardware.
Subject Synopsis/ Indicative Syllabus	1. ***Structures of intelligent motion systems*:** Specifications and requirements of intelligent motion systems. Operating modes: point to point motion, trajectory path tracking, velocity path tracking, force and tension control, compliance control, vibration damping. Switching between operation modes. 2. ***Motion actuators and driving techniques*:** Using Voice Coil Motors and DC brush motors in motion control. AC brushless motors, linear direct drive AC brushless motors and their driving techniques. Stepping motors and their limitations in motion tracking systems. Microstepping and electronic damping of stepping motors. 3. ***Motion sensing and estimation techniques*:** Optical encoders: working principle, decoding method, and resolution enhancement through interpolation. Syncro-resolvers: working principle and interface electronics. Velocity estimation and position estimation methods for large speed range actuators. 4. ***Motion control platform*:** Computer hardware requirements. Tightly coupled systems versus distributed systems. Application of DSPs in motion control. Communication methods in motion systems. Real time operating system for motion control. 5. ***Intelligent algorithms for motion control and trajectory generation*:** PID controllers and their variations. Servo tuning methods. Motion control systems based on state space configuration. States observation and Kalman filters. Using Notch filters in non-rigid systems. Profile generation and motion planning algorithms. 6. ***Issues in multi-axis intelligent motion systems*:** co-ordinate mapping and dynamics transformation. Multi-axis motion planning and profile generation. Motion synchronisation between axis. Decoupling inter-axis motion interference. Applying MIMO structure in tightly coupled system. 7. ***Case studies in intelligent motion systems*:** Three examples will be selected from the following list: a. Optical based position tracking in CD-ROMs and Laser discs. b. Magnetic head positioning in hard disk drives. c. Motion control system design in multi-axis robot manipulators. d. Gantry robot motion systems for SMT component insertion machines. e. Motion systems in high precision CNC tooling machines. **Case study:** Report on a high performance motion control application example
Teaching/Learning Methodology	Delivery of the subject is mainly through formal lectures, complemented by tutorials and worked examples. Self-learning on the part of students is strongly encouraged and extensive use of web resources will be made. A term paper and a related presentation enable students to develop skills in literature survey and writing. Oral presentation sessions develop students' skills in spoken communication and peer evaluation.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lectures	√	√	√
Tutorials	√	√	√
Assignment and oral presentation	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Examination	60%	√	√	√
2. Test	30%	√	√	√
3. Report	5%	√	√	√
4. Oral presentation	5%	√	√	√
Total	100%			

One end-of-semester written examination; one mid-semester-test; one end-of-semester test; a report on an assigned topic; and a power point presentation for the particular topic.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	30 Hrs.
▪ Presentation/Test	9 Hrs.
Other student study effort:	
▪ Case study	15 Hrs.
▪ Self-study	45 Hrs.
Total student study effort	99 Hrs.

Reading List and References

References books:

1. S. Meshkat, Advanced Motion Control, PCIM reference series in Power Conversion and Intelligent Motion, 1988
2. M.M. Gupta, Intelligent Control Systems: Concepts and Applications, IEEE Press, 1996
3. K. Rajashekara, Sensorless Control of AC Motors, IEEE Press, 1996

	4. P.H. Garrett, Advanced Instrumentation and Computer I/O Design: Real Time Systems Computer Interface Engineering, Prentice Hall, 1994 5. Y. Oshima and Y. Akiyama, Servo Sensors Elements and Applications, PCIM reference series in Power Conversion and Intelligent Motion, 1988 6. W.S. Levine, The Control Handbook, CRC Press, 1996

Subject Description Form

Subject Code	EE521D
Subject Title	Industrial Power Electronics
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide power electronics engineers with in depth knowledge of the industrial power electronics. 2. To provide latest development in power supplies, industrial power electronics system and more electric aircraft will be covered. 3. To give industrial concern in power electronics design including passive components, packaging and standards
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Acquire a good understanding of power supply concept and design and be able to analyse the industrial needs for static power conversion. b. Understand the international standards on power electronics design. c. Have a global view on recent development on power electronics and be aware of applications of power electronics in various industries d. Work in teams and independently when conducting power electronics design and testing.
Subject Synopsis/ Indicative Syllabus	1. ***Industrial power systems:*** Static power systems, battery systems, AC systems, DC systems and AC-DC power conversion. 2. ***Power conversion:*** Soft-switching, power factor correction, inverter configurations and static converters. 3. ***Special environment power electronics:*** Power electronics distribution system, industrial guidelines, variable speed and constant frequency systems, actuation systems, brushless drives and other applications of power electronics in industry 4. ***Industrial power supplies:*** Converter topologies, decentralized power, power modules, electro-magnetic compatibility, international standards and reliability. 5. ***Devices and packaging:*** Hermetic and plastic packages, wire bonding, power devices, high temperature effect and substrates. 6. ***Magnetics and capacitors:*** High frequency inductors and transformers, winding techniques, core loss analysis, optimization of magnetics and power capacitors. **Laboratory Experiments:** Computer aided design for power electronics Power electronics for DC brushless motor Power Factor correction

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on design and practical applications are given through experiments and mini-projects, in which the students are expected to solve design problems with real-life constraints and to attain pragmatic solutions with critical and analytical thinking. Interactive laboratory sessions are introduced to encourage better preparation and hence understanding of the experiments. Experiments are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Tutorials	√	√		
Experiments				√

Assessment Methods in Alignment with Intended Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	
2. Test	20%	√	√	√	
3. Laboratory performance/report	20%				√
Total	100%				

One end-of-semester written examination; one mid-semester-test; one end-of-semester test; laboratory performance evaluation (including punctuality, initiative, and technical reasoning); and laboratory report on a particular experiment.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Tutorial/Student presentation	6 Hrs.
	▪ Laboratory	6 Hrs.
	Other student study effort:	
	▪ Laboratory and presentation preparation/report	15 Hrs.
	▪ Self-study	46 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference books:

1. A. M. Trzynadlowski, Introduction to Modern Power Electronics, Wiley, 2010.
2. M.Cirrincione, M. Pucci, G. Vitale, Power Converters and AC Electrical Drives with Linear Neural Networks, CRC Press, 2012.
3. N. Mohan, Power Electronics: A First Course, John Wiley & Sons, 2012.
4. F.P. McCluskey, High temperature Electronics, CRC Press, 1997
5. K.W.E. Cheng, Classical Switched Mode and Resonant Power Converters, The Hong Kong Polytechnic University, 2002

