THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Department of
Electronic and Information Engineering
電子及資訊工程學系

Bachelor of Engineering (Honours) / Bachelor of Science (Honours) Scheme in Information and Artificial Intelligence Engineering

Code: 42481; Full-time, Credit-based

Programme Booklet

(2022/23)

Department of Electronic and Information Engineering

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Programme Booklet

2022/2023

BENG (HONS) / BSC(HONS) SCHEME IN INFORMATION AND ARTIFICIAL INTELLIGENCE ENGINEERING (42481) (FULL-TIME)

Contents

LEVEL 4

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

1. GENERAL INFORMATION

1.1 Cohort of Intakes and readership

This Programme Booklet is the Programme Requirement Document (PRD) for the 2022/23 cohort. Just in case any updated information is necessary after the publication of this booklet, students are requested to refer to the URL https://www.polyu.edu.hk/eie/study/undergraduate-programmes/beng_bsc_eie_scheme/ for the most updated information. Should there be any discrepancy between the contents of this booklet and University regulations, University regulations always prevail.

1.2 Programme Information

Title of Scheme	**Bachelor of Engineering (Honours) / Bachelor of Science (Honours) Scheme in Information and Artificial Intelligence Engineering (Scheme Code: 42481 / JUPAS Code: JS3180)**
Title of Programme	• Bachelor of Engineering (Honours) in Electronic Systems and Internet-of-Things (BEng in ESIoT) • Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering (BSc in AIIE) • Bachelor of Science (Honours) in Information Security (BSc in IS)
Host Department	Department of Electronic and Information Engineering (EIE)
Programme Structure	Credit-based
Final Award	• Bachelor of Engineering (Honours) in Electronic Systems and Internet-of-Things 電子系統及物聯網(榮譽)工學士學位 • Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering 人工智能及資訊工程學(榮譽)理學士學位 • Bachelor of Science (Honours) in Information Security 資訊安全(榮譽)理學士學位
Mode of Attendance	Full-time
Professional Recognition	Accreditation will be sought from the Hong Kong Institution of Engineers (HKIE) for the BEng(Hons) in Electronic Systems and Internet-of-Things, BSc(Hons) in Artificial Intelligence and Information Engineering and BSc(Hons) in Information Security programmes.

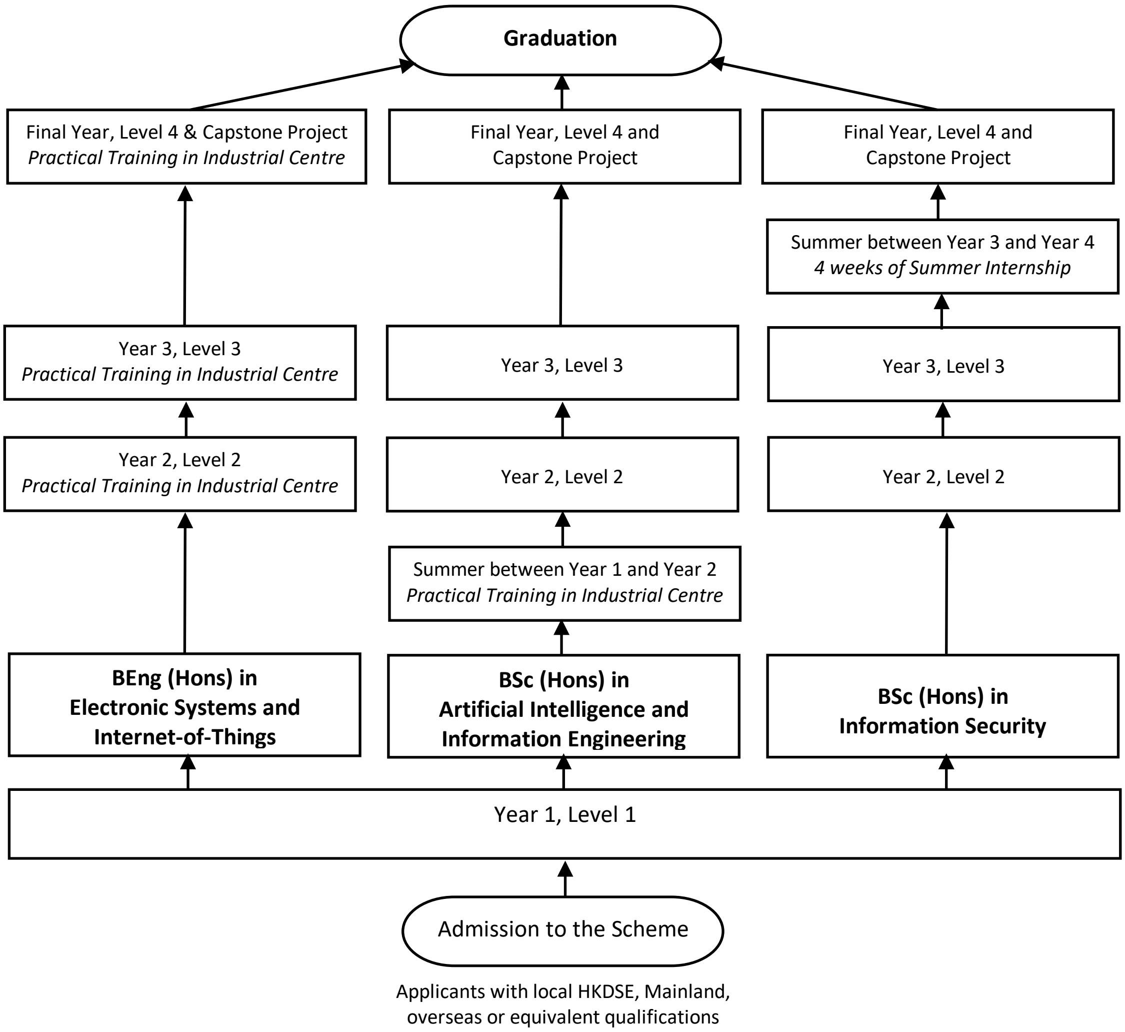
Normal Duration	Normal Year 1 Intake Full-time Mode: 4 years Senior Year Intake Full-time Mode: 2 years
Total Credits for Graduation (Academic Credits + Training Credits + WIE Training Credit)	a) **Academic Credits**: • Normal Year 1 Intake: - 124 credits for the following programmes: ▪ Bachelor of Engineering (Honours) in Electronic Systems and Internet-of-Things ▪ Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering - 127 credits for the following programme: ▪ Bachelor of Science (Honours) in Information Security • Senior Year Intake: - 67 credits for the following programmes: ▪ Bachelor of Engineering (Honours) in Electronic Systems and Internet-of-Things ▪ Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering - 64 credits for the following programme: ▪ Bachelor of Science (Honours) in Information Security b) **Training Credits (for all intakes)**: - 8 credits for the following programme: ▪ Bachelor of Engineering (Honours) in Electronic Systems and Internet-of-Things - 5 credits for the following programme: ▪ Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering c) **Work-Integrated Education Training Credit (for all intakes)**: - 1 credit for the following programmes: ▪ Bachelor of Engineering (Honours) in Electronic Systems and Internet-of-Things ▪ Bachelor of Science (Honours) in Artificial Intelligence and Information Engineering - 2 credits for the following programme: ▪ Bachelor of Science (Honours) in Information Security

1.3 Modes of Attendance

A mode of study is characterized by the credits and subjects required and the progression pattern in Year 1 to Year 4 (or in Year 1 to Year 2 for Senior Year Intake).

<u>Normal Year 1 Intake Full-time Mode</u>

Under this mode, the students admitted to the Scheme will pursue their study together in Year 1 and divert their studies in the chosen programme curriculum from Year 2 onwards. They go through Year 2, Year 3 and Year 4 in full time and then graduate at the end of Year 4 after having satisfied all programme requirements.

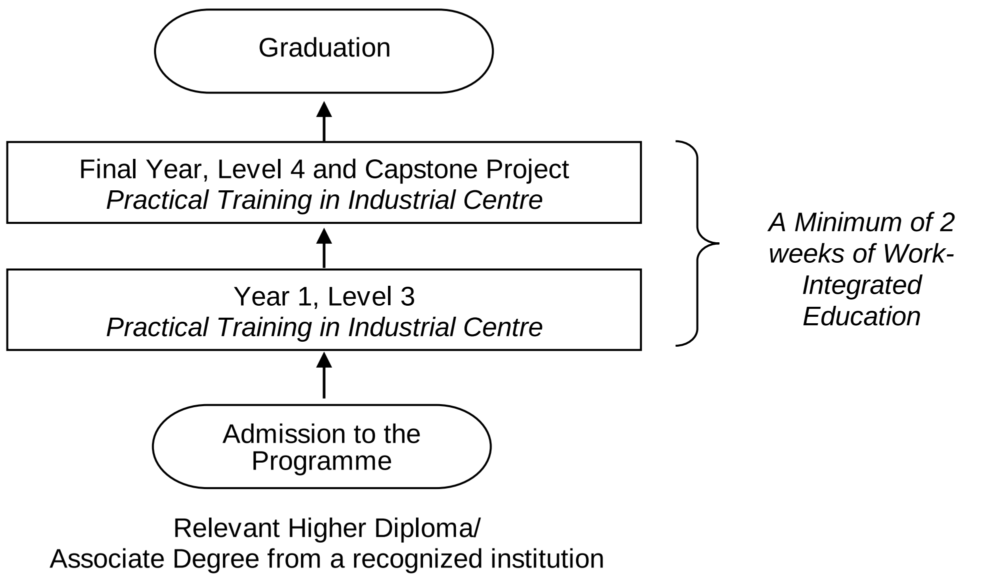


<u>Remarks</u>:
Students of BEng (Hons) in Electronic Systems and Internet-of-Things and BSc (Hons) in Artificial Intelligence and Information Engineering are required to complete a minimum of <u>2 weeks</u> of Work-Integrated Education (WIE) during the study period. Students of BSc (Hons) in Information Security who successfully complete the <u>4 weeks</u> of Summer Internship will fulfil the WIE requirement simultaneously.

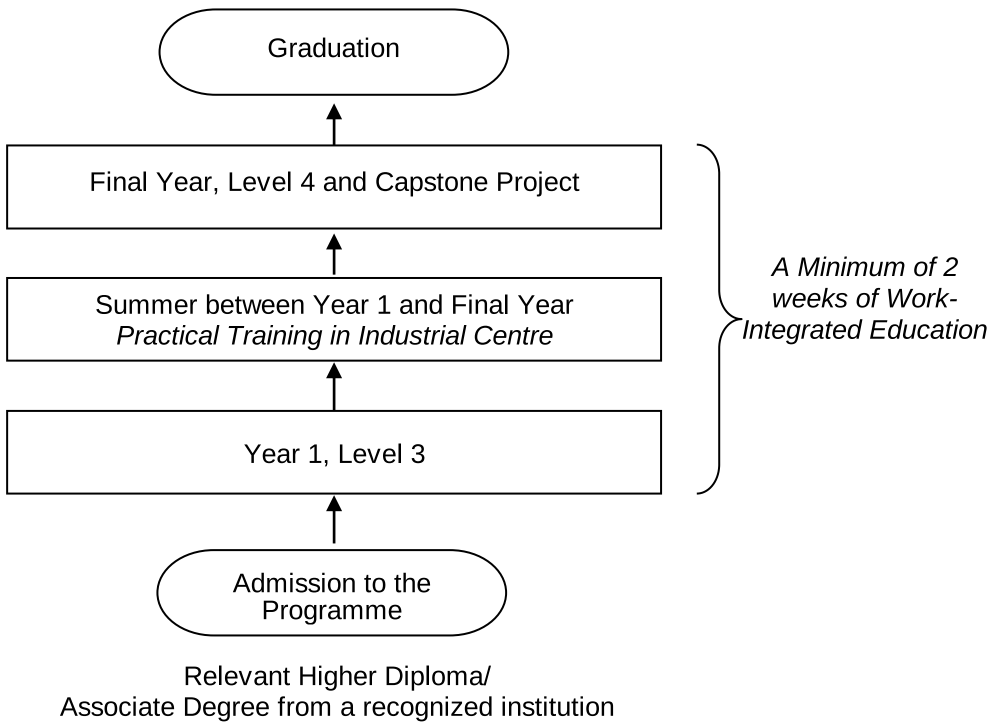
Senior Year Intake Full-time Mode

Under this mode, senior year students will normally pursue their study by going through Year 1 and Year 2 in full time and then graduate at the end of Year 2 after having satisfied all programme requirements.

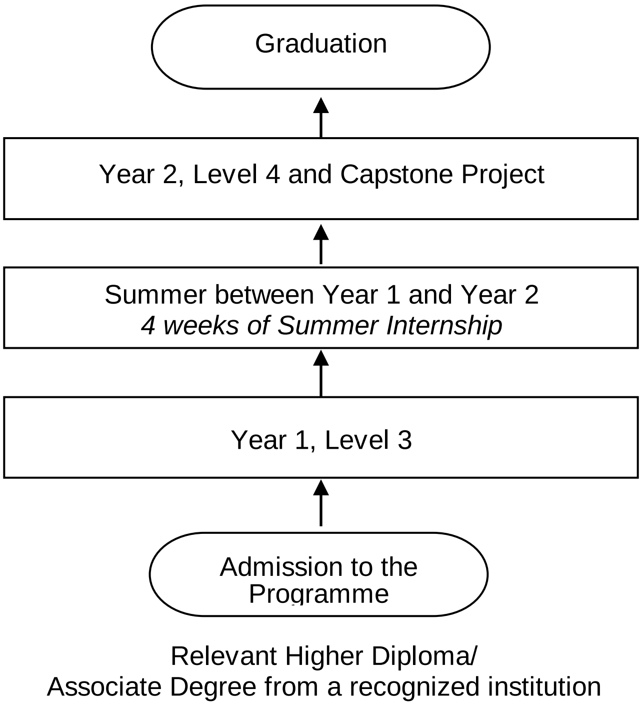
BEng(Hons) in Electronic Systems and Internet-of-Things (BEng(Hons) in ESIoT)



BSc(Hons) in Artificial Intelligence and Information Engineering (BSc(Hons) in AIIE)



BSc(Hons) in Information Security (BSc(Hons) in IS)



1.4 In addition to pursuing the BEng(Hons) in ESIoT, BSc(Hons) in AIIE or BSc(Hons) in IS as a Major, students studying in the Normal Year 1 Intake Full-time Mode may apply to study a Secondary Major (https://www.polyu.edu.hk/comp/study/ug-programmes/aida/) and a Minor (https://www.polyu.edu.hk/ar/students-in-taught-programmes/registration-information/major-minor-study/). However, the additional Secondary Major and Minor options are not available to students studying in the Senior Year Intake Full-time Mode.

2. RATIONALE, AIMS AND INTENDED LEARNING OUTCOMES OF THE PROGRAMME

2.1 Background and Rationale

BEng(Hons) / BSc(Hons) Scheme in Information and Artificial Intelligence Engineering

We are living in a smart era in which many of our daily decision-making processes are based on the collection, processing, analysis, and interpretation of a large amount of data and information. The availability of Internet-of-Things technologies enables us to collect virtually any data that are useful to our decision-making from virtually anywhere, while artificial intelligence and information engineering provide the powerful computational tools for analysing the collected data intelligently and efficiently to provide us with firmly grounded rationale for decision making. To take advantage of these technologies, various hardware and software systems are required to be closely interconnected through very complex information networks, thus posing security risks when a massive amount of data and information flows through these networks. It is therefore vitally important to protect and safeguard them against various forms of cyber attacks. The Scheme encompasses three programmes that are aimed at training professionals who are interested in working in the three closely related and mutually supporting technological areas mentioned above, namely, (1) electronic systems and Internet of Things; (2) artificial intelligence and information engineering; and (3) information security. Depending on their own areas of interest, students admitted into the Scheme are allowed to choose to specialize in one of these three areas.

BEng(Hons) in Electronic Systems and Internet-of-Things

Electronic Systems and Internet-of-Things (IoT) are among the key technologies that play important roles in modern-day living. Various sectors, including business, commerce, communication, education, entertainment, healthcare and transportation, require Electronic Systems and IoT for efficient operation. Thus, it is envisioned that there is a great need of professionals who exercise knowledge and leadership in the areas of Electronic Systems and IoT, as well as generic skills of problem solving, innovation, analysis and adaptability to contribute to the technological and economic development in the region and in the world.

In particular, IoT is a fast-developing field throughout the world. According to Fortune Business Insights, the global IoT market was valued at US$190 billion in 2018 and is projected to reach US$1,102.6 billion by 2026. However, Immersat Research finds that around 47% of organisations surveyed do not possess sufficient IoT skills and are outsourcing such work. Gartner Research predicts that around 75 percent of the IoT projects may take twice as long as they should because of the shortage of IoT talent. In 2020, the Government of the Hong Kong Special Administrative Region published the Hong Kong Smart City Blueprint 2.0 in which the Government put forward over 130 initiatives, many of them related to IoT. This Programme aims at training IoT professionals who will meet Hong Kong's the pressing manpower need in the emerging IoT area.

BSc(Hons) in Artificial Intelligence and Information Engineering

Artificial Intelligence and Information engineering encompass vital technologies that support worldwide economic growth. With the increasing popularity of and technological advancement of artificial intelligence, products and services embedded with intelligent features are in great demand. It is envisioned that there is a great need for professionals who possess professional knowledge and skills relevant to information engineering and artificial intelligence, with a particular focus on machine perception and data science; as well as generic skills of problem-solving, creativity, innovation and adaptability to changing technology and society.

In 2020, LinkedIn published a report that ranks 15 emerging jobs; among them, AI is ranked the top. Demands on AI talents indeed spread across a wide range of industries, and the market for highly skilled AI workers is outpacing the supply. As published in Hong Kong Economic Journal in 2020, the sales value of AI business worthwhile was expected to be around US$60 million in 2021 and will steadily rise to US$110 million in 2024, which is an average of 20% annual growth. Such growth obviously will introduce a big demand for talent in the area. This Programme aims at training professionals in this emerging area to fulfil the needs of society.

BSc(Hons) in Information Security

The recent advance in information and communication technologies (ICT) has brought people great convenience in their daily life. Information has become one of the most valuable assets to any country and any business which requires careful protection. To protect data security and privacy and to safeguard against the risk of potentially devastating security attacks and misuses have thus become a vital concern to all countries and organizations. With the cross-border, open-platform, highly-interconnected nature of the cyberworld, the impacts of security attacks and misuses are far-reaching, and would require integral effort from all parties involved in order to effectively combat these attacks.

In Hong Kong, since the pace of globalization continues to accelerate, supported by domestic consumption as well as the *Mainland and Hong Kong Closer Economic Partnership Arrangement* (*CEPA*), the manpower requirement in ICT will follow a growing trend in the long run. However, the further transition to knowledge society and the shifting of the ICT sector towards Cloud Computing and mobile communications requires ICT employees to acquire new skills and knowledge particularly in the area of information security. There is a need to launch relevant degree programmes to satisfy the urgent needs of the society. This programme will thus cover both large-scale and small-scale information security issues which are facing by individuals, organisations, and the society, and provide the necessary training to students so that they will be capable of preventing security threats and solving security problems in different settings.

2.2 Aims

BEng(Hons) in Electronic Systems and Internet-of-Things

This Programme aims at producing graduates with:
1. a wide range of professional knowledge and skills relevant to Electronic Systems and Internet-of-Things. These include artificial intelligence of things, robotics, sensor technologies, electronic devices, and their associated software to sense, measure, interpret, connect, and analyze data,
2. creativity and innovation,
3. adaptability to changing technology and society, and
4. all-round attributes.

BSc(Hons) in Artificial Intelligence and Information Engineering

This Programme aims at producing graduates with:
1. a wide range of professional knowledge and skills relevant to Artificial Intelligence and Information Engineering. These include technological innovations in artificial intelligence and information engineering, focusing on machine perception and data science, as well as applications related to information engineering, such as computer vision, healthcare technology, bioinformatics, natural language processing, and automatics robotics,
2. creativity and innovation,
3. adaptability to changing technology and society, and
4. all-round attributes.

BSc(Hons) in Information Security

This Programme aims at producing graduates with:
1. a wide range of professional knowledge and skills relevant to Information Security,
2. creativity and innovation,
3. adaptability to changing technology and society, and
4. all-round attributes.

2.3 Relationship of Programme Aims to University Missions

The University has the following missions:
1. To pursue impactful research that benefits the world.
2. To nurture critical thinkers, effective communicators, innovative problem solvers and socially responsible global citizens.
3. To foster a University community in which all members can excel in their aspirations with a strong sense of belonging and pride.

The following table illustrates the relationship between Programme Aims of BEng(Hons) in Electronic Systems and Internet-of-Things, BSc(Hons) in Artificial Intelligence and Information Engineering and BSc(Hons) in Information Security and University Missions:

Programme Aims	**University Missions**		
	1	**2**	**3**
1	X	X	X
2	X	X	
3	X	X	
4		X	X

2.4 Institutional Learning Outcomes

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

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

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

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

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

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

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

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

2.5 Intended Learning Outcomes of the **BEng(Hons) in Electronic Systems and Internet-of-Things** Programme

On successful completion of the programme, students will be able to:

Category A Professional/Academic Knowledge and Skills

1. Understand the fundamentals of science and engineering, and have the ability to apply them.
2. Design and conduct experiments, as well as to evaluate the outcomes.
3. Design systems, components and processes to meet given specifications and constraints.
4. Identify, formulate and solve problems relevant to Electronic Systems and Internet-of-Things.
5. Use modern engineering/IT tools appropriate to Electronic Systems and Internet-of-Things practice.
6. Know the contemporary issues, and understand the impact of engineering solutions in global and societal contexts.

Category B Attributes for All-roundedness

7. Work with others collaboratively on a multi-disciplinary team and have a knowledge of leadership.
8. Recognize social, professional and ethical responsibility.
9. Communicate effectively.
10. Recognize the need for and engage in life-long learning.

2.5.1 Relationship of Programme Outcomes to Programme Aims

Programme Outcomes	Programme Aims			
	1	2	3	4
1	X		X	
2	X	X	X	
3	X	X	X	
4	X	X	X	
5	X		X	
6	X		X	X
7				X
8	X		X	X
9				X
10			X	X

2.5.2 Relationship of Intended Learning Outcomes of the Programme to Institutional Learning Outcomes

Programme Outcomes	Institutional Learning Outcomes						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1	X						
2	X	X					
3	X	X		X			
4	X			X			
5	X						
6	X	X				X	X
7						X	X
8						X	X
9			X				
10					X		

2.6 Intended Learning Outcomes of the **BSc(Hons) in Artificial Intelligence and Information Engineering**

On successful completion of the programme, students will be able to:

Category A Professional/Academic Knowledge and Skills

1. Understand the fundamentals of mathematics, science and engineering, and have the ability to apply them.
2. Design and conduct experiments, as well as to evaluate the outcomes.
3. Design systems, components and processes to meet given specifications and constraints.
4. Identify, formulate and solve problems relevant to artificial intelligence and information engineering.
5. Use modern engineering/IT tools appropriate to artificial intelligence and information Engineering.
6. Know the contemporary issues, and understand the impact of engineering solutions in global and societal contexts.

Category B Attributes for All-roundedness

7. Work with others collaboratively on a multi-disciplinary team and have a knowledge of leadership.
8. Recognize social, professional and ethical responsibility.
9. Communicate effectively.
10. Recognize the need for and engage in life-long learning.

2.6.1 Relationship of Programme Outcomes to Programme Aims

Programme Outcomes	Programme Aims			
	1	2	3	4
1	X		X	
2	X	X	X	
3	X	X	X	
4	X	X	X	
5	X		X	
6	X		X	X
7				X
8	X		X	X
9				X
10			X	X

2.6.2 Relationship of Intended Learning Outcomes of the Programme to Institutional Learning Outcomes

Programme Outcomes	Institutional Learning Outcomes						
	1	2	3	4	5	6	7
1	X						
2	X	X					
3	X	X		X			
4	X			X			
5	X						
6	X	X				X	X
7						X	X
8						X	X
9			X				
10					X		

2.7 Intended Learning Outcomes of the **BSc (Hons) in Information Security**

On successful completion of the programme, students will be able to:

Category A Professional/Academic Knowledge and Skills

1. apply knowledge of mathematics and science appropriate to the discipline of Information Security;
2. apply knowledge of Information Security to the abstraction and conceptualisation of Information and Communications Technology (ICT) models;
3. analyse an Information Security problem, and identify and define the requirements appropriate to its solution;
4. design, implement, and evaluate an Information Security system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, social and environmental considerations; and
5. use current techniques, skills, and tools necessary for the practices in Information Security with an understanding of the limitations.

Category B Attributes for All-roundedness

6. function effectively on teams to accomplish a common goal;
7. have an understanding of professional, ethical, legal, security and social issues and responsibilities;

8. communicate effectively with a range of audiences;
9. analyse the local and global impacts of Information Security on individuals, organisations and society; and
10. recognize the need for and engage in continuing professional development.

2.7.1 Relationship of Programme Outcomes to Programme Aims

Programme Outcomes	Programme Aims			
	1	2	3	4
1	X		X	
2	X	X	X	
3	X	X	X	
4	X	X	X	
5	X		X	
6				X
7	X		X	X
8				X
9	X		X	X
10			X	X

2.7.2 Relationship of Intended Learning Outcomes of the Programme to Institutional Learning Outcomes

Programme Outcomes	Institutional Learning Outcomes						
	1	2	3	4	5	6	7
1	X			X			
2	X	X		X			
3	X	X		X			
4	X			X			
5	X						
6			X			X	
7	X					X	X
8	X	X	X	X			
9		X			X		X
10					X		

3. ENTRANCE REQUIREMENTS

For non-local students who enter this Scheme by following a different education system from that in Hong Kong, they must possess the non-local qualifications for meeting the general entrance requirements for Bachelor Degree Programmes as published by the University.

For students who enter this programme by following the Hong Kong Diploma of Secondary Education (HKDSE) system or other local qualifications, they must satisfy both the University general minimum entrance requirements AND the programme-specific requirements as set out below.

3.1 University General Minimum Entrance Requirements

3.1.1 For those applying on the basis of HKDSE:

- 4 core subjects and 2 elective subjects with
  - Level 3: English Language and Chinese Language
  - Level 2: Mathematics, Liberal Studies
  - Level 3: Two elective subjects [can include Extended Modules of Mathematics (M1/M2)]

3.1.2 For those applying on the basis of other local qualifications:

- An appropriate Diploma (as specified in section 3.2 below) passed with credit or a Higher Certificate (as specified in section 3.2 below) from a recognised institution; OR
- An appropriate Associate Degree/Higher Diploma from a recognised institution (suitable candidates will be considered for advanced standing entry to the senior year curriculum).

3.1.3 Other local/non-local qualifications deemed to be acceptable for admission purpose:

The University accepts attainments in HKALE/HKASLE, GCEALE/GCEASLE and IB for admission to its 4-year degree programmes. Applicants holding A-Level and IB qualifications will be granted credit transfer upon admission.

3.2 Programme-specific Minimum Entrance Requirements

3.2.1 For those applying on the basis of HKDSE:

- Level 3 in two elective subjects, preferably Physics, Biology, Chemistry, Combined Science, Information and Communication Technology or Extended modules of Mathematics.

3.2.2 For those applying on the basis of other qualifications:

- An Associate Degree, Higher Diploma, Higher Certificate or Diploma (with Credit) in Engineering, Electronic Engineering, Information Engineering, Communication Engineering, Electrical Engineering, Computer Engineering or other similar disciplines. An Associate Degree, Higher Diploma, Higher Certificate or Diploma (with Credit) in related areas.

3.2.3 For those applying on the basis of "advanced standing" status:

- Holders of Associate Degree/Higher Diploma in related disciplines may be given credit transfer.

3.3 Admission of Advanced Standing Students Based on Advanced Academic Qualifications

(i) With approval by the Faculty, students may be admitted to the Scheme beyond the initial stage provided they have demonstrably reached the general level of educational development which would have been reached had they taken the earlier stage(s) of the Programme, and provided that there is a high probability that they will complete the Programme successfully. These students will still be labelled as first year students even though they are following the curriculum of a later stage.

(ii) Students admitted on the basis of IB/A-Level qualifications will be given credit transfer, up to a maximum of 25% of the credit requirement for a 4-year degree programme in which 6 credits are for the Cluster Area Requirement (CAR) (not applicable to [CAR(M)] because it is mandatory for all undergraduate (Ug) students admitted in or after 2022/23) and 3 credits for University English. For IB/GCE candidates who are able to attain the specified grade and total score requirements, a maximum of 6 credits could be further given from the English and Chinese LCR subjects. Any further credit transfer on the remaining CAR or discipline-specific subjects will be decided by the programme host department.

(iii) The number of credits that a student is required to complete for the award concerned will be determined at the time of admission, and no later than the end of the subject add/drop period.

(iv) Information on the number of credits required for normal entry and for the individual students based on their admission qualifications will both be reflected on the transcripts of study.

(v) If students who are admitted to the programme with entry credit transfer wish to gain higher grades by studying the subject(s) again, they may approach their programme offering Department for declining the provision of taking fewer credits no later than the end of the add/drop period.

(vi) Students who, upon admission, wish to transfer any credits from their previous studies, and take fewer credits than those confirmed at the time of admission, will have to follow the procedures for "application for credit transfer" and to pay the related fees. The credits to be transferred are subject to the rule on validity period for subject credits.

4. PROGRAMME, SUBJECTS, AND CREDITS

4.1 Programme Specified Subjects

Most subjects to be studied at Year 1, Year 2, Year 3 and Year 4 are of standard credit value carrying 3 credits each, except for some subjects, such as Honours/Capstone Project, Professional Communication, etc. which carry credits other than 3. A student is expected to spend about 35 to 45 hours of study (inclusive of class contact and other study effort) to earn a credit. Tables 4.1.1 – 4.1.3 list the subjects, their credit values, and the category they belong to (Compulsory or Elective). All discipline-specific subjects shown as compulsory are non-deferrable and must be taken in accordance to the progression pattern. The subjects offered will be updated from time to time according to the need of society and the profession. The specified progression patterns stated in Section 5 of this programme document are subject to change due to general changes in the University's rules and regulations and reviews by the Department.

Students admitted to the Scheme through the Normal Year 1 entry route are required to complete a minimum of 124/127 or more academic credits to satisfy the degree requirements, while students admitted to the programme through Senior Year entry route are required to complete a minimum of 64/67 or more academic credits to satisfy the degree requirements. The exact minimum number of academic credits required will depend on the academic background of the students. The subjects contributing to the 124/127 or 64/67 academic credits are listed in Tables 4.1.1 – 4.1.3. However, they may choose to take additional subjects beyond the basic requirements. Please refer to Section 27 for detailed information on the requirements for graduation.

Table 4.1.1 Subjects Category and Credits of BEng(Hons) in ESIoT

Year 1, Year 2, Year 3 and Year 4 Curricula

Subject Code	Subject Title	Credit	Category	
			Normal Year 1 Intake	Senior Year Intake
General University Requirements (GUR)				
-	Cluster-Area Requirement I (CAR I)	3	COM	COM
-	Cluster-Area Requirement II (CAR II)	3	COM	COM
-	Cluster-Area Requirement III (CAR III)	3	COM	-
-	Cluster-Area Requirement IV (CAR IV)	3	COM	-
-	Language and Communication Requirement I (LCR I) – English*	3	COM	-
-	Language and Communication Requirement II (LCR II) – English*	3	COM	-
-	Language and Communication Requirement III (LCR III) – Chinese *	3	COM	-
-	Leadership Education and Development (LEAD)	3	COM	-
-	Service-Learning	3	COM	COM
EIE1005	Fundamental AI and Data Analytics (GUR-AIDA)	2	COM	-
MM1031	Introduction to Innovation and Entrepreneurship (GUR-IE)	1	COM	-
-	Healthy Lifestyle	0	COM	-
	Essential Components of General Education	0	-	COM
Discipline-Specific Requirement (DSR)				
AF3625	Engineering Economics	3	COM	-
AMA1110	Basic Mathematics I – Calculus and Probability & Statistics	3	COM	-
AMA1120	Basic Mathematics II –Calculus and Linear algebra	3	COM	-
AMA2111	Mathematics I	3	COM	-
CLC3241P	Professional Communication in Chinese	2	COM	COM
EIE1003	Foundations of Data Science	3	COM	
EIE1004	Introduction to Information and Artificial Intelligence Engineering	3	COM	-
EIE2110	Basic Circuit Analysis and Electronics	3	COM	-
EIE2113	Introduction to Internet of Things	3	COM	COM
EIE2211	Logic Design	3	COM	-
EIE3109	Mobile Systems and Application Development	3	ELE	ELE
EIE3112	Database System	3	COM	COM
EIE3123	Dynamic Electronic Systems	3	COM	COM
EIE3124	Fundamentals of Machine Intelligence	3	COM	ELE
EIE3127	Artificial Intelligence of Things	3	ELE	ELE
EIE3128	IoT Project	3	COM	COM
EIE3129	IoT Security	3	COM	COM
EIE3130	Network Security	3	ELE	ELE
EIE3311	Computer System Fundamentals	3	COM	COM
EIE3312	Linear Systems	3	COM	ELE
EIE3320	Object-Oriented Design and Programming	3	ELE	ELE

Subject Code	Subject Title	Credit	Category	
			Normal Year 1 Intake	Senior Year Intake
EIE3331	Communication Fundamentals	3	COM	COM
EIE3333	Data and Computer Communications	3	COM	COM
EIE3373	Microcontroller Systems and Interface	3	COM	COM
EIE4100	Computer Vision and Pattern Recognition	3	ELE	ELE
EIE4102	IP Networks	3	ELE	ELE
EIE4104	Mobile Networking	3	ELE	ELE
EIE4105	Multimodal Human Computer Interaction Technology	3	ELE	ELE
EIE4108	Distributed Systems and Cloud Computing	3	ELE	ELE
EIE4110	Introduction to VLSI and Computer-Aided Circuit Design	3	ELE	ELE
EIE4113	Wireless and Mobile Systems	3	COM	COM
EIE4119	Mobile Device System Architecture	3	ELE	ELE
EIE4122	Deep Learning and Deep Neural Networks	3	ELE	ELE
EIE4123	Healthcare Technology	3	ELE	ELE
EIE4124	Modern Robotics	3	ELE	ELE
EIE4125	Power Conversion Technology for Energy Harvesting	3	ELE	ELE
EIE4413	Digital Signal Processing	3	ELE	ELE
EIE4432	Web Systems and Technologies	3	ELE	ELE
EIE4126	Capstone Project	6	COM	COM
EIE4435	Image and Audio Processing	3	ELE	ELE
EIE4449	Optical Communication Systems and Networks	3	ELE	ELE
ELC3531	Professional Communication in English for Engineering Students	2	COM	COM
ENG2002	Computer Programming	3	COM	-
ENG2003	Information Technology	3	COM	-
ENG3003	Engineering Management	3	COM	COM
ENG3004	Society and The Engineer	3	COM	COM
EIE2901/IC2114	Industrial Centre Training I for EIE	5	TRN	TRN
EIE3901/IC382	Multidisciplinary Manufacturing Project	3	TRN	TRN

Note:

AF	School of Accounting and Finance
AMA	Department of Applied Mathematics
CLC	Chinese Language Centre
COM	Compulsory
EIE	Department of Electronic and Information Engineering
ELC	English Language Centre
ELE	Elective
ENG	Faculty of Engineering
IC	Industrial Centre
TRN	Training

* Details of the Language and Communication Requirement (LCR) are set out in Section 4.2.

Subject to the approval by the Programme Leader of BEng(Hons) in ESIoT, students may take at most one Level 5 subject per semester as a final-year technical elective during their final year of study. The total number of Level 5 subjects taken shall not exceed 2. Students can refer to the list of Level 5 subjects currently available on https://www.polyu.edu.hk/en/eie/study/postgraduate-programmes/msc_programme-structure-and-syllabi/.

Table 4.1.2 Subjects Category and Credits of BSc(Hons) in AIIE

Year 1, Year 2, Year 3 and Year 4 Curricula

Subject	Subject Title	Credit	Category	
			Normal Year 1 Intake	Senior Year Intake
General University Requirements (GUR)				
-	Cluster-Area Requirement I (CAR I)	3	COM	COM
-	Cluster-Area Requirement II (CAR II)	3	COM	COM
-	Cluster-Area Requirement III (CAR III)	3	COM	-
-	Cluster-Area Requirement IV (CAR IV)	3	COM	-
-	Language and Communication Requirement I (LCR I) – English*	3	COM	-
-	Language and Communication Requirement II (LCR II) – English*	3	COM	-
-	Language and Communication Requirement III (LCR III) – Chinese*	3	COM	-
-	Leadership Education and Development (LEAD)	3	COM	-
-	Service-Learning	3	COM	COM
EIE1005	Fundamental AI and Data Analytics (GUR-AIDA)	2	COM	-
MM1031	Introduction to Innovation and Entrepreneurship (GUR-IE)	1	COM	-
-	Healthy Lifestyle	0	COM	-
	Essential Components of General Education	0	-	COM
Discipline-Specific Requirement (DSR)				
AMA1110	Basic Mathematics I – Calculus and Probability & Statistics	3	COM	-
AMA1120	Basic Mathematics II –Calculus and Linear algebra	3	COM	-
CLC3241P	Professional Communication in Chinese	2	COM	COM
COMP2011	Data Structure	3	COM	-
COMP4434	Big Data Analytics	3	COM	COM
EIE1003	Foundations of Data Science	3	COM	-
EIE1004	Introduction to Information and Artificial Intelligence Engineering	3	COM	-
EIE2105	Digital and Computer Systems	3	COM	-
EIE2112	Foundation Techniques in Artificial Intelligence	3	COM	-
EIE2113	Introduction to Internet of Things	3	COM	COM
EIE3103	Digital Signals and Systems	3	COM	COM
EIE3109	Mobile Systems and Application Development	3	COM	COM
EIE3112	Database System	3	COM	-
EIE3124	Fundamentals of Machine Intelligence	3	COM	COM
EIE3127	Artificial Intelligence of Things	3	ELE	ELE
EIE3129	IoT Security	3	ELE	ELE
EIE3130	Network Security	3	ELE	ELE
EIE3320	Object-Oriented Design and Programming	3	COM	-
EIE3333	Data and Computer Communications	3	COM	COM
EIE3343	Computer Systems Principles	3	COM	COM

Subject	Subject Title	Credit	Category	
			Normal Year 1 Intake	Senior Year Intake
EIE3360	Integrated Project	3	COM	COM
EIE4100	Computer Vision and Pattern Recognition	3	ELE	ELE
EIE4102	IP Networks	3	COM	COM
EIE4104	Mobile Networking	3	ELE	ELE
EIE4105	Multimodal Human Computer Interaction Technology	3	ELE	ELE
EIE4108	Distributed Systems and Cloud Computing	3	ELE	ELE
EIE4121	Machine Learning in Cyber-Security	3	ELE	ELE
EIE4122	Deep Learning and Deep Neural Networks	3	ELE	ELE
EIE4123	Healthcare Technology	3	ELE	ELE
EIE4428	Multimedia Communications	3	ELE	ELE
EIE4127	Capstone Project	6	COM	COM
EIE4431	Digital Video Production and Broadcasting	3	ELE	ELE
EIE4432	Web Systems and Technologies	3	COM	-
EIE4435	Image and Audio Processing	3	ELE	ELE
EIE4449	Optical Communication Systems and Networks	3	ELE	ELE
ELC3531	Professional Communication in English for Engineering Students	2	COM	COM
ENG2002	Computer Programming	3	COM	-
ENG2003	Information Technology	3	COM	-
ENG3003	Engineering Management	3	COM	COM
ENG3004	Society and The Engineer	3	COM	COM
EIE2903/IC2141	Internet and Multimedia Product Development	5	TRN	TRN

Note:

AMA	Department of Applied Mathematics
CLC	Chinese Language Centre
COM	Compulsory
COMP	Department of Computing
EIE	Department of Electronic and Information Engineering
ELC	English Language Centre
ELE	Elective
ENG	Faculty of Engineering
IC	Industrial Centre
TRN	Training
*	Details of the Language and Communication Requirement (LCR) are set out in Section 4.2.

Subject to the approval by the Programme Leader of BSc(Hons) in AIIE, students may take at most one Level 5 subject per semester as a final-year technical elective during their final year of study. The total number of Level 5 subjects taken shall not exceed 2. Students can refer to the list of Level 5 subjects currently available on https://www.polyu.edu.hk/en/eie/study/postgraduate-programmes/msc_programme-structure-and-syllabi/.

Table 4.1.3 Subjects Category and Credits of BSc(Hons) in IS

Year 1, Year 2, Year 3 and Year 4 Curricula

Subject	Subject Title	Credit	Category	
			Normal Year 1 Intake	Senior Year Intake
General University Requirements (GUR)				
-	Cluster-Area Requirement I (CAR I)	3	COM	COM
-	Cluster-Area Requirement II (CAR II)	3	COM	COM
-	Cluster-Area Requirement III (CAR III)	3	COM	-
-	Cluster-Area Requirement IV (CAR IV)	3	COM	-
-	Language and Communication Requirement I (LCR I) – English*	3	COM	-
-	Language and Communication Requirement II (LCR II) – English*	3	COM	-
-	Language and Communication Requirement III (LCR III) – Chinese*	3	COM	-
-	Leadership Education and Development (LEAD)	3	COM	-
-	Service-Learning	3	COM	COM
EIE1005	Fundamental AI and Data Analytics (GUR-AIDA)	2	COM	-
MM1031	Introduction to Innovation and Entrepreneurship (GUR-IE)	1	COM	-
-	Healthy Lifestyle	0	COM	-
	Essential Components of General Education	0	-	COM
Discipline-Specific Requirement (DSR)				
AMA1110	Basic Mathematics I – Calculus and Probability & Statistics	3	COM	-
AMA1120	Basic Mathematics II –Calculus and Linear algebra	3	COM	-
CLC3241P	Professional Communication in Chinese	2	COM	COM
COMP2011	Data Structure	3	COM	-
COMP2012	Discrete Mathematics	3	COM	-
COMP2432	Operating Systems	3	COM	-
COMP3334	Computer Systems Security	3	COM	COM
COMP3335	Database Security	3	COM	-
COMP3421	Web Application Design and Development	3	COM	COM
COMP3438	System Programming	3	COM	COM
COMP3512	Legal Aspects, Professionalism and Ethics of Computing	3	COM	COM
COMP3311	Applied Cryptography	3	COM	-
COMP4127	Information Systems Audit and Control	3	ELE (Select any 2 subjects out of these 5 subjects)	ELE (Select any 2 subjects out of these 5 subjects)
COMP4142	E-Payment and Cryptocurrency	3		
COMP4334	Principles and Practice of Internet Security	3		
COMP4433	Data Mining and Data Warehousing	3		
COMP4512	Intellectual Property Protection and Management	3		
COMP4442	Service and Cloud Computing	3	COM	COM

Subject	Subject Title	Credit	Category	
			Normal Year 1 Intake	Senior Year Intake
COMP4913	Capstone Project	6	COM (select any 1 subject out of these 2 subjects)	COM (select any 1 subject out of these 2 subjects)
EIE4117	Capstone Project			
EIE1003	Foundations of Data Science	3	COM	-
EIE1004	Introduction to Information and Artificial Intelligence Engineering	3	COM	-
EIE2105	Digital and Computer Systems	3	COM	-
EIE3130	Network Security	3	COM	COM
EIE3112	Database System	3	COM	-
EIE3117	Integrated Project	3	COM	COM
EIE3320	Object-Oriented Design and Programming	3	COM	-
EIE3333	Data and Computer Communications	3	COM	COM
EIE3343	Computer Systems Principles	3	COM	COM
EIE4113	Wireless and Mobile Systems	3	COM	COM
EIE3129	IoT Security	3	ELE (Select any 2 subjects out of these 5 subjects)	ELE (Select any 2 subjects out of these 5 subjects)
EIE4114	Digital Forensics for Crime Investigation	3		
EIE4116	Surveillance Studies and Technologies	3		
EIE4118	Intrusion Detection and Penetration Test	3		
EIE4121	Machine Learning in Cyber-Security	3		
ELC3531	Professional Communication in English for Engineering Students	2	COM	COM
ENG2002	Computer Programming	3	COM	-
ENG2003	Information Technology	3	COM	-
ENG3003	Engineering Management	3	COM	COM
EIE3189	Summer Internship	2	TRN/WIE	TRN/WIE

Note:

AMA	Department of Applied Mathematics
CLC	Chinese Language Centre
COM	Compulsory
COMP	Department of Computing
EIE	Department of Electronic and Information Engineering
ELC	English Language Centre
ELE	Elective
ENG	Faculty of Engineering
TRN	Training
WIE	Work-Integrated Education

* Details of the Language and Communication Requirement (LCR) are set out in Section 4.2.

Subject to the approval by the Programme Leader of BSc(Hons) in IS, students may take at most one Level 5 subject per semester as a final-year technical elective during their final year of study. The total number of Level 5 subjects taken shall not exceed 2. Students can refer to the list of Level 5 subjects currently available on https://www.polyu.edu.hk/en/eie/study/postgraduate-programmes/msc_programme-structure-and-syllabi/.

4.2 Language and Communication Requirements (LCR)

Students are required to fulfil the four major components of the overall English and Chinese language requirements below in order to be eligible for graduation:

(i) Language and Communication Requirements (LCR) in English (6 credits) and Chinese (3 credits), as stated in Sections 4.2.1 and 4.2.2 below;
(ii) Writing Requirement, as stated in Section 4.2.3 below;
(iii) Reading Requirement, as stated in Section 4.2.4 below; and
(iv) Discipline-Specific Language Requirement, as stated in Section 4.2.5 below.

Senior year students would be considered for credit transfer for 4.2 (i) based on their previous studies in AD/HD programmes and their academic performance. Students not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take degree LCR subjects on top of the normal curriculum requirement. The Department will refer to the guidelines provided by the Language Centres (ELC and CLC) to determine whether a new student has met the equivalent standard.

4.2.1 English

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

Students entering the University with specified attainment grades in certain public examinations can be given credit transfer or exemption for one or both LCR English subjects.

Table A: English LCR subjects (each 3 credits)

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

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

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

(The above framework will also apply to students on Senior Year curriculum.)

4.2.2 Chinese

All undergraduate students are required to successfully complete one 3-credit Chinese language subject successfully as stipulated by the University, according to their Chinese language proficiency level. (Table C)

Table C: Chinese LCR subjects

Categories of students	Required subject
For Chinese speaking students	A Chinese LCR subject
For non-Chinese speakers or students whose Chinese standards are at junior secondary level or below	One subject from **Table D** below

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

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

Students who have obtained verified qualifications or certain results in some public examinations [e.g. HKDSE, HKALE, JEE, GSAT(Taiwan)] may be granted credit transfer/exemption for the Chinese LCR subject.

(The above framework and exemption arrangements will also apply to students on Senior Year curriculum.)

4.2.3 Writing Requirement in CAR Subjects

In additional to the LCR in English and Chinese explained above, all students must also, among the Cluster Areas Requirement (CAR) subjects they take, pass one subject that requires a substantial piece of writing in English and one subject that requires a substantial piece of writing in Chinese. Students who are non-Chinese speakers or those whose Chinese standards are at junior secondary level or below will be exempted from the Chinese Writing requirement.

4.2.4 Reading Requirement in CAR Subjects

All students must, among the CAR subjects they take, must pass one subject that requires the reading of an extensive text in English and one subject that requires the reading of an extensive text in Chinese. Students who are non-Chinese speakers or those whose Chinese standards are at junior secondary level or below will be exempted from the Chinese Reading requirement.

A list of approved CAR subjects for meeting the Writing Requirement (with a "W" designation) and for meeting the Reading Requirement (with an "R" designation) is shown at:

https://www.polyu.edu.hk/ous/GURSubjects/CAR.php

4.2.5 Discipline-Specific Language Requirement

In addition to the LCR mentioned in Sections 4.2.1 to 4.2.4 above, students also have to complete the subject "Professional Communication" (2 credits in English and 2 credits in Chinese) as the discipline-specific language requirements.

Students who are non-Chinese speakers or those whose Chinese standards are at junior secondary level or below will be exempted from the Discipline-Specific Chinese Language requirement, i.e. *CLC3241P Professional Communication in Chinese*. These students must take 1 subject of any level **recommended by CLC/EIE** to make up for the minimum total credit requirement.

5. SPECIFIED PROGRESSION PATTERN

5.1 BEng(Hons) in Electronic Systems and Internet-of-Things (Normal Year 1 Intake):

Year 1	
Semester 1 (16 academic credits)	**Semester 2 (17 academic credits)**
AMA1110 Basic Mathematics I – Calculus and Probability & Statistics *(3 credits)*	AMA1120 Basic Mathematics II –Calculus and Linear algebra *(3 credits)*
EIE1004 Introduction to Information and Artificial Intelligence Engineering *(3 credits)*	EIE1003 Foundations of Data Science *(3 credits)*
ENG2003 Information Technology *(3 credits)*	EIE1005 Fundamental AI and Data Analytics *(2 credits)* (GUR-AIDA)
MM1031 Introduction to Innovation and Entrepreneurship *(1 credit)* (GUR-IE)	ENG2002 Computer Programming *(3 credits)*
CAR I *(3 credits)* Note 1	LCR I – English *(3 credits)*
CAR II *(3 credits)* Note 1	Leadership Education and Development *(3 credits)*
Healthy Lifestyle *(0 credit)* Note 1	
Year 2	
Semester 1 (15 academic credits)	**Semester 2 (15 academic credits)**
AMA2111 Mathematics I *(3 credits)*	AF3625 Engineering Economics *(3 credits)*
EIE2110 Basic Circuit Analysis and Electronics *(3 credits)*	EIE2211 Logic Design *(3 credits)*
EIE2113 Introduction to Internet of Things *(3 credits)*	EIE3124 Fundamentals of Machine Intelligence *(3 credits)*
LCR II – English *(3 credits)*	EIE3331 Communication Fundamentals *(3 credits)*
LCR III – Chinese *(3 credits)*	CAR III *(3 credits)* Note 1
EIE2901/IC2114 Industrial Centre Training I for EIE *(5 training credits)*	
Year 3	
Semester 1 (15 academic credits)	**Semester 2 (15 academic credits)**
EIE3123 Dynamic Electronic Systems *(3 credits)*	EIE3112 Database System *(3 credits)*
EIE3311 Computer System Fundamentals *(3 credits)*	EIE3128 IoT Project *(3 credits)*
EIE3312 Linear Systems *(3 credits)*	EIE4113 Wireless and Mobile Systems *(3 credits)*
EIE3333 Data and Computer Communications *(3 credits)*	Technical Elective 1 *(3 credits)* Note 2
EIE3373 Microcontroller Systems and Interface *(3 credits)*	Service-Learning *(3 credits)* Note 1
EIE2901/IC2114 Industrial Centre Training I for EIE *(continued)*	
Year 4	
Semester 1 (18 academic credits)	**Semester 2 (13 academic credits)**
EIE3129 IoT Security *(3 credits)*	CLC3241P Professional Communication in Chinese *(2 credits)*
ENG3003 Engineering Management *(3 credits)*	ELC3531 Professional Communication in English for Engineering Students *(2 credits)*
Technical Elective 2 *(3 credits)* Note 2	ENG3004 Society and the Engineer *(3 credits)*
Technical Elective 3 *(3 credits)* Note 2	Technical Elective 4 *(3 credits)* Note 2
CAR IV *(3 credits)* Note 1	
EIE4126 Capstone Project *(6 credits)*	
EIE3901/IC382 Multidisciplinary Manufacturing Project *(3 training credits)*	

Total Number of Academic Credits: 124

Note 1: The study pattern for the subjects is indicative only. Students may take these subjects according to their own schedule. They are recommended to consult their Academic Advisor for guidance and planning if necessary.

Note 2: At least 2 technical electives must be at level 4 or above.

5.2 BEng(Hons) in Electronic Systems and Internet-of-Things (<u>Senior Year Intake</u>): for students with relevant Higher Diploma/Associate Degree from a recognized institution Note 3

Year 1	
Semester 1 (18 academic credits)	**Semester 2 (15 academic credits)**
EIE2113 Introduction to Internet of Things *(3 credits)*	EIE3112 Database System *(3 credits)*
EIE3123 Dynamic Electronic Systems *(3 credits)*	EIE3128 IoT Project *(3 credits)*
EIE3311 Computer System Fundamentals *(3 credits)*	EIE3331 Communication Fundamentals *(3 credits)*
EIE3333 Data and Computer Communications *(3 credits)*	EIE4113 Wireless and Mobile Systems *(3 credits)*
EIE3373 Microcontroller Systems and Interface *(3 credits)*	Technical Elective 1 *(3 credits)* Note 2
CAR – English Language *(3 credits)* Note 1	
Essential Components of General Education *(0 credits)*	
EIE2901/IC2114 Industrial Centre Training I for EIE *(5 <u>training</u> credits)*	
Year 2	
Semester 1 (18 academic credits)	**Semester 2 (16 academic credits)**
EIE3129 IoT Security *(3 credits)*	CLC3241P Professional Communication in Chinese *(2 credits)*
ENG3003 Engineering Management *(3 credits)*	ELC3531 Professional Communication in English for Engineering Students *(2 credits)*
Technical Elective 2 *(3 credits)* Note 2	ENG3004 Society and the Engineer *(3 credits)*
Service-Learning *(3 credits)* Note 1	Technical Elective 3 *(3 credits)* Note 2
CAR M *(3 credits)* Note 1, 4	Technical Elective 4 *(3 credits)* Note 2
EIE4126 Capstone Project *(6 credits)*	
EIE3901/IC382 Multidisciplinary Manufacturing Project *(3 <u>training</u> credits)*	

Total Number of Academic Credits: <u>67</u> Note 5

Note 1: The study pattern for the subjects is indicative only. Students may take these subjects according to their own schedule. However, <u>CAR – English Language should be completed in the first year of study</u>, including non-mandatory summer semester. Students are recommended to consult their Academic Advisor for guidance and planning if necessary.

Note 2: At least 2 technical electives must be at level 4 or above.

Note 3: This is an example only, which shows a possible study pattern for graduates with relevant Higher Diploma/Associate Degree from a recognized institution. The exact study pattern for senior year intakes varies from student to student depending on the approved subjects transferred.

Note 4: Students also need to fulfil the Chinese reading and writing requirements (CR/CW), if such requirements have not been fulfilled in previous studies.

Note 5: The credits required and progression pattern presented above are for students who have been given credit transfer of the 9 credits Undergraduate Degree LCR subjects based upon their previous studies. Students not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take the required subjects. Details on the Undergraduate Degree LCR subjects are given in section 4.2 of this booklet.

5.3 BSc(Hons) in Artificial Intelligence and Information Engineering (Normal Year 1 Intake):

Year 1	
Semester 1 (16 academic credits)	**Semester 2 (17 academic credits)**
AMA1110 Basic Mathematics I – Calculus and Probability & Statistics *(3 credits)*	AMA1120 Basic Mathematics II –Calculus and Linear algebra *(3 credits)*
EIE1004 Introduction to Information and Artificial Intelligence Engineering *(3 credits)*	EIE1003 Foundations of Data Science *(3 credits)*
ENG2003 Information Technology *(3 credits)*	EIE1005 Fundamental AI and Data Analytics *(2 credits)* (GUR-AIDA)
MM1031 Introduction to Innovation and Entrepreneurship *(1 credit)* (GUR-IE)	ENG2002 Computer Programming *(3 credits)*
CAR I *(3 credits)* Note 1	LCR I – English *(3 credits)*
CAR II *(3 credits)* Note 1	Leadership Education and Development *(3 credits)*
Healthy Lifestyle *(0 credit)* Note 1	
Semester 3 – EIE2903/IC2141 Internet and Multimedia Product Development *(5 training credits)*	
Year 2	
Semester 1 (15 academic credits)	**Semester 2 (14 academic credits)**
COMP2011 Data Structures *(3 credits)*	EIE3103 Digital Signals and Systems *(3 credits)*
EIE2105 Digital and Computer Systems *(3 credits)*	EIE3112 Database System *(3 credits)*
EIE2112 Foundation Techniques in Artificial Intelligence *(3 credits)*	EIE3124 Fundamentals of Machine Intelligence *(3 credits)*
LCR II – English *(3 credits)*	EIE3320 Object-Oriented Design and Programming *(3 credits)*
LCR III – Chinese *(3 credits)*	ELC3531 Professional Communication in English for Engineering Students *(2 credits)*
Year 3	
Semester 1 (17 academic credits)	**Semester 2 (15 academic credits)**
CLC3241P Professional Communication in Chinese *(2 credits)*	EIE3109 Mobile Systems and Application Development *(3 credits)*
COMP4434 Big Data Analytics *(3 credits)*	EIE3360 Integrated Project *(3 credits)*
EIE2113 Introduction to Internet of Things *(3 credits)*	Technical Elective 1 *(3 credits)* Note 2
EIE3333 Data and Computer Communication *(3 credits)*	Technical Elective 2 *(3 credits)* Note 2
EIE3343 Computer Systems Principles *(3 credits)*	Service-Learning *(3 credits)* Note 1
EIE4432 Web Systems and Technologies *(3 credits)*	
Year 4	
Semester 1 (18 academic credits)	**Semester 2 (12 academic credits)**
EIE4102 IP Networks *(3 credits)*	ENG3004 Society and the Engineer *(3 credits)*
ENG3003 Engineering Management *(3 credits)*	Technical Elective 5 *(3 credits)* Note 2
Technical Elective 3 *(3 credits)* Note 2	CAR IV *(3 credits)* Note 1
Technical Elective 4 *(3 credits)* Note 2	
CAR III *(3 credits)* Note 1	
EIE4127 Capstone Project *(6 credits)*	

Total Number of Academic Credits: 124

Note 1: The study pattern for the subjects is indicative only. Students may take these subjects according to their own schedule. They are recommended to consult their Academic Advisor for guidance and planning if necessary.

Note 2:

Technology stream electives:

EIE3130 Network Security
EIE4104 Mobile Networking
EIE4428 Multimedia Communications
EIE4431 Digital Video Production and Broadcasting
EIE4435 Image and Audio Processing

Science stream electives:

EIE4100 Computer Vision and Pattern Recognition
EIE4105 Multimodal Human Computer Interaction Technology
EIE4108 Distributed Systems and Cloud Computing
EIE4121 Machine Learning for Cyber-security
EIE4122 Deep Learning and Deep Neural Networks

5.4 BSc(Hons) in Artificial Intelligence and Information Engineering (Senior Year Intake): for students with relevant Higher Diploma/Associate Degree from a recognized institution [Note 2]

Year 1	
Semester 1 (17 academic credits)	**Semester 2 (18 academic credits)**
CLC3241P Professional Communication in Chinese *(2 credits)*	EIE3103 Digital Signals and Systems *(3 credits)*
COMP4434 Big Data Analytics *(3 credits)*	EIE3109 Mobile Systems and Application Development *(3 credits)*
EIE2113 Introduction to Internet of Things *(3 credits)*	EIE3124 Fundamentals of Machine Intelligence *(3 credits)*
EIE3333 Data and Computer Communications *(3 credits)*	EIE3360 Integrated Project *(3 credits)*
EIE3343 Computer Systems Principles *(3 credits)*	Technical Elective 1 *(3 credits)* [Note 5]
CAR – English Language *(3 credits)* [Note 1]	Service-Learning *(3 credits)* [Note 1]
Essential Components of General Education *(0 credits)*	
Semester 3: EIE2903/IC2141 Internet and Multimedia Product Development *(5 training credits)*	
Year 2	
Semester 1 (18 academic credits)	**Semester 2 (14 academic credits)**
EIE4102 IP Networks *(3 credits)*	ELC3531 Professional Communication in English for Engineering Students *(2 credits)*
ENG3003 Engineering Management *(3 credits)*	ENG3004 Society and the Engineer *(3 credits)*
Technical Elective 2 *(3 credits)* [Note 5]	Technical Elective 4 *(3 credits)* [Note 5]
Technical Elective 3 *(3 credits)* [Note 5]	Technical Elective 5 *(3 credits)* [Note 5]
CAR M *(3 credits)* [Note 1, 3]	
EIE4127 Capstone Project *(6 credits)*	

Total Number of Academic Credits: 67 [Note 4]

Note 1: The study pattern for the subjects is indicative only. Students may take these subjects according to their own schedule. However, CAR – English Language should be completed in the first year of study, including non-mandatory summer semester. Students are recommended to consult their Academic Advisor for guidance and planning if necessary.

Note 2: This is an example only, which shows a possible study pattern for graduates with relevant Higher Diploma/Associate Degree from a recognized institution. The exact study pattern for senior year intakes varies from student to student depending on the approved subjects transferred.

Note 3: Students also need to fulfil the Chinese reading and writing requirements (CR/CW), if such requirements have not been fulfilled in previous studies.

Note 4: The credits required and progression pattern presented above are for students who have been given credit transfer of the 9 credits Undergraduate Degree LCR subjects based upon their previous studies. Students not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take the required subjects. Details on the Undergraduate Degree LCR subjects are given in section 4.2 of this booklet.

Note 5:

Technology stream electives:	**Science stream electives:**
EIE3130 Network Security	EIE4100 Computer Vision and Pattern Recognition
EIE4104 Mobile Networking	EIE4105 Multimodal Human Computer Interaction Technology
EIE4428 Multimedia Communications	EIE4108 Distributed Systems and Cloud Computing
EIE4431 Digital Video Production and Broadcasting	EIE4121 Machine Learning for Cyber-security
EIE4435 Image and Audio Processing	EIE4122 Deep Learning and Deep Neural Networks

5.5 BSc(Hons) in Information Security (Normal Year 1 Intake):

Year 1	
Semester 1 (15 academic credits)	**Semester 2 (18 academic credits)**
AMA1110 Basic Mathematics I – Calculus and Probability & Statistics *(3 credits)*	AMA1120 Basic Mathematics II –Calculus and Linear algebra *(3 credits)*
EIE1004 Introduction to Information and Artificial Intelligence Engineering *(3 credits)*	EIE1003 Foundations of Data Science *(3 credits)*
ENG2003 Information Technology *(3 credits)*	EIE1005 Fundamental AI and Data Analytics *(2 credits)* (GUR-AIDA)
MM1031 Introduction to Innovation and Entrepreneurship *(1 credit)* (GUR-IE)	ENG2002 Computer Programming *(3 credits)*
CAR I *(3 credits)* Note 1	LCR I – English *(3 credits)*
CAR II *(3 credits)* Note 1	Leadership Education and Development *(3 credits)*
Healthy Lifestyle *(0 credit)* Note 1	
Year 2	
Semester 1 (15 academic credits)	**Semester 2 (15 academic credits)**
COMP2011 Data Structures *(3 credits)*	COMP2432 Operating Systems *(3 credits)*
COMP2012 Discrete Mathematics *(3 credits)*	COMP3311 Applied Cryptography *(3 credits)*
EIE2105 Digital and Computer Systems *(3 credits)*	EIE3112 Database System *(3 credits)*
LCR II – English *(3 credits)*	EIE3320 Object-Oriented Design and Programming *(3 credits)*
LCR III – Chinese *(3 credits)*	CAR III *(3 credits)* Note 1
Year 3	
Semester 1 (18 academic credits)	**Semester 2 (16 academic credits)**
COMP3335 Database Security *(3 credits)*	CLC3241P Professional Communication in Chinese *(2 credits)*
COMP3438 System Programming *(3 credits)*	COMP3334 Computer Systems Security *(3 credits)*
EIE3130 Network Security *(3 credits)*	COMP3421 Web Application Design and Development *(3 credits)*
EIE3333 Data and Computer Communication *(3 credits)*	COMP3512 Legal Aspects, Professionalism and Ethics of Computing *(3 credits)*
EIE3343 Computer Systems Principles *(3 credits)*	EIE3117 Integrated Project *(3 credits)*
CAR IV *(3 credits)* Note 1	ELC3531 Professional Communication in English for Engineering Students *(3 credits)*
Semester 3: EIE3189 Summer Internship *(2 training credits)*	
Year 4	
Semester 1 (15 academic credits)	**Semester 2 (15 academic credits)**
EIE4113 Wireless and Mobile Systems *(3 credits)*	COMP4442 Service and Cloud Computing *(3 credits)*
ENG3003 Engineering Management *(3 credits)*	Technical Elective 2 *(3 credits)* Note 2
Technical Elective 1 *(3 credits)* Note 2	Technical Elective 3 *(3 credits)* Note 2
Service-Learning *(3 credits)* Note 1	Technical Elective 4 *(3 credits)* Note 2
COMP4913 Capstone Project/EIE4117 Capstone Project *(6 credits)*	

Total Number of Academic Credits: 127

Note 1: The study pattern for the subjects is indicative only. Students may take these subjects according to their own schedule. They are recommended to consult their Academic Advisor for guidance and planning if necessary.

Note 2: At least 3 technical electives must be at level 4 or above.

5.6 BSc(Hons) in Information Security (Senior Year Intake): for students with relevant Higher Diploma/Associate Degree from a recognized institution Note 3

Year 1	
Semester 1 (18 academic credits)	**Semester 2 (16 academic credits)**
COMP3438 System Programming (3 credits)	CLC3241P Professional Communication in Chinese (2 credits)
EIE3130 Network Security (3 credits)	COMP3334 Computer Systems Security (3 credits)
EIE3333 Data and Computer Communication (3 credits)	COMP3421 Web Application Design and Development (3 credits)
EIE3343 Computer Systems Principles (3 credits)	COMP3512 Legal Aspects, Professionalism and Ethics of Computing (3 credits)
CAR – English Language (3 credits) Note 1	EIE3117 Integrated Project (3 credits)
CAR M (3 credits) Note 1, 4	ELC3531 Professional Communication in English for Engineering Students (2 credits)
Essential Components of General Education *(0 credits)*	
Semester 3: EIE3189 Summer Internship *(2 training credits)*	
Year 2	
Semester 1 (15 academic credits)	**Semester 2 (15 academic credits)**
EIE4113 Wireless and Mobile Systems *(3 credits)*	COMP4442 Service and Cloud Computing *(3 credits)*
ENG3003 Engineering Management *(3 credits)*	Technical Elective 2 *(3 credits)* Note 2
Technical Elective 1 *(3 credits)* Note 2	Technical Elective 3 *(3 credits)* Note 2
Service-Learning *(3 credits)* Note 1	Technical Elective 4 *(3 credits)* Note 2
COMP4913 Capstone Project/EIE4117 Capstone Project *(6 credits)*	

Total Number of Academic Credits: 64 Note 5

Note 1: The study pattern for the subjects is indicative only. Students may take these subjects according to their own schedule. However, CAR – English Language should be completed in the first year of study. Students are recommended to consult their Academic Advisor for guidance and planning if necessary.

Note 2: At least 3 technical electives must be at level 4 or above.

Note 3: This is an example only, which shows a possible study pattern for graduates with relevant Higher Diploma/Associate Degree from a recognized institution. The exact study pattern for senior year intakes varies from student to student depending on the approved subjects transferred.

Note 4: Students also need to fulfil the Chinese reading and writing requirements (CR/CW), if such requirements have not been fulfilled in previous studies.

Note 5: The credits required and progression pattern presented above are for students who have been given credit transfer of the 9 credits Undergraduate Degree LCR subjects based upon their previous studies. Students not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take the required subjects. Details on the Undergraduate Degree LCR subjects are given in section 4.2 of this booklet.

6. CURRICULUM MAP

6.1 Alignment of Subjects with Programme Intended Learning Outcomes of BEng(Hons) in ESIoT:

	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
A. GENERAL UNIVERSITY REQUIREMENTS (GUR)										
Language and Communication Requirements (LCR)										
LCR - English - ELCXXXX (2 Subjects)									T,P	
LCR - Chinese - CLCXXXX (1 Subject)									T,P	
Cluster-Area Requirements (CAR) (2 – 4 Subjects)										
CAR - Cluster-Area Requirement Subjects+								T,P	T,P	T,P
Other Requirements										
AIDA - Artificial Intelligence and Data Analytics									T,P	
IE – Introduction to Innovation and Entrepreneurship									T,P	
LEAD - Leadership Education and Development							T,P		T,P	
SL - Service-Learning								T,P		
B. DISCIPLINE – SPECIFIC REQUIREMENTS (DSR)										
Compulsory – Mathematics and Basic Sciences Subjects										
AMA1110 Basic Mathematics I – Calculus and Probability & Statistics				T,P	T,P					T
AMA1120 Basic Mathematics II –Calculus and Linear algebra				T,P	T,P					T
AMA2111 Mathematics I				T,P	T,P					T
Compulsory – Engineering Subjects										
EIE1003 Foundations of Data Science	T,P,M			T,P						
EIE1004 Introduction to Information and Artificial Intelligence Engineering	T,P,M					T,M				T,M
EIE2110 Basic Circuit Analysis and Electronics	T,P	T,P,M		T,P,M				T,P		
EIE2113 Introduction to Internet of Things	T				T,P,M					T,M
EIE2211 Logic Design	T	P	P	T,P	P					
EIE3112 Database System	T				T				T,P	
EIE3123 Dynamic Electronic Systems	T,P,M		T,P,M	T,P	T,P		P			
EIE3124 Fundamentals of Machine Intelligence (Elective for Senior Year Intake)	T,P			T,P	T,P				P	
EIE3128 IoT Project	T	P	P	P,M	P		M	M	P,M	
EIE3129 IoT Security				P,M		T,M		T,M	P	
EIE3311 Computer System Fundamentals	T	P	T							
EIE3312 Linear Systems	T,P	T,P	T,P	T	P					T
EIE3331 Communication Fundamentals	T	T,P	T,P	T	T,P				T	
EIE3333 Data and Computer Communications	T	T,P		T	T,P				T	
EIE3373 Microcontroller Systems and Interface	T,M	P,M		P,M	P				P	
EIE4113 Wireless and Mobile Systems	T,P,M	T,P,M			T,P	T,P				
ENG2002 Computer Programming			T,P	T,P	T,P					
ENG2003 Information Technology				T,P	T,P					
Compulsory – Language and Complementary Studies										
AF3625 Engineering Economics						T,P,M	T,P		T,P	T,P
CLC3241P Professional Communication in Chinese									T,P,M	
ELC3531 Professional Communication in English for Engineering Students									T,P,M	
ENG3003 Engineering Management						T	T,P,M	T	T,P,M	
ENG3004 Society and The Engineer						T,P,M	T,P,M	T,P,M	T,P	
Compulsory – Capstone Project										
EIE4126 Capstone Project+	T,P,M	T,P,M	T,P,M	T,P,M	T,P,M	T,P,M	T,P		T,P,M	T,P,M
Compulsory – Industrial Centre Training and Training through Work Experience										
EIE2901/IC2114 Industrial Centre Training I for EIE	T,P				T,P			T,P,M		T,P,M
EIE3901/IC382 Multidisciplinary Manufacturing Project			T,P,M		T,P		T,P,M			
Work-Integrated Education (WIE)	P,M			P,M	P,M	P,M	P,M	P,M	P,M	P,M

	Programme Outcomes									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Elective – Engineering Subjects (Select Any 4)										
EIE3109 Mobile Systems and Application Development			**T,P**		**T,P**					
EIE3127 Artificial Intelligence of Things	**T**			**P**		**T,M**				**T,M**
EIE3130 Network Security		**P**				**T**	**P**			**T,M**
EIE3320 Object-Oriented Design and Programming	**T**		**T,P, M**	**T,P**	**P**		**P**			
EIE4100 Computer Vision and Pattern Recognition	**T**	**T**	**T**	**T**	**T,P, M**		**T**			**T**
EIE4102 IP Networks	**T**				**T,P, M**	**T**				**T**
EIE4104 Mobile Networking	**T**			**T,P, M**	**T,P**	**T**				**T**
EIE4105 Multimodal Human Computer Interaction Technology	**T,P**				**T,P, M**					
EIE4108 Distributed Systems and Cloud Computing	**T,P**		**T,P**	**T**	**T,P, M**				**T,P**	
EIE4110 Introduction to VLSI and Computer-Aided Circuit Design	**T,P**	**T,P, M**		**T,P**			**T,P**			
EIE4119 Mobile Device System Architecture				**T**	**T,P**					**T,P, M**
EIE4122 Deep Learning and Deep Neural Networks	**T,P**				**T,P**					
EIE4123 Healthcare Technology	**T**			**P**		**T,M**	**P**	**T,M**	**P**	
EIE4124 Modern Robotics	**T,M**	**P,M**			**P**				**P**	**T,M**
EIE4125 Power Conversion Technology for Energy Harvesting	**T**		**T,P, M**		**P**	**T**			**P**	**T**
EIE4413 Digital Signal Processing	**T,M**	**P**	**T,P, M**	**T**	**P**					**T**
EIE4432 Web Systems and Technologies	**T**		**T,P**					**T,P, M**		**T,P, M**
EIE4435 Image and Audio Processing	**T,M**	**P**		**P**			**P**			
EIE4449 Optical Communication Systems and Networks	**T**	**T,P**	**T**	**T,M**			**T**		**T**	

<u>Note:</u>

Programme Outcomes:

1. Understand the fundamentals of science and engineering, and have the ability to apply them.
2. Design and conduct experiments, as well as to evaluate the outcomes.
3. Design systems, components and processes to meet given specifications and constraints.
4. Identify, formulate and solve problems relevant to Electronic Systems and Internet-of-Things.
5. Use modern engineering/IT tools appropriate to Electronic Systems and Internet-of-Things practice.
6. Know the contemporary issues, and understand the impact of engineering solutions in a global and societal context.
7. Work with others collaboratively in a multi-disciplinary team and have a knowledge of leadership.
8. Recognize social, professional and ethical responsibility.
9. Communicate effectively.
10. Recognize the need for and to engage in life-long learning.

T: Teach
P: Practise
M: Measured
+: Support of outcomes depends on particular project/subject design and requirements

6.2 Alignment of Subjects with Programme Intended Learning Outcomes of BSc(Hons) in AIIE:

	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
A. GENERAL UNIVERSITY REQUIREMENTS (GUR)										
Language and Communication Requirements (LCR)										
LCR - English - ELCXXXX (2 Subjects)									**T,P**	
LCR - Chinese - CLCXXXX (1 Subject)									**T,P**	
Cluster-Area Requirements (CAR) (2 - 4 Subjects)										
CAR - Cluster-Area Requirement Subjects+						**T,P**		**T,P**	**T,P**	**T,P**
Other Requirements										
AIDA - Artificial Intelligence and Data Analytics									**T,P**	
IE - Innovation and Entrepreneurship									**T, P**	
LEAD - Leadership Education and Development							**T,P**		**T, P**	
SL - Service-Learning							**T,P**		**T,P**	
B. DISCIPLINE – SPECIFIC REQUIREMENTS (DSR)										
Compulsory – Mathematics and Basic Sciences Subjects										
AMA1110 Basic Mathematics I – Calculus and Probability & Statistics				**T,P**	**T,P**					
AMA1120 Basic Mathematics II – Calculus and Linear Algebra				**T,P**	**T,P**					
EIE1003 Foundations of Data Science	**T, P**				**T, P**	**T, P**	**T, P**	**T, P**	**T, P**	
Compulsory –Engineering Subjects										
COMP2011 Data Structures	**T,P**			**T,P**						
COMP4434 Big Data Analytics	**T,P**	**T,P**	**T,P**	**T,P**	**T,P**				**T,P**	
EIE1004 Introduction to Information and Artificial Intelligence Engineering	**T, P**			**T**		**T, P**		**T, P**	**T,P**	**T, P**
EIE2105 Digital and Computer Systems	**T,P**			**T**						
EIE3103 Digital Signals and Systems				**T**	**P**				**T**	**T**
EIE3109 Mobile Systems and Application Development		**T**	**T**		**T**	**T,P**				
EIE3112 Database System	**T**				**T,P**				**T,P**	
EIE3124 Fundamentals of Machine Intelligence	**T,P**				**T,P, M**				**T,P**	
EIE3320 Object-Oriented Design and Programming	**T,M**	**T,P, M**	**T,P, M**	**T,P**	**P**					
EIE3333 Data and Computer Communications	**T**				**T,P**				**T**	
EIE3343 Computer Systems Principles	**P**			**T**						**T**
EIE3360 Integrated Project	**T,P, M**			**T,P, M**	**T,P, M**	**M**	**P,M**		**P,M**	**T,P, M**
EIE4102 IP Networks	**T**				**T,P**					**T**
EIE4432 Web Systems and Technologies	**T**				**T,P**		**P,M**			**T**
EIE2112 Foundation Techniques in Artificial Intelligence	**T,P**				**T,P**				**T,P**	
EIE2113 Introduction to Internet of Things	**T,P**				**T,P**					**T,P**
ENG2002 Computer Programming	**T,P**			**T,P**	**T,P**					**T**
ENG2003 Information Technology				**T,P**	**T,P**	**T,P**				
Compulsory – Capstone Project										
EIE4127 Capstone Project+	**P,M**	**P,M**	**P,M**	**P,M**	**P,M**	**P,M**			**P,M**	**P,M**
Compulsory – Industrial Centre Training and Training through Work Experience										
EIE2903/IC2141 Internet and Multimedia Product Development				**T,P**	**T,P**	**T**	**T,P**	**T**		
Work-Integrated Education (WIE)	**P,M**			**P,M**	**P,M**	**P,M**	**P,M**	**P,M**	**P,M**	**P,M**
Compulsory – Language and Complementary Subjects										
CLC3241P Professional Communication in Chinese									**T,P, M**	
ELC3531 Professional Communication in English for Engineering Students									**T,P, M**	
ENG3003 Engineering Management						**T,M**	**T**	**T,M**	**T**	
ENG3004 Society and The Engineer						**T,P, M**	**T,P, M**	**T,P, M**	**T,P**	
Elective – Engineering Subjects (Select Any 5)										
EIE3127 Artificial Intelligence of Things	**T,P**			**T,P, M**	**T,P, M**	**T,P**				**T,P, M**
EIE3129 IoT Security				**T,P, M**	**T,P, M**			**T,P, M**	**T,P**	
EIE4100 Computer Vision and Pattern Recognition	**T,P**	**T**	**T**	**T**	**T**		**T**			**T**

	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
EIE4104 Mobile Networking	T				T,P					T,M
EIE4105 Multimodal Human Computer Interaction Technology	T,P				T,P	T,P				
EIE4108 Distributed Systems and Cloud Computing	T,P	T,P	T,P	T	P	T,P			T,P	
EIE4121 Machine Learning for Cyber-security	T,P				T,P, M				P,M	
EIE4122 Deep Learning and Deep Neural Networks		T,P, M	T,P, M	T,P, M		T,P ,M				
EIE4123 Healthcare Technology	T,P, M	T,P	T,P	T,P			T,P, M	T,P, M	T,P, M	
EIE4428 Multimedia Communications	T			T,P, M						T
EIE4431 Digital Video Production and Broadcasting	T,P, M			T	T,P, M					T
EIE4435 Image and Audio Processing		T,M	T,M	T,M			T			
EIE4449 Optical Communication Systems and Networks	T,P, M	T,P, M	T,P	T,P, M			T,P, M		T,P, M	

Note:

Programme Outcomes:
1. Understand the fundamentals of mathematics, science and engineering, and have the ability to apply them.
2. Design and conduct experiments, as well as to evaluate the outcomes.
3. Design systems, components and processes to meet given specifications and constraints.
4. Identify, formulate and solve problems relevant to artificial intelligence and information engineering.
5. Use modern engineering/IT tools appropriate to artificial intelligence and information Engineering.
6. Know the contemporary issues, and understand the impact of engineering solutions in a global and societal context.
7. Work with others collaboratively in a multi-disciplinary team and have a knowledge of leadership.
8. Recognize social, professional and ethical responsibility.
9. Communicate effectively.
10. Recognize the need for and engage in life-long learning.

T: Teach
P: Practice
M: Measured
+: Support of outcomes depends on particular project/subject design and requirements

6.3 Alignment of Subjects with Programme Intended Learning Outcomes of BSc(Hons) in IS:

	Programme Outcomes									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
A. GENERAL UNIVERSITY REQUIREMENTS (GUR)										
Language and Communication Requirements (LCR)										
LCR - English - ELCXXXX (2 Subjects)								**T,P**		
LCR - Chinese - CLCXXXX (1 Subject)								**T,P**		
Cluster-Area Requirements (CAR) (2 – 4 Subjects)										
CAR - Cluster-Area Requirement Subjects+							**T,P**	**T,P**		**T,P**
Other Requirements										
AIDA - Artificial Intelligence and Data Analytics								**T, P**		
IE - Innovation and Entrepreneurship								**T, P**		
LEAD - Leadership Education and Development						**T,P**		**T,P**		
SL - Service-Learning						**T,P**		**T,P**		
B. DISCIPLINE – SPECIFIC REQUIREMENTS (DSR)										
Compulsory – Mathematics and Basic Sciences Subjects										
AMA1110 Basic Mathematics I – Calculus and Probability & Statistics			**T,P**		**T,P**					
AMA1120 Basic Mathematics II –Calculus and Linear algebra			**T,P**		**T,P**					
COMP2012 Discrete Mathematics	**T,M**		**T,P**							
Compulsory – Computer Science and Engineering Subjects										
COMP2011 Data Structures	**T,P, M**	**T,P**								
COMP2432 Operating Systems	**T,P**		**T,P**							
COMP3334 Computer Systems Security		**T,P, M**	**T,P, M**						**T**	**T,P**
COMP3335 Database Security			**T,P, M**	**T,P, M**		**T,P**			**T**	
COMP3421 Web Application Design and Development		**T,P**	**T,P**	**T,P**			**P,M**		**P,M**	
COMP3438 System Programming			**T,P**	**T,P**	**T,P, M**					**T,P, M**
COMP3311 Applied Cryptography	**T**		**T**							
COMP4442 Service and Cloud Computing		**T,P, M**	**T,P, M**		**T,P, M**					
EIE1003 Foundations of Data Science		**T**			**T**	**T,P**	**T,P**	**T**	**T**	
EIE1004 Introduction to Information and Artificial Intelligence Engineering	**T**		**T,P**				**T,P**	**T,P**		**T,P**
EIE2105 Digital and Computer Systems	**T**	**P**	**T**							
EIE3112 Database System	**T**				**T**				**T,P**	
EIE3117 Integrated Project		**T,P**	**T,P**	**T,P**	**T**	**T,M**		**T,P**	**T,P**	**T,M**
EIE3130 Network Security			**T,P**			**T,P, M**	**T,P**			
EIE3320 Object-Oriented Design and Programming	**T,P, M**		**T,P**	**T,P, M**	**P**					
EIE3333 Data and Computer Communications	**T**	**T,P**	**T**					**T**		
EIE3343 Computer Systems Principles		**P**	**T**							**T**
EIE4113 Wireless and Mobile Systems			**T**		**T,P**				**T,M**	
ENG2002 Computer Programming			**T,P**	**T,P**	**T,P**					
ENG2003 Information Technology				**T,P**	**T,P**					
Compulsory – Complementary Studies										
CLC3241P Professional Communication in Chinese								**T,P, M**		
COMP3512 Legal Aspects, Professionalism and Ethics of Computing							**T,P, M**	**P,M**		**T,P, M**
ELC3531 Professional Communication in English for Engineering Students								**T,P, M**		
ENG3003 Engineering Management						**T**	**T,P, M**	**T**	**T,P, M**	
Compulsory – Capstone Project (Select Any 1)										
COMP4913 Capstone Project +	**P,M**	**P,M**	**P,M**	**P,M**	**P,M**			**P,M**	**P,M**	**P,M**
EIE4117 Capstone Project +	**P,M**	**P,M**	**P,M**	**P,M**	**P,M**			**P,M**	**P,M**	**P,M**
Compulsory – Training through Work Experience										
EIE3189 Summer Internship				**P,M**		**P,M**	**P,M**	**P,M**	**P,M**	

	Programme Outcomes									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Elective - Computer Science and Engineering Subjects (Select Any 2)										
COMP4127 Information Systems Audit and Control				**T,P,M**	**T,P,M**	**T,P**	**T,P,M**		**T,P**	
COMP4142 E-Payment and Cryptocurrency	**T**		**T**	**T,M**	**T,M**	**P,M**			**T**	
COMP4334 Principles and Practice of Internet Security		**T,P**	**T,P**				**P,M**			
COMP4433 Data Mining and Data Warehousing	**T**		**T**		**T,P**					**T,P,M**
COMP4512 Intellectual Property Protection and Management					**T,P,M**		**T,P,M**		**T,M**	**T,P,M**
Elective - Computer Science and Engineering Subjects (Select Any 2)										
EIE3129 IoT Security			**T,P**		**T,P**		**T,P**	**T,P**		
EIE4114 Digital Forensics for Crime Investigation			**T,M**					**T,P,M**	**T**	
EIE4116 Surveillance Studies and Technologies	**T,M**	**T**			**T,P**		**T**		**T**	
EIE4118 Intrusion Detection and Penetration Test			**T,P**		**T,M**			**T**	**T**	
EIE4121 Machine Learning in Cyber-Security	**T,P**				**T,P,M**			**P,M**		

<u>Note:</u>

Programme Outcomes:

1. Apply knowledge of mathematics and science appropriate to the discipline of Information Security.
2. Apply knowledge of Information Security to the abstraction and conceptualisation of Information and Communications Technology (ICT) models.
3. Analyse an Information Security problem, and identify and define the requirements appropriate to its solution.
4. Design, implement, and evaluate an Information Security system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, social and environmental considerations.
5. Use current techniques, skills, and tools necessary for the practices in Information Security with an understanding of the limitations.
6. Function effectively on teams to accomplish a common goal.
7. Have an understanding of professional, ethical, legal, security and social issues and responsibilities.
8. Communicate effectively with a range of audiences.
9. Analyse the local and global impact of Information Security on individuals, organisations, and society.
10. Recognize the need for and engage in continuing professional development.

T: Teach
P: Practise
M: Measured
+: Support of outcomes depends on particular project/subject design and requirements

7. CAPSTONE PROJECT

The Capstone Project is considered to be of great importance. This is reflected in the number of credits it carries, being 6 credits which are equivalent to two standard-sized subjects. Furthermore, the result of the Capstone Project will be very important when the Board of Examiners considers the award classification of a student. Normally, the Board of Examiners will expect a very good grade for the Capstone Project when a student is to be awarded a high Honours classification.

One of the important features of the Capstone Project is “learning by doing”. It is intended to be a platform for the students to develop their intellectual and innovative abilities and to give them the opportunities to integrate and apply the knowledge and analytical skills gained in previous stages of study. It should also provide students with opportunities to develop their problem-solving skills and communication skills. The process from conceptualization to final implementation and testing, through problem identification and the selection of appropriate solutions will be practised by the students.