Subject Description Form

Subject Code	EE522D
Subject Title	Optical Fibre Systems
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce to students the theory and application of optical fibre communication and sensing technology. 2. To introduce to students the state-of the-art and future techniques for higher-performance fibre-optic systems. 3. To equip students the ability to analyse fibre-optic digital communication systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Appreciate recent developments in fibre optic communication systems, importance of fibre optic technology to the development of communications, engineering applications of fibre-optic technologies, and advantages of fibre-optic sensors to the electrical engineering industry. b. Know the principles of different types of optical fibre sensors, multiplexing techniques, and system applications. c. Select the most appropriate passive and active fibre-optic components to design fibre-optic sensor systems and fibre optic communication links d. Calculate the bit-error-rate performance of optical fibre communication systems; and the power budgets of fibre-optic links. e. Have hands-on experience in the use of fusion splicer to make low-loss fibre joints, optical spectrum analyzer to perform spectral measurements, and fibre grating sensors for temperature and strain measurements.
Subject Synopsis/ Indicative Syllabus	1. ***Overview of optical fibre communications*:** Historical perspective, basic concepts, lightwave systems and components, channel capacity. 2. ***Optical transmitters*:** Modulation response of laser diodes and LEDs; External modulation. Driving circuitry. 3. ***Optical receivers*:** Receiver components. Receiver design and performance. 4. ***System design and performance*:** System architectures. Operating wavelength and system limitations. Power and rise-time budgets. Noise effects and other source of power penalty. 5. ***Advanced systems and techniques*:** Wavelength division multiplexers. System performance aspects of semiconductor laser amplifiers and optical fibre amplifiers. Soliton transmission systems. Photonic switching. Coherent lightwave systems. 6. ***Basics of fibre optic sensors*:** Intrinsic and extrinsic sensors. Intensity modulation sensors. Phase modulation sensors. Polarisation modulation sensors. Wavelength and frequency modulation sensors. Fibre grating sensors. 7. ***Multiplexed and distributed fibre optic sensors*:** Time division multiplexing. Wavelength division multiplexing. Frequency division multiplexing. Coherence division multiplexing. Optical time domain reflectometry. Optical frequency domain reflectometry. 8. ***Fibre sensor systems and applications:*** Fibre optic acoustic sensors, current sensors, temperature and strain sensors. Fibre optic gyroscopes. Fibre sensors for structural monitoring. Chemical sensors.

	Laboratory Experiments/Demonstrations: Optical spectrum analyzer for the observation of nonlinear effects and laser spectrum Insertion loss measurement of optical fibres Fibre Bragg grating sensors Optical fibre amplifiers
Teaching/Learning Methodology	Lectures, quizzes, tests, laboratory experiments, mini-projects, and examination.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials		√	√	√	
Demonstration/Experiments			√		√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1.Tests/Quizzes/Assignments	30%	√	√	√	√	
2. Lab and report	5%			√		√
3. Mini-project and report	5%	√	√	√		
4. Examination	60%		√	√	√	
Total	100%					

This subject introduces the theory and applications of optical fibre communication and sensor technology. The outcomes are assessed by quizzes, tests, mini-projects, laboratory experiments and examination.

Student Study Effort Expected	Class contact:	
	▪ Lectures/Tutorials/Seminar	39 Hrs.
	Other student study effort:	
	▪ Mini-projects	30 Hrs.
	▪ Self-study	33 Hrs.
	Total student study effort	102 Hrs.

Reading List and References

Reference books:

1. J.M. Senior, Optical Fiber Communications-Principles and Practice, 3rd Edition, Prentice Hall, 2008
2. J.C. Palais, Fiber Optic Communications, 5th Edition, Prentice Hall, 2005
3. G.P. Agrawal, Fiber-optic Communication Systems, 3rd Edition, Wiley, 2002
4. G. Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill, 1999
5. J. P. Dakin and B. Culshaw, Optical Fibre Sensors, Artech House, Vols.1&2, 1989, and Vols.3&4, 1997.

Subject Description Form

Subject Code	EE524D
Subject Title	Open Electricity Market Operation
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to establish a broad knowledge of open electricity market operation and to understand the major market models in the world. 2. To enable students to understand the key issues in open electricity market operation including deregulated power system operation, transmission pricing, procurement of ancillary services, congestion management, available transmission capacity so that students are provided with knowledge and techniques they need to meet the electric industry's challenges in the 21st century.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Acquire a good understand of different power market models and financial tools to hedge risks used in electricity supply industries. b. Analyse the available transmission capacity and formulate equitable transmission pricing in electricity markets. c. Assess ancillary services requirements based on security and economic considerations. d. Present technical results in the form of technical report and verbal presentation
Subject Synopsis/ Indicative Syllabus	1. ***Introduction*:** Background. Competition and electricity industry structuring. Retail access and wheeling. Poolco and British model. Bilateral-contract and multilateral-contract models. Role of existing players. Power exchange. Independent system operators. Marketers, brokers and aggregators. 2. ***Electricity market*:** Purchasing electricity in an open market. Evaluating load and risk. Coordinating power suppliers. Use of financial tools. Managing risk. Derivatives and electricity futures. Transmission congestion management in electricity market. Security considerations. 3. ***Transmission and ancillary services*:** Transmission ownership and restructuring. Measuring available transmission capacity in energy markets. Purchasing transmission capacity. Network and point to point transmission services. Fixed and firm transmission rights. Ancillary services. 4. ***Transmission pricing*:** The costs of transmission services. Locational prices. Embedded cost allocation methods. Stranded assets. Game theory approach. Short-run marginal cost. Long-run marginal cost. Integrated approach of transmission pricing.

Teaching/Learning Methodology

The concept of electricity market modelling and economic analysis framework will be presented through lectures and tutorials with reference to real-life market environment. Students will be required to form groups to work through cases covering the market structure and operational aspects so as to develop ability to critically evaluate principles and operation of electricity markets. Tutorials will be structured on different sessions for better understanding on the theoretical concepts which require sufficient contribution from students. Students will also learn through active participation in the presentation of finding of their case studies.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	√
Case Studies & Presentation	√	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Examination	60%	√	√	√	
2. In-class Test	20%	√			
3. Cases study & presentation	20%	√	√	√	√
Total	100%				

The outcomes on the concepts of modelling, analysis and applications are assessed by the usual means of examination and test whilst those on problem-solving techniques and presentation of findings, as well as technical reporting and teamwork, are evaluated by the case study exercise.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	36 Hrs.
▪ Presentation	3 Hrs.
Other student study effort:	
▪ Case study and report	12 Hrs.
▪ Self-study	48 Hrs.
Total student study effort	99 Hrs.

Reading List and References

Textbooks books:

1. Daniel S. Kirschen and Goran Strbac, Fundamentals of Power System Economics, Wiley 2004
2. Mohammad Shahidehpour, Hatim Yamin, and Zuyi Li, Market Operations in Electric Power Systems, John Wiley & Sons, 2002

Reference books:

1. S. Hunt and G. Shuttleworth, Competition and Choice in Electricity, Wiley, 1996
2. P.C. Christensin, Retail Wheeling, a Guide for End-users, Penn Well Publishing Co., 1998
3. M. Ilic, F. Grliana, and L. Fink, Power System Restructuring, Kluwer Academic Publishers, 1998
4. Utility Negotiating Strategies for End-users, Penn Well Publishing Co., 1998
5. K. Bhattacharya, M.H.J. Bollen, and J.E. Daalder, Operation of Restructured Power System, Kluwer Academic Publishers, 2001