7.1 Project Management

Normally each student will be assigned one project under the supervision of an academic staff member so that he/she will work independently to achieve the project objectives. In other cases, several students may work on different aspects of a large-scale project.

The assignment of projects is expected to be completed by the month of June preceding the beginning of the final year of study. Guidelines for Capstone Project are given to students at the beginning of the final year.

7.2 Project Assessment

Assessment of the Capstone Project focuses on three main areas: project reports, oral presentations and work done over the whole project period. Assessment will be done by the project supervisor and an assessor. The Project Management Team, which is composed of the Programme Leader and staff members from teaching sections, will oversee the overall standard of assessment of the projects. The Project Management Team will also oversee the daily operation, such as fixing the dates of project report submission, oral presentation, demonstration, etc.

8. INDUSTRIAL CENTRE TRAINING

Industrial Centre (IC) Training is a practical training element in the BEng(Hons) in ESIoT and BSc(Hons) in AIIE curricula to provide a chance for the students to develop hands-on experience in various engineering domains in order to prepare for a career in the engineering profession.

Students must pass all IC Training subjects in order to be considered for the award of BEng(Hons) in Electronic Systems and Internet-of-Things and BSc(Hons) in Artificial Intelligence and Information Engineering. IC Training is graded in the normal manner from A+ to F and will be counted in the evaluation of the Grade Point Average (GPA). However, they will not be counted towards Weighted GPA or Award GPA. The assessment method of Industrial Centre Training is based on 100% continuous assessment. The assessment components are workshop reports, competency in practical works, and appreciation tests. To complete the IC Training successfully, students must demonstrate good professional attributes, including responsible attitude in training, excellent attendance with active learning, exercising best practice and care in equipment and tools while observing all safety codes. Details of the assessment scheme are available from Industrial Centre.

9. WORK-INTEGRATED EDUCATION (WIE)

9.1 WIE is a mandatory component of the programme. There can be several routes or options for the students to pursue Work-Integrated Education (WIE). These options include the One-year Internship Scheme (OIS), industrial projects, summer internship and other workplace training opportunities provided by the University or found by students themselves, etc.

9.2 Credits Requirement

In order to graduate from the programme under the Scheme chosen by the students, students must attain a minimum of one or two [Note1&2] WIE training credits within the period of study. Following the Faculty of Engineering's guidelines, students will be awarded one WIE training credit for acquiring two weeks' full-time training. WIE training credits will not be counted towards the Grade Point Average (GPA) or the Weighted GPA (WGPA). After assessing the training performance, a Pass or a Fail grade will be awarded to the student on his/her WIE component.

Note 1: For BEng(Hons) in ESIoT and BSc(Hons) in AIIE, students are required to attain a minimum of one WIE training credit for graduation.
Note 2: For BSc(Hons) in IS, students are required to attain a minimum of two WIE training credits for graduation.

9.3 Intended Learning Outcomes of WIE

Since WIE can take different forms and be applied to different kinds of job, the learning outcomes to be achieved vary depending on the job nature and its duration engaged by the student. However, based on the experience gained, WIE can bring a lot of advantages to students' learning both in the profession-specific areas and in their all-round development. The intended learning outcomes of WIE are elaborated in the following paragraph.

On successful completion of the WIE component, the students will be able to:

(i) Apply knowledge and skills learned from the Programme on the job in a broad context of networking and multimedia profession.
(ii) Recognize the operation and requirement of real-life business, leading to the development of entrepreneurship, global outlook, professional ethics, social and cultural understanding.
(iii) Recognize the expectation of employers, hence leading to better employability.
(iv) Develop their all-round attributes such as interpersonal skills and leadership.
(v) Develop their critical and creative thinking, and problem-solving skills while taking into account various real-life constraints, helping them to pursue life-long learning and continuing professional development.

9.4 WIE Options

WIE component under the Programme can be in many forms, including One-year Internship Scheme (OIS), industrial project, summer internship and other job opportunities.

9.4.1 One-year Internship Scheme (OIS)

The OIS lasts for 1 year. Under the OIS, the students will pursue Year 1, Year 2 and Year 3 study in full time (or Year 1 for Senior Year Intake), and then engage in industrial training in Year 4 (or Year 2 for Senior Year Intake). After the industrial training year, the students will pursue their final-year study in full time again. Normally the students will graduate at the end of Year 5 (or Year 3 for Senior Year Intake) after having satisfied all programme requirements.

Students who would like to join the OIS are required to submit an application to the Department prior to the commencement of the industrial training. They can choose to take subject(s) in a semester during the industrial training year but they will be required to pay a flat tuition fee.

9.4.2 Industrial Project (for BEng(Hons) in ESIoT and BSc(Hons) in AIIE only)

Industrial projects are Capstone Projects working with the industry. Students working on an industrial project will pursue the project in a company for a certain period. The students will work with a real-life project in the real working environment.

9.4.3 Summer Internship

By taking summer internship, students will work in an ICT-related organization during summer months. Students can learn the operation and requirements of real-life ICT industry, and have the chance to apply the knowledge and skills learned from the Programme to a broad context and an ICT profession.

9.4.4 Other Job Opportunities

It is possible that students find jobs for themselves to work during the summer vacation or semester breaks. This kind of job opportunity will be judged by the Department whether it is helpful to the students in achieving the intended learning outcomes of WIE. The students and the Academic Advisor/WIE Coordinators will work collaboratively with regard to the job selection and the subsequent training contents. The Department will constantly monitor the progress. At the end of the training, an assessment will be made on the achievement of learning outcomes.

9.5 Guidelines for Operation and Supervision of WIE

The Department adopts a set of strategies to support students' learning in the workplace. The followings are the details of the operation at different stages.

9.5.1 Preparation

The Department will actively align with the industry to get WIE placement opportunities for students. It is important for students to be fully aware of the benefits brought by WIE. Students will be asked to attend employment seminars as early as possible. Through this type of arrangement, students in all years will be well prepared for job hunting and employment in advance. Students will also be able to realize the benefits for engaging in WIE and the importance of taking an active role in completing the training with the best effort.

9.5.2 Operation

There will be WIE Coordinators overseeing all matters related to WIE activities under the Programme. The WIE Coordinators are the academic staff members of the Department responsible for the organization and operation of WIE activities. To guide the students and monitor their progress in taking the WIE, each student will be assigned an academic advisor from the Department. The student and his/her Academic Advisor will jointly plan the WIE details, such as job selection, training plan, logging of activities, reporting, and assessment.

In the case that the student finds job placement(s) on his/her own, the Academic Advisor will work with the student to design the learning outcomes if the placement is suitable to be recognized as a WIE activity. The Academic Advisor will make frequent contacts with the student and, if appropriate, the employer to monitor the progress of the student.

Each student will be guided by his/her Academic Advisor when conducting the WIE training. The student's work will be monitored continuously and an assessment will be given when the WIE placement is completed.

9.5.3 Assessment of the WIE Component(s)

The objective of assessment is to determine what the student has achieved through WIE. The actual type of work and duration will vary from case to case. Hence, an assessment framework is set out in the following as a general guideline.

(i) *Continuous Assessment*
The Academic Advisor may visit the student during the training period so that the Academic Advisor and the employer will be able to discuss the student's performance together. This will give better feedback on the student's performance before the training is completed.

(ii) *Report*
After the training is completed, the student is required to submit a report to the Academic Advisor. The details to be contained in the report should be commensurate with the training duration. It contains a brief reflective writing on the training received, the objectives that have been achieved, and the experience gained. The student may also conduct a self-evaluation on his/her own performance. The report must be endorsed by the student's employer before its submission.

(iii) *Employer Evaluation*
At the end of the training period, the employer will provide an evaluation of the student's performance, assessing the student's work and all-round development.

(iv) *Overall Assessment*
An overall assessment of the student's performance will be made by the Academic Advisor by considering all the assessment components as stated in Section 9.5.3(i)-(iii). A pass grade will be given to the student upon satisfactory completion of the WIE component; otherwise, a failure grade will be given.

10. DEPARTMENTAL UNDERGRADUATE PROGRAMME COMMITTEE

10.1 The composition of the Departmental Undergraduate Programme Committee (DUPC) is decided by the Head of Department. Normally, the DUPC consists of Programme Leaders of all degree and higher diploma programmes hosted by the Department, Head of Department, representative from the Departmental Learning and Teaching Committee, teaching staff representatives, representatives from major serving departments and student representatives. The Committee is responsible for programme review and development.

10.2 The DUPC will collect and consider, on a regular basis, the views of students and other key stakeholders on the relevance and currency of the syllabi, the standards of the examinations, the development of the programme, the adequacy of resources and the local and worldwide trends related to learning and teaching, for the continuous improvement of the programme.

11. NORMAL DURATION FOR COMPLETION OF A PROGRAMME

11.1 Students should complete the programme within the normal duration of the programme as specified in this booklet. Those who exceed the normal duration of the programme will be de-registered from the programme unless prior approval has been obtained from relevant authorities. The study period of a student shall exclude deferment granted for justifiable reasons, and the semester(s) when the student has been approved to undertake internship. Any semester in which the students are allowed to take zero subject will be counted towards their total period of registration.

11.2 Students who have been registered for the normal duration of the programme may request extension of their studies for up to one year with the approval of the relevant Head of the Department. Applications for extension of study period beyond one year and up to two years will require approval from the Faculty Board Chairman.

11.3 Students who have exceeded the normal duration of the programme for more than two years and have been de-registered can submit an appeal to the Academic Appeals Committee to request a further extension. If the appeal fails, the student shall be de-registered.

12. STUDENT STATUS

12.1 Students' eligibility for the range of services provided by the University will be governed by the students' status, which is determined with reference to the mode of attendance of the programmes enrolled and/or the study load as described in Sections 12.2 to 12.5 below.

<u>Full-time students</u>:

12.2 Students enrolling on this programme with a study load of 9 credits or more in a semester are classified as *full-time* students. Students who wish to change their study load to less than 9 credits in a semester will have to seek prior approval from their Department.

12.3 Full-time local students enrolled on UGC-funded programmes are eligible to apply for financial assistance from the Government in the form of grant and loan. Government grant and loan may not be granted beyond the normal period of registration for the programme.

Self-paced students:

12.4 Students who wish to study at their own pace instead of following the specified progression pattern will have to seek prior approval from their Department. These students are referred to as self-paced students.

Subject-based students:

12.5 Students who wish to take individual subjects, but do not wish to register as a candidate for an award, are classified as subject-based students.

13. SUBJECT REGISTRATION AND WITHDRAWAL

13.1 In addition to programme registration, students need to register for subjects at specified periods prior to the commencement of a semester. An add/drop period will also be scheduled for each semester. Students may apply for withdrawal of their registration on a subject after the add/drop period, if they have a genuine need to do so. The application should be made to the relevant programme offering Department and will require the approval of both the subject teacher and the host Department Programme Leader concerned (or an alternate academic staff authorised by the programme offering Department). Applications submitted after the commencement of the examination period will not be considered. Once the application of subject withdrawal is approved, 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.

13.2 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.

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

14. STUDY LOAD

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

14.2 The normal study load is 15 credits in a semester for full-time study. The maximum study load to be taken by a student in a semester is **21** credits, unless exceptional approval is given by the Head of the Department. For such cases, students are reminded that the study load approved should not be taken as grounds for academic appeal.

14.3 To help improve the academic performance of students on academic probation (the meaning of "academic probation" can be found in Section 22.2.), these students will be required to take a reduced study load in the following semester (Summer Term excluded). The maximum number of credits to be taken in a semester by students on academic probation is **12**. If these students have strong reasons to study more credits, they will have to obtain the endorsement/approval of the respective authority:

(i) study 13 to 15 credits in a semester: endorsement by the Programme Leader and approval by the Departmental Learning and Teaching Committee (DLTC);
(ii) study 16 to 18 credits in a semester: endorsement by the Programme Leader, the DLTC and the Head of Department, and approval by the Faculty Dean;
(iii) study more than 18 credits in a semester: endorsement by the Programme Leader, the DLTC and the Head of Department, and approval by QAC(AD).

14.4 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 Department; otherwise they will be classified as having unofficially withdrawn from the programme. Students who have been approved for zero subject enrolment (i.e. taking zero subject in a semester) are allowed to retain their student status and continue using campus facilities and library facilities. Any semester in which the students are allowed to take zero subject will nevertheless be counted towards the total period of registration.

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

15. 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. However, for applications submitted by students who have completed an approved student exchange programme, the subject exemption is to be decided by the programme offering Department in consultation with the subject offering Departments. In case of disagreement between the programme offering Department and the subject offering Department, the two Faculty Deans/School Board Chairmen concerned will make a final decision jointly on the application. If students are exempted from taking a specified subject, the credits associated with the exempted subject will not be counted towards the award requirements (except for exemptions granted at admission stage). 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.

16. CREDIT TRANSFER

16.1 Students may be given credits for recognised previous studies including mandatory

General University Requirements (GUR) subjects; and the credits will be counted towards meeting the requirements for award. Transferred credits may not normally be counted towards more than one award. The granting of credit transfer is a matter of academic judgment. In assessing the transferability of subjects previously taken, the syllabus of that subject should be carefully scrutinized to ascertain that it is comparable to the PolyU's curriculum. Whether the previous studies are from institutions on credit-based or non-credit-based system should not be a matter of concern, and the subject size need not be a perfect match. To ascertain the academic standing of the institution offering the previous studies, the Department might need to request the institutions concerned to provide more information.

16.2 Credit transfer may be done with or without the grade being carried over; the former should normally be used when the credits were gained from PolyU. Credit transfer with the grade being carried over may be granted for subjects taken from outside the University, if deemed appropriate, and with due consideration to the academic equivalence of the subjects concerned and the comparability of the grading systems adopted by the University and the other approved institutions. Subject credit transfer is normally decided by the subject offering Department. However, for applications submitted by students who have completed an approved student exchange programme, the decision will be made by the programme offering Department in consultation with the subject offering Departments. As the application for credit transfer may involve subjects offered by more than one Department, the programme offering Department should coordinate and check whether the maximum limit for credit transfer for a student has been exceeded, and whether the student has fulfilled the residential requirement of the University.

16.3 In case of disagreement between the programme offering Department and the subject offering Department, the two Faculty Deans/School Board Chairmen concerned will make a final decision jointly on the application. The validity period of credits previously earned is 8 years after the year of attainment.

16.4 Normally, not more than 50% of the credit requirement for award may be transferable from approved institutions outside the University. For transfer of credits from programmes offered by PolyU, normally not more than 67% of the credit requirement for award can be transferred. In cases where both types of credits are being transferred (i.e. from programmes offered by PolyU and from approved institutions outside the University), not more than 50% of the credit requirement for award may be transferred. For students admitted to an Articulation Degree or Senior Year curriculum which is already a reduced curriculum, they should not be given credit transfer for any required GUR subjects, and are required to complete at least 60 credits in order to be eligible for a Bachelor’s award.

16.5 If the credits to be transferred are part of a PolyU programme which is accredited by a professional body, the Department concerned should ensure that the transferred credits will also meet the requirement of the relevant professional body.

16.6 If a student is waived from a particular stage of study on the basis of advanced qualifications held at the time of admission, the student concerned will be required to complete fewer credits for award. For these students, the ‘deducted’ credits at admission stage will be counted towards the maximum limit for credit transfer when students apply for further credit transfer after their admission. This also applies to students admitted to an Articulation Degree or Senior Year curriculum when they claim further credit transfer after admission.

16.7 Notwithstanding the upper limits stipulated in Section 16.4 above, (and unless professional bodies stipulate otherwise) students may be given more credit transfer than these upper limits (e.g. upon completion of an exchange programme as mentioned in Section 16.8 below), subject to their satisfying the residential requirement.

16.8 Credit transfer can be applicable to credits earned by students through studying at a non-local partner institution under an approved exchange programme. Students should, before they start the exchange programme, seek prior approval from the programme offering Department (who will consult the subject offering Departments as appropriate) on their study plan and credit transferability. As with all other credit transfer applications, the Departments concerned should scrutinize the syllabuses of the subjects which the students are going to take at the partner institution, and determine their credit transferability based on academic equivalence with the corresponding subjects on offer at the PolyU, and the comparability of the grading systems adopted by PolyU and the partner institution. The transferability of credits, and the suitability for allowing grades to be carried over, must be determined and communicated to students before they start the exchange programme.

16.9 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.

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

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

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

17. DEFERMENT OF STUDY

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

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

17.3 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.

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

18. PRINCIPLES OF ASSESSMENT

18.1 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 will be designed for this purpose. The assessment methods will also enable teachers to differentiate students' different levels of performance within subjects. Assessment *for* learning is to engage students in productive learning activities through purposefully designed assessment tasks.

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

18.3 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 Planning and Regulations Committee (APRC) and reported to the Senate.

19. ASSESSMENT METHODS

19.1 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 will be clearly stated in the programme booklet. 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) will be specified in the programme booklet. Learning outcomes should be assessed by continuous assessment and/or examination appropriately, in line with the outcome-based approach.

19.2 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.

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

19.4 At the beginning of each semester, the subject teacher will inform students of the details of the methods of assessments to be used within the assessment framework as specified in the programme booklet.

20. SUBJECT RESULTS

20.1 Subject Teachers, in respect of the subject they teach, have sole responsibilities for marking and grading students' coursework and examinations scripts. Timely feedback of continuous assessment will be given to students as soon as possible (e.g. not later than a month), and in any case, before the final examination/assessment. In this regard, Subject Teachers will be accountable to the Head of the subject offering Department, to ensure that all forms of assessment, including the students' coursework and examination scripts, are correctly marked and graded where appropriate. Subject Teachers will avoid administrative errors at all times, and submit the grades for finalisation by Subject Assessment Review Panel (SARP) according to the schedule of the Department. To ensure consistency and uniformity for a common subject taught by different Subject Teachers, meetings can be arranged amongst them before the examination papers are set or before the marking is done.

20.2 Subject grades will be reviewed and finalised by SARP before being formally released to students and submitted to the Board of Examiners. Each Department forms one or several SARPs to take care of the subjects it offers. The Board of Examiners will not attempt to change any grades.

20.3 SARP(s) shall be formed by the Head of the Department offering the subjects. It shall include the Head of the Department offering the subject as the Chairman, the relevant subject examiners and where appropriate, and the Programme Leader.

21. BOARD OF EXAMINERS (BoE)

21.1 The authority for approving the overall results of students rests with the Board of Examiners (BoE). The BoE will meet at the end of each semester (except for Summer Term unless there are students who are eligible to graduate after the completion of Summer Term subjects) and is responsible to the Senate for making:

(i) decisions on straight forward progression and deregistration cases;
(ii) decisions on the classification of awards to be granted to each student on completion of the programme; and
(iii) decisions on cases with extenuating circumstance.

21.2 These decisions are made by the BoE at the end of each semester in the light of the standard of student achievement appropriate to the award to which the programme is designed to lead, the aims of the programme, the students' performance on the programme in previous years, the General Assessment Regulations of the University, the specific programme regulations, and good practice established in the University and elsewhere.

21.3 The BoE will not attempt to change the grades for any student in any subject nor condone failures. The decisions of the BoE, except those on straight forward progression and deregistration cases, will be ratified by the Faculty Board. The Faculty Board may refer the decisions back to the BoE for further consideration and explanation.

21.4 Any decisions by the BoE outside the General Assessment Regulations of the University, supported by the Faculty Board, shall be referred to the APRC for ratification. All approved cases shall be reported to the Senate. Decisions by BoE outside the programme regulations but within the General Assessment Regulations of the University fall within the authority of the Faculty Board.

21.5 For straight forward progression and deregistration cases, students shall be formally notified of decisions affecting them after the BoE meeting. For graduating students and cases with extenuating circumstances, students shall only be notified of decisions affecting them after the Faculty Board meeting. For cases which require ratification of APRC, students shall be formally notified of the decisions after APRC's ratification. Any prior communication of results to these students shall be subject to formal ratification.

22. PROGRESSION / ACADEMIC PROBATION / DEREGISTRATION

22.1 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 or the Summer Term study is mandatory for the programme)), determine whether each student is:

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

22.2 When a student has a Grade Point Average (GPA) (see Section 26.3 below) lower than 1.70, he/she will be put on academic probation in the following semester. If a student is able to pull his/her GPA up to 1.70 or above at the end of that following 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.

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

(i) the student has reached the final year of the normal period of registration for that programme, as specified in the programme booklet, unless approval has been given for extension; or
(ii) the student has reached the maximum number of retakes allowed for a failed compulsory subject; or
(iii) the student's GPA is lower than 1.70 for two consecutive semesters and his/her Semester GPA in the second semester is also lower than 1.70; or
(iv) the student's GPA is lower than 1.70 for three consecutive semesters.

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

22.4 A student may be de-registered from the programme enrolled before the time frame specified in Sections 21.3(iii) or 21.3(iv) above if his/her academic performance is poor to the extent that the Board of Examiners deems that his/her chance of attaining a GPA of 1.70 at the end of the programme is slim or impossible.

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

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

23. APPEAL AGAINST ASSESSMENT RESULTS

A student may appeal against a decision on their assessment results or the decision on deregistration upon the public announcement of the overall results. The procedures for appeals against examination results are detailed in the Student Handbook (https://www.polyu.edu.hk/ar/students-in-taught-programmes/student-handbook/).

24. RETAKING OF SUBJECTS

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

24.2 The number of retakes of a subject should be restricted to two, i.e. a maximum of three attempts for each subject is allowed.

24.3 In cases where a student takes another subject to replace a failed elective subject, the fail grade will be taken into account in the calculation of the GPA, despite the passing of the replacement subject. Likewise, students who fail a Cluster Area Requirement (CAR) subject may need to take another subject from the same Cluster Area in order to fulfil this part of the GUR, since the original CAR subject may not be offered; in such cases, the fail grade for the first CAR subject will be taken into account in the calculation of the GPA, despite the passing of the second CAR subject. In the circumstances when students do not have a choice to retake a failed subject, such as when the failed subject has been phased out, a 'tie-subject' arrangement can be made with the approval of the Faculty/School Board. Under the arrangement, another appropriate subject can be taken as equivalent to the subject which is not offered. Upon passing the equivalent subject, the fail grade of the original subject will be replaced by the latest grade of the retake subject and the failure grade of the original subject will not be taken into account in the calculation of the GPA.

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

24.5 Students who have failed a compulsory subject after two retakes and have been deregistered can submit an appeal to the Academic Appeals Committee (AAC) for a third chance of retaking the subject.

24.6 In relation to 24.5 above, in case AAC does not approve further retakes of a failed compulsory subject or the taking of an equivalent subject with special approval from the Faculty, the student concerned would be de-registered and the decision of the AAC shall be **final** within the University.

25. EXCEPTIONAL CIRCUMSTANCES

Absence from an assessment component

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

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

Assessment to be completed

25.3 For cases where students fail marginally in one of the components within a subject, the BoE can defer making a decision until the students concerned have completed the necessary remedial work to the satisfaction of the subject examiner(s). The remedial work must not take the form of re-examination.

Aegrotat award

25.4 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/her 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.

25.5 A student who has been offered an aegrotat award shall have the right to either 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.

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

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

Other particular circumstances

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

26. GRADING

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

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

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

Indicative descriptors for modifier grades

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

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

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

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

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

$$\text{GPA} = \frac{\sum_{n=1}^{N} \text{Subject Grade Point}_n \times \text{Subject Credit Value}_n}{\sum_{n=1}^{N} \text{Subject Credit Value}_n}$$

where N = number of subjects (inclusive of failed subjects) taken by the student up to and including the latest semester. 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 (Subjects taken in PolyU or elsewhere and with grades assigned, and

for which credit transfer has been approved, will be included in the GPA calculation.)

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

26.4 Different types of GPA

26.4.1 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.

26.4.2 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.

26.4.3 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 a student will likely get if he/she makes steady progress on his/her academic studies.

26.4.4 When a student has satisfied the requirements for award, an award GPA will be calculated to determine his/her award classification.

26.4.5 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/her award classification, which will be so reflected on the award parchment. The Minor GPA can be used as a reference for the Board of Examiners to moderate the award classification for the Major, as explained further in Section 28.13.

26.4.6 For students taking the Major/Secondary Major study route, there is no separate "Secondary Major GPA". The Major GPA is the weighted GPA of all subjects contributing to the Major and Secondary Major.

26.4.7 The relationship between the different types of GPA, and the methods for calculating each, is further explained in Appendix 1.

27. GRADUATION REQUIREMENTS FOR THE PROGRAMME OF BENG(HONS) IN ELECTRONIC SYSTEMS AND INTERNET-OF-THINGS / BSC(HONS) IN ARTIFICIAL INTELLIGENCE AND INFORMATION ENGINEERING / BSC(HONS) IN INFORMATION SECURITY

All students qualifying for a 4-year Full-time Undergraduate Degree must meet:

(i) the University Graduation Requirements, as explained in Section 27.1 below; and
(ii) the specific graduation requirements of their chosen programme of study (Majors and Minors), as stated in Section 27.2 below.

27.1 University Graduation Requirements

27.1.1 Normal Year 1 Intake:

(i) Satisfy the following requirements in general education (GUR):
   (a) 9 credits of Language and Communication Requirements (LCR) as set out in Section 4.2 [Note 1].
   (b) 2 credits of Artificial Intelligence and Data Analytics (AIDA) Requirement.
   (c) 1 credit of Innovation and Entrepreneurship (IE) Requirement.
   (d) 3 credits of Leadership Education and Development.
   (e) 3 credits of Service-Learning.
   (f) 12 credits of Cluster Areas Requirement (CAR)
   (3 credits from each of the 4 cluster areas).
   (g) Non-credit bearing Healthy Lifestyle [Note 2].
(ii) Earn a cumulative GPA of 1.70 or above at graduation.
(iii) Satisfy the WIE requirement as set out in Section 9.2.

27.1.2 Senior Year Intake:

(i) Satisfy the following requirements in general education (GUR):
   (a) 3 credits of Service-Learning.
   (b) 6 credits of Cluster Areas Requirement (CAR)
   (3 credits from CAR – English Language and 3 credits from CAR(M)).
   (c) Fulfilment of the English and Chinese reading and writing requirements in CAR subjects.
   (d) Non-credit bearing Essential Components of General Education
   (e) Having met the equivalent standard of the Undergraduate Degree Language and Communication Requirements (LCR) as set out in Section 4.2 [Note 1].
(ii) Earn a cumulative GPA of 1.70 or above at graduation.
(iii) Satisfy the WIE requirement as set out in Section 9.2.

Further details about the University Graduation Requirements can be found in Appendix 2.

Note 1: Non-Chinese speakers and those students whose Chinese standards are at junior secondary level or below will by default be exempted from the DSR - Chinese and CAR - Chinese Reading and Writing requirements. However, this group of students would still be required to take one Chinese LCR subject **recommended by CLC/EIE** to fulfil their Chinese LCR.

Note 2: Students admitted to the programmes as Senior Year Intakes are not required to take the Healthy Lifestyle Programme. Advanced Standing students are required to take Healthy Lifestyle (except for those who are HD/AD holders who follow the Senior Year/Articulation Degree programme GUR curriculum).

27.2 Specific Graduation Requirements for the **<u>BEng(Hons) in Electronic Systems and Internet-of-Things</u>** Programme

27.2.1 <u>Normal Year 1 Intake</u>:

(i) Complete successfully <u>a minimum of **124** academic credits</u> composed of the following:
   (a) 30 credits of General University Requirements (GUR) as set out in Section 27.1.1(i).
   (b) 94 credits of Discipline-Specific Requirements (DSR), of which 82 credits from subjects categorized as COM (compulsory) and 12 credits from subjects categorized as ELE (elective) (<u>at least 2 of these electives must be at level 4 or above</u>) as stated in Table 4.1.1.

(ii) Obtain a total of 8 credits in TRN (Training) as stated in Table 4.1.1.

(iii) Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award the student is currently enrolled, unless the professional bodies stipulate otherwise.

27.2.2 Senior Year Intake:

(i) Complete successfully <u>a minimum of **67** academic credits</u> composed of the following:
   (a) 9 credits of General University Requirements (GUR) as set out in Section 27.1.2 (i).
   (b) 58 credits of Discipline-Specific Requirements (DSR), of which 46 credits from subjects categorized as COM (compulsory) and 12 credits from subjects categorized as ELE (elective) (<u>at least 2 of these electives must be at level 4 or above</u>) as stated in Table 4.1.1.

(ii) Obtain a total of 8 credits in TRN (Training) as stated in Table 4.1.1.

(iii) Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award the student is currently enrolled, unless the professional bodies stipulate otherwise.

27.3 Specific Graduation Requirements for the **<u>BSc(Hons) in Artificial Intelligence and Information Engineering</u>** Programme

27.3.1 <u>Normal Year 1 Intake</u>:

(i) Complete successfully <u>a minimum of **124** academic credits</u> composed of the following:
   (a) 30 credits of General University Requirements (GUR) as set out in Section 27.1.1(i).
   (b) 94 credits of Discipline-Specific Requirements (DSR), of which 79 credits from subjects categorized as COM (compulsory) and 15 credits from subjects categorized as ELE (elective) as stated in Table 4.1.2.

(ii) Obtain a total of 5 credits in TRN (Training) as stated in Table 4.1.2.

(iii) Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award the student is currently enrolled, unless the professional bodies stipulate otherwise.

27.3.2 Senior Year Intake:

(i) Complete successfully a minimum of **67** academic credits composed of the following:
   (a) 9 credits of General University Requirements (GUR) as set out in Section 27.1.2 (i).
   (b) 58 credits of Discipline-Specific Requirements (DSR), of which 43 credits from subjects categorized as COM (compulsory) and 15 credits from subjects categorized as ELE (elective) as stated in Table 4.1.2.

(ii) Obtain a total of 5 credits in TRN (Training) as stated in Table 4.1.2.

(iii) Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award the student is currently enrolled, unless the professional bodies stipulate otherwise.

27.4 Specific Graduation Requirements for the **BSc(Hons) in Information Security** Programme

27.4.1 Normal Year 1 Intake:

(i) Complete successfully a minimum of **127** academic credits composed of the following:
   (a) 30 credits of General University Requirements (GUR) as set out in Section 27.1.1(i).
   (b) 97 credits of Discipline-Specific Requirements (DSR), of which 85 credits from subjects categorized as COM (compulsory) and 12 credits from subjects categorized as ELE (elective) (at least 3 of these electives must be at level 4 or above) as stated in Table 4.1.3.

(ii) Obtain a total of 2 credits in TRN (Training) as stated in Table 4.1.3.

(iii) Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award the student is currently enrolled, unless the professional bodies stipulate otherwise.

27.4.2 Senior Year Intake:

(i) Complete successfully a minimum of **64** academic credits composed of the following:
   (a) 9 credits of General University Requirements (GUR) as set out in Section 27.1.2 (i).
   (b) 55 credits of Discipline-Specific Requirements (DSR), of which 43 credits from subjects categorized as COM (compulsory) and 12 credits from subjects categorized as ELE (elective) (at least 3 of these electives must be at level 4 or above) as stated in Table 4.1.3.

(ii) Obtain a total of 2 credits in TRN (Training) as stated in Table 4.1.3.

(iii) Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award the student is currently enrolled, unless the professional bodies stipulate otherwise.

27.5 Remedial subjects are designed for new students who are in need of additional preparations in a particular subject area, and only identified students of a programme are required to take these subjects. These subjects should therefore be counted outside the regular credit requirement for award.

27.6 In addition, students may be required to take subjects that are designed to enhance their skills in particular subject areas to underpin their further advanced study in the discipline. These underpinning subjects could be of different subject areas (e.g. Mathematics, science subjects), and the number of credits each student is required to take in a particular underpinning subject area may vary according to the different academic backgrounds of the students.

27.7 Level-0 subjects and training subjects (including clinical/field training) will not be counted to fulfil free elective requirement for graduation purpose.

27.8 Senior Year intakes admitted to the 4-year Undergraduate Degree programmes on the strength of the Associate Degree/Higher Diploma qualifications are required to complete at least 60 credits in order to be eligible for a Bachelor's degree. Exemption may be given from subjects already taken in the previous Associate Degree/Higher Diploma studies. In that case, students should take other electives (including free electives) instead to make up the total of 60 credits required. All students admitted to an Articulation Degree or Senior Year curriculum, irrespective of the entry qualifications they held when applying for admission to the programmes, are required to complete at least 60 credits to be eligible for award.

27.9 Students Taking the Major/Minor Option

Students taking the Major/Minor option will be considered for an award when they have satisfied the requirements for both the Major and Minor studies (i.e. having a GPA of 1.70 or above) and have submitted an application for graduation. If the 18 credits taken for the approved Minor study can meet the requirements for that Minor, the Major students may apply to graduate with a specific Minor, in addition to their Major. Otherwise, students will graduate with a Major only.

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

27.10 Students Taking the Major/Secondary Major Option

Students may count up to 12 credits of their Major/GUR subjects towards the Secondary Major. Nevertheless, students must take at least 12 credits from their chosen Secondary Major in order to satisfy the residential requirement of the chosen Secondary Major. Students who have completed more than 12 credits of subjects that are eligible for double counting will need to apply for graduation and indicate the subjects intended for double counting. Notwithstanding the above, students must meet the minimum credit requirements of the “X + Secondary Major” concerned, i.e. 132 credits.

27.11 A student is required to graduate as soon as he/she satisfies the graduation requirements as stipulated in Sections 27.1, 27.2 – 27.4, 27.8, 27.9 and 27.10 above. The student concerned is required to apply for graduation, in the semester in which he/she is able to fulfil all his/her graduation requirements, and after the add/drop period for that semester has ended.

28. GUIDELINES FOR AWARD CLASSIFICATION

28.1 The guidelines for award classification of BEng(Hons) in ESIoT, BSc(Hons) in AIIE and BSc(Hons) in IS awards are stated in the following. In using these guidelines, the Board of Examiners shall exercise its judgement in coming to its conclusions as to the award for each student, and where appropriate, may use other relevant information.

28.2 This Programme uses Weighted GPA as a guide for helping to determine award classifications. A University-wide standard weighting is applied to all subjects of the same level, with a weighting of <u>2</u> for Level 1 and 2 subjects, a weighting of <u>3</u> for Level 3, 4 and 5 subjects.Weighted GPA will be computed as follows:

$$\text{Weighted GPA} = \frac{\sum_{n=1}^{N} \text{Subject Grade Point}_n \times \text{Subject Credit Value}_n \times W_n}{\sum_{n=1}^{N} \text{Subject Credit Value}_n \times W_n}$$

where W_n = 2 for all Level 1 and Level 2 subjects, and
W_n = 3 for all Level 3, Level 4 and Level 5 subjects.
N = number of subjects counted towards the award as listed in Table 4.1 according to the Specified Progression Pattern (Section 5) (inclusive of failed subjects) taken by the student up to and including the latest semester. (For subjects that have been retaken, only the grade obtained in the final attempt will be included in the GPA calculation except those exclusions specified in Section 28.3.)

Same as GPA, Weighted GPA ranges from 0.00 to 4.30 from 2020/21.

28.3 Any subjects passed after the graduation requirement has been met or subjects taken on top of the prescribed credit requirements for award will <u>not</u> be taken into account in the grade point calculation for award classification (see sections 26.3 and 28.2 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/she becomes eligible for award, the elective subjects (or optional subjects), except for subjects which are selected by students to fulfil the free electives requirement for graduation, 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).

28.4 The followings are guidelines for the Board for Examiners' reference in determining award classifications:

Honours Degrees	***Guidelines***
1^{st}	The student's performance/attainment is outstanding, and identifies him/her as exceptionally able in the field covered by the programme in question.
2^{nd} (Division I)	The student has reached a standard of performance/attainment which is more than satisfactory but less than outstanding.

Honours Degrees	Guidelines
2nd (Division 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.

28.5 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 has nonetheless covered the prescribed work of the programme in an adequate fashion while failing to show sufficient evidence of the expected intellectual calibre of Honours degree graduates. For example, if a student in an Honours degree programme has a Grade Point Average (GPA) of 1.70 or more, but his/her Weighted GPA is less than 1.70, he/she 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.

28.6 Students who have committed academic dishonesty or non-compliance with examination regulations will be subject to the penalty of lowering the award classification by one level. For undergraduate students who should be awarded a Third class Honours degree, they will be downgraded to a Pass-without-Honours. The minimum of downgraded overall result will be kept at a Pass. In rare circumstances where both the Student Discipline Committee and Board of Examiners of a Department consider that there are strong justifications showing the offence be less serious, the requirement for lowering the award classification can be waived.

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

Honours Classification	Award GPA
1st	3.60 – 4.30
2nd (Division I)	3.00 – 3.59
2nd (Division II)	2.40 – 2.99
3rd	1.70 – 2.39

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

<u>Students Taking the Major (including the Major/Secondary Major option)/Minor Studies</u>:

28.9 For students who have completed a Major (including the Major/Secondary Major option)/Minor programme, a single classification will be awarded and their award classification will mainly be based on the "Major GPA", but it can be moderated by the Board of Examiners with reference to the "Minor GPA". For students who have completed a Major programme combined with free electives, their award classification will be determined by their "Major GPA" which includes grades obtained for the free electives, if appropriate.

28.10 "Major GPA" is derived based on all subjects of the Major programme, as well as the Secondary Major programme, if any, including those meeting the mandatory General University Requirements (GUR) and programme-specific language requirement, but not necessarily including the training credits.

28.11 "Minor GPA" is derived based on the 18 credits of the specific Minor programme. Minor GPA is unweighted.

28.12 The "Major GPA" and the "Minor GPA" will be presented separately to the Board of Examiners for consideration. The guidelines for determining award classification as stipulated in Sections 28.1 to 28.8 above are applicable to programmes with Major (including the Major/Secondary Major option)/Minor studies.

28.13 Where a student has a high GPA for his/her Major (including the Major/Secondary Major option) but a low GPA for his/her Minor, he/she will not be 'penalised' in respect of his/her award classification, which is attached to the Major. On the other hand, if a student has a lower GPA for his/her Major (including the Major/Secondary Major option) than his/her GPA for the Minor, the Board of Examiners may consider recommending a higher award classification for the student for ratification by the APRC via the FacultyBoard.

29. RECORDING OF DISCIPLINARY ACTIONS IN STUDENTS' RECORDS

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

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

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

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

30. SYLLABI

(Please see pages 64 to 303.)

APPENDIX

(Please see pages 304 to 311.)

Subject Description Form

Subject Code	AMA1110
Subject Title	Basic Mathematics I – Calculus and Probability & Statistics
Credit Value	3
Level	1
Pre-requisite	Nil
Objectives	This subject aims to introduce students to the basic concepts and applications of elementary calculus and statistics. Emphasis will be on the understanding of fundamental concepts and the use of mathematical techniques in handling practical problems in science and engineering.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. Apply analytical reasoning to solve problems in science and engineering; 2. Make use of the knowledge of mathematical/statistical techniques and adapt known solutions to various situations; 3. Apply mathematical modeling in problem solving; 4. Demonstrate abilities of logical and analytical thinking.
Subject Synopsis/ Indicative Syllabus	Elementary calculus: Limit and continuity, derivatives and their geometric meaning, rules of differentiation including chain rule, Leibniz's rule and L'Hopital's rule, exponential and logarithmic functions, trigonometric functions and their inverses, hyperbolic and inverse hyperbolic functions, applications of differential calculus. Elementary Probability and Statistics: Descriptive statistics, random variables, probability and probability distributions, binomial, Poisson and normal distributions, applications. Population and random samples. Sampling distributions related to sample mean, sample proportions, and sample variances. Concepts of a point estimator and a confidence interval. Point and interval estimates of a mean and the difference between two means.
Teaching/Learning Methodology	Basic concepts and elementary techniques of differential and integral calculus and elementary statistics will be taught in lectures. These will be further enhanced in tutorials through practical problem solving.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table below)

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Assignments and mid-term tests	40%	✓	✓	✓	✓
2. Examination	60%	✓	✓	✓	✓
Total	100%				

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

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

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The subject focuses on understanding of basic concepts and application of techniques in differential/integral calculus, elementary statistics. As such, an assessment method based mainly on examinations/tests/quizzes is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.	
Student Study Effort Expected	**Class contact:**	
	• Lecture	26 Hours
	• Tutorial	13 Hours
	Other student study effort:	
	• Homework and self-study	81 Hours
	Total student study effort	**120 Hours**
Reading List and References	1. Chung, K.C. *A Short Course in Calculus and Matrices*, McGraw Hill 2013 2. Hung, K.F., Kwan, Wilson, Pong, T.Y. *Foundation Mathematics & Statistics*, McGraw Hill 2013 3. Larson, R., Edwards, B. *Single Variable Calculus*, Brooks/Cole 2012 4. Walpole, R.E., Myers, R.H., Myers, S.L. Ye, K. *Probability and Statistics for Engineers and Scientists*, Prentice Hall, 2012	
Last Updated	June 2019	
Prepared by	AMA Department	

Subject Description Form

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

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

Continuous Assessment comprises of assignments and tests. An examination is held at the end of the semester.

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

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

The subject focuses on understanding of basic concepts and application of techniques in differential/integral calculus, elementary statistics and</td></tr>
</table>

	elementary linear algebra. As such, an assessment method based mainly on examinations/tests is considered appropriate. Furthermore, students are required to submit homework assignments regularly in order to allow subject lecturers to keep track of students' progress in the course.	
Student Study Effort Expected	**Class contact:**	
	• Lecture	26 Hours
	• Tutorial	13 Hours
	Other student study effort:	
	• Homework and self-study	81 Hours
	Total student study effort	**120 Hours**
Reading List and References	1. Chung, K.C. *A Short Course in Calculus and Matrices*, McGraw Hill 2013 2. Hung, K.F., Kwan, Wilson, Pong, T.Y. *Foundation Mathematics & Statistics*, McGraw Hill 2013 3. Larson, R., Edwards, B. *Single Variable Calculus*, Brooks/Cole 2012 4. Larson, R. *Elementary Linear Algebra*, Brooks/Cole 2013	
Last Updated	July 2021	
Prepared by	AMA Department	

Subject Description Form

Subject Code	EIE1003
Subject Title	Foundations of Data Science
Credit Value	3
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Being able to discover useful knowledge and information from a large amount of data is very critical to industry, business and government. This subject aims to provide students the fundamental concepts of data science and the basic technologies for data analytics. It provides hands-on experiences in data analytics and case studies in applications of data science in engineering, social science, healthcare, business and government. It also prepares students with the right mentality towards data and the ability to leverage data for decision-making.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the basic concepts and technologies of data science. 2. Acquire the basic technical know-how on data analytics. Category B: Attributes for all-roundedness 3. Understand the data-driven process for problem solving. 4. Demonstrate how to harness and process data for decision-making.
Subject Synopsis/ Indicative Syllabus	1. Introduction to Data Science • Data science vs. big data vs. data analytics • Benefits of data science • Skill sets required • Privacy, security and ethics • Example applications and case studies 2. Technologies for Data Science • Basic concepts in summary statistics • Graphs and plots for data analytics, e.g., box plots, scatter plots, histograms, run charts, etc. • Example case studies of exploratory data analytics for data science • Fundamental of machine learning for data science • Cloud technologies 3. Tools for Data Science • Data cleaning, e.g., OpenRefine • Machine learning tools, e.g., Microsoft ML Studio, Weka • Data visualization tools, e.g., Google Chart, Tableau 4. Applications with Case Studies • Recommendation systems • Spam filtering • Stock prediction • Social networks • Sentiment analysis
Teaching/Learning Methodology	**Lectures**: The subject matters will be delivered through lectures (both in-person and online ones). Students will be engaged in the lectures through Q&A, discussions and specially designed classroom activities. Practitioners and software vendors will be invited to give guest lectures. **Tutorials and Workshops**: Students will work on data analytics projects

	using software tools. Students will start from small and easy projects in the first half of the subject. In the second half, students will work on a more realistic project that solves real-world problems, using the knowledge and know-hows that they have learnt from the small projects. **Assignment**: Students will need to do a group-based mini-project on data science.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table below)

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Continuous Assessment (total: 100%)					
• Mini-project (proposal, report and presentation)	30%	✓	✓	✓	✓
• Exercises	16%	✓	✓		
• Tests	30%	✓	✓		
• Laboratory activities	24%	✓	✓	✓	✓
Total	100%				

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

Laboratory exercises and mini-project will require students to apply what they have learnt to solve problems. There will be open-ended questions that allow students to exercise their creativity in solution design.

Tests and Exercises assess students' achievement of the learning outcomes in a more formal manner.

Mini-project is group-based and weights 30% of the whole assessment. Among the 30% weight, 7% is for proposal, 13% is for final report, and 10% is for presentation (in the form of a 10-minutes video). Proposal and report (20% in total) are evaluated based on group, while presentation (10%) is evaluated individually. Each group member will present the part he/she is responsible for in the mini-project. The mini-project will make use of publicly available tools such as Microsoft Azure Machine Learning Studio so that requirements on programming knowledge is kept to a minimum, i.e., no programming background is assumed. Students will perform drag and drop of data sources, machine learning models, analytic methods, and evaluation methods from the tool to solve data science problems. Enthusiastic students could use the cloud-based API to perform more complex tasks.

Tests and Exercises weight 46% and they are individual assessments.

Laboratory activities weight 24% and they are individual assessments.

Overall, 80% of the assessment is individual assessment and 20% is group-based assessment.

Student Study Effort Expected		
	Class contact (time-tabled):	
	• Lectures (In-person and online)	22 Hours
	• Tutorial/Laboratory/Practice Classes	17 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	30 Hours

	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	36 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Materials:** 1. L. Cao, *Data Science Thinking: The Next Scientific, Technological and Economic Revolution*. Cham: Springer International Publishing, 2018. 2. L. Igual and S. Sequi, *Introduction to Data Science: a Python Approach to Concepts, Techniques and Applications*. Cham, Switzerland: Springer, 2017. 3. S. Alan and V. Torra, *Data Science in Practice*. Cham, Switzerland: Springer 2019. 4. G. Rebala, A. Ravi, and S. Churiwala, *An Introduction to Machine Learning*. Cham, Switzerland: Springer 2019. 5. P. Kromer and R. Jurney, *Big Data for Chimps*. O'Reilly, 2016. 6. T. Ojeda et al., *Practical Data Science Cookbook*. Packt Publishing Ltd, 2014. 7. A. Adhikari and J. DeNero, *Computational and Inferential Thinking: The Foundations of Data Science*. https://www.inferentialthinking.com/	
Last Updated	Aug 2021	
Prepared by	F. Leung, Man-Wai Mak	

Subject Description Form

Subject Code	EIE1004
Subject Title	Introduction to Information and Artificial Intelligence Engineering
Credit Value	3
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Curiosity for new technologies An open mind to accepting and using new technologies
Objectives	This subject introduces the technology trends in artificial intelligence (AI) and information engineering (IE) to first-year students. The subject is an exploration of the technologies that will shape organizations and industry in the coming decade. It also aims to strengthen the awareness of the importance of EIE-related technologies and how these technologies affect the local and global economy and students' future careers. After taking this subject, students will gain insights into the new technologies and how organizations could cope with the disruption caused by these technologies. Students will also understand what IE and AI are about and their relationship with other disciplinary-specific subjects in the academic programmes.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Aware the technological trends in information engineering (IE#) and artificial intelligence (AI). 2. Understand what AI and IE are about 3. Understand how AI and IE will affect the global economy and the job market in the future <u>Category B: Attributes for all-roundedness</u> 4. Recognize the need for and engage in life-long learning #IE includes electronic systems, Internet-of-things, and information security
Subject Synopsis/ Indicative Syllabus	1. Lifelong Learning 1.1. Exploring emerging technologies for lifelong learning 1.2. Habits of successful lifelong learners 2. Artificial Intelligence 2.1. Introduction to artificial intelligence and machine learning 2.2. Why historical AI fails and modern AI successes 2.3. Example applications of AI: face recognition; speech recognition; natural language processing; biometrics; voice cloning; emotion recognition; machine translation; autonomous driving; imaging diagnosis; AI composers; AI reporters; creative art; music generation; bioinformatics and drug development 2.4. Non-mathematical view of learning (model training) and inferencing 2.5. Role of data and the cloud in AI 2.6. Limitation of current AI and machine learning 2.7. Workflow of an AI project 2.8. AI in society: discrimination, bias, adversarial attacks, adverse use of AI, deepfake, spoofing; jobs affected by AI, and new job opportunities 2.9. Trends in AI and machine learning: artificial general intelligence; self-learning 3. Cybersecurity and Information Security 3.1. Fundamental of cyberthreat: malware, ransomware, phishing, DDoS attacks, etc.

3.2. Fundamental of blockchain
3.3. Applications of blockchain: bitcoins, contract, securing data, payment
3.4. Thread to the society and economy
3.5. Trends in cybersecurity: IoT security; AI for cyber-attack; AI in fintech

4. Information Engineering
   4.1. Cloud and edge computing
   4.2. Data organization and representation
   4.3. Data science and big-data analytics
   4.4. Internet of Things
   4.5. Virtual reality and augmented reality
   4.6. 5G and beyond

5. Electronic Systems
   5.1. Role of electronic engineering in environmental sustainability
   5.2. Wireless power transfer
   5.3. Wireless wearable technology
   5.4. Smart household appliances
   5.5. Smart city
   5.6. Brain machine interface
   5.7. Trends in electronic systems

Teaching/Learning Methodology

Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions, and specially designed classroom activities.

Tutorials: During tutorials, students will work on/discuss some chosen topics. This will help strengthen the knowledge taught in lectures.

Literature survey, essay writing, and presentation: Students are required to pick a topic, study the background information of the selected topic, search for the latest development and application of the topic from the Internet, and write an essay about the selected topic. Students also need to present their essay either through video recordings or in front of their fellow classmates.

While lectures and tutorials will help to achieve the professional outcomes, the literature surveys and essay writing will strengthen students' awareness of new technologies and their impact on society.

Mini project: Students will use toolkits to develop AI applications such as recognizing hand signs (scissors, paper, and stone) and voice-control robot cars.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment					
• Literature surveys, essay writing, and presentation	40%	✓	✓	✓	✓
• Mini Project	30%	✓	✓	✓	✓
• Test and quizzes	30%	✓	✓	✓	
Total	100%				

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

The tests will ensure that students know the fundamental knowledge of EIE-related technologies and the relationship between these technologies and

	society. The mini project will ensure that students have the ability to use existing toolkit to develop AI applications. The literature surveys, essay writing, and presentation will ensure that students understand the importance of life-long learning.	
Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lectures	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Materials:** 1. Selected articles from recent issues of IEEE Spectrum 2. Selected articles from recent issues of IEEE Potential 3. Selected video from ColdFusion and Future Now 4. The World in 2050: Future Technology (https://www.youtube.com/watch?v=PlSjpRce18s)	
Last Updated	June 2021	
Prepared by	Prof. M.W. Mak	

Subject Description Form

Subject Code	EIE1005
Subject Title	Fundamental AI and Data Analytics
Credit Value	2
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Data analytics is for extracting valuable knowledge from raw data. It is very critical to industry, business, and government. Artificial intelligence and machine learning are widely used to automate data analytics processes. This subject aims to provide students with the fundamental concepts of artificial intelligence and data analytics. In particular, it offers hands-on experiences and case studies in the applications of AI and data analytics. It also helps students appreciate how data analytics and artificial intelligence influence our daily life.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the basic concepts and technologies of artificial intelligence. 2. Acquire the basic technical know-how on data analytics. Category B: Attributes for all-roundedness 3. Understand the data-driven process for problem-solving. 4. Demonstrate how to harness and process data for decision-making.
Subject Synopsis/ Indicative Syllabus	1. Understanding and Presenting Data • Introduction to data analytics • Data quality and preprocessing • Data analysis – Basic statistics, clustering, frequent pattern mining • Data visualization with ParaView 2. AI and Data Analytics in the Virtual World • Introduction to machine learning • Development of game AI • Reward scheduling via data analytics • AI and data analytics in the Metaverse • Developing game AI with Unity ML-Agents 3. AI and Data Analytics for Computer Vision • Machine learning for computer vision • Predictive analytics for computer vision • Feature extraction • Pattern recognition • Convolutional neural network • Developing computer vision systems with Google Colab 4. Conversational AI and Data Analytics • Prescriptive analytics for human-computer interaction • Spoken language technologies • Natural language understanding • Understanding users' behaviours via data analytics • Google Dialogflow and Chatbots

Teaching/Learning Methodology	**Lectures**: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions, and specially designed classroom activities. **Tutorial Workshops**: Students will work on four AI and data analytics workshops using software tools. In each workshop, students may start from doing some small and easy tasks at the first stage. Students will solve a simple real-world problem commonly found in daily life in the second stage, using the knowledge and know-how that they have learnt from the first stage and the lectures. Tutorials are conducted in an interactive manner through discussions between students and tutors on the problems encountered during the workshop activities. The subject will offer the datasets used in the workshop.. **Assignment and Demonstration**: Students will write a report for each workshop and demonstrate their work for one of the four workshops.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	See below

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Continuous Assessment (total: 100%)					
• Workshop report	60%	✓	✓	✓	✓
• Workshop demonstration	10%	✓	✓	✓	✓
• Tests	30%	✓	✓		
Total	100%				

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

Tutorial Workshops will require students to apply what they have learnt to solve problems. There will be open-ended tasks that allow students to exercise their creativity in solution design. Tutorial Workshops are group-based and the workshop reports weight 60% of the whole assessment.

Students will think critically to discuss various aspects of one of the four workshops in the demonstration. The demonstration will be assessed individually and weights 10% of the whole assessment. Each group member will demonstrate the part he/she is responsible for in the workshop.

Tests will assess students' achievement of the learning outcomes in a more formal manner. There will be a short test after each workshop and a final test for the whole subject. Tests are assessed individually and weights 30% of the whole assessment.

The workshops will use publicly available or proprietary software tools so that programming knowledge and mathematical skills are kept to a minimum, i.e., no programming and high-level mathematical background is assumed. Students will use available data sources, machine learning models, analytic algorithms, and evaluation methods from the tools to solve data analytics problems. Enthusiastic students could use the cloud-based API to perform more complex tasks.

Overall, 40% of the assessment is individual assessment and 60% is group-based assessment.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lectures	8 Hours
	• Tutorial Workshops	16 Hours
	• Tests	2 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; Self-studying	24 Hours
	• Workshop assignment and demonstration; preparation for tests	20 Hours
	Total student study effort:	**70 Hours**
Reading List and References	**Reference Materials:** 1. J. Moreira, T. Horvath, and A. Carvalho, A General Introduction to Data Analytics, Newark: John Wiley & Sons, Incorporated, 2018. 2. K. Moreland. The ParaView Tutorial, Version 5.6. Technical Report SAND 2018-11803 TR, Sandia National Laboratories, 2018. 3. A. Majumder, *Deep Reinforcement Learning in Unity: With Unity ML Toolkit*. Berkeley, CA: Apress, 2020. 4. D. Buckley, “Unity ML-Agents Tutorials – Complete Guide,” *GameDev Academy*, 2022 (online resource). 5. Deconstructing Chatbots: https://www.youtube.com/hashtag/deconstructingchatbots 6. A.R. Freed, *Conversational AI: Chatbots that work*. Manning, 2021 7. M. McTear, *Conversational Ai: Dialogue Systems, Conversational Agents, and Chatbots (Synthesis Lectures on Human Language Technologies)*. Morgan & Claypool, 2020 8. A. Dertat, “Applied Deep Learning – Part 4: Convolutional Neural Networks,” https://towardsdatascience.com/applied-deep-learning-part-4-convolutional-neural-networks-584bc134c1e2 (online resources) 9. Vaibhav Verdhan, *Computer Vision Using Deep Learning: Neural Network Architectures with Python and Keras*. Apress, 2021.	
Last Updated	April 2022	
Prepared by	F. Leung, M.W. Mak, D. Lun, Y.L. Chan, and I. Lau	

<u>**Subject Description Form**</u>

Subject Code	MM1031
Subject Title	Introduction to Innovation and Entrepreneurship
Credit Value	1
Level	1
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject introduces students to the essential aspects of innovation and entrepreneurship in a digital world. The objective is to prepare the first-year students with an entrepreneurial mindset and apply innovative strategies to find creative solutions that benefit both organizations and society in the age of digital transformation.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: 1. demonstrate an elementary understanding of innovation and entrepreneurship; 2. appreciate the importance of innovation and entrepreneurship in the local and global community; 3. appreciate the applications and implications of the latest technologies on entrepreneurship and innovation; and 4. identify ethical issues in entrepreneurship and innovation.
Subject Synopsis/ Indicative Syllabus	This subject is built upon three pillars – **Nature and importance of innovation and entrepreneurship** Defining innovation and entrepreneurship; differences between innovation and entrepreneurship; the importance of innovation and entrepreneurship in Hong Kong and beyond; entrepreneurship as a career path; ethical issues **Innovation** Technology and innovation; technology life cycle; diffusion of innovation; technology leadership and followership; assessing technology needs; making technology decisions; sourcing and acquiring new technologies; organizing for innovation **Entrepreneurship** Technology and entrepreneurship; design thinking; value proposition canvas; business model canvas; lean start-up **Indicative Outline:** *<u>(A) Introduction</u>* Videos (~10 minutes in total), plus discussion/activities/self-study in between the following topics • Defining innovation and entrepreneurship • Differences between innovation and entrepreneurship • The importance of innovation and entrepreneurship in Hong Kong and beyond • Entrepreneurship as a career path *<u>(B) Innovation and entrepreneurship toolkit</u>*

	Videos (~40 minutes in total), plus discussion/activities/self-study in between the following topics • Design Thinking • Value Proposition Canvas • Business Model Canvas • Lean Start-up (including MVP) *(C) Applications and implications of artificial intelligence on entrepreneurship and innovation* Videos (~40 minutes in total), plus discussion/activities/self-study in between the following topics • Hand-written digit recognition • Face detection • Stock price prediction • ROC Concept • Chatbot applications, e.g. customer service, enquiry handling in the customer journey • Latest A.I. development *(D) Applications and implications of blockchain technology on entrepreneurship and innovation* Videos (~40 minutes in total), plus discussion/activities/self-study in between the following topics • Defining blockchain technology • Background • Applications (e.g., verifying educational or employment credentials, intellectual property, smart contract, billing and revenue allocation, rights and royalties, history of ownership – critical minerals, diamond, fine art, garment, wine and spirits, supply chains, etc.) • Advantages and Disadvantages • Ethical implications (e.g., cryptojacking, co-ownership of illegal data, etc.) *(E) Applications and implications of Internet of Things technology on entrepreneurship and innovation* Videos (~40 minutes in total), plus discussion/activities/self-study in between the following topics • Defining Internet of Things technology • Background (from 1G to 5G) • Applications (e.g., daily life, manufacturing, retail, smart cities, etc.) • Advantages and Disadvantages • Ethical implications (e.g., privacy, security, etc.) *(F) Managing technology for competitive advantage in a digital world* Videos (~10 minutes in total), plus discussion/activities/self-study in between the following topics • Technology life cycle • Diffusion of innovation • Technology leadership and followership • Assessing technology needs • Making technology decisions • Sourcing and acquiring new technologies • Organizing for innovation

<table>
<tr><td>Teaching/Learning Methodology</td><td>This subject is designed to be interactive, with short videos, cases, in-class discussions and activities interspersed throughout an introductory session and thirteen 1-hour seminars. Students are encouraged to go beyond the understanding of concepts, and to reflect on their learning process. Learning from the responses and feedback from their peers is also critical.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>1. Quizzes</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Reflection</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Requiring students to answer multiple-choice questions at the end of each module is appropriate for helping the first-year students confirm their understanding of the concepts. The requirement of writing some textual responses is to assess the schema established by the students toward innovation and entrepreneurship.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td colspan="2">Class contact:</td></tr>
<tr><td>▪ One online introductory session, plus four online video modules, combined with in-class discussions and activities, interspersed throughout</td><td>13 Hours</td></tr>
<tr><td colspan="2">Other student study effort:</td></tr>
<tr><td>▪ Self-study and preparation</td><td>20 Hours</td></tr>
<tr><td>▪ Assignment</td><td>10 Hours</td></tr>
<tr><td>Total student study effort</td><td>43 Hours</td></tr>
</table></td></tr>
<tr><td>Reading List and References</td><td>Bateman, T. S., & Konopaske, R. (2021). Management: Leading & collaborating in a competitive world. NY: McGraw-Hill.

Bamford, C., & Bruton, G. (2022). Entrepreneurship: The art, science, and process for success. McGraw-Hill.

Osterwalder, A., & Pigneur, Y. (2010). Business model generation: A handbook for visionaries, game changers, and challengers. Hoboken, NJ: John Wiley & Sons.

Osterwalder, A., Pigneur, Y., Bernarda, G., & Smith, A. (2014). Value proposition design: How to create products and services customers want. Hoboken, NJ: John Wiley & Sons.

Ries, E. (2011). The lean start-up. NY: Crown Business.</td></tr>
<tr><td>Last Updated</td><td>August 2022</td></tr>
<tr><td>Prepared by</td><td>MM</td></tr>
</table>

Subject Description Form

Subject Code	AMA2111
Subject Title	Mathematics I
Credit Value	3
Level	2
Pre-requisite	AMA1007 Calculus and Linear Algebra or AMA1101 Calculus I or AMA1102 Calculus IA or AMA1120 Basic Mathematics II – Calculus and Linear Algebra or AMA1130 Calculus for Engineers or AMA1500 Foundation Mathematics for Accounting and Finance
Exclusion	AMA2007 Intermediate Calculus and Linear Algebra AMA2308 Mathematics for Engineers AMA2380 Engineering Mathematics AMA2511 Applied Mathematics I AMA2882 Mathematics for Scientists and Engineers AMA290 Engineering Mathematics
Objectives	This subject aims to introduce students to the basic principles and techniques of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply mathematical reasoning to analyze essential features of different problems in science and engineering; 2. extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations; 3. develop and extrapolate the mathematical concepts in synthesizing and solving new problems 4. demonstrate abilities of logical and analytical thinking; 5. search for useful information in the process of problem solving.
Subject Synopsis/ Indicative Syllabus	1. <u>Algebra of complex numbers</u> Complex numbers, geometric representation, complex exponential functions, n-th roots of a complex number. 2. <u>Linear algebra</u> Systems of linear equations, vector spaces, inner product and orthogonality, eigenvalues and eigenvectors, applications. 3. <u>Ordinary differential equations</u> ODE of first and second order, linear systems, Laplace transforms, Convolution theorem, applications to mechanical vibrations and simple circuits. 4. <u>Differential calculus of functions of several variables</u> Partial derivatives, total differential, chain rule, Taylor's expansion, maxima and minima, directional derivatives, Lagrange multipliers, implicit differentiation, applications.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures aim to provide the students with an integrated knowledge required for the understanding and application of mathematical concepts and techniques. Tutorials will mainly be used to develop students' problem solving ability.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Homework, quizzes and mid-term test	40%	✓	✓	✓	✓	✓
2. Examination	60%	✓	✓	✓	✓	✓
Total	100%					

Continuous Assessment comprises of assignments, in-class quizzes, online quizzes and a mid-term test. An examination is held at the end of the semester. Questions used in assignments, quizzes, tests and examinations are used to assess students' level of understanding of the basic concepts and their ability to use mathematical techniques in solving problems in science and engineering.

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

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

Student Study Effort Expected

Class contact:	
• Lecture	26 Hours
• Tutorial	13 Hours
• Mid-term test and examination	
Other student study effort	
• Assignments and Self study	78 Hours
Total student study effort:	**117 Hours**

Reading List and References

1. C.K. Chan, C.W. Chan and K.F. Hung, *Basic Engineering Mathematics*, McGraw-Hill, 2015.
2. Anton, H. *Elementary Linear Algebra* (11th edition). Wiley, 2014.
3. Kreyszig, E. (2011). *Advanced Engineering Mathematics*, 10th ed. Wiley.
4. James, G. (2015). *Modern Engineering Mathematics*, 5th ed. Pearson Education Limited
5. Thomas, G. B., Weir, M. D. & Hass, J. R. *Thomas' Calculus*, 14th ed. Pearson Education 2017

Last Updated: December 2020

Prepared by: AMA

Subject Description Form

Subject Code	COMP2011
Subject Title	Data Structures
Credit Value	3
Level	2
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP1011
Objectives	The objectives of this subject are to: 1. introduce students to basic concepts of data structures and algorithms; and 2. teach students to apply simple data structures and algorithms in developing computer programs.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. understand the properties of basic data structures; 2. identify the strengths and weaknesses of different data structures; 3. acquire specialised knowledge of various typical algorithms; 4. design and employ appropriate data structures and algorithms for developing computer applications; and 5. think critically for improvement in the solutions.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Programming and Algorithms** Computer algorithms; types of algorithms; data structures; and abstract data types. **2. Data Structures: Representation and Algorithms** Linear structures: linked-lists, stacks, queues; tree structures: binary trees, balanced trees, tree traversals; and other common data structures: priority queues, heaps. **3. Sorting** Basic sorting algorithms: bubble sort, insertion sort, selection sort; and advanced sorting algorithms: quicksort, mergesort, heapsort. **4. Searching** Common searching algorithms: sequential search, binary search; and advanced searching algorithms: tree search, dictionary and hashing. **5. Applications** Practical program development using combination of various data structures and algorithms, e.g., friends-book; and efficiency of the various approaches.

Teaching/ Learning Methodology

The course material will be delivered as a combination of mass lectures and small group supervised tutorial and laboratory sessions. Lectures will provide the required knowledge while tutorials and laboratory sessions allow students to acquire hands- on experience on programming with different algorithms. Programming project provides students with a chance to integrate their knowledge on applying appropriate data structures and algorithms to solve practical problems.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	**2**	**3**	**4**	**5**
Continuous Assessment	**60%**					
1. Laboratory Exercises	20%	✓		✓	✓	
2. Programming Project	20%	✓	✓	✓	✓	✓
3. Test	20%	✓	✓	✓	✓	
Examination	**40%**	✓	✓	✓	✓	✓
Total	100%					

Student Study Effort Expected

Class contact:	
▪ Lecture	39 Hours
▪ Tutorial/Lab	13 Hours
Other student study effort:	
▪ Assignments, Quizzes, Projects, Self-study	55 Hours
Total student study effort	107 Hours

Reading List and References

Reference Books:

1. Goodrich, Michael T., Tamassia, Roberto, and Goldwasser, Michael H., *Data Structures and Algorithms in Java*, 6th Edition, Wiley, 2014.

2. Sedgewick, Robert and Wayne, Kevin, *Algorithms*, 4th Edition, Addison- Wesley, 2011.

3. Cormen, Thomas H., Leiserson, Charles E., Rivest, Ronald L. and Stein, Clifford, *Introduction to Algorithms*, 3rd Edition, MIT Press, 2009.

Last Updated	June 2021
Prepared by	COMP

Subject Description Form

Subject Code	COMP2012
Subject Title	Discrete Mathematics
Credit Value	3
Level	2
Pre-requisite / Co-requisite / Exclusion	
Objectives	The objectives of this subject are to: 1. introduce students to the concepts and applications of discrete mathematical structures; and 2. help students attain the fundamental mathematical knowledge and reasoning skills they need to be successful in upper-level computing subjects.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: 1. apply discrete structures knowledge and skills to solve real world problems using computers; 2. understand the major mathematical knowledge in computer systems; 3. apply the computer programming techniques to solve practical engineering problems; 4. acquire mathematical knowledge and skills required to further study other more advanced computing-related subjects; and 5. relate learned mathematical knowledge to other computing subjects.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Set, Relations and Functions** Sets, relations and functions, equivalence, cardinality, order relations. **2. Propositional and Predicate Logic** Logical expressions; truth tables; tautologies; formal reasoning; predicates; quantifiers; proof system; soundness and completeness. **3. Discrete Mathematical Skills** Mathematical induction; counting techniques; inclusion-exclusion principle; pigeonhole principle. **4. Graphs and Trees** Graph, digraph, isomorphism; connectivity; Euler and Hamilton path; shortest path problems; planar graphs; graph colouring; trees and tree traversal; spanning trees and minimum spanning trees; decision tree and isomorphism of tree. **5. Basic Network Problems** Network flows; maximal-flow minimum-cut problem; minimal-cost flow problem; applications, e.g., network design, transportation problem.

	6. Boolean Algebras and Combinatorial Circuits Combinatorial circuits and its properties, Boolean algebras, Boolean functions and synthesis of circuits.
Teaching/ Learning Methodology	A mix of lectures and tutorial sessions is used to deliver the various topics in this subject. Lectures are conducted to initiate students with the discrete structures concepts and knowledge that are reinforced by in-class exercises and quizzes. Tutorial sessions are used to provide more opportunity to understand solutions to the mathematical problems and to gain hands-on experience on solving real world problems by applying learned mathematical knowledge and computing skills.
Assessment Methods in Alignment with Intended Learning Outcomes	(see table below)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	**60%**					
1. Assignments			✓		✓	
2. Exercises		✓	✓	✓		✓
3. Quizzes			✓		✓	
Examination	**40%**		✓		✓	
Total	100%					

Student Study Effort Expected	**Class contact:**	
	▪ Lecture	26 Hours
	▪ Tutorial	13 Hours
	Other student study effort:	
	▪ Assignments, Quizzes, Projects, Self-study	66 Hours
	Total student study effort	105 Hours

Reading List and References	**Textbook:** 1. Johnsonbaugh, R., *Discrete Mathematics*, 8th Edition, Prentice Hall, 2017. 2. Rosen, K.H., *Discrete Mathematics and Its Applications*, 8th Edition, McGraw Hill, 2019. 3. Dossey, J.A., *Discrete Mathematics*, 5th Edition, Pearson Addison Wesley, 2006. **Reference Books:** 1. Truss, J.K., *Discrete Mathematics for Computer Scientists*, Pearson Addison-Welsey, 2011. 2. Kolman, B., Busby, R.C. and Ross, S.C., *Discrete Mathematical Structures*, 6th Edition, Prentice Hall, 2009. 3. Ralph P.G., *Discreteand Combinatorial Mathematics: An Applied Introduction*, 5th Edition, Pearson Addison Wesley, 2004.
Last Updated	Dec 2018
Prepared by	COMP

Subject Description Form

Subject Code	COMP 2432
Subject Title	Operating Systems
Credit Value	3
Level	2
Pre-requisite / Co-requisite / Exclusion	Prerequisites: COMP 2011
Objectives	The objective of this subject is to: 1. introduce to students about the different types of services provided by operating systems; 2. equip students with knowledge and understanding on the concepts and theories of operating systems; and 3. equip students with skills on the implementation issues of operating systems.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. identify the services provided by operating systems; 2. understand the internal structure of an operating system and be able to write programs using system calls; 3. understand and solve problems involving key concepts and theories in operating systems, including process control, communication, memory management, deadlock and synchronisation; Category B: Attributes for all-roundedness 4. develop skills in problem solving; and 5. solve problems in groups and develop group work.
Subject Synopsis/ Indicative Syllabus	1. **Introduction to operating systems** Types and functionalities of operating systems; system components and services; resource management. 2. **Unix and Linux** Usage of Unix and Linux; shell and commands; scripts; interrupts; kernel; system calls. 3. **Process management** Process concepts; process creation and termination; concurrent processes; process scheduling. 4. **Process communication and synchronisation** Inter-process communication; critical section problem; synchronisation; deadlock.

	5. **Memory management** Address translation; memory allocation; paging and segmentation system; virtual memory. 6. **File systems, protection and security** Directory and file system structure; secondary storage; protection and access control; capabilities; security and threats. 7. **Case studies on operating systems** Structure of Unix, Linux, Mac OS, Windows 10, etc.
Teaching/ Learning Methodology	During the *lectures*, students will come across the common concepts and theories in operating systems. Those concepts and theories would be explained with reference to real operating systems such as Unix and Linux. Case studies on those operating systems would be provided. During the *laboratories*, students will have to practice the OS usage and concepts, via programming with different system calls and scripts to achieve the learning effect. During the *tutorials*, students will have the opportunity to practice and apply what they have learned during the lecture to reinforce their knowledge. Written and programming assignments let students apply their knowledge to solve problems. The group project provides the students an environment to work together for a bigger problem and to stimulate learning from peers.
Assessment Methods in Alignment with Intended Learning Outcomes	(see table below)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	55%	✓	✓	✓	✓	✓
Examination	45%	✓	✓	✓		
Total	100%					

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

The course will be accessed by assignments, project, test and examination.

Assignments are designed to reinforce the concepts and algorithms learned in the lecture and laboratory, by solving bigger problems. Project is used to develop students' analytic and problem-solving skills by implementing a significant piece of software. Test and examination are used to assess independent problem solving and critical thinking skills.

Student Study Effort Expected		
	Class contact:	
	▪ Lectures	39 Hours
	▪ Tutorials / Labs	13 Hours
	Other student study effort:	
	▪ Assignments, project, self-study, test and exam preparation	68 Hours
	Total student study effort	120 Hours

Reading List and References	**Textbook:** 1. Silberschatz, A., Galvin, P.B. and Gagne, G., *Operating System Concepts*, 10/E, John Wiley and Sons, 2018. **Reference Books:** 1. Elmasri, E., Carrick, A.G. and Levine, D., *Operating Systems: A Spiral Approach*, McGraw Hill, 2010. 2. McHoes, A.M. and Flynn, I.M., *Understanding Operating Systems*, 8/E, Thomson, 2018. 3. Dhamdhere, D.M., *Operating Systems: A Concept-based Approach*, 2/E, McGraw Hill, 2006. 4. Fox, R.I., *Linux with Operating System Concepts*, CRC Press/Taylor & Francis Group, 2015. 5. Diaz, C., *Introduction to Unix/Linux*, Thomson, 2007.
Last Updated	July 2021
Prepared by	COMP

Subject Description Form

Subject Code	EIE2105
Subject Title	Digital and Computer Systems
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with the foundation knowledge in digital systems and the organization and architecture of a computer
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the fundamentals of digital systems and associated technologies; 2. Understand the architecture and organization of microprocessors; 3. Understand the functions and features of components in a computer.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Number Systems, Operations, and Codes Binary, octal and hexadecimal numbers; base conversions 1's complement, 2's complement and binary arithmetic Binary-coded-decimal (BCD) representation Floating-point numbers 2. The Basics of Logic Design Gates, truth tables, and logic equations Combinational logic Constructing a basic arithmetic logic unit Sequential logic: Clocks, Counters, Flip-flops, latches, and registers Programmable Logic (PAL, PLA, FPGAs) 3. Microprocessor Design Basics Basic organization of a microprocessor Building a simple datapath The control unit Example: x86 microprocessor organization 4. Instruction Set Architecture Basic computer operation cycle Register set Operand addressing Addressing modes Types of instructions Example: x86 instruction set architecture 5. Introduction to Computer Systems Internal organization of computers Working principle of computer systems Types of computer systems Buses and memories Measurement of computer performance

Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3	Supplementary to lectures are conducted with smaller class size. The students will be able to clarify concepts and to have a better understanding of the lecture material. Some exercises and application examples are given for discussion.
Assignments	1, 2, 3	Through working assignment and end-of-chapter problems in text books, students will develop a firm understanding and comprehension of the knowledge taught.
Laboratory sessions	1, 2, 3	Students will make use of the software and hardware tools to develop simple digital systems and perform simulations.

Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**		
		1	**2**	**3**
1. Continuous Assessment (total 100%)				
• Assignments		✓	✓	✓
- homework	25%			
- Class question/ participation	10%			
• Quiz	10%	✓	✓	✓
• Test	40%	✓	✓	✓
• Laboratory sessions	15%	✓	✓	
2. Examination	0%			
Total	100%			

The continuous assessment will consist of assignments, laboratory exercises, a quiz and a test.

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

Specific Assessment Methods/Tasks	Remark
Assignments, tests and quizzes	End-of chapter type problems are used to evaluate students' ability in applying concepts and skills learned in class. Larger individual assignments will bet set in order to challenge students to apply the course contents in a more realistic setting. Students are needed to think critically and creatively in order to come with an alternate solution for an existing problem.
Laboratory sessions	Each student is required to answer several questions related to each lab session in the lab sheet and hand in his/her answers.

Student Study Effort Required	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References	**Textbooks:** 1. M.M. Mano and C.R. Kime, *Logic and Computer Design Fundamentals*, 4th ed., Upper Saddle River, NJ: Prentice-Hall, 2008. **Reference Books:** 1. M. Rafiquzzaman, *Fundamentals of Digital Logic and Microcomputer Design*, 5th ed., John Wiley & Sons, 2005. 2. B. Brey, *The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processor: Architecture, Programming and Interfacing*, 7th ed., 2005. 3. D.A. Patterson and J.L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, 4th ed., Morgan Kaumann Publishers, 2009.
Last Updated	July 2020
Prepared by	Dr Chris Chan

Subject Description Form

Subject Code	EIE2110
Subject Title	Basic Circuit Analysis and Electronics
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. Introduce fundamental circuit theory. 2. Develop ability for solving problems involving electric circuits. 3. Develop skills for experimentation on electric circuits. 4. Impart relevant skills and knowledge for independent learning of other subjects that require such skills and knowledge.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Acquire a good understanding of fundamental circuit theory and electronics. 2. Solve simple problems in electric circuits. 3. Use suitable instrumentation to carry out experimental investigations to validate the theoretical investigations. Category B: Attributes for all-roundedness 4. Search for useful information in solving problems in electric circuits.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. DC Circuits Introduction to electric circuits. Kirchhoff's current and voltage laws. Independent and dependent sources. Simple circuits: voltage divider, current divider, series and parallel circuits. Nodal and mesh analysis. Thévenin and Norton theorems. Maximum power transfer. 2. Capacitance, Inductance and First Order Transient Constitutive relations of capacitor and inductor. Introduction to time-varying circuits. Time-domain solution of simple RC and LC circuits. 3. Introduction to Transformers Concept of ideal transformer. Dot convention. Applications in galvanic isolation and voltage/current level conversion. 4. Steady-state Analysis of AC Circuits Average and rms values. Steady-state analysis of circuits driven by single frequency sinusoidal sources. Real and reactive powers. Power factor. 5. Load Line Analysis and Diode Circuits I-V characteristics of diodes. Practical diode circuits. 6. Transistor Amplifiers The bipolar junction transistors (BJT). DC biasing and analysis of BJT circuits. Basic BJT amplifier configurations. 7. Operational Amplifiers Ideal operational amplifier. Op-amp circuits: inverting amplifier, non-inverting amplifier, summer, difference amplifier, integrator and differentiator.

	Laboratory Experiments: 1. Introduction to laboratory instrumentation / Thévenin and Norton theorems 2. First order transient
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures, supplemented with interactive questions and answers	1, 2, 4	In lectures, students are introduced to the *knowledge* of the subject, and *comprehension* is strengthened with interactive Q&A.
Practice classes, where problems are discussed and are given to students for them to solve	1, 2, 4	In practice classes, students *apply* what they have learnt in solving the problems given by the tutor.
Laboratory sessions, where students will perform experimental verifications. They will have to record results and write a report on one of the experiments.	2, 3, 4	Students *acquire* hands-on experience in using electronic equipment and *apply* what they have learnt in lectures/tutorials to experimentally validate the theoretical investigations.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Continuous Assessment (Total 40%)					
• Laboratory works	14%		✓	✓	✓
• Laboratory reports	6%		✓	✓	✓
• Mid-semester test	10%	✓	✓		✓
• End-of-semester test	10%	✓	✓		✓
2. Examination	60%	✓	✓		✓
Total	100%				

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

Specific Assessment Methods/Tasks	Remark
Laboratory works and reports	Students will be required to perform two experiments and submit a report on one of the experiments. The assessment can measure the practical skills and theoretical knowledge of students.
Mid-semester test	There will be a mid-semester test to evaluate students' achievement of topics learned in the first six weeks and give feedback to them for prompt improvement.
End-of-semester test and Examination	There will be an end-of-semester test and examination to assess students' achievement of all the learning outcomes. These are mainly summative in nature.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References

Textbook:

1. W.H. Hayt, J.E. Kemmerly and S.M. Durbin, *Engineering Circuit Analysis,* 9th ed., New York: McGraw-Hill, 2019.
2. G. Rizzoni, *Fundamentals of Electrical Engineering*, 1st ed., McGraw-Hill, 2009.

References:

1. C.K. Tse, *Linear Circuit Analysis,* London: Addison-Wesley, 1998.
2. D.A. Neamen, *Microelectronics: Circuit Analysis and Design*, Boston: McGraw-Hill, 3th ed., 2010.
3. A.H. Robbins and W.C. Miller, *Circuit Analysis: Theory and Practice*, Thomson Learning, 5th ed., 2013.

Last Updated	April 2020
Prepared by	Dr WY Tam

Subject Description Form

Subject Code	EIE2112
Subject Title	Foundation Techniques in Artificial Intelligence
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce the latest development of Artificial Intelligence (AI) and Information Engineering (IE) and their relationship with the society development. 2. To introduce the common mathematical and programming tools used in the study of Artificial intelligence and Information Engineering.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the relationship between AI, machine learning and applications; 2. Understand the common mathematical tools used in the study of AI and IE; 3. Apply computer programming techniques to solve practical scientific problems; and Category B: Attributes for all-roundedness 4. Solve problems independently.
Subject Synopsis/ Indicative Syllabus	1. Introduction to AI and IE • Expert systems, Fuzzy logic systems, Neural networks, Natural language processing, Robotics • Techniques and technologies in information engineering: Linear regression, Decision tree, Support vector Machine, Clustering, Dimensionality reduction, machine learning 2. Mathematical Foundations of AI and IE • Calculus: Differentiation, partial derivatives, chain rule, maxima and minima. Review of integration. Case study: Optimization using differentiation. • Signals and systems: Complex number, the Euler theorem, time and frequency, Fourier transform, sampling theorem, discrete Fourier transform. Case study: Real life application of discrete Fourier transform. • Linear algebra: Review of basic matrix operations. Determinants and systems of linear equations. Inner product and orthogonality, eigenvalues and eigenvectors. Case study: Real life application of linear algebra. 3. Scientific programming for AI • Python programming for scientific problems. • Introduction of Python specialized modules for numerical computation (e.g., Numpy, Scipy, Matplotlib, etc.) • Python framework for AI applications (e.g., Pytorch, tensorflow, etc)

Teaching/Learning Methodology	see below

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1,2,3	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1,2,3	Supplementary to lectures: Students will be able to clarify concepts and to have a deeper understanding of the lecture materials; Problems and applications are given and discussed.
Laboratory sessions	2,3,4	Students will experience the applications of different mathematical tools by means of some computer programming experiments in numerical computation.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment (100%)					
• Tests	18%	✓	✓	✓	✓
• Short quizzes and assignments	18%	✓	✓	✓	
• Laboratory sessions/projects	18%		✓	✓	✓
2. Examination	46%	✓	✓	✓	✓
Total	100%				

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

Specific Assessment Methods/Tasks	**Remark**
Short quizzes and assignments	They can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.
Tests and examination	End-of-chapter-type problems are used to evaluate the students' understanding of subject materials and the ability in applying concepts and skills learned in the classroom. Students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem. They need to present their solutions logically and systematically in the tests and the examination.

<table>
<tr><td></td><td colspan="2"><table><tr><td>Laboratory sessions</td><td>Students are required to make a demonstration of their solutions on a selected open-ended question in each laboratory session for evaluating their problem solving skill. Students also need to submit lab reports for evaluating their overall performance in the laboratory sessions.</td></tr></table></td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lectures</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. M.J. Roberts, Fundamentals of Signals & Systems, McGraw-Hill, 2008.
2. R. Larson, Edwards, B. Single Variable Calculus, Brooks/Cole 2012
3. R. Larson, Elementary Linear Algebra, Brooks/Cole 2013
4. S. Nagar, Introduction to Python for Engineers and Scientists: Open Source Solutions for Numerical Computation, Apress, 2018
5. Joshi Ameet, “Machine learning and artificial intelligence”, Springer 2020.
6. Ashish Ranjan Jha, Dr. Gopinath Pilai, “Mastering PyTorch”, Packt Publishing 2021.
7. Singh Pramod and Manure Avinash, “Learn TensorFlow 2.0: Implement Machine Learning and Deep Learning”, Apress, 2020.</td></tr>
<tr><td>Last Updated</td><td colspan="2">June 2021</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr. Chris Chan</td></tr>
</table>

Subject Description Form

Subject Code	EIE2113
Subject Title	Introduction to Internet of Things
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	The students are expected to have some basic knowledge on computer hardware and software, as well as computer networks.
Objectives	1. To provide an overview on the Internet of things (IoT) including circuits, sensors, embedded systems, communications and networking, data processing, and security; 2. To introduce basic hands-on IoT concepts including sensing, actuation, and communications through lab exercises with IoT development kits.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand key IoT concepts on circuits, sensors, embedded systems, communications and networking, and data processing; 2. Basic hands-on skills on developing simple IoT applications. Category B: Attributes for all-roundedness 3. Understand the creative process when designing solutions to a problem; 4. Take up new technology for life-long learning.
Subject Synopsis/ Indicative Syllabus	1. Introduction to the Internet of Things (IoT) - What is IoT? Why is IoT important? - The IoT system stack: Sensors, edge computing, networking, cloud computing - How IoT could enable innovative products and services - Introduction of IoT Security 2. Cool IoT Applications - Smart cities: waste management, street lights, and connected vehicles - Healthcare: Baby monitoring, elderly monitoring, mood enhancing, disease treatment, enhance adherence and challenges 3. Electronics for IoT - Overview of electronic signals and circuits (sampling and the Nyquist theorem) - Battery current - Energy management and wireless links - Digital computing - ADC and DAC concepts 4. Sensors for IoT - Sensor terminology - Sensor dynamics and specifications - Linearization and error - Sampling frequency and bandwidth requirements for different sensors - Interface common sensors and actuators to IoT development kits 5. Embedded Systems for IoT - Typical cost and computing an energy budget - Energy management and sleep states - Microcontrollers: Peripherals, buses, and direct memory access (DMA) - General purpose input/output (GPIO) and pulse width modulation (PWM) - Operating systems and multiprogramming 6. Software and Data Analytics for IoT - Libraries of development kits and examples (e.g., Arduino) - Selection of development programming languages for different IoT services

	- Web server and web services (e.g., ThingsBoard, MQTT/HTTP) - Data analytics with machine learning techniques (e.g., Python, Anaconda) 7. Connectivity and Networking for IoT - Historical evolution of wireless systems - Energy harvesting and wirelessly powered transmitters - Capacity of wireless channels - Massive multiple access and embracing collisions - Computation versus communication - Low power wide area networks (LPWAN)
Teaching/Learning Methodology	The theories and applications of IoT will be described and explained in lectures. Tutorial and lab sessions will be conducted to deliver hands-on skills on prototyping IoT products and applications based on IoT development kits. The assignments and lab exercises will help students review the knowledge taught in class.