Subject Description Form

Subject Code	EE525D
Subject Title	Energy Policy and Restructuring of Electricity Supply Industry
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with a comprehensive knowledge in formulating practical energy policies for sustainable energy utilization. 2. To develop a conceptual framework for understanding key and practical issues of restructuring electricity supply industry.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Identify, evaluate and formulate energy polices for sustainable energy utilization. b. Identify the rationale and key issues for restructuring electricity supply industry. c. Explain the market structures and regulatory framework for electricity supply industry. d. Explain and evaluate different pricing concepts and pricing contracts in restructured electricity supply industry. e. Present the results of study in the form of written technical reports and oral presentation.
Subject Synopsis/ Indicative Syllabus	1. ***Energy policy*****:** Scope and limit of energy policy. Policy responses: environmental control and clean energy technology, energy efficiency and alternative energy sources. Policy instruments and their evaluation. Sustainable energy concept: trade-off between energy consumption, resources availability and environment deterioration. 2. ***Energy conservation and demand side management*****:** Energy conservation policy: efficient utilization and transformation, recycling of materials and waste heat extraction. Load management: energy and load growth, direct and indirect load control. Integrated Resources Planning: system cost, end-use development and environment cost. 3. ***Restructuring of the ESI*****:** Electricity supply industry structures; Privatisation and competition; Market structures and architectures; Regulation of Electricity Markets; Key issues for China and Hong Kong. 4. ***Electricity pricing and management*****:** Short range marginal cost. Real time and time-of-day pricing applications. Analysis of BOT option. Transmission contracts pricing. Futures and forward markets. **Case Study:** 1. Functional analysis on energy policies 2. Practical application of sustainable energy measures 3. Analysis on key issues of ESI restructuring 4. Implementation issues on ESI restructuring

Teaching/Learning Methodology	The concept of energy policy, identifications and discussions of ways of restructuring electricity supply industry will be presented through lectures and tutorials on case studies and international experiences. Students are expected to take initiative to learn through the process of engagement and participation in lectures and tutorial sessions. Mini-Projects are used to enhance students learning experiences and practical applications. They provide students with the opportunity to develop independent evaluation, formulation and technical report writing skills pertinent to the field of energy policy and restructuring electricity supply industry.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials	√	√	√	√	
Mini-projects	√	√		√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√	√	
2. Class Test/Quiz	25%	√	√	√	√	
3. Mini-project & report	15%	√	√		√	√
Total	100 %					

The subject outcomes on concepts, evaluations and formulations are assessed by means of examination, quizzes and tests. The outcomes on practical formulations, implementation and evaluations of energy polices, restructuring electricity supply industry and electricity pricing, as well as technical writing, are assessed by mini-project and reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Case studies/Group discussion	9 Hrs.
	Other student study effort:	
	▪ Mini-project discussion/report	18 Hrs.
	▪ Self-study	40 Hrs.
	Total student study effort	97 Hrs.

Reading List and References

Reference books:

1. M. Chick, Electricity and Energy Policy in Britain, France and the United States since 1945, Cheltenham, Northampton, Mass: Edward Elgar, 2007
2. J. Glachant, Competition, Contracts and Electricity Markets: A New Perspective, Edward Elgar, 2011
3. A. Kerstin, Energy Policy Instruments: Perspectives on their Choice, Combinations and Evaluation, Lund University Press, 2006
4. International Energy Agency, Electricity Supply Industry, OECD/IEA, 1994
5. M. Shahidehpour, Restructured Electrical Power System, Operation, Trading and Volatility, Marcel Dekker. 2001
6. H. Khatib, Economic Evaluation of Projects in the Electricity Supply Industry, IEE, 2003

Subject Description Form

Subject Code	EE526D
Subject Title	Power System Analysis and Dynamics
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the students to the advanced concepts and analytical skills for the stability analysis in modern power systems. 2. To understand the impact due to different system instabilities. 3. To analyse and provide solutions to the power system stability problems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Acquire in-depth understanding of different types of power system stability problems. b. Model the dynamic behaviours of system components under disturbances. c. Apply and adapt applications of mathematics and engineering skills in the analysis of stability problems. d. Discuss the causes and effects of instabilities and recommend possible solutions. e. Acquire skills in presentation and interpretation of experimental results and communicate in written form
Subject Synopsis/ Indicative Syllabus	1. ***Reactive power compensation*:** System Q-V Characteristics. Reactive support theory. Load Characteristics. Synchronous condensers; Static Var Compensators (SVS); Thyristor Switched Capacitor (TSC); Thyristor controlled Reactor (TCR). 2. ***Voltage stability*:** Fundamental concepts. Singularities and multiple load flow techniques, eigenvalue methods. Load modelling, tap-changer effects, voltage controllability and voltage compensation. Proximity of collapse, Measures against collapse. Practical experience. 3. ***Dynamic stability & power system stabilisers*:** Eigenvalue and modal analysis. Generator and load modelling. Power system stabiliser. Small-signal stability of multi-machine systems. PSS Design and commissioning. 4. ***AC/DC systems and FACTS devices*:** HVDC link operation. Control of the d.c. terminals to damp a.c. dynamic instability and improve transient stability. Flexible AC transmission devices; power angle control. **Laboratory Experiment:** Power system stability analysis using Power System Stability Tools "DST".

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through experiments, in which the students are expected to solve the power system stability and control design problems with practical constraints and to attain pragmatic solutions with critical and analytical thinking. Experiments are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials			√		
Experiments		√			√

Assessment Methods in Alignment with Intended Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√	√	
2. Class Test	30%	√	√	√	√	
3. Laboratory Performance & Report	10%				√	√
Total	100%					

The outcomes on concepts, design and applications are assessed by the usual means of examination and test Experiments and written reports assess those on analytical skills, problem-solving techniques and practical considerations of power system stability and control design as well as technical reporting.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	36 Hrs.
	▪ Laboratory	8 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	12 Hrs.
	▪ Self-study	44 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference Books:

1. P. Kundur, Power System Stability and Control, McGraw Hill, 1994
2. P.M. Anderson and A.A. Fouad, Power System Control and Stability, Wiley-IEEE Press, 2nd Edition, 2002
3. G. Rogers, Power System Oscillations, Springer, 1999
4. Voltage Stability of Power Systems: Concepts, Analytical Tools and Industry Experience, IEEE Publication 90th 0358-2-PWR, 1990
5. Y.H. Song, and A.T. Johns, Flexible AC Transmission Systems, IEE, 1999
6. T.V. Cutsem, and C. Vournas, Voltage Stability of Electric Power Systems, Springer, 2nd Edition, 2007

Subject Description Form

Subject Code	EE527D
Subject Title	Auto-tuning for Industrial Processes
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To facilitate a solid understanding of system identification. 2. To provide students with a solid knowledge of adaptive control. 3. To present a detailed survey of different auto-tuning methods used in industry.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Conduct parametric and non-parametric estimation for unknown processes. b. Design self-tuning and adaptive controllers. c. Design auto-tuning control systems based on relay auto-tuner. d. Use CAD package for design and simulation.
Subject Synopsis/ Indicative Syllabus	1. ***System identification*:** Lower-order modelling, Frequency response identification, Continuous-time and discrete-time identification, Identification by correlation, Least-squares algorithm, Recursive least-squares, Extended least-squares. Computer implementation of these algorithms. 2. ***Auto-tuning*:** PID auto-tuning, Relay auto-tuning, Applications in industry. 3. ***Self-tuning control*:** Self-tuning algorithms, Minimum variance and generalised minimum variance, Pole-placement algorithms, Model reference adaptive systems. **Case study:** Individual assignment related to above methods. Students will write a report and present their finding to the class.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Case studies are designed to supplement the lecturing materials. The students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes			
	a	b	c	d
Lectures	√	√	√	
Tutorials	√	√	√	
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. Examination	60%	√	√	√	
2. Case studies	40%	√	√	√	√
Total	100%				

The outcomes on concepts, analysis and design are assessed by the usual means of examination.

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Case study	9 Hrs.
	Other student study effort:	
	▪ Case study preparation/report	19 Hrs.
	▪ Self-study	44 Hrs.
	Total student study effort	102 Hrs.

Reading List and References

Reference books:

1. L. Ljung, System Identification: Theory for the User, Upper Saddle River, N.J., Prentice Hall, 1999
2. C.C. Hang, T.H. Lee and W.K. Ho, Adaptive Control, Research Triangle Park, N.C. Instrument Society of America, 1993
3. Selected papers from IEEE Transactions and IEE proceeding and other relevant journals
4. P.E. Wellstead and W. Zarrop, Self-tuning Systems: Control and Signal Processing, Cichester, England: New York; Wiley, 1991
5. K. J. Astrom abd B. Wittenmark, Adaptive control, Reading: Mass., Addison-Wesley, 1995.

Subject Description Form

Subject Code	EE528D
Subject Title	System Modelling and Optimal Control
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. Provide students with a sound knowledge of system modelling techniques in areas of prediction and control. In addition, modern control design techniques will also be introduced.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Model systems using State Variable and Transfer Functions. b. Design optimal controllers for system models. c. Apply computer packages for control system modelling and design. d. Report and present the technical findings in logical and organised manner. e. Practice their knowledge in team work.
Subject Synopsis/ Indicative Syllabus	1. ***System models*****:** State Space Models, State Space Representations of Transfer Functions. 2. ***Optimisations***: Multivariables optimisations; Optimisations with constraints. 3. ***Optimal control*****:** Calculus of variations, Formulation of optimal control problems, Pontryagin maximum principle, Riccati equation, Application to linear regulator, Application to time and fuel optimal systems, Bang Bang control. 4. ***Case Studies*****:** Application of the above topics in the solution of engineering problems. **Laboratory Experiments:** Matlab Fundamentals Transformation of System Models with Matlab Simulations of optimal control systems
Teaching/Learning Methodology	Basic concepts and theories are taught in lectures and tutorials. When conducting the experiments, the students are expected to solve practical control problems with critical and analytical thinking. Interactive assignments and on-the-spot discussions are conducted in both lectures and laboratory sessions. Experiments are designed so that the students should use the references in the instruction sheets to look for the supplementary information.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√		
Tutorials	√	√	√		
Experiments			√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes	The outcomes on concepts, design and applications are assessed by the usual means of examination and tests. The outcomes on analytical skills, problem-solving techniques and practical considerations of designing control systems, as well as technical reporting and teamwork, are evaluated by experiments and the reports.

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√		
2. Tests	20%	√	√	√		
3. Laboratory performance & reports	10%			√	√	√
4. Assignments & class works	10%	√	√	√		
Total	100%					

Student Study Effort Expected	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Laboratory	9 Hrs.
	Other student study effort:	
	▪ Laboratory preparation/report	15 Hrs.
	▪ Self-study and assignments	48 Hrs.
	Total student study effort	102 Hrs.

Reading List and References

Reference books:

1. M. Gopal: Control Systems, 3rd Edition, Tata McGraw-Hill, 2008.
2. K. Ogata, Modern Control Engineering, Prentice-Hall, 2010
3. F.S. Hillier, Introduction to operations research, McGraw Hill, 2010
4. A.C. Chiang, Elements of Dynamic Optimization, McGraw Hill, 1992

Subject Description Form

Subject Code	EE529D
Subject Title	Power Electronics for Utility Applications
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to understand the problems faced by modern power utilities and how power electronics can overcome these problems. 2. To introduce to students to the various topologies of the power electronics circuits. 3. To provide basic understanding of the emerging power electronics technologies for power utility applications. 4. To enable students to understand the harmonics issues in power utility and means of controlling it using power electronics. 5. To enable students to design power electronics circuit that can control active and reactive power flow.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Explain why power electronics are needed in modern power system and understand of various emerging power electronics technologies for power utility applications. b. Explain the main topologies of power electronic circuits used in utility applications and how these differ from low power applications. c. Determine the harmonic filter required to satisfy the harmonic standard for a given harmonic load in a power system. d. Identify power electronics topologies for used in controlling active and reactive power in a power system. e. Communicate and work effectively on why and how power electronics can be used for power utility applications in terms of written reports and oral presentations
Subject Synopsis/ Indicative Syllabus	1. Power electronics revolutions in utility applications: High power devices, Power Electronics and utility needs, control of power flow in the utility grid, distributed generation, improvement of electrical energy efficiencies, power quality, an overview of power electronics systems and their applications. 2. Inverters for high power applications: Basic principles of current and voltage source inverters for high power applications, Multi-level Inverters, Analysis of their performance, AC and DC harmonics, Interaction with power grid. 3. Transmission systems: High power issues, Source side model, Power transfer and voltage control issues, Damping of oscillation issues, Power Electronics solutions. 4. Power system harmonic elimination techniques: Harmonics measures, Harmonic models, Harmonics standards, Propagation of Harmonics, Passive Filters, Source side issues, Active Filters. 5. Reactive power compensations: concepts of reactive power, traditional means of controlling reactive powers, Power electronics applications for Static VAr Compensation (SVC), control of SVC, Harmonic issues, Analysis of performance and instabilities, Voltage Source Static Condensers (STATCON). 6. New applications of power electronics for power system controls: Power Electronics for HVDC system, High Power DC-DC Converter, Topology Analysis of HVDC conversion, Flexible AC Transmission Devices, Unified Power Flow Controller (UPFC), Battery Energy Storage Systems, Analysis of performance and Control strategies.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Mini-projects are designed to supplement the lecturing materials so that the students are given a design. They are given in the beginning of the study. Students are encouraged to form group to jointly investigate an power electronics utilization problem and they have to present the projects in front of the class.

Teaching/Learning Methodology	Outcomes				
	a	b	c	d	e
Lectures	√	√	√	√	
Tutorials	√	√	√	√	
Mini-project	√				√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a	b	c	d	e
1. Examination	60%	√	√	√	√	
2. Class Test	20%	√	√	√	√	
3. Mini-project & Report	20%	√	√	√	√	√
Total	100%					

It is a high power electronics application subject. The outcomes on concepts, design and applications are assessed by the usual means of examination and test whilst those on analytical skills, problem-solving techniques and practical considerations of power design, as well as technical reporting and teamwork, are evaluated by mini-project and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture	30 Hrs.
	▪ Tutorial/Student presentation	9 Hrs.
	Other student study effort:	
	▪ Mini-project/report	15 Hrs.
	▪ Self-study	46 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Textbooks:

1. V.K. Sood, HVDC and FACTS Controllers: Applications of Static Converters in Power Systems, Kluwer Academic Publishers, 2008.
2. Ghosh and Ledwich, Power Quality Enhancement Using Custom Power Devices, Kluwer, 2002

Reference books:

1. Zhang, Rehtanz and Pal, Flexible AC Transmission Systems: Modelling and Control, Springer, 2006
2. M.H. Rashid, Power Electronics Handbook: Devices, Circuits and Applications, Elsevier, 2005
3. K.W.E.Cheng, Classical Switched Mode and Resonant Power Converters, The Hong Kong Polytechnic University, 2002
4. E.Acha, V.Agelidis, O. Anaya-Lara, T. Miller, Power Electronic Control in Electrical

	Systems, Newnes, 2002. 5. Xi-Fan Wang, Yonghua Song and Malcolm Irving, Modern Power Systems Analysis (Power Electronics and Power Systems), Springer, 2008.