Teaching/Learning Methodology	**Intended Subject Learning Outcomes**			
	1	**2**	**3**	**4**
Lecture and Tutorial	✓	✓		
Laboratory and Practical Sessions	✓	✓	✓	✓
Assignments and lab exercises	✓	✓	✓	✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment					
• Homework and assignments	10%	✓	✓	✓	✓
• Tests	10%	✓	✓		
• Laboratory exercises	30%	✓	✓	✓	✓
2. Examination	50%	✓	✓		
Total	100%				

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

Assignments, tests/quizzes, and examination let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving problems.

Lab exercises require students to do further reading, search for information, keep abreast of current IoT development, and develop their own IoT prototypes.

Student Study Effort Expected

Class contact (time-tabled):	
• Lectures	27 Hours
• Tutorial/Laboratory/Practice Classes	12 Hours
Other student study effort:	
• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	36 Hours
• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
Total student study effort:	**105 Hours**

Reading List and References	**Textbook:** 1. R. Buyya, A. V. Dastjerdi, *Internet of Things: Principles and Paradigms*, Cambridge, MA: Morgan Kaufmann, 2016. **Reference Materials:** 1. S. Greengard, *The Internet of Things*, Cambridge, MA: MIT Press, 2015. 2. A. Chaudhuri, *Internet of Things, for Things, and by Things*, Boca Raton, FL: CRC Press, 2019.
Last Updated	June 2021
Prepared by	Dr Ivan Ho

Subject Description Form

Subject Code	EIE2211
Subject Title	Logic Design
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To provide students with a broad view in both hardware and software aspects of digital systems in general and microprocessor systems in particular, and enable them to gain understanding and skills that will be used in later computer related courses. Emphasis will be placed on topics including: 1. Common binary logic components found in a microcomputer system 2. Use and applications of programmable logic devices 3. Structure and organization of microprocessors
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the fundamentals of digital systems and associated technologies. 2. Analyse and design simple systems related to digital logic. 3. Apply logic design techniques to construct digital systems with programmable logic devices and microprocessors, and appreciate the use of them. 4. Appreciate the importance of creativity and critical thinking on finding "good" solutions or making "good" designs. <u>Category B: Attributes for all-roundedness</u> 5. Think critically.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Logic Circuit and ICs</u> 1.1 Decoders and encoders 1.2 Multiplexers and demultiplexers 1.3 Binary adders, binary adder-subtractors 1.4 Binary multipliers 1.5 Sequential circuit analysis and design 1.6 Registers and counters 1.7 HDL representation. 2. <u>Memory and Programmable Logic Devices</u> 2.1 RAM: Write and read operations, timing waveforms, RAM integrated circuits, three-state buffers, DRAM ICs 2.2 Programmable logic technologies 2.3 ROM, PLA and PAL 2.4 VLSI programmable logic devices: Xilinx FPGA. 3. <u>Microprocessor</u> 3.1 Register transfer operations 3.2 Microoperations 3.3 Bus-based transfer 3.4 ALU 3.5 Shifter 3.6 Datapath representation 3.7 Control word 3.8 Control unit

3.9 Hardwired control
3.10 Basic Assembly Language Programming.

Laboratory Experiment:

1. Basic logic gates and their applications
2. Hardware description language and programmable logic devices

Teaching/ Learning Methodology

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3, 4	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 4, 5	Supplementary to lectures and are conducted with smaller class size. Students will be able to clarify concepts and to have a deeper understanding of the lecture materials. Problems and application examples are given and discussed.
Laboratory sessions	1, 2, 3, 4, 5	students will make use of the software and hardware tools to develop simple digital systems, perform simulations

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**				
		1	**2**	**3**	**4**	**5**
1. Continuous Assessment	50%					
• Assignments		✓	✓			
- homework	15%					
- Class question/ participation	5%					
• Test	20%	✓	✓	✓	✓	
• Laboratory sessions	10%	✓	✓	✓	✓	✓
2. Examination	50%	✓	✓	✓	✓	
Total	100%					

	The continuous assessment will consist of a number of assignment, lab reports, and two tests. **Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:**

Specific Assessment Methods/Tasks	**Remark**
Assignments, tests and examination	End-of chapter type problems used to evaluate students' ability in applying concepts and skills learned in the lessons. Students need to think critically and creatively in order to come up with solutions for existing problems.
Laboratory sessions	Each student is required to do a demonstration.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References	**Textbooks:** 1. M.M. Mano and C.R. Kime, *Logic and Computer Design Fundamentals*, 4th ed., Upper Saddle River, NJ: Prentice-Hall, 2008. **Reference Books:** 1. M.M. Mano and M.D. Ciletti, *Digital Design.* Upper Saddle River, NJ: Prentice-Hall, 2007. 2. S. Yalamanchili, *VHDL – A Starter's Guide*, 2nd ed. Prentice-Hall, 2005. 3. E.O. Hwang, *Digital Logic and Microprocessor Design With VHDL*, 1st ed., CL-Engineering, 2006.
Last Updated	February 2018
Prepared by	Prof. Gang Li

Subject Description Form

Subject Code	EIE2901/IC2114
Subject Title	Industrial Centre Training I for EIE
Credit Value	5 training credits
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objective of this subject is to equip students with knowledge and skills through technical training that are fundamental and essential in their study and professional practice in electronic and information engineering (EIE).
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply the features and functions of typical CAD system for producing CAD models and drawing with application in engineering, as well as applying 3D CAD drawings for technical communication; 2. explain legal duties related to occupational safety, identify common workplace health and safety hazards, corresponding control measures and apply personal protection equipment; 3. apply and create computer program on scientific computing software for technical analysis and modelling; 4. design electronic circuit on printed wiring board with EDA tool; 5. prescribe and use basic electronic instrument to perform parametric test and analysis on simple electronic circuit, troubleshooting, create and apply virtual instrument and identify common electronic product safety tests; 6. recognize training as an important part for a professional engineering career and the needs for multi-disciplinary training and continual professional development in professional engineering practice. 7. explain the manufacturing, assembly, interconnection, and operation of mechatronic products and machines, specify system components and production process, and construct simple prototype for test and investigation; 8. generate control programmes for building or industrial embedded systems.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>3D CAD Modelling for EIE (18 hours)</u> 1.1. Introduction to Computer-aided Design (CAD); general concepts on 3D computer modeling; parametric feature based solid modelling; construction and detailing of solid features; solid model modification and its limitations; concepts of assembly modeling - bottom up approach for the generation of subassemblies, and final assembly; 1.2. . Generation of 2D drawings from 3D parts and assemblies; data exchange; techniques for export files for different prototyping processes (e.g. 3D printing, laser machining). 2. <u>Industrial Safety Overview (15 hours)</u> 2.1. Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures. 2.2. Safety Law: F&IU Ordinance and principal regulations, OSH Ordinance and principal regulations.

	2.3. Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling. 2.4. Safety Technology: Mechanical lifting, fire prevention, dangerous substances and chemical safety, machinery hazards and guarding, electrical safety, first aid, job safety analysis, fault tree analysis, personal protective equipment. 3. <u>Application of Computing Tool (21 hours)</u> 3.1. Introduction to Python; interactive calculations and basic operations with basic data type; mathematical operations, matrix and array operations, data analysis and curve fitting; data manipulation and data file processing. 3.2. Script programming & debugging; logic operations & flow control; Use of functions and popular Python packages, such as Numpy, Panda and Matplotlib; Data visualization by using graphics packages. 4. <u>Electronic Circuit Design Practice (18 hours)</u> 4.1. Introduction to electronic design automation (EDA) software; circuit schematics capture and representation; placement of components, capturing, annotation, labelling, net list. Electronic parts library, symbols, decals, physical packages, discrete components, integrated circuits, logic and analogue circuits, electronic parts creation and application. 4.2. Printed Circuit Board (PCB) design, hands on practice on PCB circuit design with EDA tools. 4.3. Wiring diagram and wiring table for electronic and electrical installation, functional representation of circuit, system block diagram, electrical & electronic device symbols and layout, circuit artwork, etching process, prototype PCB fabrication. 5. <u>Electronic Measurement with Product Safety Test and Practice (15 hours)</u> 5.1. Application and use of electronic test instruments: current and voltage measurements, two wire and four wire techniques, power supply and signal sources, oscilloscope probes and oscilloscopes. 5.2. Introduction to Virtual Instrument, application and hands-on practice on LabVIEW. 5.3. Electronic product safety test methods: for example, High Voltage Isolation Test, Insulation Resistance Test, Continuity Test, Leakage Current Measurement. *One of the following streams as decided by hosting programme* **Stream A:** 6. <u>Electronic Workshop Practice for EIE (36 hours)</u> 6.1. Introduction to common electronics parts, use of basic test instruments, best practice and basic troubleshooting techniques, electronic workshop safety. 6.2. Introduction to electronic assembly design and manufacturing process, components, tools and machines. 6.3. Introduction to electronic circuit interconnect technologies like Surface Mounted Technology (SMT) and Chip-on-board (COB). 6.4. Introduction to advanced electronic packaging and assembly process such as: fine-pitch SMT, Ball Grid Array (BGA), Flip-chip and Chip Scale Package (CSP). 6.5. Soldering and de-soldering techniques, mounting and installation of electronic circuits, wiring of subassemblies.

	6.6. Hands-on practice on basic electronic circuit troubleshooting, including both digital & analogue circuitries. 6.7. Introduction to rapid prototyping for electronic design using tools like breadboard and circuit simulation software. 6.8. Introduction to rapid prototyping for mechanical design using 3D printing equipment and CAD tools. 7. <u>Embedded System Application and Practice (27 hours)</u> 7.1. Introduction to a contemporary Microcomputer family and its development tools. 7.2. Hands-on practice on memory, I/O, data communications, ADC operations. 7.3. Hands-on practice on LED and LCD displays. 7.4. Hands-on practice on motor control and sensors. 7.5. Application of Microcomputer on consumer electronic products, mechatronics, home automation products, wired and wireless connectivity. **Stream B:** 8. <u>Basic Mechatronics Practice (27 hours)</u> 8.1. Design approach of mechatronic system design; Key elements of mechatronic system, sensing device, controller, actuators, human-machine interfaces and input & output signal conditioning unit. 8.2. Introduction of design and operation of typical mechatronic systems 8.3. Introduction of controllers and basic programmable control concept, overview of system structure of controllers, Input/Output (I/O), programming languages, instructions and technique, programming software and applications of controllers such as Programmable Logic Controller (PLC). 9. <u>Integrated Building Systems (36 hours)</u> 9.1. Basic concepts and application methods for integrated building system. 9.2. Lighting control systems; dimming functions, blind / shutter controls, light-scene controls. 9.3. Heating/Cooling HVAC system control scheme. 9.4. PID control function loops; BMS control system for industrial applications. 9.5. Building system project planning for realistic work applications; On-line and Off-line program integration test; Fault monitoring and reporting systems.
Teaching/ Learning Methodology	The teaching and learning methods include lectures, workshop tutorials, and practical works. The lectures aim at providing students with an overall and concrete background knowledge required for understanding key issues in engineering communication, use of standard engineering components and systems, and importance of industrial safety. The workshop tutorials aim at enhancing students' in-depth knowledge and ability in applying the knowledge and skills to complete specific tasks. The practical works aim at facilitating students to review the diverse topics covered in this course and perform active learning with research, practice, questioning, and problem solving in a unified activity.

Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed							
		1	2	3	4	5	6	7	8
Continuous Assessment									
• Assignment / Project	50%	✓	✓	✓	✓	✓		✓	✓
• Tests	24%	✓	✓	✓	✓	✓		✓	✓
• Reports & Logbook	26%	✓	✓	✓	✓	✓	✓	✓	✓
Total	100%								

Specific Assessment Methods/ Task	Remarks
Assignment / Project	The projects are designed to facilitate students to reflect and apply the knowledge periodically throughout the training.
Tests	Tests are designed to facilitate students to review the breadth and depth of their understanding on specific topics.
Others (Reports & Logbook)	Report writing is designed to facilitate students to acquire deep understanding on the topics of the training and to present those concepts clearly.

Student Study Effort Expected

Class contact (Time-tabled)	
• Lecture/Tutorial	10 Hours
• Workshop	140 Hours
Other student study effort	0 Hour
Total student study effort	150 Hours

Reading List and References

Reference Software List:

1. SolidWorks from Assault Systemes
2. PADS from Mentor Graphics Inc.
3. LabVIEW from National Instrument
4. CubeMX from STM Electronics
5. uVision IDE from ARM KEIL

Reference Standards and Handbooks:

6. IEEE Standard 315 / ANSI Y32.2 / CSA Z99 Graphic Symbols for Electrical and Electronics Diagrams
7. IEC 61082 Preparation of Documents used in Electrotechnology
8. IPC-D-279-1996, Design Guidelines for Reliable Surface Mount Technology Printed Board Assemblies, IPC.
9. IPC-J-STD-001F-2014, Requirements for Soldered Electrical and Electronic Assemblies, IPC.
10. IPC-A-610F-2014, Acceptability of Electronic Assemblies, IPC.

Reference Books:

11. R.S. Villanucci, A.W. Avtgis, W.F. Megow, *Electronic Techniques: Shop Practices and Construction*, 7th ed., Practice-Hall, 2002.
12. Training material, manual and articles published by Industrial Centre

	13. D. Shetty, R. Kolk, "Mechatronics System Design", PWS Publishing Company, 1997 14. EMSD, Code of Practice for the Electricity (Wiring) regulations, 2003 Edition.
Last Updated	July 2022
Prepared by	Industrial Centre

Subject Description Form

Subject Code	EIE2903/IC2141
Subject Title	Internet and Multimedia Product Development
Credit Value	5 Training Credits
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject provides to students hands-on practical training with a focus on Internet and multimedia product development. This subject also trains students on the use of scientific computing software.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. Design simple Internet and multimedia applications for experimentation and demonstrations; 2. Build simple product prototypes using contemporary microcomputer platforms; 3. Apply troubleshooting techniques and tools in product and system development; and 4. Apply scientific computation software to solve engineering problems
Subject Synopsis/ Indicative Syllabus	1 <u>Microcomputer Applications and Practice for Internet & Multimedia</u> 1.1 Introduction to Microcomputer systems and development tools 1.2 Knowledge on the corresponding operating system and its operation 1.3 Basic hardware concepts and practice: Input/output ports, peripherals, system design and testing 1.4 Hands-on practice on controlling the peripherals 1.5 Hands-on practice on typical sensor applications 2 <u>Advanced System Applications and Practice for Internet & Multimedia</u> 2.1 Introduction to contemporary IMT systems, related devices, tools and implementation 2.2 Basic database application and practice 2.3 Introduction to web application development tools 2.4 Web application practice 2.5 Basic graphics practice and introduction to Pygame 2.6 Hands-on practice on simple game development 3 <u>Application of Computing Tool</u> 3.1 Introduction to Python; interactive calculations and basic operations with basic data type; mathematical operations, matrix and array operations, data analysis and curve fitting; 3.2 Use of functions and popular Python packages, such as Numpy, Panda and Matplotlib; 3.3 Python script programming & debugging; logic operations & flow control; data visualization by using graphics packages; 3.4 Data manipulation and data science operations with Panda 4 <u>Project with Internet and Multimedia Application</u> 4.1 Project management techniques 4.2 System integration involving IOT, edge computing, web applications, data visualization, analysis and manipulation.

Learning Methodology	The teaching and learning methods include lectures, practical workshop tutorials, and group project. The lectures aim at providing students with background knowledge required for understanding key concepts in programming languages, use of microcomputer development systems and tools. The practical workshop tutorials aim at reinforcing students' knowledge and developing their ability in applying the knowledge and skills to complete specific tasks. Group project aims at facilitating students to review the diverse topics covered in this subject and perform active learning with research, practice, questioning, and problem solving in a unified activity. In addition, students should be able to cultivate their personal quality, creativity, management skills and leadership in teamwork collaborations.
Assessment Methods in Alignment with Intended Learning Outcomes	(see table below)

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed			
		1	2	3	4
1. Assignment	45%	✓	✓	✓	✓
2. Report	37%	✓	✓	✓	
3. Product performance	18%	✓	✓	✓	
Total	100%				

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

1. Assignment is to facilitate students to apply the skills and knowledge periodically throughout the training.
2. Report writing is to facilitate students to acquire deep understanding on the topics of the training, to present those concepts clearly, and to do reflection on achievement of learning outcomes.
3. Product performance is to review the completeness and quality of the product constructed by students.

Student Study Effort Expected

Class contact:

▪ Mini-Lecture	16 Hours
▪ Workshop Practices	134 Hours
Total student study effort:	**150 Hours**

Reading List and References

Reference Reading List:

1. Gareth Halfaceree, (2018). The Official Raspberry Pi Beginner's Guide, Raspberry Press
2. Samarth Shah, (2015). Learning Raspberry Pi, Packt Publishing
3. Andrea Chiarelli, (2018). Beginning React, Packt Publishing
4. *Padmanabhan, T. (2016). Programming with Python. Singapore: Springer.
5. McKinney, W. (2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython (Second ed.). Sebastopol, CA: O'Reilly.

Last Updated	Jun 2021
Prepared by	Industrial Centre

Subject Description Form

Subject Code	ENG2002
Subject Title	Computer Programming
Credit Value	3
Level	2
Pre-requisite/Co-requisite/Exclusion	Nil
Objectives	1. To introduce the fundamental concepts of computer programming. 2. To equip students with solid skills in Python programming. 3. To equip students with techniques for developing structured and object-oriented computer programs. 4. To demonstrate the techniques for implementing engineering applications using computer programs.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. Familiarize themselves with at least one Python programming environment. 2. Be proficient in using the basic constructs of Python to develop a computer program. 3. Develop a structured and documented computer program. 4. Understand the fundamentals of object-oriented programming and be able to apply it in computer program development. 5. Apply computer programming techniques to solve practical engineering problems.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. **Introduction to Programming** Components of a computer; Data representation in computers; Programming environment; Process of application development. 2. **Bolts and Nuts of Python** Data types; Variables and constants; Operators, expressions, and statements; Basic syntax; Functions and modules; Python IDE; Editing, saving, and running a script; Python modules; Absolute and relative import. 3. **Program Flow Control and Functions** Branching and looping; Iterators; Scope of variables; Python functions; static functions; Lambda function; Position arguments and default arguments; args and kwargs; Interface with command line; argparse 4. **Program Design and Debugging** Structured program design; Testing and debugging a program; Exception and assertion. 5. **Strings and File I/O** String encoding format; F-string; Unicode; String operations; String and number conversion; File and directory manipulations; The “os”, “sys”, and “shutil” modules; Reading/writing text and numbers from/to a file. 6. **Tuples, Lists, and Dictionaries** Basic tuple and list operations; Searching and sorting lists; Dictionary literals; Basic dictionary operations; Built-in tuple/list/dictionary methods and functions; Use of enumerate and zip 7. **Basic Object-Oriented Programming** Objects and classes; Attributes and methods; Inheritance and polymorphism; Special methods and operator overloading.

	8. **Data Analytics with Python Libraries** Introduction to NumPy, Pandas, and Matplotlib; NumPy arrays, built-in methods, and mathematical operations; Reading/writing data files using Pandas; Pandas operations and functions; Data visualization with Matplotlib; OpenCV-Python for computer vision; Scikit-learn for machine learning

Teaching/Learning Methodology

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
1. In-class exercises and homework	15%	✓	✓	✓	✓	
2. Short-quizzes	10%		✓	✓	✓	
3. Programming tests	30%	✓	✓	✓	✓	✓
4. Assignment	25%	✓	✓	✓	✓	✓

	5. Final examination	20%	✓	✓	✓	✓	✓
	Total	100%					

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

The short-quizzes are for assessing the understanding of fundamental concepts. The in-class exercises and homework are conducted to help students familiarized with the programming language and skills. The programming tests are for assessing the ability of students on solving computer problems through programming within a specified period. Through doing assignments, students will be able to experience how to solve engineering problems and design solutions by using a systematic approach. The final examination is for assessing the students' ability on using the programming language and analysing computer programs.

Student Study Effort Expected	**Class contact:**	
	• Lectures, Tests and Quizzes	26 Hours
	• Laboratory/Tutorial	13 Hours
	Other student study effort:	
	• Self-studying	57 Hours
	• Homework	12 Hours
	Total student study effort:	**108 Hours**
Reading List and References	**Reference Books:** 1. G. v. Rossum and the Python development team, *Python Tutorial Release 3.10.0*, Nov. 2021. 2. C. Hill, *Learning Scientific Programming with Python*, 2nd ed., Cambridge University Press, Cambridge, UK, 2020. 3. Z. A. Shaw, *Learning Python 3 the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code,* Addison-Wesley Professional, Boston, MA, USA, 2017. 4. E. Matthes, *Python Crash Course: A Hands-On, Project-Based Introduction to Programming,* 2nd ed, No Starch Press, San Francisco, CA, USA, May 2019.	
Last Updated	July 2022	
Prepared by	FENG	

Subject Description Form

Subject Code	ENG2003
Subject Title	Information Technology
Credit Value	3
Level	2
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	To provide the foundation knowledge in internet applications, computer networks, and database management that is essential to modern information system design
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the functions and features of modern computing systems. 2. Understand the client-server architecture and be able to set up multiple internet applications. 3. Understand the principles of computer networks and be able to set up simple computer networks. 4. Understand the basic structure of a database system and be able to set up a simple database system. Category B: Attributes for all-roundedness 5. Solve problems using systematic approaches.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction to computers Introduction to information technology using Internet of Things as a real life example. Introduction to modern computing systems. 2. Computer Networks Introduction to computer networks (Client-Server Architecture). Study different internet applications (HTTP/FTP/DNS). Explain basic concepts on packet routing (Data Encapsulation/IP Addressing/Functions of Routers). Introduction to basic network security measures. 3. Introduction to data processing and information systems Database systems – architecture, relational database concept, structural query language (SQL), database management systems, Web and database linking, database application development. Introduction to Information systems. Workflow management. Case study: Database design, implementation and management.
Teaching/Learning Methodology	There will be a mix of lectures, tutorials, and laboratory sessions/workshops to facilitate effective learning. Students will be given case studies to understand and practice the usage of modern information systems.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Quizzes (in tutorials)	3%	√	√	√		√
2. Quizzes (in lectures)	14%	√	√	√	√	√
3. Workshops	14%	√	√	√	√	√
4. Mid-term Test	11%	√	√	√		√
5. Assignment	8%				√	√
6. Examination	50%	√	√	√	√	√
Total	100 %					

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

The assessment methods include an end-of-subject 2-hour written examination (total 50%) and other assessment methods (total 50%), including quizzes, a mid-term test, workshops, and an assignment, which cover intended subject learning outcomes 1, 2, 3, 4, and 5.

Student Study Effort Expected

Class contact:	
• Lectures (18), tutorials (6), and workshops (15)	39 Hours
Other student study effort:	
• Workshops preparation (6/workshop)	30 Hours
• Self study (3/week)	39 Hours
Total student study effort	**108 Hours**

Reading List and References

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

Last Updated	July 2018
Prepared by	Faculty of Engineering

Subject Description Form

Subject Code	AF3625
Subject Title	Engineering Economics
Credit Value	3
Level	3
Exclusion	AF2618
Objectives	This subject aims to equip students with 1. The fundamental concepts of micro- and macroeconomics related to the engineering industry; 2. The fundamental understanding of finance and costing for engineering operations, budgetary planning and control.
Intended Subject Learning Outcomes	**Upon successful completion of this subject, students will be able to:** 1. Understand how the relevant economic factors shape the environment within which an engineering company operates; 2. Evaluate the financial condition of a company; 3. Apply the basic cost accounting techniques in the planning and control of engineering and production activities.
Subject Synopsis/ Indicative Syllabus	<u>Economic Environment of a Firm</u> **Microeconomic Factors** Scarcity, choice and opportunity cost; Demand, supply and price; Profit-maximizing behavior of the firm; Organization of industry: perfect competition and monopoly **Macroeconomic Factors** International trade and globalization <u>Engineering Economics</u> Return on investment; Accounting profit versus economic profit <u>Fundamentals of Budgetary Planning and Control</u> 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	See table below

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)		
		1	**2**	**3**
Continuous Assessment	50%			
1. In-class activities	15%	√	√	√
2. Written assignments	15%	√	√	√
3. Test	20%	√	√	√
Final Examination	50%	√	√	√
Total	100 %			

Student Study Effort Required		
	Class contact:	
	• Lecture	26 Hours
	• Tutorial	13 Hours
	Other student study effort:	
	• Study and self-learning	48 Hours
	• Presentation preparation and written assignments	18 Hours
	Total student study effort:	**105 Hours**

Reading List and References

Recommended Textbooks

1. Parkin and Bade, *Foundations of Microeconomics*, 8th ed., Pearson, 2018.
2. Sullivan, Wicks and Koelling, *Engineering Economy,* 17th ed., Pearson, 2019.

References

1. Robert H. Frank, *The Economic Naturalist: Why Economics Explains Almost Everything?,* Basic Books, 2011.

Last Updated	July 2022
Prepared by	School of Accounting and Finance

Subject Description Form

Subject Code	CLC3241P (2019-20 onward) / CBS3241P (2018-19 and before)
Subject Title	Professional Communication in Chinese
Credit Value	2
Level	3
Pre-requisite / Co-requisite	Chinese LCR subjects (in Semester 2 of Year 3 or Semester 1 of Year 4)
Objectives	This subject aims to develop the language competence for professional communication in Chinese required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals and reports.
Intended Subject Learning Outcomes	**Upon completion of the subject, and in relation to effective communication with a variety of intended readers/audiences in Chinese, students will be able to:** 1 Plan, organise and produce professionally acceptable project proposals and reports with appropriate text structures and language for different intended readers. 2 Plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences. 3 Adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences.
Subject Synopsis/ Indicative Syllabus	1. Project proposals and reports in Chinese • Planning and organising project proposals and reports • Explaining the background, rationale, objectives, scope and significance of a project • Referring to the literature to substantiate project proposals • Describing the methods of study • Describing and discussing project results, including anticipated results and results of pilot study • Presenting the budget, schedule and/or method of evaluation • Writing executive summaries./abstracts 2. Oral presentations of projects • Selecting content for audience-focused presentations • Choosing language and style appropriate to the intended audience • Using appropriate transitions and maintaining coherence in team presentations • Using effective verbal and non-verbal interactive strategies
Teaching/Learning Methodology	Learning and teaching approach The subject is designed to develop the students' Chinese language skills, both oral and written, that students need to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects. The study approach is primarily seminar-based. Seminar activities include instructor input as well as individual and group work, involving drafting and evaluating texts, mini-presentations, discussions and simulations. The learning and teaching activities in the subject will focus on a course-long project which will engage students in proposing and reporting on an engineering-

related project to different intended readers/audiences. During the course, students will be involved in:

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

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)		
		1	2	3
1. Project proposal in Chinese	60%	✓		✓
2. Oral presentation of project proposal	40%		✓	✓
Total	100%			

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

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.

Student Study Effort Expected

Class contact:	
• Seminars	26 Hours
Other student study effort:	
• Researching, planning, writing, and preparing the project	44 Hours
Total student study effort:	**70 Hours**

Reading List and References

1. 司有和 (1984) ：《科技寫作簡明教程》，安徽教育出版社。
2. 葉聖陶、呂叔湘、 朱德熙、 林燾 (1992)：《文章講評》 語文出版社。
3. 于成鯤主編（2003）：《現代應用文》，復旦大學出版社。
4. 岑紹基、謝錫金、祈永華 (2006) ：《應用文的語言· 語境· 語用》，香港教育圖書公司。
5. 邵敬敏主編 (2010) ：《現代漢語通論 (第二版)》，上海教育出版社。
6. 于成鯤、陳瑞端、秦扶一、金振邦主編 (2010)：《中國現代應用文寫作規範叢書：科教文與社交文書寫作規範》，復旦大學出版社。
7. 香港特別行政區政府教育局· 課程發展處中國語文教育組 (2012) ：《常用字字形表》，政府物流服務署印。

Last Updated	May 2019
Prepared by	Chinese Language Centre

Subject Description Form

Subject Code	COMP3334
Subject Title	Computer Systems Security
Credit Value	3
Level	3
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: Basic understanding of modern operating systems is preferred
Objectives	To equip students with a foundational understanding of the threats to computer systems. Students will be equipped to: 1. understand the practical principles and models for protecting computer systems from various forms of attacks; 2. understand the major security issues and problems in computer systems, and the countermeasures to mitigate the corresponding attacks; and 3. acquire practical skills in using various tools and resources to analyse the security of computer systems, particularly the web systems.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. understand the major security threats to computer systems and software, and the countermeasures to mitigate the corresponding attacks; 2. understand the major security threats to web systems and the countermeasures to mitigate the corresponding attacks; 3. understand and apply basic cryptographic techniques to secure information of computer systems; Category B: Attributes for all-roundedness 4. combine various security mechanisms to address the security requirements of computer systems; and 5. realise potential threats of new systems and the state-of-the-art technologies for protecting computer systems.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Overview** Security goals and policies, types of attacks, threat models. **2. Cryptography** Classical cryptography, modern symmetric cryptography, public-key cryptography, and steganography. **3. Authentication** Password systems, one-time passwords, strong password protocols, and password authentication protocols, key agreement protocols. **4. Software exploits and countermeasures** Buffer overflow, memory protection and corruption, principles of secure coding, code audit and review, malicious codes, rootkits, malwares, and browser security. **5. Web security**

	Input validation, SQL injection, cross-site scripting, cross-site request forgery, unvalidated redirects and forwards. **6. Case study & Advanced topics** Blockchain, Merkle tree, blind signatures, ring signatures, and zero knowledge proof, etc. Workshops: A series of workshops will be given to let students acquire practical experience on the different topics.
Teaching/ Learning Methodology	The course will emphasise on both the principles and practices of computer system security. The principles will be covered mainly through the lectures and problem-solving activities in the tutorials, whereas the practice aspects will be taught through a series of workshops which are designed to reinforce what has been taught in the lectures and to help students acquire practical skills and group projects.
Assessment Methods in Alignment with Intended Learning Outcomes	(see table below)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	**2**	**3**	**4**	**5**
Continuous Assessment	**60%**					
1. Assignments	25%	✓	✓	✓		✓
2. Workshops	10%				✓	
3. Project	25%				✓	✓
Examination	**40%**	✓	✓	✓		✓
Total	100%					

The examination and assignments are designed to evaluate the students' understanding on the principles undergirding the web and software security. The workshops, on the other hand, are designed to evaluate the students' practical skills on solving computer system security problems.

Student Study Effort Expected		
	Class contact:	
	▪ Lectures	39 Hours
	▪ Tutorials/Workshops	0 Hour
	Other student study effort:	
	▪ Self-study (average 6 hours per week)	66 Hours
	Total student study effort	105 Hours

Reading List and References	**Textbooks:** 1. Bishop, Matt, *Introduction to Computer Security*, Addison Wesley, 2005. **Reference Books:** 1. W. Stallings, Cryptography and Network Security: Principles and Practice, 7th ed., Pearson 2017. 2. W. Du, Computer & Internet Security: A Hands-on Approach, 2nd ed., Wenliang Du 2019. 3. D. A. Tevault, Mastering Linux Security and Hardening: Protect your Linux systems from intruders, malware attacks, and other cyber threats, 2nd ed., Packt Publishing 2020. 4. R. Anderson, Security Engineering: A Guide to Building Dependable Distributed Systems, 3rd ed., Wiley 2020. 5. G. Hoglund and G. McGraw, *Exploiting Software*, Addison Wesley, 2004.
Last Updated	July 2022
Prepared by	COMP

Subject Description Form

Subject Code	COMP3335
Subject Title	Database Security
Credit Value	3
Level	3
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP2411 or equivalent introductory database subject
Objectives	The objectives of this subject are to: 1. introduce to students about security threats with respect to database applications; 2. equip students with knowledge of security measures and understanding on the concepts in protecting data; and 3. equip students with skills to design and implement secure database applications with respect to the security requirements.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: <u>Category A: Professional/academic knowledge and skills</u> 1. identify security threats in database systems; 2. understand the concepts and security mechanisms in the protection of data; 3. design and implement secure database systems; <u>Category B: Attributes for all-roundedness</u> 4. develop skills in problem-solving; and 5. solve complex problems in team and function effectively in a team environment to achieve a common goal.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Overview of Database Concepts** Common database technologies and database application architectures, including ER modelling and existing relational database management systems such as MySQL and Oracle; advanced database technologies, including object-oriented databases and distributed databases. **2. Introduction to Database Security** Threats to databases; commonly accepted security goals (integrity, availability and confidentiality); kinds of security control measures. **3. Access Control** Database authorisation, including discretionary security mechanisms and mandatory security mechanisms. **4. File System Security** FAT, NTFS, HFS, disk encryption. **5. Inference Control** Nature of statistical database and the inference control mechanism to prevent detailed confidential information. **6. Advanced Topics** Including security threats with respect to SQL injection attacks, virtual private databases and database auditing, searchable encryption, blockchain and decentralised storage.
Teaching/ Learning Methodology	During the lectures, students will come across the common concepts and theories in database security issues. Those concepts and theories would be explained with reference to real database systems such as Oracle and MySQL. Hands-on exercises in tutorial/laboratory will be included to allow students to explore and analyse practical problems and topics. Group project to solve database security problems will help students to integrate and apply what they have learnt.

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

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	**55%**	✓	✓	✓	✓	✓
Examination	**45%**	✓	✓	✓	✓	
Total	100%					

Types of assessments include assignments, project, test and examination. Assignments are designed to reinforce the concepts and mechanisms learned in the lecture and laboratory, by solving bigger problems. Project is used to develop students' analytic and problem-solving skills by developing a practical database security policy. Test and examination are used to assess independent problem solving and critical thinking skills.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>

Class contact:	
▪ Lecture	39 Hours
Other student study effort:	
▪ Assignments, Projects, Self-study, Test and Exam Preparation	66 Hours
Total student study effort	105 Hours
</td></tr>
<tr><td>Reading List and References</td><td>

Reference Books:

1. Vinicius M. Grippa and Sergey Kuzmichev, Learning MySQL (2nd Edition), O'Reilly Media, Inc., 2021
2. Ettore Galluccio, Edoardo Caselli, Gabriele Lombari, SQL Injection Strategies, 2020
3. Afyouni, Hassan A., *Database Security and Auditing: Protecting Data Integrity and Accessibility*, Course Technology, ISBN 0619215593, 2006.
4. Basta, Alfred and Zgola, Melissa, *Database Security*, Cengage Learning, ISBN 1435453905, 2011.
</td></tr>
<tr><td>Last Updated</td><td>Jun 2022</td></tr>
<tr><td>Prepared by</td><td>COMP</td></tr>
</table>

Subject Description Form

Subject Code	COMP3421
Subject Title	Web Application Design and Development
Credit Value	3
Level	3
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP1011
Objectives	The objectives of this subject are to: 1. highlight the impact of Web in facilitating a truly distributed, wide area and highly accessible computing environment; 2. equip students with the ability to analyse, design and implement techniques required to develop for the Web and Internet based business applications; and 3. review state-of-the-art technologies such as distributed client/server computing paradigm, middleware concepts and architecture, web-based client/server computing technologies, XML, wireless and intelligent Internet computing.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. differentiate different components of distributed client/server on Web and Internet computing; 2. utilise the specialised concepts of Web services and related technologies in various Web development tasks; 3. show in-depth understanding of client-side as well as server programming with related Web development tools, such as Ajax and GoogleApps; 4. design, develop and implement innovative interactive Web applications; 5. differentiate different components of XML and its related standards and technologies; 6. understand latest and future Web technology, including wireless and intelligent Internet computing; Category B: Attributes for all-roundedness 7. communicate effectively in project / system presentation and technical documents / reports; 8. demonstrate independent learning skills and apply new knowledge to solve non-routine technical problems; 9. accept responsibility and accountability for determining and achieving personal and group outcomes while exhibiting leadership in a project team; and 10. demonstrate critical thinking and creative mind in applying different computing technologies to interactive Web applications.

Subject Synopsis/ Indicative Syllabus

Topic
1. Introduction to Distributed Client/Server Web and Internet Computing Client/server evolution and its relation to Internet computing; overview of Internet services including file servers, database servers, transaction servers, web servers; concepts of two-tier versus three-tier architectures; network infrastructure and support for Web computing.
2. Web-Based Client/Server Computing Revolution of Web as the intergalactic client/server Internet computing platform; web model. Web protocols and hypertext technology; HTTP data representation and response; interactive Web-based client/server; Web programming such as JavaScript, ASP, Java Servlets; Servlet, PHP, JSP and others.
3. Extensible Markup Language (XML) XML introduction: XML data modelling such as DTD and XML Schema; XML related standards, DOM and SAX; XML data management: Querying XML data, XML data storage, and related XML tools and API, such as Ajax and GoogleAPI.
4. Latest and Future Web Computing Recent advancement of Web technologies, Web 2.0 and Web 3.0; Introduction to wireless Internet; wireless Internet applications; intelligent Internet computing using agent technology.

Teaching/ Learning Methodology

This subject emphasises the design and technical aspects of web application development. It is intended to equip the student with knowledge and practical experience on how to complete a web-based application.

The lectures will be used to deliver course material that will be practised/reinforced during the labs and tutorials.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed									
		1	2	3	4	5	6	7	8	9	10
Continuous Assessment	**55%**										
1. Assignments, Tests & Projects		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Examination	**45%**	✓	✓				✓		✓		
Total	100 %										

Student Study Effort Expected

Class contact:	
▪ Lectures	26 Hours
▪ Tutorials/Lab	13 Hours
Other student study effort:	
▪ Assignments, Tests, Projects, Exams	80 Hours
Total student study effort	119 Hours

Reading List and References

Reference Books:

1. Duckett, Jon, *Web Design with HTML, CSS, JavaScript and jQuery Set*, Wiley, 2014.

	2. Myers, Mark, *A Smarter Way to Learn JavaScript: The new approach that uses technology to cut your effort in half*, Kindle Edition, 2013. 3. Deitel, Paul J., *Internet & World Wide Web: How to Program*, 4th Edition, Deitel & Associates Inc., Prentice Hall, 2008. 4. Godbole, Achyut S. and Kahate, Atul, *Web Technologies: TCP/IP Architecture, and Java Programming*, McGraw-Hill, 2009. 5. Welling, Luke and Thomson, Laura, *PHP and MySQL Web Development*, Addison-Wesley, 2008. 6. Steelman, Andrea and Murach, Joel, *Murach's Java Servlets and JSP*, Mike Murach & Associates, 2010.
Last Updated	Jun 2022
Prepared by	COMP

Subject Description Form

Subject Code	COMP3438
Subject Title	System Programming
Credit Value	3
Level	3
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP2432
Objectives	The objectives of this subject are to: 1. introduce students the concepts and principles of system programming and to enable them to understand the duties and scope of a system programmer; 2. provide students the knowledge about both theoretical and practical aspects of system programming, teaching them the methods and techniques for designing and implementing system-level programs; and 3. train students in developing skills for writing system software with the aid of sophisticated OS services, programming languages and utility tools.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. organise the functionalities and components of a computer system into different layers, and have a good understanding of the role of system programming and the scope of duties and tasks of a system programmer; 2. grasp the concepts and principles, and be familiar with the approaches and methods of developing system-level software (e.g., compiler, and networking software); 3. apply the knowledge and techniques learnt to develop solutions to real-world problems; 4. select and make use of the OS kernel functions and their APIs, standard programming languages, and utility tools; 5. organise and manage software built for deployment and demonstration; and Category B: Attributes for all-roundedness 6. analyse requirements and solve problems using systematic planning and development approaches.

Subject Synopsis/ Indicative Syllabus	**Topic** **1. Introduction to System Programming and Unix** Layered structure of a computer system; system software and application software; scope and tasks of system programming. Evolution of UNIX; features of UNIX; UNIX standards; good style of UNIX programming. **2. Introduction to UNIX Systems** Files; types of UNIX files; UNIX file system; structure and representation of files in UNIX file system; directories; accessing files in UNIX; I/O redirection; devices and device drivers; UNIX file interface (APIs). UNIX shell; UNIX process creations and execution; process management; parent and child processes; UNIX process interfaces (APIs). **3. Introduction to Unix Device Driver** Device Drivers; design issues; types of device drivers; major components of a device driver. **4. Device Driver Development** OS/Driver interface; internal operations of a device driver; structure and major components; address spaces and data transfer; typical character/block driver design and implementation. **5. Overview of Compiler Construction** Syntax and semantics of programming languages; language translation approaches; tasks of a compiler; the compiler process. **6. Lexical Analysis** Tasks of lexical analysis; specifying tokens by regular grammars and regular expressions; recognizing tokens by Finite Automata (FA); construction of FA from regular expressions; converting NFA to DFA; simulating DFA. **7. Syntax Analysis** Tasks of syntax analysis; specifying language constructs by context-free grammars; BNF; derivation; parse and syntax trees; recognizing language constructs by Pushdown Automata; top-down and bottom-up parsing methods. **8. Code Generation** Intermediate compilation phases; symbol table; intermediate code generation; code optimisation; code generation. Tutorials: 3 hours Laboratory Experiment: **Topic** 1. UNIX System and C Programming 2. UNIX Programming (processes, files, device drivers)
Teaching/ Learning Methodology	In lectures, concepts, models and algorithms will be explained with illustrative examples. Tutorials and lab sessions help students understand concepts and improve their skills on solving problems. Assignments help develop students' programming skills and critical thinking.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		1	2	3	4	5	6
Continuous Assessment	**55%**						
1. Assignments	35%	✓	✓	✓	✓	✓	✓
2. Mid-Term	20%	✓	✓	✓			✓
Examination	**45%**	✓	✓	✓	✓		✓
Total	100%						

	All three items are appropriate to evaluate the intended learning outcomes. Assignments are used to evaluate writing skills, critical thinking, and problem solving. Mid-term test and final examination can further help evaluate the related outcomes.	
Student Study Effort Expected	**Class contact:**	
	▪ Lecture and Tutorial	39 Hours
	▪ Lab	13 Hours
	Other student study effort:	
	▪ Assignments and Self-study	60 Hours
	Total student study effort	112 Hours
Reading List and References	**Textbook:** 1. Aho, A.V., Lam, Monica S., Sethi, R. and Ullman, J.D., C*ompilers: Principles, Techniques, and Tools*, 2nd Edition, Addison-Wesley, 2006. 2. Molay, B., *Understanding Unix/Linux Programming*, Pearson Education, 2003. **Reference Books:** 1. Stevens, W. R. and Rago, S. A., *Advanced Programming in the UNIX Environment*, 2nd Edition, Addison-Wesley, 2005. 2. Appel, A.W., *Modern Compiler Implementation in Java*, Foundation Books, 2007. 3. Beck, L.L., *System Software: an Introduction to System programming*, 3rd Edition, Addison Wesley, 1996. 4. Cooper, K. and Torczon, L., *Engineering a Compiler*, Morgan Kaufmann, 2003. 5. Cooperstein, J., *Writing Linux Device Drivers: a guide with exercises,* CreateSpace, 2009. 6. Corbet, J., Rubini, A., and Kroah-Hartman, G., *Linux Device Drivers*, 3rd Edition, O'Reilly, 2005.	
Last Updated	July 2021	
Prepared by	COMP	

Subject Description Form

Subject Code	COMP3512
Subject Title	Legal Aspects, Professionalism and Ethics of Computing
Credit Value	3
Level	3
Pre-requisite / Co-requisite / Exclusion	
Objectives	The objectives of this subject are to: 1. be fully aware of the basic set of legal, ethical and security responsibilities; 2. introduce relevant professional bodies and be able to apply codes of conduct and ethical standards as a computing/IT practitioner; and 3. be in a position to deal with ethical dilemmas and legal challenges that they can expect to face when they start work.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. demonstrate a basic understanding of professional issues, including contemporary legislation, and ethical considerations, from the viewpoint of computing/IT professionals; 2. apply the conceptual tools provided in the course to develop analytical skills for determining what to do in ethical and legal decision-making; Category B: Attributes for all-roundedness 3. communicate effectively both verbally and in writing as a professional in computing/IT; 4. develop the basic skills to work independently to solve routine problems; and 5. think and reason critically, especially on different issues related to computing/IT professional in society.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Introduction** A brief account of the development of computing/IT industry; exploration of computing technologies whose impact is likely to grow in the near future. **2. Computer Ethics and Profession** Generic skills; typical scenarios of profession; characteristics of a profession; the system of professions; the computing profession; social issues. **3. Professional Bodies and Codes of Ethics** Role and functions of professional bodies; professional bodies for computing/IT practitioners; Impact of computing/IT professional bodies. **4. Methods and Tools for Ethical Analysis** Traditional/philosophical ethics; policy vacuum; social context; competing factors in decision making; practical approach/ analysis; sample cases. **5. Computer Crimes and Laws** Computer criminals; computer fraud; computer sabotage; computer forensics. **6. Privacy** Personal privacy; computer and privacy; relevant privacy acts. **7. Software Ownership and Intellectual Property** Ethical/legal issues of software; intellectual property; property rights; legal protection; philosophical basis; consequentialist argument. **8. Security** Fundamental concepts about security, Security at e-commerce, Security and legislation.