Subject Description Form

Subject Code	EE530D
Subject Title	Electrical Energy-saving Systems
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To enable students to establish a broad concept on energy saving using techniques of electrical engineering. 2. To provide an in-depth knowledge on selected topics of energy-saving systems in electrical engineering. 3. To enable students to understand typical energy storage systems, its associated issues of grid connection and related technical considerations. 4. To enable students to understand the potential of solar energy and characteristics & performance of various kinds solar energy systems. 5. To enable students to understand various techniques and systems for control and monitoring of energy saving, as well as the related communication protocol and interfacing requirements. 6. To enable students to understand control gears for lighting systems and variable speed drives for HVAC systems & elevators.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Describe the operation principle & control strategy of various energy storage systems and topologies of these systems and identify their benefits & impacts. b. Describe the principle and characteristics of various solar energy devices, and identify the potentials of solar energy. Calculate available solar irradiation for a given location. c. Describe the operation principle and characteristics of typical control and monitoring systems for energy saving, including the communication protocols. d. Identify different energy saving control for industrial plants and multi-storey buildings, including giving examples. e. Describe the operation principle and characteristics of typical control gear for lighting and variables speed drives. f. Given a technical topic, carry out literature search and report the findings in a presentation and be able to work and communicate effectively in a team setting.
Subject Synopsis/ Indicative Syllabus	1. ***Energy storage systems:*** Utility Load Factor, peak lopping and valley filling, energy storage systems, battery energy storage, power electronics topologies, control strategy, grid connection, voltage support, power quality improvement, environmental impact, improvement of utility energy efficiencies. 2. ***Solar energy utilization:*** Solar irradiation on earth, potentials of solar energy, solar thermal system systems, photovoltaic systems, characteristics and performance of typical BIPV systems and estimation of its energy output, passive solar devices on buildings for energy saving, and case study. 3. ***Energy saving control and monitoring systems:*** Theory of energy saving, concept of building energy efficiency, control and monitoring systems and some of its related communication protocols. Application examples.

	4. ***Lighting, ballast, and variable speed drives:*** Magnetic ballast, electronic ballast, lighting design, fluorescent, LED and HID lamps, variable speed drives for HVAC systems and elevators, harmonics implications. **Laboratory Experiments, Seminars, Site Visits:** Demonstration on operating principles of some selected energy-saving systems. **Case study:** Selections of practical real life energy-saving systems in Hong Kong.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Practical experiences on power electronics design, energy saving and applications are given through mini-projects. Mini-projects are given in the beginning of the study. Students are encouraged to form group to jointly investigate an industrial problem and they have to present the projects in front of the class.

Teaching/Learning Methodology	Outcomes					
	a	b	c	d	e	f
Lectures	√	√	√	√	√	
Tutorials	√	√	√	√	√	
Mini-project						√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		a	b	c	d	e	f
1. Examination	60%	√	√	√	√	√	
2. Class Test	30%	√	√	√	√	√	
3. Mini-project & Report	10%	√	√	√	√	√	√
Total	100%						

It is a fundamental energy saving subject. The outcomes on concepts, design and applications are assessed by the usual means of examination and test whilst those on analytical skills, problem-solving techniques and practical considerations of circuit design, as well as technical reporting and teamwork, are evaluated by experiments, mini-project and the reports.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Seminar/Case study	9 Hrs.
	Other student study effort:	
	▪ Mini-project/report	15 Hrs.
	▪ Self-study	46 Hrs.
	Total student study effort	100 Hrs.

Reading List and References

Reference books:

Battery Storage Systems
1. D. Andrea, Battery Management Systems for Large Lithium Ion Battery Packs, Artech House, 2010.
2. P.W. Parfomak, Energy storage for Power Grids and Electric Transportation: A Technology Assessment, Congressional Research Service, 2012,
3. Y. Brunet, Energy storage, Wiley, 2010
4. F. S. Barnes, J.G. Levine, Large Energy Storage Systems Handbook, CRC Press, 2011

Solar Energy Utilisation

	5. S. Yannas, Solar Energy and Housing Design, Architectural Association, 2005/2006 6. R. Messenger, Photovoltaic Systems Engineering, CRC Press, 2000 7. C. Prapanavarat, Investigation of the Performance of a Photovoltaic AC Module, Generation, Transmission and Distribution, IEE Proceedings, Vol: 149, Issue 4, Jul 2002 8. Web site of Energy Efficiency and Renewable Energy from the Dept. of Energy of USA, http://www.eere.energy.gov/ 9. Web site of the Key Centre of Photovoltaic Engineering in University of New South Wales, http://www.pv.unsw.edu.au/ <u>Energy Saving Control and Monitoring Systems</u> 10. EMSD of HKSAR Govt, Code of Practice for Energy Efficiency of Building Services Installation, 2012 11. EMSD of HKSAR Govt, Code of Practice for Building Energy Audit, 2012 12. M. Wiebe, A Guide to Utility Automation: AMR, SCADA, and IT Systems for Electric Power, c1999 13. Bela Liptak, Instrument Engineers' Handbook, 4th Edition, Volume Two: Process Control and Optimization, CRC 2005. <u>Lighting, Ballast, and Variable Speed Drives</u> 14. J.R. Benya, D.J. Leban, Lighting Retrofit and Relighting: A Guide to Energy Efficient Lighting, John Wiley & Son, 2011 15. M.H. Rashid, Power Electronics Handbook: Devices, Circuits and Applications, Academic Press, 2010 16. Guidelines on Energy Efficiency of Lift and Escalator Installations, 2000 Edition, Electrical and Mechanical Services Department (EMSD), the Government of the HKSAR, Hong Kong 17. K.W.E.Cheng, Design and Fabrication of Electronics and Optical Systems for Advanced Automotive Lighting Systems, The Hong Kong Polytechnic University, 2007

Subject Description Form

Subject Code	ELC1012/ELC1013
Subject Title	English for University Studies (This subject will be offered in two versions for students who will primarily be using (1) APA/Harvard referencing styles or (2) IEEE/Vancouver referencing styles in their university studies.)
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	Students entering the University with Level 5 from the HKDSE will be exempted from this subject. They can proceed to Advanced English for University Studies (ELC1014).
Objectives	This subject aims to help students study effectively in the University's English medium learning environment, and to improve and develop their English language proficiency within a framework of university study contexts.
Intended Learning Outcomes *(Note 1)*	Upon successful completion of the subject, students will be able to: a. refer to sources in written texts and oral presentations b. paraphrase and summarise materials from written and spoken sources c. plan, write and revise expository essays with references to sources d. deliver effective oral presentations To achieve the above outcomes, students are expected to use language and text structure appropriate to the context, select information critically, and present information logically and coherently.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	1. Written communication Analysing and practising common writing functions; improving the ability of writing topic sentences and strategies for paragraph development; understanding common patterns of organisation in expository writing; taking notes from written and spoken sources; practisingsummarising and paraphrasing skills; improving coherence and cohesion in writing; developing revision and proofreading skills. 2.Spoken communication Recognising the purposes of and differences between spoken and written communication in English in university study contexts; identifying and practising the verbal and non-verbal interaction strategies in oral presentations; developing and applying critical thinking skills to discussions of issues. 3.Language development Improving and extending relevant features of grammar, vocabulary and pronunciation.
Teaching/Learning Methodology *(Note 3)*	The study method is primarily seminar-based. Following a blended delivery approach, activities include teacher input as well as in- and out-of-class individual and group work involving drafting and evaluating texts, mini-presentations, discussions and simulations. The process approach to writing is adopted, and students make use of elearning resources to engage in academic discussions and to reflect on their learning.