	9. Entrepreneurship Emerging technologies; entrepreneurship in computing profession; professional capabilities extended through virtual firms.
Teaching/ Learning Methodology	This subject emphasises both ethical and legal aspects of computing/IT professional. It is intended to provide students with knowledge and practical experience on ethical, technological and legal issues related to computing. Lectures would cover the conceptual aspects. Guest lectures with external speakers provide students with knowledge from another perspective. Laboratory and tutorial sessions focus on the exercises to gain understanding both of what being a professional in computing involves and how they can most effectively deal with the challenges they will encounter.
Assessment Methods in Alignment with Intended Learning Outcomes	

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	**100%**					
Assignment		✓	✓	✓	✓	✓
Tests		✓	✓		✓	✓
Projects		✓	✓	✓	✓	✓
Presentations		✓	✓	✓		✓
Examination	**0%**					
Total	100%					

Student Study Effort Expected		
	Class contact:	
	▪ Lectures	39 Hours
	▪ Tutorials/Lab	0 Hours
	Other student study effort:	
	▪ Assignments, Quizzes, Projects, and Tests	66 Hours
	Total student study effort	105 Hours

Reading List and References

Reference Books:

1. Herman T. Tavani, *Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing,* 3rd Edition, Wiley, Hoboken, N.J., 2011.
2. Deborah G. Johnson and Keith W. Miller, *Computer Ethics: Analyzing Information Technology*, 4th Edition, Prentice Hall, Upper Saddle River, N.J, 2009.
3. Tobias Kollmann, Andreas Kuckertz, Christoph Stèockmann (2010) E-Entrepreneurship and ICT Ventures: Strategy, Organization and Technology, Hershey, PA: Business Science Reference. 2010.
4. Thomas N. Duening, Robert D. Hisrich, Michael A. Lechter, *Technology Entrepreneurship: Creating, Capturing, and Protecting Value*, Academic Press, Burlington, MA, 2010.
5. D. G. Johnson, *Computer Ethics*, 4th Edition, Prentice Hall, 2009.
6. M. J. Quinn, *Ethics for the Information Age*, Addison Wesley, 2013.

Last Updated	Jun 2022
Prepared by	COMP

Subject Description Form

Subject Code	EIE3103
Subject Title	Digital Signals and Systems
Credit Value	3
Level	3
Pre-requisite	
Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with basic concepts and techniques for the modelling and analysis of discrete-time signals and systems. 2. To provide students with an analytical foundation for further studies in Communication Engineering and Digital Signal Processing.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the representations and classifications of digital signals and systems. 2. Understand the modelling of linear discrete-time systems. 3. Use different techniques to analyze and design discrete-time systems. 4. Apply software tools to laboratory exercises for experimenting with theories, and to the analysis and design of discrete-time systems. 5. Appreciate the advantages and disadvantages of using the different representations and modelling approaches. Category B: Attributes for all-roundedness 6. Present ideas and findings effectively.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Fourier Representations for Discrete-time Signals Mathematical Description of Discrete-Time Signals. Discrete Fourier Series. Discrete-Time Fourier Transform. Discrete Fourier Transform. Relationship Among Various Fourier Transforms. 2. Discrete-Time Systems Time-Domain Analysis of Discrete-Time Systems. Unit pulse response. Difference Equation Representation. Convolution. 3. System Analysis Frequency Response of LTI Discrete-Time Systems. Concept of Filtering: Lowpass, Bandpass and Highpass Filters. FIR Filters and IIR Filters. Linear and Circular Convolution. FIR Filter Analysis. Filtering Examples to Different Signals. 4. z-Transform Definition and Properties of z-Transform. Inverse z-Transform: Power Series Expansion, Partial-Fraction Expansion. z-Transfer Analysis of LTI Systems. 5. Filter design FIR filter design using windows, FIR design by frequency sampling, etc.

	Laboratory Experiments: 1. Linear Time-Invariant Discrete-time Systems 2. Fourier Analysis of Discrete-time Signals 3. Convolution and Correlation 4. Application of Digital Filters

Teaching/ Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 5	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 5	These are supplementary to lectures; Students will be able to clarify concepts and to gain a deeper understanding of the lecture material; Problems and application examples are given and discussed.
Laboratory sessions	4, 6	Students will make use of the software MATLAB and/or LabView to simulate various theories and visualize the results.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment	50%						
• Laboratory sessions	14%				✓		✓
• Short quizzes	18%	✓	✓	✓		✓	
• Tests	18%	✓	✓	✓		✓	✓
2. Examination	50%	✓	✓	✓		✓	✓
Total	100%						

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

Specific Assessment Methods/Tasks	Remark
Short quizzes	These can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.
Tests and examination	End-of-chapter-type problems are used to evaluate the students' ability in applying concepts and skills learnt in the classroom; Students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem.
Laboratory sessions	Oral examination based on the laboratory exercises will be conducted to evaluate student's technical knowledge and communication skills.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**References:** 1. M.J. Roberts, *Fundamentals of Signals & Systems,* McGraw-Hill, 2008. 2. James H. McClellan, Ronald W. Schafer and Mark A. Yoder, *DSP First: A Multimedia Approach,* Prentice-Hall, 1999.	
Last Updated	January 2018	
Prepared by	Dr Chris Chan	

Subject Description Form

Subject Code	EIE3109
Subject Title	Mobile Systems and Application Development
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	ENG2002 Computer Programming
Objectives	This course aims at providing students with an understanding of the real-time embedded and mobile systems, and the techniques essential to the design and implementation of mobile applications.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the structure of real-time operating systems for modern mobile computer systems. 2. Understand the programming techniques and tools for developing software that is run in modern mobile computer systems 3. Apply the knowledge to develop practical applications for modern real-time mobile computer systems. Category B: Attributes for all-roundedness 4. understand the creative process when designing solutions to a problem
Subject Synopsis/ Indicative Syllabus	1. Introduction Introduction to Embedded Systems – embedded real-time systems, embedded programming and program models, real-time operating system (RTOS). Introduction to Mobile Systems and Mobile Application Development – advancement of mobile devices, comparison of various mobile platforms (iOS, Android, Windows Phone, Blackberry, etc.), application design process. 2. iOS Application Development Introduction to iOS – system architecture, development environment (Xcode), MVC architecture. Introduction to Swift Programming – basic syntax, optional type, dictionary, closure, property observer, computed properties. 3. Android Application Development Introduction to Android OS – development environment (Android Studio), Android application basic (activity, service, content provider, broadcast receiver, intent resolution). User Interface – layout overview, user interface widget, user interface event handling, user notification. Data Storage – shared preference, internal storage, external storage, SQLite, content provider. Networking – Android network overview and management, socket and HTTP, Wi-Fi and Bluetooth, GPS & telephony. Multimedia – voice recording, image capturing, basic drawing & animation.
Teaching/Learning Methodology	Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions and specially designed classroom activities.

	Tutorials: During tutorials, students will work on/discuss some chosen topics in small group. This will help strengthen the knowledge taught in lectures. Laboratory and assignments: During laboratory exercises, students will perform hands-on tasks to practice what they have learned. They will evaluate performance of systems and design solutions to problems. The assignments will help students to review the knowledge taught in class. While lectures and tutorials will help to achieve the professional outcomes, the open-ended questions in laboratory exercises and assignments will provide the chance to students to exercise their creatively in problem solving.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table below)

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment (total: 50%)					
• Homework and assignments	15%	✓	✓	✓	✓
• Tests	15%	✓	✓	✓	
• Laboratory exercises	20%			✓	✓
2. Examination	50%	✓	✓	✓	✓
Total	100%				

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

Assignment, homework and laboratory exercises will require students to apply what they have learnt to solve problems. There will be open-ended questions that allow students to exercise their creativity in making design.

Examination and tests: They assess students' achievement of the learning outcomes more rigorously.

Student Study Effort Expected		
	Class contact (time-tabled):	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References	**Reference Books:** 1. Raj Kamai, Embedded Systems: Architecture, Programming and Design, 3rd ed., McGraw-Hill, 2015. 2. Sahar, Ahmad ; Clayton, Craig, IOS 13 Programming for Beginners: Get Started with Building IOS Apps with Swift 5 and Xcode 11, 4th Edition, Birmingham: Packt Publishing, Limited 2020. 3. Wei-Meng Lee, Beginning Swift programming, John Wiley & Sons 2015. 4. J. F. DiMarzio, Beginning Android programming with Android studio, Fourth edition, Wrox, a Wiley brand 2017. 5. Ted Hagos, Learn Android Studio 3 with Kotlin: Efficient Android App Development, Apress 2018 6. Dmitry Jemerov Svetlana Isakova, Kotlin in action, Manning Publications Co. 2017
Last Updated	June 2020
Prepared by	Mr Ivan Lau

Subject Description Form

Subject Code	EIE3112
Subject Title	Database System
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	**To introduce:** 1. database design, development, and programming 2. advanced database queries and database security 3. data warehousing and data mining
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Database design, development, and programming 2. Advanced database queries and database security. 3. Data warehousing and data mining Category B: Attributes for all-roundedness 4. Communicate effectively
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Database Design and Development 1.1 DBMS systems; Client-server architecture; Database architectures and the web 1.2 SQL: data manipulation; data definition; 1.3 DB Development: DB applications and views; 1.4 Advanced SQL: SQL programming language; stored procedures; functions; triggers; cursors; exception handling 1.5 ER Modelling: ER diagrams; Transforming ER diagrams to relations 1.6 Normalization: Data redundancy and update anomalies; functional dependencies; normalization processes; normal forms 2. Managing Database Environments 2.1 Database Security: Database security best practices; SQL injection; Preventing SQL injection 3. Data Warehouse and Data Mining 3.1 Architectures of data warehouse; applications of data warehouse; data warehouse tools and technologies 3.2 Data warehouse queries; OLTP versus OLAP; 3.3. Data-mining processes; Data representation; 3.4. Classification, regression, and cluster Analysis **Laboratory Experiments** Lab 1: Database Implementation and SQL Lab 2: Advanced SQL Lab 3: Data Mining and Data Analysis
Teaching/Learning Methodology	Lectures: Fundamental principles and key concepts of the subject are delivered to students. Tutorials: Students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed. Students will be given programming exercises and

<table>
<tr><td></td><td>use database development tools to design database.

Laboratory Sessions: Students will do some programming exercises to enhance their understanding on database design and development.</td></tr>
<tr><td>Alignment of Assessment and Intended Subject Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific Assessment Methods/Tasks</th><th rowspan="2">% Weighting</th><th colspan="4">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Continuous Assessment (Total: 50%)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Assignment</td><td>10%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>• Test / quizzes</td><td>20%</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>• Laboratory</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>Total</td><td>100%</td><td></td><td></td><td></td><td></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Short quizzes: These can measure the students’ understanding of the theories and concepts as well as their comprehension of subject materials.

Test & Examination: End-of-chapter-type problems are used to evaluate the students’ ability in applying concepts and skills learnt in the classroom; students need to think critically and to learn independently in order to come up with an appropriate design.

Laboratory: Each student is required to produce a report; the accuracy and presentation of the report will be assessed.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture/Tutorial</td><td>30 Hours</td></tr>
<tr><td>• Laboratory/Practice Classes</td><td>9 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
</table></td></tr>
<tr><td>Reading List and References</td><td>1. Thomas Connolly and Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation, and Management, 6/E, Pearson, 2015.
2. Mark L. Gillenson, Fundamentals of database management systems, Wiley, 2nd ed., Wiley, 2012.
3. I.H. Witten, Data Mining: Practical Machine Learning Tools and Techniques, 3rd ed., Morgan Kaufmann, 2011</td></tr>
<tr><td>Last Updated</td><td>July 2019</td></tr>
<tr><td>Prepared by</td><td>Dr Pauli Lai and Mr Ivan Lau</td></tr>
</table>

Subject Description Form

Subject Code	EIE3117
Subject Title	Integrated Project
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	At a mid-stage of the programme, this subject plays the role of applying knowledge acquired in other subjects in an integrated manner. While the emphasis will be placed on the technical challenges that may encompass system integration, software development and troubleshooting, students will also be given opportunities to face various non-technical difficulties behind the development of information security systems.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Design effective and reliable software programs to achieve the objectives of a project 2. Critically evaluate the different alternatives and strategies when implementing a project 3. Locate and resolve problems in an information security system and the related software <u>Category B: Attributes for all-roundedness</u> 4. Search, self-learn and try untaught solutions 5. Effectively use the limited resource and exercise discipline and time-planning to meet deadlines 6. Present ideas and findings effectively
Subject Synopsis/ Indicative Syllabus	**Syllabus:** The project(s) shall be of software development in nature with defined milestones (or **Subtasks**). The scope to be covered will include information security system design. The project will not be close-ended in nature and will provide ample headroom for the more enthusiastic students to excel. Each **Subtask** will be given a certain period of time to complete. Progress will be measured by functional **Demonstrations**, and one or two written **Progress Reports**. Upon the completion of the project, each student will give a demonstration/presentation of the completed system and submit a **Final Report**. Students are required to individually keep an electronic **Logbook** on the work performed during the entire period. The logbooks are to be evaluated by the supervisor /assessor. At the end of the project, the logbooks will be collected and graded. **Lectures:** Lectures are to be conducted at the beginning of the semester. During these lectures, the instructor shall give clear explanation on the functional and technical requirements, with a schedule for submitting deliverables. Concepts specific to the project(s), which are not yet learnt by the students, are to be covered in these lectures. Concepts behind critical use of tools and equipment will also be strengthened. Copies of supplementary/reference material will be distributed, or, links to on-line material will be provided for self-paced learning. **Guided Laboratory Experiments:**

The project will normally require the students to learn to use specific tools and/or equipment. Laboratory demonstrations and exercises will be arranged in the early weeks. Below are some examples:

1. Use of project-specific development tools, software and hardware.
2. Implementation of the basic framework of the project.
3. Software techniques to optimize the performance of the system.

Self-Paced Work:

Multiple sessions of laboratory will be scheduled to cater for self-paced work in the laboratory, particularly during the second half of the semester. To ensure the students are working in a correct direction, defined milestones are given in the course of their work. Students are required to demonstrate their works at each milestone to show their progress.

Teaching/Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3	Principles and key concepts of the information security platform used in the project are explained to students. Uses of tools are demonstrated. The goals are specified. Various problems to be encountered are explained.
Supervised Laboratory Sessions	1, 2, 3	Students need to learn to use the provided software modules and expand them to accommodate new functionalities.
Extended self-paced laboratory work	1, 2, 3, 4, 5, 6	Students will work to construct an information security system. They need to learn to use the provided software modules and expand them to accommodate new functionalities.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment	100%						
• Lab reports		✓	✓	✓			
• Log book and reports		✓	✓	✓	✓	✓	✓
• Progress and final demonstrations		✓	✓	✓	✓	✓	✓
Total	100%						

Assessment on individual student's ability and contribution will be conducted, according to the attributes detailed below.

INSIGHT	as evidenced by how well the concepts are understood
CREATIVITY	as evidenced by ingenuity and imagination
WORKMANSHIP	as evidenced by how well ideas are implemented and how problems are resolved
DRIVE	as evidenced by initiative, diligence and tenacity
COMMUNICATION	as evidenced by an ability to express ideas clearly and succinctly
MANAGEMENT	as evidenced by how time, manpower and other resources are effectively used

At the completion of each subtask, the student will be asked to give a demonstration to the assessor. Based on the presentation and response to questions addressed to the members, the assessor will rate the contribution, achievement, and performance of each member. Other assessment items include lab reports, logbook, progress report, final demonstration, report and presentation.

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

Specific Assessment Methods/Tasks	**Remark**
Lab reports	To measure the students' understanding of the theories and concepts as well as some practical issues in their subject materials
Progress and final demonstrations	Students need to think critically and creatively in order to come up with good alternate solution for an existing problem. Oral examination on the approach taken will be conducted for each student to evaluate his contribution, technical knowledge and communication skills.
Log book and reports	Each student is required to produce one or two progress reports and a final report. Accuracy and the presentation of the reports will be assessed. Each student needs to explain in the reports the solutions they plan to use or have been used in the project. The reason behind of choosing such solutions should also be exemplified. The students also need to explain how the limited resources are used in the project. Logbooks are assessed to evaluate contributions and the quality of records on the progress.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	12 Hours
	• Laboratory	12 Hours
	• Mini-project / Meetings / Presentation	15 Hours
	Other student study effort:	
	• Revision	12 Hours
	• Additional laboratory work	12 Hours
	• Mini-project work / presentation / report writing	42 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** To be specified by the subject lecturer for each project.	
Last Updated	July 2020	
Prepared by	Dr. Haibo Hu	

Subject Description Form

Subject Code	EIE3123
Subject Title	Dynamic Electronic Systems
Credit Value	3
Level	3
Pre-requisite / Co-requisite / Exclusion	Basic calculus
Objectives	**To enable students to gain knowledge and understanding in the following aspects:** 1. Modelling dynamic electronic systems using Laplace Transform technique. 2. Analysis of the stability, steady-state error, and transient response performances of dynamic electronic systems. 3. Using scientific computing software in control systems design. 4. Application of different feedback compensator design techniques to meet a set of given specifications. 5. Implementation of designed feedback compensator on real electronic systems and verify their performances.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the fundamentals of dynamic electronic systems and the importance of feedback control. 2. Design feedback compensator to meet a set of given specifications and constraints. 3. Use scientific computing software to analyse dynamic electronic systems and solve control problems. 4. Implement feedback compensator on real electronic systems. <u>Category B: Attributes for all-roundedness</u> 5. Communicate effectively. 6. Think critically and creatively. 7. Work with others as a team during practical classes.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Modelling of Dynamic Systems</u> Laplace Transform; transfer functions; examples of modelling dynamic electronic systems. 2. <u>Transient Response</u> Poles and zeros; effect of pole locations; first-order systems; second-order systems; time-domain specifications; effects of zeros and additional poles. 3. <u>Stability</u> Stability of linear time-invariant systems; Routh-Hurwitz stability criterion; Nyquist stability criterion; stability margins. 4. <u>Steady-State Errors</u> Steady-state error for unity feedback systems; system types; static error constants; steady-state error for disturbances; steady-state error for non-unity feedback systems. 5. <u>Design via Root Locus Techniques</u> The root locus concept; properties of root locus; gain adjustment; lag

	compensation; lead compensation; lead-lag compensation. 6. Design via Frequency Response Techniques Frequency response; Bode plots; gain adjustment; lag compensation; lead compensation; lead-lag compensation. 7. Tuning PID Controllers Ziegler-Nichols tuning method; Cohen-Coon tuning method. 8. Digital Control Systems Basic structure of digital control system, z-Transform, discrete transfer function, stability/steady-state error/transient performances of digital control systems, concept of discrete equivalents, digital compensator design in z-plane, implementation of digital compensator. **Laboratory Experiments:** 1. Virtual (software-based) control lab 2. Mini-project
Teaching/Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3, 6	In lectures, students will be introduced to the fundamental knowledge of the subject, and comprehension is strengthened through interactive Q&A. They will be able to explain and generalize knowledge in the analysis and control design of dynamic electronic systems.
Tutorials	1, 2, 3, 5, 6	In tutorials, students will apply the knowledge learned in lectures in analysing the cases and solving the problems given by the tutor. They will analyse the given information, compare and contrast different scenarios and propose solutions or alternatives.
Mini-project (practical works)	1, 2, 3, 4, 5, 6, 7	Students will acquire hands-on skills in using scientific computing software to analyse dynamic electronic systems and design feedback compensator. They will apply the knowledge learned in lectures / tutorials to complete a mini-project on the design and implementation of feedback compensator on real electronic systems.
Take-home assignment	1, 2, 3, 5, 6	By working on take-home assignment, students will develop a firm understanding of the knowledge related to the subject. They will analyse the available information and apply the knowledge learned in solving problem. For some design problems, they will have to synthesize solutions by evaluating different alternatives.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)						
		1	2	3	4	5	6	7
1. Continuous Assessment (total 50%)								
• Take-home assignment	5%	✓	✓	✓		✓	✓	
• Mini-project	35%	✓	✓	✓	✓	✓	✓	✓
• Mid-semester test	10%	✓	✓				✓	
2. Examination	50%	✓	✓				✓	
Total	100 %							

The continuous assessment consists of one take-home assignment, one test, and one mini-project.

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

Specific Assessment Methods/Tasks	Remark
Take-home assignment	One take-home assignment will be given to students to assess their competence level of knowledge and comprehension, ability to analyze given information, ability to apply knowledge and skills in different situations, ability to synthesize structure, and ability to evaluate given data to make judgment. The criteria (i.e. what to be demonstrated) and level (i.e. the extent) of achievement will be graded according to six levels: (A+ and A), Good (B+ and B), Satisfactory (C+ and C), Marginal (D) and Failure (F). These will be made known to students before the assignment is handed out. Feedback about their performance will be given promptly to students to help them improve their learning.
Mini-project (practical works)	Students will be required to complete a mini-project and submit a report. The emphasis is on assessing their ability to use scientific computing tools to analyze dynamic electronic systems and design feedback compensator to meet a given set of specifications, and implement the design on real electronic systems. Expectation and grading criteria are similar to the case of take-home assignment.
Mid-semester test	There will be a mid-semester test to evaluate students' understanding and ability to apply all the key concept. Feedback about their performance will be given promptly to students to help them improve their learning. Expectation and grading criteria are similar to the case of take-home assignment.

<table>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reference Books:

1. Norman S. Nise, Control Systems Engineering, 7th ed., John Wiley and Sons, Inc., 2015.
2. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 13th ed., Pearson, 2016.
3. Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, 8th ed., Pearson, 2019.
4. K. Ogata, Modern Control Engineering, 5th ed., Prentice Hall, 2010.
5. Karl J. Astrom and Richard M. Murray, Feedback Systems: An Introduction for Scientists and Engineers, Princeton University Press, 2008.</td></tr>
<tr><td>Last Updated</td><td colspan="2">Mar 2019</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr K.H. Loo</td></tr>
</table>

Subject Description Form

Subject Code	EIE3124
Subject Title	Fundamentals of Machine Intelligence
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce basic knowledge about various algorithms that forms the foundation of machine intelligence. 2. To develop practical knowledge about machine intelligence.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the foundation knowledge about machine intelligence 2. Apply different techniques of machine intelligence to solve problems <u>Category B: Attributes for all-roundedness</u> 3. Presents ideas and findings effectively
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Introduction to machine intelligence</u> Ideas of machine intelligence; Use of statistics in various phases of machine intelligence including data preparation, model selection, model evaluation, model presentation and prediction. 2. <u>Use of statistics in machine intelligence</u> Descriptive statistics; inferential statistics; Important findings in statistics for machine intelligence such as the Law of Large Numbers and Central Limit Theorem; Hypothesis testing and Significance tests. 3. <u>Parametric estimation</u> Introduction to parametric estimation; classical parametric estimation such as Bayes Theorem, maximum likelihood estimation, maximum a posteriori estimation; Application examples of parametric estimation in machine intelligence including data pre-processing, parametric identification, model generation, validation and selection criteria. Applications of parametric estimation and linear regression techniques. 4. <u>Non-parametric estimation</u> Introduction to basic ideas of non-parametric estimation Introduction to techniques such as k-k-nearest neighbors, artificial neural networks and radial basis functions. Application examples of non-parametric estimation. Laboratory experiments: 1. Lab 1: Use of statistics in machine intelligence 2. Lab 2: Parametric estimation 3. Lab 3: Non-parametric estimation

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

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2	Supplementary to lectures: Students will be able to clarify concepts and to have a deeper understanding of the lecture materials; Problems and applications are given and discussed.
Laboratory sessions / Mini-project	2, 3	Students will evaluate different methods of machine intelligence.

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

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)		
		1	2	3
1. Continuous Assessment (total 40%)				
• Tests	15%	√	√	
• Quizzes	5%	√		
• Laboratory sessions	12%		√	√
• Mini-project	18%		√	√
2. Examination	50%	√	√	
Total	100%			

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

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

Specific Assessment Methods/Tasks	Remark
Quizzes	They can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.
Tests and examination	End-of-chapter-type problems are used to evaluate the students' ability in applying concepts and skills learned in the classroom; Students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem. They need to present their solutions logically and systematically in the tests and the examination.
Laboratory sessions, mini-project	Oral examination will be conducted to evaluate student's technical knowledge and communication skills.

</td></tr>
<tr><td></td><td>Class contact (time-tabled):</td><td></td></tr>
</table>

<table>
<tr><td rowspan="6">Student Study Effort Expected</td><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. Joshi Ameet, “Machine learning and artificial intelligence”, Springer 2020.
2. Jose Unpingco, Python for Probability, Statistics, and Machine Learning, second edition, Springer, 2019.
3. Steven W. Knox and Hoboken NJ, Machine learning: a concise introduction, Wiley 2018.
4. James D. Miller, Statistics for Data Science: leverage the power of statistics for data analysis, classification, regression, machine learning, and neural networks, Packt Publishing, 2017.
5. Pratap Dangeti, Statistics for machine learning: build supervised, unsupervised, and reinforcement learning models using both Python and R, Packt Publishing, 2017.
6. 5. Machine Learning: a Probabilistic Perspective by Kevin Murphy, MIT Press, 2012.</td></tr>
<tr><td>Last Updated</td><td colspan="2">June 2021</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr Bonnie Law</td></tr>
</table>

Subject Description Form

Subject Code	EIE3127
Subject Title	Artificial Intelligence of Things
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Introduction of IoT Foundation Techniques in Artificial Intelligence
Objectives	1. To introduce major application scenarios of artificial intelligence of things (AIoT) and their societal impacts. 2. To introduce AI techniques for AIoT applications. 3. To introduce communication, networking, and computing technologies for AIoT.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand key features of AIoT systems and design principles. 2. Understand AI techniques, cloud/edge computing platforms, and wireless communication and networking techniques for AIoT. 3. Understand key application scenarios of AIoT and their social impacts. <u>Category B: Attributes for all-roundedness</u> 4. Think critically and creatively. 5. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	1. <u>AIoT Basics</u>: Key features of AIoT; Applications of AIoT; Market and ecosystem of AIoT. 2. <u>Communication and Networking for AIoT</u>: Wireless communications and networking for AIoT; Communication standards and protocols for AIoT. 3. <u>Machine Learning for IoT</u>: Introduction of basic machine learning techniques for AIoT. 4. <u>AIoT Devices</u>: Onboard processors; Onboard sensors; Communication modules; AI accelerators. 5. <u>Cloud/edge Computing for AIoT</u>: Cloud computing platforms; edge computing platforms. 6. <u>Techniques for Resource-constrained AIoT Devices</u>: Neural network compression; Edge computing-assisted inference. 7. <u>AIoT application scenarios</u>: Smart City; Industrial automation; Smart health; Internet of Vehicles.

Teaching/Learning Methodology	The basic features of AIoT will be described and explained in lectures. Supporting techniques, including wireless communication and networking, cloud/edge computing, as well as machine learning techniques, will be presented in lectures and tutorials. The application scenarios of AIoT will be introduced in lectures. Tutorial and lab sessions will be conducted to deliver hands-on skills on AIoT applications. The assignments and lab exercises will help students review the knowledge taught in class.

Teaching/Learning Methodology	Intended Subject Learning Outcomes				
	1	2	3	4	5
Lectures / Tutorials /Test	✓	✓	✓	✓	
Laboratory			✓	✓	✓

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Assignments	25%	✓	✓	✓	✓	
2. Test	15%	✓	✓	✓		
3. Laboratory	20%			✓	✓	✓
4. Examination	40%	✓	✓	✓		
Total	100%					

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

Assignments, test, and examination let students review the taught materials, do further reading for deeper learning and apply the learnt materials to solving problems for AIoT systems.

Laboratory requires students to do further reading, search for information, and develop AIoT applications.

Student Study Effort Expected

Class contact (time-tabled):	
• Lectures	27 Hours
• Tutorial/Laboratory	12 Hours
Other student study effort:	
• Lecture: preview/review of notes; assignment; preparation for test/examination	36 Hours
• Tutorial/Laboratory: preview of materials, revision and/or reports writing	30 Hours
Total student study effort:	**105 Hours**

Reading List and References	**Textbook:** 1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos and David Boyle, *From Machine-To-Machine to the Internet of Things: Introduction to a New Age of Intelligence*, Academic Press, 2014. 2. Gurjit Kaur, Pradeep Tomar, and Marcus Tanque, *Artificial Intelligence to Solve Pervasive Internet of Things Issues*, Academic Press, 2020. 3. Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin, *Learning from Data*, AMLBook, 2017. **Reference Materials:** 1. J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of Things (IoT): A vision, architectural elements, and future directions," Future Gener. Comput. Syst., vol. 29, no. 7, pp. 1645–1660, Sep. 2013. 2. A. A. Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, and M. Ayyash, "Internet of Things: A survey on enabling technologies, protocols, and applications," IEEE Commun. Surveys Tuts., vol. 17, no. 4, pp. 2347–2376, 4th Quart., 2015.
Last Updated	June 2021
Prepared by	Dr ZHANG Jun

Subject Description Form

Subject Code	EIE3128
Subject Title	IoT Project
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	ENG2002 Computer Programming EIE2211 Logic Design
Objectives	At a mid-stage of the programme, this subject plays the role of applying knowledge acquired in other subjects in an integrated manner. While the emphasis will be placed on the technical challenges that may encompass system integration, software development and troubleshooting, students will also be given opportunities to face various non-technical difficulties behind the development of Internet-of-Things (IoT) systems.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand technical knowledge specific to IoT systems and applications. 2. Design effective and reliable software programs, and integrate them into hardware platforms to achieve the objectives of a project. 3. Critically evaluate different alternatives and strategies when implementing a project. 4. Locate and resolve practical problems in an IoT system and the related hardware/software. Category B: Attributes for all-roundedness 5. Search, self-learn and try untaught solutions. 6. Exercise discipline and time-planning to meet deadlines. 7. Present ideas and findings effectively. 8. Work with others in a team collaboratively and exercise leadership.
Subject Synopsis/ Indicative Syllabus	**Syllabus / Operation:** The project(s) shall be of software development and system integration in nature with defined milestones (or Subtasks). The scope to be covered will be IoT system design, but does not exclude the possibilities of extending into areas such as artificial intelligence and robotics. The project will not be close-ended in nature and will provide ample headroom for the more enthusiastic students to excel. Students will work in groups of two or three. Each Subtask will be given a certain period of time to complete. Progress will be measured by functional **Demonstrations**, and one or two written **Progress Reports**. Upon the completion of the project, each group will give a demonstration / presentation of the completed system and submit a **Final Report**. Students are required to individually keep a **Logbook** on the work performed during the entire period. The logbooks are to be evaluated and signed by the supervisor /assessor on a monthly or more frequent basis. At the end of the project, the logbooks will be collected and graded. **Lectures:** Lectures are to be conducted at the beginning of the semester. During these lectures, the instructor shall provide an overview of IoT systems and applications, and give clear explanation on the functional and technical requirements on the project, with a schedule for submitting deliverables. Concepts specific to the project(s), which are not yet learnt by the students, are to be covered in these lectures. Concepts behind critical use of tools and equipment will also be strengthened. Copies of supplementary/reference material will be distributed, or, links to on-line material will be provided for self-paced learning.

	Guided Laboratory Experiments: The project will normally require the students to learn to use specific tools and/or equipment. Laboratory demonstrations and exercises will be arranged in the early weeks. Below are some examples: 1. Use of the project-specific IoT development kit and tools. 2. Implementation of the basic framework of the IoT system. 3. Software techniques to optimize the performance of the IoT system. **Self-Paced Work:** Multiple sessions of laboratory will be scheduled to cater for self-paced work in the laboratory, particularly during the second half of the semester. To ensure the students are working in a correct direction, defined milestones are given in the course of their work. Students are required to demonstrate their works at each milestone to show their progress.
Teaching/Learning Methodology	(see table below)

Teaching/Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 4	Principles and key concepts of the IoT platform used in the project are explained to students. Uses of tools are demonstrated. The goals are specified. The various problems to be encountered are explained.
Supervised Laboratory Sessions	1, 2, 3, 4	Students need to learn to implement an IoT system with the provided hardware platform. They also need to learn to use the provided software modules and expand them to accommodate new functionalities.
Extended Self-paced Laboratory Work	1 - 8	Students will work in teams of two or three to construct an IoT system. They need to learn to implement an IoT system with the provided hardware platform. They also need to use the provided software modules and expand them to accommodate new functionalities.

Assessment Methods in Alignment with Intended Subject Learning Outcomes	

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)							
		1	2	3	4	5	6	7	8
Continuous Assessment	100%								
• Lab Reports	25%	✓	✓	✓	✓				
• Logbook & Reports	25%	✓	✓	✓	✓	✓	✓	✓	✓
• Progress & Final Demonstration	50%	✓	✓	✓	✓	✓	✓	✓	✓
Total	100%								

Assessment on individual student's ability and contribution will be conducted, according to the attributes detailed below.

INSIGHT	as evidenced by how well the concepts are understood
CREATIVITY	as evidenced by ingenuity and imagination
WORKMANSHIP	as evidenced by how well ideas are implemented and how problems are resolved
DRIVE	as evidenced by initiative, diligence and tenacity
COMMUNICATION	as evidenced by an ability to express ideas clearly and succinctly
MANAGEMENT	as evidenced by how time, manpower and other resources are effectively used

At the completion of each subtask, team members will be asked to give a demonstration to the assessor. Based on the presentation and response to questions addressed to the members, the assessor will rate the contribution, achievement, and performance of each member. Other assessment items include lab reports, logbook, progress report, final demonstration, report and presentation.

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

Specific Assessment Methods/Tasks	Remark
Lab Reports	To measure the students' understanding of the theories and concepts as well as some practical issues in their subject materials.
Progress & Final Demonstrations	Students need to think critically and creatively in order to come up with good alternate solution for an existing problem. Oral examination on the approach taken will be conducted for each group member to evaluate his contribution, technical knowledge and communication skills.
Logbook & Reports	Each group of students is required to produce one or two progress reports and a final report. Accuracy and the presentation of the reports will be assessed. Each group needs to explain in the reports the solutions they plan to use or have been used in the project. The reason behind of choosing such solutions should also be exemplified. The students also need to explain how the limited resources are used in the project and how the team members work together to achieve the project goal. Logbooks are assessed to evaluate contributions and the quality of records on the progress.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lectures	12 Hours
	• Laboratory	12 Hours
	• Mini-project / Meetings / Presentation	15 Hours
	Other student study effort:	
	• Revision	12 Hours
	• Additional laboratory work	12 Hours
	• Mini-project Work / Presentation / Report writing	42 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Textbook:** 1. R. Buyya, A. V. Dastjerdi, Internet of Things: Principles and Paradigms. Morgan Kaufmann, Cambridge, MA, USA, 2016. 2. C. Dow, Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python. Packt Publishing, Birmingham, UK, 2018. **Reference Materials:** 1. Selected Reading from recent issues of IEEE Journals and Transactions. 2. Other materials to be specified by the subject lecturer for each project.	
Last Updated	June 2021	
Prepared by	Dr Yuyi MAO, Dr Liang LIU and Dr Jun ZHANG	

Subject Description Form

Subject Code	EIE3129
Subject Title	IoT Security
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject aims at providing senior students with knowledge and skills in the latest developments in the security domain of Internet of Things (IoT). The topics to be covered include cryptographic foundations, wireless security, data security, and IoT system security. The subject will blend theory and practice. After attending this subject, the students will master the basic principles and skills of network and information security for IoT. They will also be able to identify security problems in the context of IoT, apply these principles and skills to design and evaluate solutions to meet different security requirements in IoT applications.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Identify, formulate, and describe security issues and problems in the context of Internet of Things. 2. Understand and describe the basic theories and principles in IoT security. 3. Analyze, design, and evaluate solutions to IoT security problems. Category B: Attributes for all-roundedness 4. Communicate effectively. 5. Think critically and creatively. 6. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	1. Overview of Security Challenges in IoT An introduction to the common security issues in Internet of Things across its whole architecture, including perception layer, network layer, management layer, and application layer, with identification on unique security challenges of IoT systems such as computational and power limits, system vulnerabilities, and high data volume. 2. Applied Cryptography Cryptographic tools for security models: cryptographic hash function for integrity, symmetric and asymmetric encryption for confidentiality, digital signature for authentication. 3. Physical and Hardware Security Trust computing for IoT, such as root of trust and Trusted Platform Module); physical security attacks, side channel attacks, such as differential power analysis and timing attacks; firmware security. 4. Network and Wireless Security Public-Key Infrastructure (X.509), IP security (IPSec); firewall, virtual private network, authentication, and network access control, with a focus on the following wireless radio and communication technologies for IoT: Wi-Fi, Bluetooth, Low-power wide-area network, 5G, and MQTT. 5. Data and Cloud Security Technologies key management, intrusion detection, access control, data anonymization, differential privacy, enterprise data protection. 6. Internet of Things Security Standards and Case Studies ISO 27001/2 and similar standards such as NIST SP 800 and HIPAA; real-life security threats and solutions of IoT applications, such as smart home, smart grid, connected vehicle, wearable computing and mobile health care.

Teaching/Learning Methodology	<u>Lectures and Tutorials are effective teaching methods:</u> 1. To provide an overview of the subject contents. 2. To introduce, identify and describe common security issues in IoT. 3. To introduce the common approaches and solutions for ensuring security in IoT. 4. To use feedbacks from students for gauging their progress <u>Assignments and Tests:</u> 1. To supplement the teaching materials. 2. To foster a deeper understanding of the concepts. 3. To test the mastery of the subject matter by the students at different stages. <u>Case studies, lab sessions:</u> 1. To ensure deep learning and real understanding of the students. 2. To cultivate students' problem-solving skills. 3. To foster deep understanding of the subject.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	See table below

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment							
• Assignments	10%	✓	✓	✓	✓	✓	
• Tests	10%	✓	✓	✓	✓		
• Laboratory demonstration and reports	15%	✓	✓	✓	✓		
• Mini project	15%	✓	✓	✓	✓	✓	✓
2. Examination	50%	✓	✓	✓	✓	✓	
Total	100%						

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

The assessment methods above fully address the intended learning outcomes.

Student Study Effort Expected		
	Class contact (time-tabled):	
	• Lectures	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	24 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	42 Hours
	Total student study effort:	**105 Hours**

Reading List and References	**Textbook:** 1. “Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem.” Brian Russell, and Drew Van Duren. Packt Publishing; 2nd edition (November 30, 2018). **Reference Materials:** 1. “Practical IoT Hacking: The Definitive Guide to Attacking the Internet of Things.” Fotios Chantzis, Ioannis Stais, Paulino Calderon, Evangelos Deirmentzoglou, and Beau Woods, No Starch Press, Apr 2021. 2. “The IoT Hacker's Handbook: A Practical Guide to Hacking the Internet of Things.” Aditya Gupta, Apress; 1st ed. edition (April 1, 2019). 3. “Hacking Connected Cars: Tactics, Techniques, and Procedures.” Alissa Knight, Wiley; 1st edition (March 17, 2020). 4. “The IoT Architect's Guide to Attainable Security and Privacy.” Damilare D. Fagbemi, David M Wheeler, and JC Wheeler, Auerbach Publications; 1st edition (October 4, 2019). 5. “IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security.” Perry Lea, 2nd Edition, Packt Publishing (March 6, 2020).
Last Updated	June 2021
Prepared by	Dr Haibo Hu

<u>**Subject Description Form**</u>

Subject Code	EIE3130
Subject Title	Network Security
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	EIE3333 Data and Computer Communication
Objectives	This course aims to train students to master basic network security knowledge and skills. They will learn how to apply security services of confidentiality, integrity, availability and authentication in various scenarios. They also need to design solutions for network management and solve security problems using the software tools.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Describe common security issues arising from the use of telecommunication and data networks for the transmission of information; 2. Analyse a network security problem and identify and define the requirements appropriate to its solution; 3. Identify and solve network security problems by applying knowledge learnt and by using appropriate tools and techniques; 4. Use current techniques, skills, and tools necessary for the practices in network security with an understanding of the limitations. <u>Category B: Attributes for all-roundedness</u> 5. Function effectively on teams to accomplish a common goal; 6. Communicate effectively and understand the importance of life-learning as well as continual professional development.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Introduction to basic network technologies and components</u> 1.1 Computer security objectives, security services and mechanisms 1.2 X.800 classifies security attacks 1.3 Network and cryptography basics 1.4 Introduction to Public and Private key encryption 1.5 Security at the transport layer 1.6 Understanding the operations of secure sockets layer (SSL) and secure shell (SSH)/Open SSH 2. <u>Network threats and mechanisms</u> 2.1 Vulnerabilities and attacks of internet protocols 2.2 Review the IP protocol, TCP functions, data formats and basic security problems 2.3 The concepts of DNS lookup, DNS caching and DNS packet formats 2.4 IP spoofing mechanisms, DNS cache poisoning and DNS rebinding attack 2.5 Denial-of-Service (DoS) vulnerability and DoS at SSL handshake 2.6 The concepts of SYN cookies 3. <u>Network security applications and services</u> 3.1 Introduction to IP security using AH, ESP and IKE 3.2 Symmetric key distribution and user authentication 3.3 Public key certification and public key infrastructure (X.509) 3.4 Introduction to firewalls and packet filtering principle

	4. <u>Web application security and web tracking</u> 4.1 Introduction to web threat models 4.2 Same origin policy (SOP) for document object model (DOM) and cookies 4.3 Cross-site scripting (CSS) and cross-site request forgery (CSRF) 4.4 Third-party tracking techniques; cookie syncing; sticky tracking and fingerprinting in web browsers 4.5 The concepts of “Do Not Track” (DNT) 5. <u>Network access control and cloud security</u> 5.1 Introduction to network access control system using EAP 5.2 Cloud service models: IaaS, PaaS and SaaS 5.3 The basic concepts of data encryption and crypto management in cloud environment 6. <u>Network management</u> 6.1 Factors in network management and simple network management protocols (SNMP) 6.2 Management information base (MIB) concepts and usages **Laboratory Experiments:** 1. Linux firewall/pfSense firewall 2. SSH key authentication 3. IPsec configuration and usages
Teaching/Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3, 4	Fundamental principles and key concepts of the subject are delivered to students and to be supplemented with interactive discussion, self-learning videos and website information.
Tutorials	1, 2, 3, 4, 5, 6	Students will be able to clarify concepts and to have a deeper understanding of the lecture materials; practical exercises and Q&A will be provided to strengthen students’ understanding about taught materials.
Laboratory	3, 4, 5, 6	Students will perform hands-on tasks to practice what they have learned. They will analyse network security issues, ethical hacking and implementing security mechanisms.
Quizzes/Tests	1, 2, 3	Students require to solve network security problems within a specific time and without access to other materials.
Case studies project	1, 2, 3, 4, 5, 6	Students will be able to design and solve a real-life security issue through hands-on activities.

Assessment Methods in Alignment with Intended Subject Learning Outcomes	

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
Continuous Assessment (total 100%)							
• Tutorials	15%	✓	✓	✓	✓	✓	✓
• Lab works/reports	25%			✓	✓	✓	✓
• Quizzes/Tests	32%	✓	✓				
• Case study project (Peer-review, presentation, and report)	28%	✓	✓	✓	✓	✓	✓
Total	100%						

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

Specific Assessment Methods/Tasks	Remark
Laboratory sessions and lab reports	Students are required to complete three hands-on activities such as setting up a firewall, generate the SSH keys and configure the IPsec on Windows/Linux and analyse network packets during the lab sessions. They are also required to write reports to explain the network security issues and describe the network packets passing. Students will be accessed based on (1) their ability to apply the knowledge that they learn in classes to deal with network security issues and (2) their ability to write a clear report that explains the principle of operation and architecture of the network security environment that they have created.
Quizzes/Tests	Quizzes/Tests are given to students to assess their competence level of knowledge and comprehension and their ability to apply knowledge within a specific time and without access to other materials. This is a good way to assess students' mastery of knowledge and understanding.
Case study project	Case studies will be used to enable students to probe into a real-life security issue deeply through extensive hands-on activities, readings and research. Students communication skills and function effectively on teams will also be cultivated with project demonstration, peer-review, presentation and report writing.

Student Study Effort Expected		
	Class contact (time-tabled):	
	• Lectures	21 Hours
	• Tutorial/Laboratory/Practice Classes	18 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for tests/quizzes	30 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing, presentation and peer-review	36 Hours
	Total student study effort:	**105 Hours**

Reading List and References	A set of comprehensive lecture notes will be provided to students for the study of this subject, together with tutorial materials and laboratory hand-outs. Students may refer to the following suggested reading lists for more in-depth and extensive discussion of topics covered and end-of chapter problem sets (when applicable): **Reference Books:** 1. Dijiang Huang, Ankur Chowdhary, Sandeep Pisharody, Software-Defined Networking and Security 1st Edition, c2021. 2. J. Michael Stewart, Denise Kinsey, Network Security, Firewalls, and VPNs (Issa) 3rd Edition, c2020. 3. Russell Scott, Computer Networking Beginners Guide: An Easy Approach to Learning Wireless Technology, Social Engineering, Security and Hacking Network, Communications Systems, c2020. 4. Quinn Kiser, Cybersecurity: A Simple Beginner's Guide to Cybersecurity, Computer Networks and Protecting Oneself from Hacking in the Form of Phishing, Malware, Ransomware, and Social Engineering, c2020. 5. Ben Malisow, CCSP (ISC)2 Certified Cloud Security Professional Official Study Guide & Practice Tests Bundle 2nd Edition, c2020. 6. Mark Ciampa, CompTIA Security+ Guide to Network Security Fundamentals (MindTap Course List) 7th Edition, c2020. 7. Ian Neil, CompTIA security+ certification guide: master IT security essentials and exam topics for CompTIA security+ SY0-501 certification, Birmingham: Packt Publishing 2018, (eBook, online access) 8. Manuj Aggarwal, Network Security with pfSense: Architect, deploy, and operate enterprise-grade firewalls, c2018. 9. Stallings, William, Cryptography and Network Security: Principles and Practice (7th Edition): Pearson, c2016. **Classics Materials:** 1. ITU-T Recommendation X.800 Data Communication Networks: Open System Interconnection (OSI); Security, Structure and Applications, ITU-T CCITT, Geneva, 1991 (PDF version available from https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-X.800-199103-I!!PDF-E&type=items) 2. “Communication theory of secrecy systems” in Claude Elwood Shannon: collected papers, Shannon, Claude Elwood, 1916-2001, New York: Institute of Electrical and Electronics Engineers, c1993., PolyU Lib. Acc. No.: TK5101 .S448 1993, (p.84-143)
Last Updated	June 2021
Prepared by	Ms Doris Lin

Subject Description Form

Subject Code	EIE3311
Subject Title	Computer System Fundamentals
Credit Value	3
Level	3
Pre-requisite	EIE2211 Logic Design
Co-requisite/ Exclusion	Nil
Objectives	To provide a broad treatment of the fundamentals of computer systems.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Apply knowledge of mathematics, science, and engineering appropriate to a basic computer system. 2. Use computer tools with an understanding of the processes and limitations. 3. Understand the fundamentals of computer systems and associated technologies. Category B: Attributes for all-roundedness 4. Communicate effectively.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Microprocessors and Microcomputers The following topics will be discussed in detail with references to one or two well-established (contemporary) microprocessor systems. 1.1 CPU architecture: instruction fetch and execution, pipelining, instruction types, examples of assembly language programs, processor control units and micro-programmed control unit, real mode and protected mode of x86 processors, advanced processors, Graphics Processing Units (GPUs) and general-purpose computing. 1.2 Memory interface and memory management: memory devices, address decoding, memory interface, banking, bus buffering and driving, bus cycle and wait state, memory segmentation and paging. 1.3 Basic I/O interface: memory-mapped I/O, I/O port address decoding, programmable peripheral interface, handshaking. 1.4 Interrupts: polling, programmed I/O, interrupt I/O; basic interrupt processing, software interrupt, expanding the interrupt structure. 1.5 Direct Memory Access and DMA-controlled I/O: basic DMA operation, DMA controller, shared-bus operation. 1.6 Cache memory: mapping, associativity, replacement policies, write policies, performance. 1.7 Computer buses: evolution of bus architectures, PCI (PCIe) local bus, USB bus 2. Introduction to Operating System 2.1 File systems: secondary memory, disk formatting, file allocation table, file management, directory entry and file control block. 2.2 Multitasking and time-sharing: time-slicing, process states and process control block, context-switching mechanism, scheduling schemes and process priorities. 2.3 Boot-up ROM, firmware, hardware, device drivers. 2.4 Extension of OS and computing system to cloud Computing.

	3. <u>Computer Arithmetic</u> 3.1 Data formats: signed/unsigned numbers, binary/decimal/BCD numbers, ASCII, fixed/floating point numbers, IEEE standard. 3.2 Arithmetic algorithms: fast addition, multiplication and division algorithms. **Laboratory Experiment:** 1. x86 registers and memory architecture 2. x86 assembly language programming 3. Cache memory 4. I/O interface and Interrupt I/O
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3	fundamental principles and key concepts of the subject are delivered to students
Tutorials and Assignments	1, 2, 3, 4	supplementary to lectures and are conducted with a smaller class size; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed Students take home more questions after each tutorial session and hand in their answers in the subsequent tutorial session
Laboratory sessions	1, 2, 3, 4	students will make use of a x86 assembler and debugger to develop an assembly program; software to simulate various OS management techniques and evaluate their performance; and circuit board to study various interfacing techniques and evaluate their efficiency and performance

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment (Total: 50%)					
• Assignments	15%	✓	✓	✓	✓
• Laboratory Exercises	10%	✓	✓	✓	✓
• Tests	25%	✓		✓	✓
2. Examination	50%	✓		✓	✓
Total	100%				

The continuous assessment consists of short quizzes, assignments, laboratory reports and tests.

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

Specific Assessment Methods/Tasks	**Remark**
Assignments, tests and examination	end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom;
Laboratory exercises	each student is required to produce a written report; accuracy and the presentation of the report will be assessed;

Student Study Effort Expected

Class contact (time-tabled):	
• Lecture	24 Hours
• Tutorial/Laboratory	15 hours
Other student study effort:	
• Lecture/Tutorial: preview/review of notes; assignments; preparation for test/examination	54 Hours
• Laboratory: preview of materials, revision and/or reports writing	12 Hours
Total student study effort:	**105 Hours**

Reading List and References

Reference Books:

1. B.B. Bery, The Intel Microprocessors 8086/8088, 80186/80188, 8086, 80386, 80486, Pentium, Pentium pro processor, Pentium II, Pentium III, Pentium 4 and Core2 with 64-bit extensions: Architecture, Programming, and Interfacing, 8th ed., Pearson Prentice Hall, 2009.
2. C. Hamacher, Z. Vranesic, S. Zaky, and N. Manjikian, Computer Organization and Embedded Systems, 6th ed., McGraw-Hill, 2012.
3. W. Stallings, Computer Organization & Architecture: Designing for Performance, 10th ed., Prentice Hall, 2016.
4. Muhammad A. Mazidi and Janice G. Mazidi, The 80x86 IBM PC and

	Compatible Computers: Assembly Language, Design, and Interfacing, International Edition, 5th ed., Pearson Education, 2010. 5. J. Uffenbeck, The 80x86 Family: Design, Programming, and Interfacing, 3rd ed., Prentice Hall, 2002. 6. T. Erl, Z Mahmood, and R. Puttini, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, 2013.
Last Updated	April 2022
Prepared by	Dr Lawrence Cheung

Subject Description Form

Subject Code	EIE3312
Subject Title	Linear Systems
Credit Value	3
Level	3
Pre-requisite	Mathematics I (AMA2111)
Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with basic concepts and techniques for the modelling and analysis of linear continuous-time and discrete-time signals and systems. 2. To provide students with an analytical foundation for further studies in Communication Engineering and Digital Signal Processing.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the representations and classifications of the signals and systems. 2. Understand the modelling of linear systems. 3. Use different techniques to analyze and design systems. 4. Apply software tools to laboratory exercises for experimenting with theories, and to the analysis and design of signals and systems. 5. Appreciate the advantages and disadvantages of using the different representations and modeling approaches. Category B: Attributes for all-roundedness 6. Present ideas and findings effectively. 7. Think critically and learn independently. 8. Work in a team and collaborate effectively with others.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Signal Representation Signal Classification, Continuous and Discrete-Time Signals, Random Signals. Time-Domain and Frequency-Domain Representations. 2. Continuous-Time and Discrete-Time Systems Impulse Representation and Convolution, Linear Time-Invariant Systems. Properties of Systems: Causality, Time Invariance, Linearity, Systems with Memory, Inverse of a System, Stability. LTI Systems: Differential and Difference Equation Representation, Block Diagram Representations. 3. Fourier Representations for Signals Reviews on Periodic and Nonperiodic Signals, Continuous and Discrete Signal, Fourier Series and Transform, Frequency Spectra. Properties of Fourier Representations, Time Functions, Applications on System Frequency Response and Signal Frequency Spectrum. Frequency Response of LTI Systems, Sampling. Discrete-Time Fourier Transform, 4. Laplace Transform Definition and Properties of Laplace Transform, Inversion of Laplace Transform, Bilateral Laplace Transform. Transform Analysis of LTI Systems, Poles and Zeros. Relationship of Laplace Transform and Fourier Transform. 5. Analogue Filters

Ideal Filters, Bode Plots. Filter Design: Butterworth Filters, Chebyshev Filters, Frequency Transformations.

Laboratory Experiments:

1. Fundamentals of Signals
2. Linear Time-Invariant Systems
3. Fourier Analysis of Continuous-time Signals
4. Sampling
5. Fourier Analysis of Discrete-time Signals

Teaching/ Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 5, 7	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 5, 7	These are supplementary to lectures and are conducted with smaller class sizes; students will be able to clarify concepts and to gain a deeper understanding of the lecture material; problems and application examples are given and discussed.
Laboratory sessions	4, 6, 7, 8	Students will make use of the software MATLAB to simulate the various theories and visualize the results.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)							
		1	2	3	4	5	6	7	8
1. Continuous Assessment	45%								
• Assignments	15%	✓	✓	✓		✓	✓	✓	
• Laboratory sessions	10%				✓		✓		✓
• Tests	20%	✓	✓	✓		✓	✓	✓	
2. Examination	55%	✓	✓	✓		✓	✓	✓	
Total	100%								

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

<table>
<tr><th>Specific Assessment Methods/Tasks</th><th>Remark</th></tr>
<tr><td>Short quizzes</td><td>These can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.</td></tr>
<tr><td>Assignments, tests and examination</td><td>End-of-chapter-type problems are used to evaluate the students' ability in applying concepts and skills learnt in the classroom;
students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem.</td></tr>
<tr><td>Laboratory sessions</td><td>Each student is required to produce a written report;
the accuracy and presentation of the report will be assessed;
oral examination based on the laboratory exercises will be conducted for each student to evaluate his/her technical knowledge and communication skills.</td></tr>
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Student Study Effort Required

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<tr><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
</table>

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

Reading List and References

</td><td>

Reference Books:

1. Ed. Kamen and Bonnie Heck, *Fundamentals of Signals and Systems Using the Web and Matlab*, 3/e, Prentice-Hall, 2007.
2. M.J. Roberts, *Fundamentals of Signals & Systems,* McGraw-Hill, 2008
3. Simon Haykin and Barry Van Veen, *Signals and Systems*, Wiley, 2003.
4. Charles L. Phillips, et al., *Signals, Systems, and Transforms,* 3/e, Prentice-Hall, 2003.

</td></tr>
<tr><td>Last Updated</td><td>June 2021</td></tr>
<tr><td>Prepared by</td><td>Prof. Kenneth Lam</td></tr>
</table>

Subject Description Form

Subject Code	EIE3320
Subject Title	Object-Oriented Design and Programming
Credit Value	3
Level	3
Pre-requisite	ENG2002 Computer Programming
Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with the principles of object-oriented software design and programming from the perspective of Java implementation and UML. Students are expected to learn the concepts of and practical approaches to object-oriented analysis, design and programming using UML and Java.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the principles of object oriented design. 2. Apply Java in object oriented software development. 3. Apply UML in object oriented software modeling. 4. Apply object oriented approach to developing computer software. <u>Category B: Attributes for all-roundedness</u> 5. Learn independently and be able to search for the information required in solving problems. 6. Present ideas and findings effectively. 7. Think critically. 8. Work in a team and collaborate effectively with others.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Introduction to Software Engineering</u> Software products; software processes; software process models; 2. <u>Java Programming Basic</u> Java technologies; Java platform; Java language basic: variables, operators, expressions, statements, blocks, control flow, methods, arrays. 3. <u>Object-Oriented Programming with Java</u> Objects and classes; class definition; fields, constructors and methods; object interaction; grouping objects; array and collections; designing classes; inheritance and polymorphism; managing inheritance: creating subclasses and super-classes, hiding member variables, overriding methods. Interfaces and packages. 4. <u>Data Structures with Java</u> Implementation-dependent structures such as array and linked list; Implementation-independent structures such as stack, queue, list, map, tree, graph; Fundamental algorithms such as searching and sorting. 5. <u>Unified Modelling Language (UML)</u> Purposes of modelling. Structural Modelling: classes, relationships, class Diagrams, interfaces, packages, and object diagrams. Behavioural modelling interactions and use case diagrams. Architectural modelling: components, deployment, and collaborations. Mapping UML diagrams to Java Code.

Laboratory Experiment:

Students will be requested to use integrated development environment (IDE) to write and debug Java programs during tutorial and lab sessions.

Teaching/ Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3	fundamental principles and key concepts of the subject are delivered to students
Quizzes/Tests	1, 2, 3	students' knowledge on understanding of certain topics can be easily estimated, and the corresponding teaching time will be adjusted accordingly
Assignments	2,4,5,7	Programming exercises are used to reinforce the knowledge taught in lectures.
Laboratory sessions	2,3,4,5,6,7,8	Students will need to design, develop, test, and document Java programs.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed							
		1	2	3	4	5	6	7	8
1. Continuous Assessment	(Total: 100%)								
• Assignments	8%		✓		✓	✓		✓	
• Lab reports	20%		✓	✓	✓	✓	✓	✓	✓
• Knowledge Tests/ Quizzes	32%	✓		✓					
• Practical Tests	40%		✓		✓				
Total	100%								

The continuous assessment consists of programming assignments, laboratory reports, knowledge tests/quizzes and practical tests.

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

Specific Assessment Methods/Tasks	Remark
Knowledge Tests/Quizzes	Short questions will be used to test and enhance students' understanding about the topics covered in lectures. End-of-chapter problems will be used to evaluate students' ability in applying concepts and skills learnt in the classroom.

	Assignments	Students will be asked to write Java programs and test the programs. Students will need to think critically and creatively in order to come up with a good solution for an existing problem.
	Lab reports	Each group of students are required to produce a written report for the Laboratory sessions. Students will be assessed based on the quality of their programs and the clarity of their reports. Students will be asked to work as a team to develop a Java application. Each of them will be responsible for part of the software. They will also need to use UML diagram to illustrate the structure of their programs. Students will need to think critically and creatively in order to come up with a good solution for an existing problem.
	Practical Tests	Students will be given programming problems and asked to write Java programs to solve the problems.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	26 Hours
	• Tutorial/Laboratory/Practice Classes	13 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. G. Booch, I. Jacobson and J. Rumbaugh, *The Unified Modeling Language User Guide*, 2nd ed., Addison-Wesley, 2005. 2. D.J. Barnes and M. Kolling, *Objects First with Java: A Practical Introduction using BlueJ*, 5th ed., Prentice-Hall, 2012. 3. Nell Dale, Daniel T. Joyce, and Chip Weems. *Object-Oriented Data Structures Using Java (4th. ed.)*. Jones and Bartlett Publishers, Inc., USA. 2018. 4. H.M. Deitel and P.J. Deitel, *Java: How To Program (Early Objects)*, 10th ed., Prentice-Hall, 2014. 5. J. Lewis and W. Loftus, Java Software Solutions, 8th Edition, Pearson, 2015. 6. J. Rumbaugh, I. Jacobson and G. Booch, *The Unified Modeling Language Reference Manual*, 2nd ed., Addison-Wesley, 2004.	
Last Updated	July 2020	
Prepared by	Dr Pauli Lai and Mr Richard Pang	

Subject Description Form

Subject Code	EIE3331
Subject Title	Communication Fundamentals
Credit Value	3
Level	3
Pre-requisite	AMA2111 Mathematics I
Co-requisite/ Exclusion	Nil
Objectives	Telecommunication plays an important role in modern societies that rely heavily on a knowledge economy. Telecommunication systems enable the transfer and exchange of information over communication channels that are corrupted by disturbances and noises in a cost-effective manner. The major objectives of this subject are for the students to establish a firm foundation for the understanding of telecommunication systems, and the relationship among various technical and socio-economic factors when such systems are designed and operated.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Identify various elements, processes, and parameters in telecommunication systems, and describe their functions, effects, and interrelationship. 2. Analyze, measure, and evaluate the performance of a telecommunication system against given criteria. 3. Design typical telecommunication systems that consist of basic and essential building blocks. <u>Category B: Attributes for all-roundedness</u> 4. Communicate effectively. 5. Think critically and creatively. 6. Assimilate new technological development in related field.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Introduction (2 hour)</u> 1.1 Introduction to telecommunication systems, their past and present development; elements of a basic communication system; examples of practical telecommunication systems. 2. <u>Analog Communications</u> (18 hours) 2.1 Amplitude Modulation (AM): double sideband, double sideband with suppressed carrier, single sideband, frequency spectrum and power of the AM signal, Frequency Division Multiplexing. 2.2 Demodulation of AM signals: coherent detector, direct demodulation 2.3 Frequency modulation: bandwidth of FM signals, Stereo FM. 2.4 Demodulation of FM signals: Phase-Locked Loop (PLL) detector. 2.5 Comparison of AM and FM performance: bandwidth, signal-to-noise ratio 3. <u>Analog to Digital Conversion (4 hours)</u> 3.1 Sampling theorem; pulse amplitude modulation 3.2 Quantizing: uniform quantization and quantization noise, SNR (e.g.: Audio CD standard), non-uniform quantization (e.g. A-law, u-law) 3.3 Pulse code modulation (PCM) 3.4 Time division multiplexing: T1 multiplexing system

	4. <u>Digital Modulation and Demodulation (9 hours)</u> 4.1 ASK, FSK, PSK, DPSK, QPSK (e.g. satellite system), OQPSK, QAM (e.g. Microwave link applications), constellation diagram, bandwidth. 4.2 Coherent demodulation 4.3 Non-coherent demodulation (e.g. DPSK, OQPSK) 4.4 BER performance over Additive White Gaussian Noise (AWGN) channel 4.5 Effects of bandwidth, distortion, noise, timing error on detection, eye diagram **Practical:** • Matlab/Python simulation/experiments in communication systems (6 hours)
Teaching/ Learning Methodology	

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures, supplemented with interactive questions and answers, and short quizzes	1,2,3,5,6	In lectures, students are introduced to the *knowledge* of the telecommunication field; *comprehension* of the knowledge is strengthened with interactive Q&A and short quizzes. The students will be able to *define* and *describe* key terms and concepts about telecommunication. They will also be able to *explain* and *generalize* knowledge about telecommunication (e.g. different modulation techniques and their performance, difference between analog and digital modulation techniques)
Tutorials where case studies are conducted, and problems are given to students for them to solve	1,2,3,4,5,6	In tutorials, students *apply* what they have learnt in analyzing cases (e.g. superheterodyne receiver structure) and solving problems (e.g. calculating the channel capacity of a given channel). They will *analyze* the given information, *compare* and *contrast* different scenarios and propose solutions or alternatives.
Lab, where students will conduct simulations/experiments on communication systems	2,3,4,5,6	By performing hands-on authentic tasks, the students will be able to *synthesize* a structure of knowledge by *designing* a solution to a communication problem. They will *relate* the observation to theories and principles. They will also *evaluate* outcomes of the tasks they perform and *interpret* the data they gather.

	Lab/ homework, quizzes, tests, end-of-chapter problems	1,2,3,4,5,6	Through working assignment and homework, online quizzes, and end-of-chapter problems in text books, students will develop a firm understanding and *comprehension* of the *knowledge* taught. They will *analyze* given information and *apply* knowledge in solving problems. For some design type of questions (e.g. design a communication link with a given S/N ratio), they will have to *synthesize* solutions by *evaluating* different alternatives.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment (total 50%)							
•							
• Lab assignment	10%		✓	✓	✓	✓	✓
• Quiz	20%	✓	✓	✓	✓	✓	
• Test	20%	✓	✓	✓	✓	✓	
2. Examination	50%	✓	✓	✓	✓	✓	
Total	100 %						

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

Specific Assessment Methods/Tasks	Remark
Quizzes/ tests/examination	Quizzes, tests, and examinations are given to students to assess their competence level of *knowledge* and *comprehension*, ability to *analyze* given information, ability to *apply* knowledge and skills in new situation, ability to *synthesize* structure, and ability to evaluate given data to make judgment. The criteria (i.e. *what* to be demonstrated) and level (i.e. the *extent*) of achievement will be graded according to six levels: Excellent (A+ and A), Good (B+ and B), Satisfactory (C+ and C), Marginal (D) and Failure (F). These will be made known to the students. Feedback about their performance will be given promptly to students to help them improvement their learning.
Lab assignment	Students are required to conduct Matlab/Python simulations/experiments on communication systems. The emphasis is on assessing their ability to *apply* knowledge and skills learned in *designing*, *synthesizing* and ev*aluating* and ability to take data and relate the measurement results to theory. Expectation and grading criteria will be given as in the case of quizzes and tests.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Lab/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Lab/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. B. P. Lathi, Z. Ding, *Modern Digital and Analog Communication Systems*, 5^{th} ed., Oxford University Press, 2019 2. H. Stern, S. A. Mahmoud, *Communication Systems: Analysis and Design*, Pearson, 2004 3. S. Haykin, *Communication Systems*, 4th ed., John Wiley, 2001 4. J. Proakis and M. Salehi, *Fundamentals of Communication Systems*, 2nd ed., Pearson, 2014	
Last Updated	June 2022	
Prepared by	Dr S. Zhang	

Subject Description Form

Subject Code	EIE3333
Subject Title	Data and Computer Communications
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide solid foundation to students about the architectures and operations of communication networks. 2. To enable students to master the knowledge about computer networking in the context of real-life applications. 3. To prepare students to learn and to critically evaluate new knowledge and emerging technology in communication networks.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the services, functions, and inter-relationship of different layers in communication network models 2. Describe how components in different layers inter-operate and analyze their performance. 3. Understand and apply the principles and practices of communication networks. 4. Learn new techniques and to align new technologies to existing network infrastructure. <u>Category B: Attributes for all-roundedness</u> 5. Present ideas and findings effectively. 6. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Computer Networks, Services, and Layered Architectures</u> Evolution of networking and switching technology. Protocol and services. Layered network architectures: OSI 7-layer model, TCP/IP architecture. 2. <u>Digital Transmission and Protocols in Data Link Layer</u> Line coding techniques, error detection and correction. Automatic Repeat Request (ARQ) protocol and reliable data transfer service. Sliding-window flow control. Framing and point-to-point protocol, flow control and error controls. High level data link control (HDLC) protocol and point-to-point protocol (PPP). 3. <u>Local Area Networks (LANs) and Wireless LANs</u> Media Access Control (MAC) protocols: the IEEE802.3 Ethernet and IEEE802.11 wireless LAN standards. Interconnection of LANs: bridge, switch, and virtual LAN. 4. <u>Network Layer Protocols</u> Network layer operations, connection oriented and connectionless services. Internet protocol (IP): IP datagram format, IP addressing, subnetting, IP routing and router operations. Internet control message protocol (ICMP), dynamic host configuration protocol (DHCP), network address translation (NAT). 5. <u>Transport Layer Protocols</u>

	Transmission control protocol (TCP) and user datagram protocol (UDP) **Possible Laboratory Experiments:** 1. Cisco router configuration and programming. 2. Static and Dynamic routing. 3. Network monitoring and analysis 4. Address resolution, ARP, IP, and TCP.
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 4	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 4, 5	Supplementary to lectures. Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Problems and application examples are given and discussed.
Laboratory sessions	3, 5, 6	Students will conduct practical exercises to reinforce concepts and techniques learned.

Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment	50%						
• Mid-Term Test	15%	✓	✓	✓	✓	✓	
• End-of-Term Test	15%	✓	✓	✓	✓	✓	
• Assignments	8%	✓	✓	✓	✓	✓	
• Laboratories	12%			✓		✓	✓
2. Examination	50%	✓	✓	✓	✓	✓	
Total	100%						

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: <table><tr><th>Specific Assessment Methods/ Tasks</th><th>Remark</th></tr><tr><td>Assignments, Tests and examination</td><td>These can measure the students' understanding of the theories and the concepts of the subject. End-of-chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; Assignments of reading report type to assess students' ability in acquiring new knowledge related to communication networks; Students need to think critically and creatively in order to come with an alternate solution for an existing problem.</td></tr><tr><td>Laboratory sessions</td><td>Each group of students is required to complete work-sheets, to indicate their understanding and correct completion of the laboratories. Accuracy and the presentation of the work-sheets will be assessed;</td></tr></table>

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References	**Textbook :** 1. Behrouz A. Forouzan, *Data Communications & Networking,* 5th ed., McGraw-Hill, 2012. **Reference Books:** 1. Behrouz A. Forouzan, *Computer Networks: A Top-Down Approach*, McGraw-Hill, 2012. 2. William Stallings, *Data and Computer Communications*, 9th ed., Pearson/ Prentice-Hall, 2012. 3. Douglas Comer, *Computer Networks and Internets*, 5th ed., Pearson/ Prentice-Hall, 2009.
Last Updated	July 2020
Prepared by	Dr K.T. Lo

Subject Description Form

Subject Code	EIE3343
Subject Title	Computer Systems Principles
Credit Value	3
Level	3
Pre-requisite	EIE2105 Digital and Computer Systems
Co-requisite/ Exclusion	Nil
Objectives	This subject provides students with a broad treatment of the fundamentals of computer operating systems and the related system programming techniques.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the basic structure of a computer operating system. 2. Comprehend the basic concepts of file system and management, process control, scheduling and communication, as well as memory management. 3. Develop software programs to implement the abovementioned system functions. Category B: Attributes for all-roundedness 4. Understand the creative process when designing solutions to a problem.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** • Operating System Overview OS objectives and functions Modern operating systems Microsoft windows overview UNIX and LINUX • File System and Management File organization and access File directories File sharing Secondary storage management System programming for file, directory and I/O access • Process Description and Control Definition of process Process description Process control Process communication System programming for process control and communication • Threads and Scheduling Processes and threads Thread management and scheduling Thread synchronization System programming for thread management • Memory Management Memory management requirement Memory partitioning Paging

	Segmentation Dynamic Link Library (DLL) System programming for memory management • <u>Processor Scheduling</u> Types of processor scheduling Scheduling algorithms Multiprocessor scheduling Case study
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3	Supplementary to lectures and are conducted with smaller class size; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed.
Laboratory sessions	1, 2, 3, 4	Students will make use of software tools to develop system programs in order to resolve different system problems.
Assignments	1, 2, 3	Through working assignment and end-of-chapter problems in text books, students will develop a firm understanding and comprehension of the knowledge taught.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**			
		1	**2**	**3**	**4**
1. Continuous Assessment	50%				
• Laboratory sessions	20%	✓	✓	✓	✓
• Quizzes	15%	✓	✓	✓	
• Assignment(s)	15%	✓	✓	✓	
2. Examination	50%	✓	✓	✓	
Total	100%				

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

<table>
<tr><td>Specific Assessment Methods/Tasks</td><td>Remark</td></tr>
<tr><td>Assignments, tests and examination</td><td>End-of-chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom;</td></tr>
<tr><td>Laboratory sessions</td><td>Each student is required to answer several questions related to each lab session in the lab sheet and hand in his/her answers. Students need to think critically and creatively in order to come with an alternate solution for an existing problem.</td></tr>
</table>

</td></tr>
<tr><td rowspan="7">Student Study Effort Required</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or report writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">

Reference Books:

1. J. Hart, *Windows System Programming*, 4th ed., Addison-Wesley, 2010.
2. W. Stallings, *Operating Systems: Internals and Design Principles,* 7th ed., Prentice-Hall, 2011.
3. H.M. Deital, P.J. Deital, and D.R. Choffnes, *Operating Systems*, 3rd ed., Prentice-Hall, 2004.

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<tr><td>Last Updated</td><td colspan="2">January 2021</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr C. Chan</td></tr>
</table>

Subject Description Form

Subject Code	EIE3360
Subject Title	Integrated Project
Credit Value	3
Level	3
Pre-requisite	ENG2002 Computer Programming
Co-requisite/ Exclusion	Nil
Objectives	At a mid-stage of the programme, this subject plays the role of applying knowledge acquired in other subjects in an integrated manner. While the emphasis will be placed on the technical challenges that may encompass system integration, software development and troubleshooting, students will also be given opportunities to face various non-technical difficulties behind the development of multimedia/information systems.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Design effective and reliable software programs to achieve the objectives of a project. 2. Critically evaluate the different alternatives and strategies when implementing a project. 3. Apply higher-order thinking skills and knowledge from other subjects in an integrated manner to implement a project. <u>Category B: Attributes for all-roundedness</u> 4. Self-improvement in the context of interpersonal skills and recognising life-learning. 5. Plan, manage and evaluate the learning in pursuit of self-determined goals. 6. Present ideas and findings effectively. 7. Work in a team and collaborate effectively with others.
Subject Synopsis/ Indicative Syllabus	**Syllabus / Operation:** The project(s) shall be of software development in nature with defined milestones (or **Subtasks**). The scope will include multimedia and network system design but does not exclude the possibilities of extending into areas such as computer animation or image processing. Students need to work in groups of two or three. **Each Subtask** needs to complete in a certain period. **Functional Demonstrations** and **Progress Reports** measure the project. Upon completing the project, each group needs to have a demonstration/presentation of the completed system and submit a **Final Report**. Students are required to individually keep a **Logbook** on the work performed during the entire period. The logbooks are to be evaluated on a more frequent basis. At the end of the project, the logbooks will be collected and graded. **Lectures:** Lectures are to be conducted at the beginning of the semester. During these lectures, the instructor shall give clear explanation on the functional and technical requirements, with a schedule for submitting deliverables. Concepts specific to the project(s), which are not yet learnt by the students, are to be covered in these lectures. Concepts behind critical use of tools and equipment will also be strengthened. Copies of supplementary/reference material will be distributed, or, links to on-line material will be provided for self-paced learning.

	Guided In-class Exercises/Tutorials/ /Laboratory Experiments: The project requires the students to learn to use specific tools and/or equipment. The demonstrations and exercises will be arranged in the early weeks. Below are some examples: 1. Use of project-specific development tools, software and hardware. 2. Implementation of the basic framework of the project. 3. Software techniques to optimize the performance of the system. **Self-Paced Work:** Multiple tutorials and laboratory sessions will be scheduled to cater to self-paced work in the laboratory to ensure the students are working in a correct direction and defined milestones are given in the course of their work. Students are required to demonstrate their works at each milestone to show their progress.
Teaching/ Learning Methodology	

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3	1. Principles and key concepts of the multimedia platform used in the project are explained to students. Uses of tools are demonstrated. 2. The goals are specified. The various problems to be encountered are explained.
Tutorial/In-class exercises	2, 3	1. Students review the basic knowledge of object-oriented programming. 2. Students will learn **basic C#** programming to build a simple application.
Laboratory	2, 3	1. Students will learn to use the provided software modules and expand them to accommodate new functionalities. 2. Students will develop a software controller to trigger the event handler. 3. Students need to present ideas and findings through the reports.
Extended self-paced laboratory work	2, 3, 4, 5, 6, 7	Students need to work in teams of two or three to construct a multimedia application. They learn to use the provided software modules and expand them to accommodate new functionalities.
Logbooks	5	Students describe the project progress through the logbooks.
Project Proposal	1, 2, 6, 7	1. Students present ideas and evaluate the different

		alternatives to compose the project proposal. 2. Students work as a team to collaborate on the project idea.
Preliminary Project Demo	3, 4, 6, 7	Students need to illustrate the project progress through the preliminary demo.
Final Project Demo	3, 4, 6, 7	Students demonstrate the final application and indicate the project achievement.
Final Report	1, 5, 6, 7	Students require to present the findings, resources management, project achievement, workload distribution, and resolved problems in the final report.
Peer Review	5, 6, 7	Students need to evaluate teammates' performance during preliminary and final project demonstrations using the teamwork performance system.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)						
		1	2	3	4	5	6	7
Continuous assessment	100%							
• Tutorials/in-class exercises	10%		✓	✓				
• Lab exercises/demo and reports	10%		✓	✓				
• Project proposal, final report and project presentation	25%	✓	✓			✓	✓	✓
• Preliminary demonstrations	15%			✓	✓	✓	✓	
• Final demonstrations	30%			✓	✓	✓	✓	
• Logbooks and peer review	10%					✓	✓	✓
Total	100%							

Assessment on individual student's ability and contribution will be conducted, according to the attributes detailed below.

INSIGHT	as evidenced by how well the concepts are understood
CREATIVITY	as evidenced by ingenuity and imagination
WORKMANSHIP	as evidenced by how well ideas are implemented and how problems are resolved
DRIVE	as evidenced by initiative, diligence and tenacity
COMMUNICATION	as evidenced by an ability to express ideas clearly and succinctly
MANAGEMENT	as evidenced by how time, manpower and other resources are effectively used

At the completion of each subtask, team members need to have demonstrations with the assessor. Based on the presentation and response to questions addressed to the members, the assessor will rate each member's contribution, achievement, and performance.

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

Specific Assessment Methods/Tasks	**Remark**
Lab Reports	To measure the students' understanding of the theories and concepts as well as some practical issues in their subject materials.
Preliminary and Final Demonstrations	1. Students need to think critically and creatively to come up with reasonable alternate solutions for an existing problem. 2. Each group member will have an oral examination of the approach taken to evaluate his/her contributions, technical knowledge and communication skills.
Proposal, Logbook, Reports and Peer Review	1. Each group of students is required to produce a project proposal and a final report. 2. Each group needs to explain the solutions in both proposal and the final report to describe how the limited resources are used in the project, how the team members work together to achieve the project goal, and why the reason behind choosing such solutions. 3. Logbooks **and peer review** are assessed to evaluate contributions and the quality of records on the progress.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	12 Hours
	• Tutorial and Laboratory	12 Hours
	• Mini-project presentation / demonstrations	12 Hours
	Other student study effort:	
	• Revision	12 Hours
	• Additional laboratory work	12 Hours
	• Mini-project work / presentation / proposal and report writing	45 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** *To be specified by the subject lecturer for each project.*	
Last Updated	June 2022	
Prepared by	Dr Doris Lin	

Subject Description Form

Subject Code	EIE3373
Subject Title	Microcontroller Systems and Interface
Credit Value	3
Level	3
Pre-requisite	EIE2211 Logic Design
Co-requisite/ Exclusion	Nil
Objectives	To provide students with the concepts and techniques required in designing computer hardware interfaces and embedded software for microcontrollers.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the architecture of 8-bit and 32-bit microcontrollers. 2. Use the C programming language in developing programs for the use of microcontrollers. 3. Apply basic skills for interfacing common devices to microcontrollers. Category B: Attributes for All-roundedness 4. Present ideas and findings effectively. 5. Think critically and creatively.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Overview of Typical Microcontrollers: Features and architectures of 8-bit and 32-bit microcontrollers; hardware connections, hex file and flash loaders; overview of different built-in devices in a microcontroller; 2. Software Development Environment: Understand C compilers, microcontroller programming in C. 3. Microcontroller Programming: I/O programming, timer/counter programming, interrupt programming, serial port programming, programming for other (built-in) devices connected to microcontrollers. 4. Laboratory Exercises: I/O programming, timer/counter programming, interrupt programming, serial port programming, programming for other (built-in) devices connected to microcontrollers.
Teaching/ Learning Methodology	

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1,2,3	Fundamental principles and key concepts of the subject are delivered to students
Laboratory sessions	1,2,3,4,5	Students will make use of software and hardware tools to carry out laboratory assignments

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Continuous Assessment (Total: 50%)						
• Laboratory Exercises	20%	✓	✓	✓	✓	✓
• Tests	30%	✓	✓	✓		
2. Examination	50%	✓	✓	✓		
Total	100%					

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

Specific Assessment Methods/Tasks	Remark
Assignments	Enhance the understanding of the taught materials in the lectures
Tests and examination	End-of chapter type problems are used frequently to evaluate students' ability in applying concepts and skills learned in class The students are also needed to think critically and creatively in the process of solving problems
Laboratory sessions	Each student is required to illustrated their achievement and produce a detailed work record when presenting his/her demonstrations Students are also needed to think critically and creatively to accomplish certain laboratory assignments

Student Study Effort Expected

Class contact (time-tabled):	
• Lecture	24 Hours
• Tutorial/Laboratory/Practice Classes	33 Hours
Other student study effort:	
• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	24 Hours
• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	24 Hours
Total student study effort:	**105 Hours**

Reading List and References

Reference Books:

1. The AVR Microcontroller and Embedded Systems: Using Assembly and C, M. A. Mazidi, S. Naimi, and S. Naimi, Pearson, 2014.
2. The Definitive Guide To The ARM Cortex-M3, Joseph Yiu, 2nd edition, Newnes, 2010.

Last Updated	June 2022
Prepared by	Dr Lawrence Cheung

Subject Description Form

Subject Code	EIE3901/IC382
Subject Title	Multidisciplinary Manufacturing Project
Credit Value	3 Training Credits
Level	3
Pre-requisite	ME39002/IC348 or EIE2901/IC2114 or AAE3103/IC381
Objectives	The subject provides opportunity for students to work in a multidisciplinary project team to accomplish realistic engineering goals. Through the project, students will apply and integrate the engineering knowledge and practical skills acquired from prior engineering subjects and industrial trainings. Students will also be able to analyse engineering problems from multiple perspectives, and synthesize a solution from ideas contributed by teammates of multiple disciplines.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: 1. apply engineering knowledge in carrying out an industrial project starting from problem definition, design, manufacturing, down to assembly, testing and evaluation; 2. select and use appropriate technology building blocks, components and manufacturing processes to develop a solution to meet given specifications and constraints; 3. Work collaboratively and effectively in a multidisciplinary team to accomplish mutual project goals; and 4. Communicate effectively in a multidisciplinary project team.
Subject Synopsis/ Indicative Syllabus	Students will be divided into groups to design and manufacture an engineering product that satisfy an existing demand in IC or a certain customer from the industry. Throughout the project, students will encounter situations that reinforce the following skills: 1) **Project specification**: Identification of client needs and wants; Identification of resource constraints such as time, manpower, equipment, budget; Formulation of project plan. 2) **Engineering design**: Selection of design methodology; collaborative design; Make-or-buy decisions; Design prototyping; Testing and simulation. 3) **Product manufacturing:** Material procurement; Component machining; PCB fabrication; Programming; Assembly and fine-tuning. 4) **Project collaboration:** Determination of project stages and milestones; CAD and PDM; Leadership and Collaborative decision making; Tolerances and fits; Project documentations.
Learning Methodology	Students will be divided into groups of 5-8 to design and manufacture an engineering product. Each project group will be formed by students from two or more engineering streams. The project topics will be provided by the subject supervisor team. Topics will be either initiated by supervisors or by commercial clients. All topics shall demand two or more skillsets including Mechanics, Electronics, and IT. Typical topics include: automated production equipment, mobility products, robotic toys, airframe structures, cabin installations, aircraft maintenance tools, jigs and

gauges, *etc*.

The subject is divided into two stages:

- Design Stage

  During this period, the project team, under the guidance of the supervisors and clients, have to discover, understand and analyze the requirement of the project; and apply their knowledge to design a solution. Furthermore, students are required to search and track down parts and components with suppliers to obtain materials for the following manufacturing stage.

- Manufacturing stage

  During this period, the project team will fabricate, test, and debug the product they designed. The supervisors will guide and monitor the groups on personal commitment, cooperation and coordination among team members.

Regular group tutorials in the form of student-centred project meeting will be arranged between project group and respective supervisors.

Assessment Methods in Alignment with Intended Learning Outcomes

Assessment Methods	Weighting (%)	Intended Learning Outcomes Assessed			
		1	2	3	4
1. Quality of final product	30%	✓	✓		
2. Report	20%	✓	✓	✓	✓
3. Presentation and demonstration	20%			✓	✓
4. Reflective Journal	30%	✓	✓	✓	✓
Total	100%				

<u>Group assessment components</u>

Quality of final product will be assessed by the supervisor team during demonstration. The assessment is to determine how well the group's solution meets with client's requirement in terms of completeness and functionality. The assessment also determines how well the group has carried out the manufacturing in terms of accuracy and craftsmanship. This addresses the intended learning outcomes (1) & (2).