	Learning materials developed by the English Language Centre are used throughout the course. Students will be referred to learning resources on the Internet and in the ELC's Centre for Independent Language Learning. Additional reference materials will be recommended as required.
Assessment Methods in Alignment with Intended Learning Outcomes *(Note 4)*	See table below

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Academic essay 1	30%	√	√	√	
2. Academic essay 2	30%	√	√	√	
3. Oral presentation	40%	√	√		√
Total	100 %				

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

Assessments 1 and 2 necessitate achievement of LOs (a), (b) and (c) in order to write an effective academic essay via the process of extending and improving the essay for assessment 1. In order for students to present an effective academic oral presentation, as demanded in assessment 3, they will need to read, note and synthesise from a variety of sources, and refer to those sources in their presentation (ref. LOs (a), (b) and (d)).

In addition to these assessments, students are required to complete further language training, through web-based language work, reading tasks and online reflections. The additional language training offered in online tasks is aligned with all the four LOs. In some of the tasks, students to critically read and summarise information contained in a variety of sources, as required in LOs (a) and (b).

Student Study Effort Expected	Class contact:	
	▪ Seminars	39Hrs.
	Other student study effort:	
	▪ Self study/preparation	78Hrs.
	Total student study effort	117Hrs.

Reading List and References

Course material

Learning materials developed by the English Language Centre

Recommended references

Comfort, J. (2001). *Effective presentations*. Oxford: Cornelsen& Oxford University Press.

Hung, T. T. N. (2005). *Understanding English grammar: A course book for Chinese learners of English*. Hong Kong: Hong Kong University Press.

McWhorter, K. T. (2012). *The successful writer's handbook*. (2nd ed.). Boston: Longman.

Zwier, L. J. (2002). *Building academic vocabulary*. Ann Arbor, MI: University of Michigan

	Press.

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus
The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology
This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method
This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

Subject Description Form

Subject Code	ELC1014
Subject Title	Advanced English for University Studies
Credit Value	3
Level	1
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: English for University Studies (ELC1012/ELC1013) (unless exempted)
Objectives	This subject aims to help students study effectively in the University's English medium learning environment, and to improve and develop their English language proficiency within a framework of university study contexts.
Intended Learning Outcomes *(Note 1)*	Upon successful completion of the subject, students will be able to: a. use academic sources appropriately and effectively b. plan, write and revise position argument essays (i.e. one-sided discursive essays) with appropriate referencing; and c. present views effectively and critically in spoken communication To achieve the above outcomes, students are expected to use language and text structure appropriate to the context, select information critically, and present and support stance and opinion logically and persuasively.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	1. Written communication Developing logical and persuasive arguments; applying a variety of organisation patterns in discursive writing, including the writing of explanatory and evaluative texts; selecting information critically; supporting stance; maintaining cohesion and coherence in discursive writing; achieving appropriate style and tone. 2. Spoken communication Enhancing and practising the specific oral and aural skills required to participate effectively in academic discussions and to present views in a formal academic context. 3. Reading and listening Understanding the content and structure of information in oral and written texts; comprehending, inferring and evaluating messages and attitude. 4. Language development Improving and extending relevant features of grammar, vocabulary and pronunciation.
Teaching/Learning Methodology *(Note 3)*	The study method is primarily seminar-based. Following a blended delivery approach, activities include teacher input as well as in- and out-of-class individual and group work involving drafting and evaluating texts, mini-presentations, discussions and simulations. The process approach to writing is adopted, and students make use of elearning resources to engage in academic discussions and to reflect on their learning. Learning materials developed by the English Language Centre are used throughout the course. Students will be referred to learning resources on the Internet and in the ELC's

	Centre for Independent Language Learning. Additional reference materials will be recommended as required.
Assessment Methods in Alignment with Intended Learning Outcomes *(Note 4)*	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Position Argument Essay (draft)	20%	√	√	
2. Position Argument Essay (final)	45%	√	√	
3. Academic presentation & discussion	35%	√		√
Total	100 %			

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

Assessments 1 and 2 assess the students' abilities in producing a coherent academic text which requires effective use and referencing of sources (ref. LOs (a) and (b)). Assessment 3 assesses their abilities to plan and present their ideas, in two different academic contexts (ref. LOs (a) and (c)).

In addition to these assessments, students are required to complete further language training through working on their ePortfolio throughout the course. This will involve students in reading texts and subsequent online writing and discussion that will parallel the process writing approach involved in assessments 1 and 2, and align with all three LOs.

Student Study Effort Expected	Class contact:	
	▪ Seminars	39 Hrs.
	Other student study effort:	
	▪ Self study/preparation	78 Hrs.
	Total student study effort	117 Hrs.

Reading List and References

Course material

Learning materials developed by the English Language Centre

Recommended references

Faigley, L. (2008). Backpack writing: Reflecting, arguing, informing, analyzing, evaluating. New York, NY: Pearson/Longman.

Madden, C. and Rohlck, T. N. (1997). *Discussion and interaction in the academic community*. Ann Arbor, MI: University of Michigan Press.

Oshima, A. & Hogue, A. (2006). *Writing academic English* (4th ed.). White Plains, NY: Pearson/Longman.

Reinhart, S. M. (2002). *Giving academic presentations.* Ann Arbor, MI: University of Michigan Press.

	Wood, N. V. (2009). *Perspectives on argument* (6th ed). Upper Saddle River, NJ: Pearson/Prentice Hall.

Note 1: Intended Learning Outcomes
Intended learning outcomes should state what students should be able to do or attain upon completion of the subject. Subject outcomes are expected to contribute to the attainment of the overall programme outcomes.

Note 2: Subject Synopsis/ Indicative Syllabus
The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology
This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method
This section should include the assessment method(s) to be used and its relative weighting, and indicate which of the subject intended learning outcomes that each method purports to assess. It should also provide a brief explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes.

Subject Description Form

Subject Code	ELC3521
Subject Title	Professional Communication in English
Credit Value	2
Level	3
Pre-requisite / Co-requisite/ Exclusion	English LCR subjects
Objectives	This subject aims to develop the language competence for professional communication in English required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals.
Intended Learning Outcomes	Upon completion of the subject, and in relation to effective communication with a variety of intended readers/audiences in English, students will be able to: a. plan, organise and produce professionally acceptable project proposals with appropriate text structures and language for different intended readers b. plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences c. adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences
Subject Synopsis/ Indicative Syllabus	1. Project proposals in English • Planning and organising project proposals • Explaining the background, rationale, objectives, scope and significance of a project • Referring to the literature to substantiate project proposals • Describing the methods of study • Describing and discussing project results, including anticipated results and results of pilot study • Presenting the budget, schedule and/or method of evaluation • Writing executive summaries/abstracts 2. Oral presentations of projects in English • Selecting content for audience-focused presentations • Choosing language and style appropriate to the intended audience • Using appropriate transitions and maintaining coherence in team presentations • Using effective verbal and non-verbal interactive strategies
Teaching/Learning Methodology	<u>Learning and teaching approach</u> The subject is designed to develop the students' English language skills, both oral and written, that students need to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects. The study approach is primarily seminar-based. Seminar activities include instructor input as well as individual and group work, involving drafting and evaluating texts, mini-presentations, discussions and simulations. The learning and teaching activities in the subject will focus on a course-long project which will engage students in proposing and reporting on an engineering-related project to different intended readers/audiences. During the course, students will be involved in: - planning and researching the project - writing project-related documents such as project proposals - giving oral presentations to intended stakeholders of the project <u>Collaboration of input/support from the English Language Centre and the Engineering discipline</u> Students of this subject will also take the subject *Professional Communication in Chinese*, and will work on the same project in both subjects. In producing professionally acceptable documents and delivering effective presentations, students will be engaged in the use of appropriate Chinese and English language and skills, as well as applying knowledge learned in their Engineering subjects. As such, the planning, design and implementation of the teaching and learning activities and assessments will involve collaboration between the teaching staff from the CLC, the ELC, and staff from the Engineering discipline.
Assessment Methods in Alignment with Intended Learning Outcomes	See table below

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

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

1. The assessments will arise from the course-long engineering-related project.
   - Students will be assessed on written documents and oral presentations targeted at different intended readers/audiences. This facilitates assessment of students' ability to select content and use language and style appropriate to the purposes and intended readers/audiences.
   - Students will collaborate in groups in planning, researching, discussing and giving oral presentations on the project. The written proposals will be individual work to ensure that students will be rigorously engaged in the application of language skills for the entire document.
2. There will be collaboration between the teaching staff from the English Language Centre and the discipline in assessing students' performances. It is expected that the teaching staff of the Engineering discipline will provide support in assessing students' application of discipline knowledge. They will be involved in assessing the oral presentations intended for experts rather than those for laymen.

3. Hence the assessment pattern will be as follows:

	Assessment type	Intended readers/audience	Timing	Assessors
	(English) Written proposal in English – Document of around 1,500 words for the initial proposal	Mainly engineering experts	Week 8	ELC and Engineering staff
	(English) Oral presentation of project in English – Team presentation of 30 minutes, in groups of 4 – Simulating a presentation of the final proposal	Mainly non-experts	Weeks 12-13	ELC
Student Study Effort Expected	Class contact:			
	▪ Seminars			26 Hrs.
	Other student study effort:			
	▪ Researching, planning, writing, and preparing the project			52 Hrs.
	Total student study effort			78 Hrs.
Reading List and References	Beer, D. F. (Ed.). (2003). *Writing and speaking in the technology professions*: *A practical guide* (2nd ed.). Hoboken, NJ: Wiley. Johnson-Sheehan, R. (2008). *Writing proposals* (2nd ed.). New York, NY: Pearson/Longman. Kuiper, S. (2007). *Contemporary business report writing* (3rd ed.). Cincinnati, OH: Thomson/South-Western. Lawrence, M. S. (1975). *Writing as a thinking process: Teacher's manual*. Ann Arbor, Mich: University of Michigan Press. Reep, D. C. (2006). *Technical writing: Principles, strategies and readings* (6th ed.). New York, NY: Pearson/Longman.			

Subject Description Form

Subject Code	ENG2001
Subject Title	Fundamentals of Materials Science and Engineering
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	1. To realize the impact of the development of engineering materials on human civilization; 2. To enable students to establish a broad knowledge base on the structure and properties of materials for solving engineering problems. 3. To enable students to understand the applications and selection of engineering materials based on the consideration of properties, cost, ease of manufacture, environmental issues and their in service performance.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. comprehend the importance of materials in engineering and society; b. explain the properties and behaviour of materials using fundamental knowledge of materials science. c. apply the knowledge of materials science to analyze and solve basic engineering problems related to stress, strain and fracture of materials; d. select appropriate materials for various engineering applications taking into consideration of issues in cost, quality and environmental concerns.
Subject Synopsis/ Indicative Syllabus	1. Introduction Historical perspective; Evolution of engineering materials; Materials science and engineering; Classification of materials 2. Atomic Structure and Structures of Materials Atomic structure; Bonding forces and energies; Primary interatomic bonds and secondary bonding; Crystalline and non-crystalline materials; Phase diagram and microstructure of alloys 3. Electrical and Optical Properties of Materials Conductors and insulators; Semi-conductor materials; N-type and P-type semiconductors; P/N junction; Light interactions with materials; Light emitting diode (LED) and photovoltaics; Light propagation in optical fibers; Liquid crystal; Photoelasticity 4. Mechanical Properties of Materials Concept of stress and strain; Stress-strain behaviour; Elastic and plastic properties of materials; Concepts of dislocations and strengthening mechanisms; Tensile properties; Elastic recovery after plastic deformation; Hardness; Stress concentration; Impact energy, Fracture toughness; Design and safety factors 5. Introduction to Failure Analysis and Prevention Fundamentals of fracture: ductile, brittle, fatigue and creep; Corrosion; Nondestructive testing; Techniques for failure analysis and prevention 6. Selection of Engineering Materials Characteristics of metallic, polymeric, ceramic, electronic and composite materials; Economic, environmental and recycling issues
Teaching/Learning Methodology	The subject will be delivered mainly through lectures but tutorials, case studies and laboratory work will substantially supplement which. Practical problems and case studies of material applications will be raised as a focal point for discussion in tutorial classes, also laboratory sessions will be used to illustrate and assimilate some fundamental principles of materials science. The subject emphasizes on developing students' problem solving skills.
Assessment Methods in Alignment with Intended Learning Outcomes	See table below

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

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

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

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

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

Student Study Effort Expected		
	Class contact:	
	▪ Lectures, tutorials, practical	39Hrs.
	Other student study effort:	
	▪ Guided reading, assignments and reports	37Hrs.
	▪ Self-study and preparation for test and examination	47Hrs.
	Total student study effort	123Hrs.

Reading List and References	1. William D. Callister, Jr., David G. Rethwisch, *Fundamentals of materials science and engineering,* 4th edition, *E-Text* John Wiley & Sons; ISBN: 978-1-118-53126-6 2. William D. Callister, Jr., David G. Rethwisch, *Materials Science and Engineering*, 8th edition, *E-Text* John Wiley & Sons; ISBN: 978-1-118-37325-5 3. Materials World (Magazine of the Institute of Materials, Minerals and Mining)

Subject Description Form

Subject Code	ENG3003
Subject Title	Engineering Management
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject provides students with: 1. A practical introduction to management and a comprehensive guide to the tools and techniques used in managing people and other resources. 2. Opportunities to trace the historical development and describe the functions of management, from planning, and decision making to organizing, staffing, leading, motivating, and controlling. It also includes a discussion on engineering ethics. 3. Opportunities to explore the core business strategy, technology, and innovation, and exam how these functions intertwine to play a central role in structural design, as well as supporting an organization's overall success.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. perform tasks in an organization related to organizing, planning, leading and controlling project and process activities; b. select appropriate management techniques for improving organizational structures, work procedures, and quality performance of operational tasks; c. analyze the factors that affect changes in the work environment, and be aware of the approaches in implementing change in an organization; d. be aware of the imperatives of ethical and business behaviors in engineering organizations in a fast-changing business environment.
Subject Synopsis/Indicative Syllabus	1. Introduction General management concepts in organizations; Functions and types of industrial organizations; Organizational structures; Corporate objectives, strategy, and policy 2. Industrial Management Roles of managers: Process of management, leadership, planning, organizing, motivating, and control of social and engineering activities; Quality management: Related tools and techniques 3. Project Management Project scope and objectives; Network analysis; Tools that support engineering operations and task scheduling 4. Management of Change Strategic leadership and innovation; Organizational change; Leading planned change; Organizational development; Stress management; Factors that affect the execution of change
	5. Effects of Environmental Factors The effects of extraneous factors on the operations of engineering organizations, such as ethics and corporate social responsibilities issues
Teaching/Learning Methodology	A mixture of lectures, tutorial exercises, and case studies are used to deliver various topics in this subject. Some topics are covered by problem-based format whenever applicable in enhancing the learning objectives. Other topics are covered by directed study so as to develop students' "life-long learning" ability. The case studies, largely based on real experience, are designed to integrate the topics covered in the subject and to illustrate the ways various techniques are inter-related and applied in real life situations.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			
		a	b	c	d
1. Coursework • Group learning activities (20%) • Final presentation (individual presentation and group report) (20%)	40%	√	√	√	√
2. Final examination	60%	√	√	√	√
Total	100%				

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

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

Student Study Effort Expected

Class contact:	
▪ Lectures and review	27 Hrs.
▪ Tutorials and presentations	12 Hrs.
Other student study effort:	
▪ Research and preparation	30 Hrs.
▪ Report writing	10 Hrs.
▪ Preparation for oral presentation and examination	37 Hrs.

	Total student study effort	116 Hrs.
Reading List and References	1. Introduction to Management, Schermerhorn, 12th Edition, John Wiley, 2013 2. Fundamentals of Management - Global 8th ed by Robbins, De Cenzo and Mary, Pearson, 2013 3. Morse, L C and Babcock, D L, 2010, Managing Engineering and Technology: an Introduction to Management for Engineers, 5th Ed., Prentice Hall 4. White, M A and Bruton, G D, 2010, The Management of Technology and Innovation: A Strategic Approach, 2nd Ed., , Cengage Learning	

Subject Description Form

Subject Code	ENG3004
Subject Title	Society and the Engineer
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject is designed for engineering students as a complementary subject on the role of the professional engineer in practice and their responsibilities toward the profession, colleagues, employers, clients, and the public. The objectives of the subject are to enable students to 1. appreciate the historical context of modern technology and the nature of the process whereby technology develops and its relationship between technology and the environment, as well as the implied social costs and benefits; 2. understand the social, political, legal, and economic responsibilities and accountability of the engineering profession and the organizational activities of professional engineering institutions; 3. be aware of the short-term and long-term effects related to safety and health of technology applications; 4. observe the professional conduct as well as the legal and other applicable constraints related to various engineering issues.
Intended Learning Outcomes	Upon completion of the subject, students will be able to a. identify and evaluate the effects of technology applications in the social, cultural, economic, legal, health, safety, environment, and dimensions of the society; b. explain the importance of local and international professional training, professional conduct, ethics, and responsibilities in various engineering disciplines, particularly the Washington Accord; c. evaluate in a team setting the implications of a specific project in the eight dimensions of project issues related to engineers, and present the findings to laymen and peers.
Subject Synopsis/ Indicative Syllabus	1. <u>Impact of Technology on Society</u> Innovation and creativity; History and trends of technology on social and cultural developments of society 2. <u>Environmental Protection and Related Issues</u> Roles of the engineer in energy conservation, ecological balance, and sustainable development 3. <u>Outlook of Hong Kong's Industry</u> Support organizations and impacts on economic development in Greater China and the Pacific Rim
	4. <u>Industrial Health and Safety</u> The Labour Department and the Occupational Health and Safety Council; Legal dimensions such as contract law and industrial legislation 5. <u>Professional Institutions</u> Local and overseas professional institutions; Washington Accord and the qualifications and criteria of professional engineers 6. <u>Professional Ethics</u> Prevention of bribery and corruption; The work of the Independent Commission Against Corruption (ICAC); Social responsibilities of engineers
Teaching/Learning Methodology	Class comprises short lectures to provide essential knowledge and information on the relationships between society and the engineer under a range of dimensions. Other methods include discussions, case studies, and seminars to develop student's in-depth analysis of the relationship. Students form groups; throughout the course, they will work on engineering cases by completing the following learning activities: 1. Case analysis where students provide weekly summary reports on the relationships between society and the engineering issues of a project under specific dimensions; 2. The final report as a case portfolio which includes i. Presentation slides ii. Feedback critique iii. Weekly summary report iv. Reflection 3. Final presentation
Assessment Methods in Alignment with Intended Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Continuous assessment	60%			
• Group weekly learning activities	(24%)	√	√	√
• Individual final presentation	(18%)	√		
• Group report, individual reflection report	(18%)	√	√	√
2. Examination	40%	√	√	
Total	100%			

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The coursework requires students to work in groups to study cases from the perspectives of the eight dimensions in an engineering setting. Through these exercises, students' ability to apply and synthesize acquired knowledge can be assessed on the basis of their performance in group discussion, oral presentations, and the quality of their portfolio reports on the case studies. The open-book examination is used to assess students' critical thinking and problem-solving skills when working on their own.	
Student Study Effort Expected	Class contact:	
	▪ Lectures and review	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.
Reading List and References	**Reference Books & Articles:** 1. Education for Sustainable Development - An Expert Review of Processes and Learning, UNESCO, 2011 2. Engineering-Issues, Challenges and Opportunities for Development, USECO, 2010 3. Engineering for Sustainable Development: Guiding Principles, Royal Academy of Engineering, 2005 4. Securing the future: delivering UK sustainable development strategy, 2005 5. Johnston, F S, Gostelow, J P, and King, W J, 2000, *Engineering and Society Challenges of Professional Practice*, Upper Saddle River, N.J.: Prentice Hall 6. Hjorth, L, Eichler, B, and Khan, A, 2003, *Technology and Society A Bridge to the 21st Century*, Upper Saddle River, N.J.:Prentice Hall 7. The Council for Sustainable Development in Hong Kong, http://www.susdev.gov.hk/html/en/council/ 8. Poverty alleviation: the role of the engineer, http://www.arup.com/_assets/_download/download67.pdf **Reading materials:** Engineering journals: - Engineers by The Hong Kong Institution of Engineers - Engineering and Technology by The Institution of Engineers and Technology Magazines: Time, Far East Economic Review Current newspapers: South China Morning Post, China Daily, Ming Pao Daily	