Report submitted at the end of project will be summative evidence of how well the group applied knowledge and made decisions collectively. Compulsory report chapters include: Technical description of final design; Justification of technology building blocks used; Critical review on project execution; and Record of internal communications. This addresses the intended learning outcomes (1), (2), (3) & (4).

<u>Individual assessment components</u>

Oral presentation and demonstration in an exhibition booth setting allow individual members to demonstrate their ability in presenting engineering contents clearly and logically. Through Q&A session supervisors can also determine the effectiveness of individual members' effort toward the final product outcomes. This addresses the intended learning outcomes (3) & (4).

Individual reflective journal serves as summative evidence of how well the student has functioned in the group and embrace the multidisciplinary collaboration concept. Compulsory journal contents include: Technical description of design and manufacturing tasks performed; Critical review of technical ideas proposed and adapted; Critical review on personal performance in the project execution and the collaboration experience. This addresses the intended learning outcomes (1), (2), (3) & (4).

Student Study Effort Required	**Class Contact**	
	• Project works	78 Hours
	• Tutorial	12 Hours
	Other Study Effort	**0 Hour**
	Total Study Effort	**90 Hours**
Reading List and References	1. E. Tebeaux and S. Dragga, 'Chapter.9 Proposals and Progress Reports', in *The Essentials of Technical Communication*, 3rd ed., New York: Oxford, 2012 2. J. Abarca et al, 'Teamwork and Working in Teams', in *Introductory Engineering Design: A Projects-Based Approach*, 3rd ed., University of Colorado at Boulder, 2000. 3. J. Tropman, *Effective meetings*. Thousand Oaks, Calif.: Sage Publications, 3rd ED. 2014. 4. P. Harpum, 'Design Management', in *Engineering Project Management*, 3rd ed., N. Smith, Ed. Oxford: Blackwell, 2008, pp. 234-254. 5. Alur, Rajeev. Principles of Cyber-physical Systems. Cambridge, Massachusetts: MIT, 2015. 6. Valvano, Jonathan W. Introduction to ARM Cortex-M Microcontrollers. Fifth ed. , Jonathan W. Valvano, 2017	
Last Updated	July 2021	
Prepared by	Industrial Centre	

Subject Description Form

Subject Code	ELC3531
Subject Title	Professional Communication in English for Engineering Students
Credit Value	2
Level	3
Pre-requisite / Co-requisite	English LCR subjects
Objectives	This subject aims to develop the language competence for professional communication in English required by students to communicate effectively with various parties and stakeholders in regard to engineering-related project proposals.
Intended Subject 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**: 1. plan, organise and produce professionally acceptable project proposals with appropriate text structures and language for different intended readers 2. plan, organise and deliver effective project-related oral presentations with appropriate interactive strategies and language for different intended audiences 3. adjust the style of expression and interactive strategies in writing and speaking in accordance with different intended readers/audiences
Subject Synopsis / Indicative Syllabus	1. Project proposal in English • Planning and organising a project proposal • Explaining the background, rationale, objectives, scope and significance of a project • Referring to the current situation or existing literature to substantiate a project proposal • Describing the methods of study • Describing and discussing anticipated project results and (if applicable) results of a pilot study • Presenting the budget, schedule and (if applicable) method of evaluation • Writing an executive summary 2. Oral presentation of project proposal in English • Selecting content for an audience-focused presentation • Choosing language and style appropriate to the intended audience • Using appropriate transitions and maintaining coherence in a team presentation • Using effective verbal and non-verbal interactive strategies
Teaching/Learning Methodology	The subject is designed to develop the English language skills, both oral and written, that students need to use to communicate effectively and professionally with a variety of stakeholders of engineering-related projects. It builds upon the language and communication skills covered in GUR language training subjects. The study approach is primarily seminar-based. Seminar activities include instructor input as well as individual and group work, involving drafting and evaluating texts, mini-presentations, discussions and simulations. The learning and teaching activities in the subject will focus on a course-long project which will engage students in proposing and reporting on an

engineering-related project to different intended readers/audiences. During the course, students will be involved in:

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

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		1	2	3
1. Project proposal in English	40%	✓		✓
2. Oral presentation of project proposal in English	60%		✓	✓
Total	100%			

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

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

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

Student Study Effort Expected

Class contact:	
• Seminars	26 hours
Other student study effort:	
• Researching, planning and writing the project • Rehearsing the presentation	52 hours
Total student study effort:	78 hours

Reading List and References	**Course material:** Learning materials developed by the English Language Centre **Recommended references:** 1. D. F. Beer, Ed., *Writing and Speaking in the Technology Professions: A practical guide*, 2nd ed. Hoboken, NJ: Wiley, 2003. 2. R. Johnson-Sheehan, *Writing Proposals*, 2nd ed. New York: Pearson/Longman, 2008. 3. S. Kuiper and D. Clippinger, *Contemporary Business Reports*, 5th ed. Mason, OH: South-Western, 2013. 4. M. H. Markel, *Practical Strategies for Technical Communication*, 2nd ed. New York: Bedford/St. Martin's, 2016. 5. D. C. Reep, *Technical Writing: Principles, strategies, and readings*, 8th ed. Boston: Pearson/Longman, 2011. 6. E. D. Zanders and L. Macleod, *Presentation Skills for Scientists: A practical guide*, 2nd ed. Cambridge: Cambridge University Press, 2018.
Last Updated	July 2021
Prepared by	English Language Centre

Subject Description Form

Subject Code	ENG3003
Subject Title	Engineering Management
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject provides students with: 1. A practical introduction to management and a comprehensive guide to the tools and techniques used in managing people and other resources. 2. Opportunities to trace the historical development and describe the functions of management, from planning, and decision making to organizing, staffing, leading, motivating, and controlling. It also includes a discussion on engineering ethics. 3. Opportunities to explore the core business strategy, technology, and innovation, and examine how these functions intertwine to play a central role in structural design, as well as supporting an organization's overall success.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. Perform tasks in an organization related to organizing, planning, leading and controlling project and process activities; 2. Select appropriate management techniques for improving organizational structures, work procedures, and quality performance of operational tasks; 3. Analyze the factors that affect changes in the work environment, and be aware of the approaches in implementing change in an organization; 4. Be aware of the imperatives of ethical and business behaviors in engineering organizations in a fast-changing business environment.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Introduction</u> General management concepts in organizations; Functions and types of industrial organizations; Organizational structures; Corporate objectives, strategy, and policy 2. <u>Industrial Management</u> Roles of managers: Process of management, leadership, planning, organizing, motivating, and control of social and engineering activities; Quality management: Related tools and techniques 3. <u>Project Management</u> Project scope and objectives; Network analysis; Tools that support engineering operations and task scheduling 4. <u>Management of Change</u> Change leadership; Organizational change; Phases of planned change; Stress management; Factors that affect the execution of change 5. <u>Effects of Environmental Factors</u> The effects of extraneous factors on the operations of engineering organizations, such as ethics and corporate social responsibilities issues

<table>
<tr><td>Teaching/Learning Methodology</td><td colspan="2">A mixture of lectures, tutorial exercises, and case studies are used to deliver various topics in this subject. Some topics are covered by problem-based format whenever applicable in enhancing the learning objectives. Other topics are covered by directed study so as to develop students' "life-long learning" ability.

The case studies, largely based on real experience, are designed to integrate the topics covered in the subject and to illustrate the ways various techniques are inter-related and applied in real life situations.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td colspan="2">
<table>
<tr><td rowspan="2">Specific Assessment Methods/Tasks</td><td rowspan="2">% Weighting</td><td colspan="4">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>1. Coursework
• Group learning activities (10%)
• Presentation (individual) (30%)</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Final examination</td><td>60%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
The coursework of this subject involves students working in groups to study cases that reflect the realities of management situations in an engineering setting. Through such exercises, students' ability to apply and synthesize acquired knowledge can be assessed on the basis of their performance in group discussion, oral presentations, and the quality of their written reports on these case studies. A written final examination is also designed to assess the intended learning outcomes.</td></tr>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Class contact:</td><td></td></tr>
<tr><td>• Lectures and review</td><td>27 Hours</td></tr>
<tr><td>• Tutorials and presentations</td><td>12 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Research and preparation</td><td>30 Hours</td></tr>
<tr><td>• Report writing</td><td>10 Hours</td></tr>
<tr><td>• Preparation for oral presentation and examination</td><td>37 Hours</td></tr>
<tr><td>Total student study effort:</td><td>116 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">1. John R. Schermerhorn, Jr., 2013, Introduction to Management, 12th ed., John Wiley
2. Robbins, S P, DeCenzo, D A, and Coulter, M, 2013, Fundamentals of Management Essential Concepts and Applications, 8th ed., Pearson
3. Morse, L C and Babcock, D L, 2010, Managing Engineering and Technology: an Introduction to Management for Engineers, 5th ed., Prentice Hall
4. White, M A and Bruton, G D, 2011, The Management of Technology and Innovation: A Strategic Approach, 2nd ed., South-Western Cengage Learning</td></tr>
<tr><td>Last Updated</td><td colspan="2">July 2016</td></tr>
<tr><td>Prepared by</td><td colspan="2">Faculty of Engineering</td></tr>
</table>

Subject Description Form

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

Support organizations, policies and their impacts on industrial and economic development in Greater China, the Pacific Rim, and the world.

4. Regulatory Organizations and Compliance

   Discussion of engineer's responsibilities within different regulatory frameworks and environments; Examples from various entities such as the Labor Department and the Occupational Health and Safety Council; Legal dimensions to engineering such as liability, contract law, and industrial legislation.

5. Professional Institutions

   Local and overseas professional institutions; Washington Accord and the qualifications and criteria of professional engineers.

6. Professional Ethics

   Prevention of bribery and corruption; The work of the Independent Commission Against Corruption (ICAC); Social responsibilities of engineers.

Teaching/ Learning Methodology

Class comprises short lectures to provide essential knowledge and information on the relationships between society and the engineer under a range of dimensions.

Other methods include in-class discussions, case studies, and seminars to develop students' in-depth analysis of the relationships.

Each student will submit two assignments based on their weekly learning activities, which will be part of the subject's evaluation. The assignments will deal with important issues of social, cultural, economic, legal, health, safety, and environmental dimensions of society.

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

1. Case analysis where students explore the relationships between society and the engineering issues of a project under specific dimensions;

2. Construction and assembly of a case portfolio which includes

   i. Presentation slides
   ii. Feedback critiques
   iii. Individual Reflections

3. Final oral presentation

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	**% weighting**	**Intended subject learning outcomes to be assessed**		
		1	**2**	**3**
1. Continuous assessment	70%			
• Group weekly learning activities	(20%)	✓	✓	✓
• Individual Assignments (2)	(20%)	✓	✓	
• Individual final presentation	(15%)	✓	✓	
• Individual reflection statement	(5%)	✓	✓	
• Group project	(10%)	✓	✓	✓
2. Take-home Assignment	30%	✓	✓	
Total	100%			

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The coursework requires students to work in groups to study cases from the perspectives of the eight dimensions in an engineering setting. Based on these exercises, students' ability to apply and synthesize acquired knowledge can be assessed through their performance during groups' discussion, oral presentations, and the quality of their portfolio reports on the case studies. The take-home assignment is used to assess students' critical thinking and problem-solving skills when working on their own and give students more time and flexibility to complete an assignment. It provides students the opportunity to review and extend what they have learnt in class and to check their understanding and progress.	
Student Study Effort Expected	**Class contact:**	
	▪ Lectures and review	27 Hours
	▪ Presentation	12 Hours
	Other student study efforts:	
	▪ Research and preparation	55 Hours
	▪ Report and Assignments writing	25 Hours
	Total student study effort	**119 Hours**
Reading List and References	**Reference Books & Articles:** 1. Education for Sustainable Development - An Expert Review of Processes and Learning, UNESCO, 2011 2. Poel, Ibo van de, and Lambèr M. M. Royakkers. Ethics, Technology, and Engineering : an Introduction. Wiley-Blackwell, 2011 3. Engineering-Issues, Challenges and Opportunities for Development, USECO, 2010 4. Engineering for Sustainable Development: Guiding Principles, Royal Academy of Engineering, 2005 5. Securing the future: delivering UK sustainable development strategy, 2005 6. Johnston, F S, Gostelow, J P, and King, W J, 2000, *Engineering and Society Challenges of Professional Practice*, Upper Saddle River, N.J.: Prentice Hall 7. Hjorth, L, Eichler, B, and Khan, A, 2003, *Technology and Society A Bridge to the 21st Century*, Upper Saddle River, N.J.:Prentice Hall 8. The Council for Sustainable Development in Hong Kong, http://www.enb.gov.hk/en/susdev/council/ 9. Poverty alleviation: the role of the engineer, http://publications.arup.com/publications/p/poverty_alleviation_the_role_of_the_engineer	

	Reading materials: Engineering journals: - Engineers by The Hong Kong Institution of Engineers - Engineering and Technology by The Institution of Engineers and Technology Magazines: Time, Far East Economic Review Current newspapers: South China Morning Post, China Daily, Ming Pao Daily
Last Updated	June 2021
Prepared by	FENG

Subject Description Form

Subject Code	COMP4127
Subject Title	Information Systems Audit and Control
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	
Objectives	The objectives of this subject are to: 1. recap of different information systems in operation and their management; 2. extend the potential graduates' horizon into the realm of audit and control aspects of information management; 3. evaluate the effectiveness of information systems; and 4. integrate the elements of risk assessment and cybersecurity in project management.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. apply the concept of audit in managing information systems and project management; 2. identify various types of controls and develop new control measures; 3. conduct audit exercises, collect and evaluate audit evidence. Category B: Attributes for all-roundedness 4. improve presentation and communication skills through various exercises; 5. develop the ability to conduct group works and solve related problems; and 6. think and reason in a critical manner, especially on different issues related to audit and control.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Information Systems Audit and Control** Nature of IS audit; concepts of auditing; types of audit; concepts of internal controls. **2. Management Controls** Top management control frameworks: CobiT, COSO; ISO27001; systems development management controls; programming management controls. **3. Applications Controls** Boundary controls; input/output controls; data validation edit and controls, processing controls; business process controls; testing application systems. **4. Evidence Collection and Evaluation** Nature of evidence; evidence collection; computer-assisted audit techniques; analysis and review. **5. Protection of Information Assets** Information security management; risk management concepts and methodologies; the process and components of information assets and risk management.

	6. The Application of IS Audit and Control The application of IS audit and control in financial systems and industry; Basel; case studies. **7. Business Continuity and Disaster Recovery** Concepts; the planning process and components; case studies.
Teaching/ Learning Methodology	This subject emphasises both theoretical and practical aspects of information systems audit and control. It is intended to provide students with knowledge and practical experience on conducting information systems audit projects. Guest seminars from the audit industry will be included. Various auditing tools, data analytics, simulations and exercises on information system audit will be provided in laboratory and tutorial sessions.
Assessment Methods in Alignment with Intended Learning Outcomes	(see table below)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		1	**2**	**3**	**4**	**5**	**6**
Continuous Assessment	**55%**						
1. Assignments, Tests & Projects		✓	✓	✓	✓	✓	✓
Examination	**45%**	✓	✓	✓	✓	✓	✓
Total	100%						

Student Study Effort Expected	**Class contact:**	
	▪ Lecture	39 Hours
	▪ Tutorial/Lab	0 Hour
	Other student study effort:	
	▪ Assignments, Quizzes, Projects, Exam	80 Hours
	Total student study effort	119 Hours

Reading List and References	**References:** 1. CISA Review Manual, ISACA publications. 2. CRISC Review Manual, ISACA Publications. 3. CISSP CBK, ISC2 publication 4. Calder, Alan and Watkins, Steve, *IT Governance – An international guide to data security and ISO27001/ISO27002.* 5. Whitman, Michael E. and Mattord, Herbert J., *Management of Information Security*, Cengage. 6. ISACA Journal 7. The Computer Journal, British Computer Society 8. Harvard Business Review
Last Updated	Jun 2022
Prepared by	COMP

Subject Description Form

Subject Code	COMP4134
Subject Title	Biometrics and Security
Credit Value	3
Level	4
Pre-requisite	AMA1104 Introductory Probability or HKDSE Maths Extended Module or equivalent subjects COMP3422 Creative Digital Media Design or equivalent subjects.
Co-requisite/ Exclusion	Nil
Objectives	The objectives of this subject are to: 1. understand the fundamental technologies for e-security, in particular the basic technologies for digital watermarking and cryptography for various applications; 2. introduce biometric computing knowledge and methods; and 3. learn some basic biometrics systems with real case studies
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. understand fundamental issues and challenges for e-security; 2. get familiar with the basic techniques for cryptography including conventional encryption, public-key cryptography, message authentication, hash functions and digital signature; 3. comprehend and appreciate digital watermarking applications for data security; 4. recognise physical and behaviour biometric characteristics for human identification; 5. have a good understanding on biometrics technologies for different security applications; Category B: Attributes for all-roundedness 6. communicate effectively with project presentation and technical reports; and 7. learn independently for problem solving and solution seeking for various applications.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Introduction to Information Security** Why is information security important? What is information security concerned? How to achieve information security – basic concepts, techniques and applications. **2. Conventional Encryption Technology** Classic and modern techniques for encryption, stream ciphers and block ciphers, DES (Data Encryption Standard). **3. Public-key Cryptography and Message Authentication** public-key cipher, classes of public-key algorithms, message authentication **4. Digital Watermarking for Information Security** watermarking concept, watermarking definition, problems with watermarking, watermark attacks, classification of watermarking, applications of watermarking (copyright protection, authentication and

	integrity checking, hidden annotation, secure and invisible communication **5. Introduction to Biometrics and Authentication** Why biometrics? What about biometrics? How to design biometric systems? Biometrics definitions and notations; biometric applications; information security; security technologies and systems; authentication. **6. Fundamental Techniques** Biometrics data acquisition and biometrics database; the related image processing and pattern recognition technologies, including digital image and signal representation, pattern extraction and classification; biometrics system performance using error rates and plots. **7. Typical Physical Biometrics** Basic physical characteristics of biometrics; introduction tobiometrics systems using physiological features (such as fingerprint, palmprint, finger knuckle, iris, face, etc.). **8. Typical Behavioral Biometrics** Basic behavioural characteristics of biometrics; some basic introduction of behavioural biometrics systems (such as voice, signature, and gait recognition, etc.). **9. Multi-Biometrics and Applications** Security application: Internet/Intranet; e-commerce; banking services; immigration and naturalisation service; computer systems; physical access; telephone systems; time, attendance and monitoring. Case Study: Electronic security and biometric applications.
Teaching/Learning Methodology	The course material will be delivered as a combination of lectures, tutorials and small group project. Students will get familiar with basic concepts and technologies of network security, biometric systems and applications.
Assessment Methods in Alignment with Intended Learning Outcomes	

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1. Continuous Assessment	60%							
• Assignments		✓	✓	✓	✓	✓	✓	✓
• Lab exercises								
• Project		✓		✓	✓	✓	✓	✓
• Mid-term								
2. Examination	40%	✓	✓				✓	✓
Total	100 %							

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	39 Hours
	Other student study effort:	
	• Homework	25 Hours
	• Project	41 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. R. M. Bolle, J. H. Connell, S. Pankanti, N. K. Ratha, A. W. Senior, *Guide to Biometrics*, Springer 2004 2. A. K. Jain, A. Kumar, Biometrics on Next Recognition, An Overview, *Second Generation Biometrics*, Springer, 2010.Frank Y. Shih, Digital Watermarking and Steganography: Fundamentals and Techniques, 2nd Edition, Taylor & Francis, 2017. A. Kumar, *Contactless 3D Fingerprint Identification*, Springer, 2018.IEEE Transaction on Pattern Analysis and Machine Intelligence. 3. IEEE Transaction Biometrics Behavior and Identity Science	
Last Updated	Jun 2022	
Prepared by	COMP	

Subject Description Form

Subject Code	COMP4142
Subject Title	E-Payment and Cryptocurrency
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP3334
Objectives	To understand the technologies and applications for e-payment and cryptocurrency. Specifically, the students should: 1. understand fundamental security technologies for supporting e-payment and cryptocurrency; 2. evaluate different types of payment methods; and 3. understand the design and application of e-payment and cryptocurrency systems.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. acquire a fundamental understanding of cryptocurrency and e-payment – the basic principles as well as the technical and business aspects; 2. evaluate cryptocurrency and e-payment systems, applications and protocols; 3. design and implement cryptocurrency and e-payment systems/applications; Category B: Attributes for all-roundedness 4. follow trends of e-payment and crypto-currency; and 5. acquire critical thinking and analytical skills, and improve technical writing as well as presentation skills.
Subject Synopsis/ Indicative Syllabus	(see topic table below)

Topic
1. Introduction Payment fundamentals; Different types of payment; Regulatory issues.
2. Security Fundamentals Review of security mechanisms (encryptions, digital signatures, hash functions, authentication protocols, digital certificate, Internet security). Elliptic curve cryptography (ECDLP, ECDSA); recent hash functions (SHA-256, RIPEMD-160)
3. Internet Payment Systems SET and 3D credit card payment protocols; Electronic check; E-cash; Internet payment services.

	4. Mobile Payment Systems Smart card payment; Apple Wallet; Google Wallet; Other mobile payment systems. **5. Cryptocurrency** Block chain; Bitcoin (ant its variants, e.g. Litecoin); Other crypto-currency systems (e.g. Ethereum, Monero, ZCash). **6. Related Topics** Legal issues; Advanced/emerging technologies; Case studies. <u>Laboratory Experiments:</u> Laboratory exercises on blockchain, cryptocurrency and e-payment. <u>Case Studies:</u> Case studies on blockchain, Bitcoin, Internet/mobile payment systems.
Teaching/ Learning Methodology	Teaching is mainly conducted through lectures. Learning is supplemented by exercises in labs/tutorials. Students are assessed through assignments, a project, a mid-term test and an examination.
Assessment Methods in Alignment with Intended Learning Outcomes	(see table below)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	55%					
1. Assignments		✓	✓		✓	
2. Project		✓	✓	✓	✓	✓
3. Mid-Term Test		✓	✓			
Examination	**45%**	✓	✓		✓	
Total	100 %					

Continuous assessments consist of assignments, a project and a mid-term test, which are designed to facilitate students to achieve the intended learning outcomes. The project is used to assess all learning outcomes. It is designed to enhance students' ability to a deeper understanding of a problem of a larger-scope and solving it systematically. Examination will provide a summative evaluation of the overall ability and understanding of the subject (i.e., e-payment and cryptocurrency).

Student Study Effort Expected		
	Class contact:	
	▪ Class activities (lecture, tutorial, laboratory, etc.)	39 Hours
	Other student study effort:	
	▪ Self-study and other related work	66 Hours
	Total student study effort	105 Hours

Reading List and References	**Reference Books:** 1. Narayanan, A., Bonneau, J., Felten, E., Miller, A. and Goldfeder, S., *Bitcoin and Cryptocurrency Technologies*, Princeton University Press, 2016. 2. Liébana-Cabanillas, Francisco, *Electronic Payment Systems for Competitive Advantage in E-Commerce*, IGI Global, 2014. 3. Nakajima, Masashi, P*ayment System Technologies and Functions: Innovations and Developments*, IGI Global, 2011. 4. Tapscott, Alex and Tapscott, Don, *Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business, and the World*, Portfolio, 2016. 5. Vigna, Paul and Casey, Michael J., *The Age of Cryptocurrency: How Bitcoin and the Blockchain Are Challenging the Global Economic Order*, Picador, 2016. 6. Antonopoulos, Andreas M., M*astering Bitcoin: Unlocking Digital Cryptocurrencies*, O'Reilly, 2014. 7. Stallings, W., C*ryptography and Network Security: Principles and Practice*, 7th Edition, Prentice Hall, 2017. 8. Mostafa Hashem Sherif, Protocols for Secure Electronic Commerce, ISBN 9781138586055, CRC Press, 2018.
Last Updated	Jun 2022
Prepared by	COMP

Subject Description Form

Subject Code	COMP4334
Subject Title	Principles and Practice of Internet Security
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP3334
Objectives	To equip students with a foundational understanding of the threats to the Internet infrastructure. Students will be equipped to: 1. understand the practical principles, models, cryptographic methods for protecting Internet from various forms of attacks; 2. understand the major security issues and problems in the TCP/IP protocol suite and the lower layers, and the countermeasures to mitigate the corresponding attacks; and 3. acquire practical skills in using various tools and resources to analyse the security of Internet protocols.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. acquire a foundational understanding of the cryptographic primitives, security functions and Internet threats; 2. understand the major security issues and problems in the TCP/IP protocol suite and the lower layers, and the countermeasures to mitigate the corresponding attacks; 3. acquire practical skills, such as setting up a secure private network using firewalls, secure tunnels, and end-to-end secure applications, implementing and/or integrating security functions, and assessment of system security; Category B: Attributes for all-roundedness 4. acquire critical and independent analytical skills in the process of analysing the security problems in the Internet; and 5. synthesise various security problems into a small set of fundamental security issues and propose feasible security mechanisms and solutions.
Subject Synopsis/ Indicative Syllabus	**Topic** 1. **Overview** Types of attacks; threat models; the role of cryptography in network security. **2. Cryptographic Functions and Services** Symmetric encryption, block cipher; hash functions; message authentication codes; public-key encryption, digital signatures, and authentication protocols. **3. IP and Link-Layer Security** IP security and Internet key exchange protocols; routing security; wireless network security. **4. End-to-End Security** TCP security; Secure Socket Layer; examples of secure application protocols; e.g., Secure Shell, Kerberos, and Pretty Good Privacy. **5. Other Topics** DNS security, denial-of-service attacks, botnet, firewalls and intrusion detection/prevention systems.

Workshops:

A series of workshops on Web security will be given to let students acquire practical experience.

Teaching/ Learning Methodology

The course will emphasise on both the principles and practices of network and system security. The principles will be covered mainly through the lectures and problem-solving activities in the tutorials, whereas the practice aspects will be taught through a series of workshops on Web security which are designed to reinforce what has been taught in the lectures and to help students acquire practical skills and group projects.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	**60%**					
1. Assignments	25%	✓	✓		✓	✓
2. Workshops	10%			✓		
3. Project	25%			✓	✓	✓
Examination	**40%**	✓	✓		✓	✓
Total	100%					

The examination and assignments are designed to evaluate the students' understanding on the principles undergirding the network and system security. The workshops on Web security and group projects, on the other hand, are designed to evaluate the students' practical skills on solving Internet security problems.

Student Study Effort Expected

Class contact:	
▪ Lectures	39 Hours
▪ Tutorials/Workshops	0 Hour
Other student study effort:	
▪ Self-study (around 7 hours per week)	94 Hours
Total student study effort	133 Hours

Reading List and References

Textbooks:

1. Stallings, William, *Cryptography and Network Security: Principles and Practice*, 6th Edition, Pearson, 2013.

Reference Books:

1. Anderson, Ross J., *Security Engineering*, 2nd Edition, Wiley, 2008.

2. Kaufman, Charlie, Perlman, Radia and Speciner, Mike, *Network Security: Private Communication in a Public World*, 2nd Edition, Prentice Hall PTR 2003.

3. Zwicky, Elizabeth D., Cooper, Simon and Chapman, D. Brent, *Building Internet Firewalls,* 2nd Edition, O'Reilly & Associates, 2000.

4. Cheswick, William and Bellovin, Steven M., *Firewalls and Internet Security*, 2nd Edition, Addison Wesley, 2003.

	5. Schneier, Bruce, *Applied Cryptography*, 2nd Edition, Wiley, 1996. 6. Schneier, Bruce, *Secrets and Lies*, Wiley, 2000. 7. Young, Adam and Yung, Moti, *Malicious Cryptography*, Wiley, 2004. 8. Stinson, Douglas R., *Cryptography: Theory and Practice*, 3rd Edition, Chapman and Hall/CRC, 2006. 9. Forouzan, Behrouz A., *Cryptography and Network Security*, McGraw-Hill, 2008. 10. Boyd, Colin and Mathuria, Anish, *Protocols for Authentication and Key Establishment*, Springer, 2003. 11. Katz, Jonathan, and Yehuda Lindell. *Introduction to modern cryptography*. CRC press, 2nd Edition, 2020.
Last Updated	Jun 2022
Prepared by	COMP

Subject Description Form

Subject Code	COMP4434
Subject Title	Big Data Analytics
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	**Pre-requisites**: AMA1104 or COMP1004, COMP1011 or COMP1012 or ENG2002, COMP2011 or COMP2013, COMP2411 or equivalent introductory database subject
Objectives	The objectives of this subject are to: 1. introduce students the concept and challenge of big data (3 V's: volume, velocity, and variety); and 2. teach students in applying skills and tools to manage and analyse the big data.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: 1. understand the concept and challenge of big data and why existing technology is inadequate to analyse the big data; 2. understand how to collect, manage, store, and query various form of big data; 3. understand how to analyse big data using various quantitative methods; 4. gain hands-on experience on large-scale analytics tools to solve some open big data problems; and 5. be able to conduct thorough analysis on the impact of big data for business decisions and strategy in real-world applications.
Subject Synopsis/ Indicative Syllabus	

Topic
1. Introduction to Big Data Different V's, their challenges and application domains.
2. Collection of Big Data Eventual Consistency and NoSQL systems (MongoDB, BigTable, etc.)
3. Large-Scale Data Analytics Systems Hadoop, MapReduce, Hive, etc.
4. Basic Statistical Analysis
5. Machine Learning Systems for Big Data
6. Graph Analytics Graph structures, PageRank, Centrality, etc.
7. Data Analysis Application: Recommender System
8. Data Visualisation

<table>
<tr><td>Teaching/ Learning Methodology</td><td>A mix of lectures and lab sessions is used to deliver the various topics in this subject. Lectures are conducted to initiate students with the concepts and techniques of big data. Students are given the opportunity to gain hands-on experience on both open-source and commercial big data analytics software during the laboratory sessions.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="5">Intended subject learning outcomes to be assessed</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>Continuous Assessment</td><td rowspan="4">60%</td><td colspan="5"></td></tr>
<tr><td>1. Lab Exercises / Assignments</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Project</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>3. Quiz</td><td>✓</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>Examination</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Continuous assessments consist of a project, assignments, lab exercises, and quizzes, which are designed to facilitate students to achieve intended learning outcomes. Lab exercise is designed to encourage students to acquire deep understanding of the relevant knowledge, practice in order to enrich their hands-on experience with various software tools. The project is designed to enhance students' ability to acquire the understanding and using different knowledge, principles, techniques, tools to solve a real problem through team. Quizzes are to ensure the students understand the concepts.
Examination will evaluate student's understanding and usage of big data technologies.
</td></tr>
<tr><td rowspan="10">Student Study Effort Expected</td><td colspan="2">Class contact:</td></tr>
<tr><td>▪ Lectures</td><td>26 Hours</td></tr>
<tr><td>▪ Tutorials/Laboratory</td><td>13 Hours</td></tr>
<tr><td colspan="2">Other student study effort:</td></tr>
<tr><td>▪ Review the lecture</td><td>28 Hours</td></tr>
<tr><td>▪ Review the lab</td><td>14 Hours</td></tr>
<tr><td>▪ Work on the project</td><td>15 Hours</td></tr>
<tr><td>▪ Prepare the quizzes</td><td>9 Hours</td></tr>
<tr><td>▪ Prepare the examination</td><td>11 Hours</td></tr>
<tr><td>Total student study effort</td><td>116 Hours</td></tr>
</table>

Reading List and References	**Reference Books:** 1. Segaran, Toby, and Jeff Hammerbacher, *Beautiful data: the stories behind elegant data solution*, O'Reilly Media, Inc., 2009 2. Dean, Jeffrey and Ghemawat, Sanjay, “MapReduce: simplified data processing on large clusters”, *Communications of the ACM*, January 2008. 3. Stonebraker, M., Abadi, D., DeWitt, David J., Madden, S., Paulson, E., Pavlo, A. and Rasin, A., “MapReduce and Parallel DBMS’s: Friends or Foes?”, *Communications of the ACM*, January 2010. 4. Dean, Jeffrey and Ghemawat, Sanjay, “MapReduce: A Flexible Data Processing Tool”, *Communications of the ACM*, January 2010. 5. K. Shvachko, H. Kuang, S. Radia and R. Chansler, “The Hadoop Distributed File System”, *IEEE Symposium on Mass Storage Systems and Technologies*, 2010 6. White, Tom, *Hadoop: The definitive guide*, O'Reilly Media, Inc., 2012. 7. Cattell, Rick, “Scalable SQL and NoSQL Data Stores”, *ACM SIGMOD Record*, Volume 39, Issue 4, December 2010. 8. Page, Lawrence and Brin, Sergey and Motwani, Rajeev and Winograd, Terry, “The PageRank Citation Ranking: Bringing Order to the Web”, Technical Report, Stanford InfoLab, 1999. 9. Toby Segaran, *Programming Collective Intelligence*, O'Reilly Media, Inc., 2007 10. Han, Jiawei, Micheline Kamber, and Jian Pei, *Data Mining: Concepts and Techniques*, 3rd Edition, Morgan Kauffman, 2011. 11. Tan, Pang-Ning, Michael Steinbach, and Vipin Kumar, *Introduction to data mining*, Pearson Education India, 2016. 12. Murphy, Kevin P., *Machine Learning: A Probabilistic Perspective*, MIT press, 2012. 13. Theobald, Oliver, *Machine Learning for Absolute Beginners: A Plain English Introduction*, 2nd Edition, Scatterplot press, 2017. 14. The NumPy community, NumPy: The Absolute Basics for Beginners. 15. The Pandas community, 10 minutes to Pandas 16. Géron, A., Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems, O'Reilly Media, 2019 17. Turnbull, J. The Docker Book: Containerization is the new virtualization, James Turnbull, 2014.
Last Updated	July 2022
Prepared by	COMP

Subject Description Form

Subject Code	COMP4442
Subject Title	Service and Cloud Computing
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	**Pre-requisite**: COMP2421 Computer Organization & COMP2432 Operating Systems, or equivalent subjects
Objectives	This is a fundamental course that provides students with the foundations of service and cloud computing, focusing on software development and applications. It covers the principles and concepts, the technical underpinnings and supporting technologies, and the best practices and applications. The objectives of this subject are to: 1. provide students with a broad view of the theoretical and technological aspects that has led to the evolution of service and cloud computing; 2. teach students how service and cloud computing supports different forms of functionality that are essential to the modern IT industry, and the requirements of working with cloud computing environments and develop cloud-based services and applications; 3. equip students with the underlying technologies of service and cloud computing including service-oriented architecture, cloud architecture and service models, virtualisation, and cloud management; and 4. equip students with the knowledge and skills for the planning, design and programming of cloud systems and software services for real-world applications.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. demonstrate in-depth understanding and appreciation of the technological impact of service and cloud computing for future enterprises, and the technologies underpinning it; 2. apply systematic and principled practices to designing, implementing and deploying service and cloud-oriented computing; 3. review and assess the risks, opportunities, costs and steps towards migrating existing systems to service and cloud computing; Category B: Attributes for all-roundedness 4. develop systematic and incremental approach to resolving practical enterprise computing problems and challenges; 5. demonstrate teamwork spirit and work effectively as a team member; and 6. write technical reports and present solutions.

Subject Synopsis/ Indicative Syllabus	**Topics:** 1. **Overview** The evolution of computing paradigms; Motivations and benefits of service and cloud computing; Definitions and principles of service and cloud computing; Applications of cloud computing. 2. **Cloud Architecture and Service Models** Cloud architecture and major components; Physical infrastructure; Service models; Service provisioning; 3. **Service and Cloud Computing Technology Foundation** Key technologies behind service and cloud computing; Resource sharing, scalability, multi-tenancy, and heterogeneity; Virtualisation and Containerisation; Cloud computing and service-orientation; Web Services, SOA, Web 2.0; Services co-ordination and composition, MSA, Devops, Agile; SDN. 4. **Cloud Service Providers and Platforms** Services and functions provided by cloud service providers; Representative providers and platforms (Amazon, Microsoft, IBM, Google, Alibaba, etc); AWS (EC2, S3, CloudFront, composite services, etc); 5. **Cloud-based Application Development** Concepts and principles: common cloud use cases; types of cloud services; support for cloud application development; principles of building cloud-based applications. Methods and techniques: general procedure of cloud application development; paradigms of cloud applications (Web, Mobile, Content delivery, Event-driven, IoT, Big Data, Machine learning); Case study with AWS. 6. **Cloud Management** Functionalities and requirements of cloud management; Core functions of cloud management; Platforms and tools for cloud management; Cloud security and data privacy.
Teaching/ Learning Methodology	The course is comprised of lectures, tutorials and laboratory exercises. During lectures, students are taught the important concepts and principles that drive the development of service computing, and how it connects to cloud. In the lecture, students are encouraged to actively participate in mini-discussions and questions that are designed to reinforce their understanding of concepts taught. During tutorials, students will be presented with real and practical scenarios of enterprise case studies. In particular, they will be given the unique opportunities to study, analyse and propose solutions that leverage service and cloud computing concepts. Small group discussions will be encouraged and students will need to present their results and solutions in the form of reports and presentations. To reinforce practical aspects of their training, simple lab exercises will be conducted to expose students to the state-of-the-art tools and development environment that uses service and cloud computing as the underlying architecture to provide enterprise solutions.
Assessment Methods in Alignment with Intended Learning Outcomes	See table below.

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
		1	2	3	4	5	6
1. Continuous Assessments	**55%**	✓	✓	✓	✓	✓	✓
2. Final Examination	**45%**	✓	✓	✓	✓		
Total	100%						

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

Students taking the subject will be assessed by performance in two parts: continuous assessments and examination. Continuous assessment may include in-class discussions / quizzes, assignments, and tests.

	The in-class discussions and quizzes engage students to actively participate in learning during lectures and tutorials. Students are to collaboratively work together to apply what they have learned in the class to solve practical problems. Assignment may include group projects that are designed to help students to work together in a small group to solve practical case studies and examples by applying concepts that are taught in the class. The results are to be presented in the form of reports and presentations. Tests and assignments are designed to help students reinforced their understanding of concepts and principles that are taught in the class. They are conducted to assess independent problem solving and critical thinking skills.	
Student Study Effort Expected	**Class contact:**	
	▪ Lectures, Tutorials / Labs	39 Hours
	Other student study effort:	
	▪ Assignments, Projects, Reading and Exam	66 Hours
	Total student study effort	105 Hours
Reading List and References	**Reference Books:** 1. Chellammal Surianarayanan and Pethuru Raj Chelliah, *Essentials of Cloud Computing*, Springer, 2019. 2. Arshdeep Bahga and Vijay Madisetti, *Cloud Computing Solutions Architect: A Hands-On Approach*, Arshdeep Bahga & Vijay Madisetti, 2019. 3. Articles from web, technical journals, and conference proceedings will be handed out or posted on L@PU Blackboard when needed.	
Last Updated	Jun 2022	
Prepared by	COMP	

Subject Description Form

Subject Code	COMP4512
Subject Title	Intellectual Property Protection and Management
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	-
Objectives	The objectives of this subject are to: 1. introduce to students the management and protection of intellectual property in this knowledge-based society from the legal, technical and business perspectives, with emphasis on the technical perspective; 2. equip students with knowledge of the value of innovation and value of protection; and 3. introduce to students various techniques for digital rights management.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. understand the value of intellectual property and their protection; 2. understand various measures in the protection of digital content; 3. use current technologies and tools for the practice of software protection; Category B: Attributes for all-roundedness 4. recognise the need for continuing development; and 5. have an understanding of professional, ethical and legal issues and responsibilities in the use of digital content.
Subject Synopsis/ Indicative Syllabus	**Topic** **1. Overview of Intellectual Property Protection and Management** IP management perspective: legal, business and technical; IP acquisition: purchase, JV, strategic alliances, licenses, patent pooling; the value of IP in business strategy; the law (Copyright Acts) and economics governing intellectual property protection (secrecy and patent), the use of I.P. in the digital content industry. **2. Intellectual Property Protection** Copyright, related rights; trademarks and patents; problem of IP theft and their solutions. **3. Digital Right Management** Digital rights management in different scenarios including computer software, documents, e-books, films, music and television. Also include different generations of DRM software and their limitations. **4. Common DRM Techniques** Restrictive Licensing Agreements; Software Obfuscation and Encryption; trusted hardware/ trusted computing; reverse engineering; digital watermarking; steganography; traitor-tracing techniques in encryption. **5. Optional Topics** Opposition to DRM; Alternatives to DRM; DRM system in practice (Adobe Adept DRM, Apple FairPlay, Ubisoft Uplay, etc.).
Teaching/ Learning Methodology	During the lectures, students will come across the common concepts and theories. Those concepts and theories would be further explained with reference to case studies in the tutorials.

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

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		1	2	3	4	5
Continuous Assessment	**55%**	✓	✓	✓	✓	✓
Examination	**45%**	✓	✓	✓	✓	✓
Total	100%					

Types of assessments included assignments, project, test and examination. Assignments are designed to reinforce the concepts and theories learned in the lecture, by solving bigger problems. Project is used to develop students' analytic and problem-solving skills by developing a study report. Test and examination are used to assess independent problem solving and critical thinking skills.</td></tr>
<tr><td>Student Study Effort Expected</td><td>

Class contact:	
▪ Lecture	39 Hours
Other student study effort:	
▪ Assignments, Project, Self-study, Test and Exam Preparation	66 Hours
Total student study effort	105 Hours

</td></tr>
<tr><td>Reading List and References</td><td>

Reference Books:

1. Bouchoux, Deborah E., *Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets*, 5th Edition, Cengage, 2017.
2. European Union Intellectual Property Office. https://euipo.europa.eu/knowledge/course/view.php?id=1738
3. Halt Jr., G.B., Donch Jr., J.C., Stiles, A.R. and Fesnak, R., *Intellectual Property in Consumer Electronics, Software and Technology Startups*, Springer, 2014.
4. WIPO - World Intellectual Property Organization http://www.wipo.int
</td></tr>
<tr><td>Last Updated</td><td>Jun 2022</td></tr>
<tr><td>Prepared by</td><td>COMP</td></tr>
</table>

Subject Description Form

Subject Code	COMP4913
Subject Title	Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite / Exclusion	**Exclusion**: Any other equivalent capstone project
Objectives	The objectives of this subject are to: 1. provide a student the opportunities to apply and integrate his/her knowledge acquired throughout the undergraduate study; 2. develop the capabilities of a student in analysing and solving complex and possibly real-life problems; and 3. train students with skills on systematic development and documentation of a significant piece of work.
Intended Learning Outcomes	**Upon completion of the subject, students will be able to**: Category A: Professional/academic knowledge and skills 1. conduct literature survey to locate for materials and sources relevant to the selected problem area; 2. understand the materials obtained and connect the materials with the problem to be solved; 3. define and specify the problem precisely; 4. assimilate and apply the knowledge learnt in generating good solutions to the problem; 5. think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; 6. evaluate the final outcome in an objective manner; Category B: Attributes for all-roundedness 7. improve presentation and communicate skills via oral presentation; 8. enhance technical report writing skills with proper organisation of materials; 9. develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems; 10. manage the project efficiently and effectively through the supervision of supervisor(s); and 11. work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).
Subject Synopsis/ Indicative Syllabus	1. In-depth Study of a Topic Typically Proposed by the Supervisor 2. Project Meeting and Planning 3. Proposal Writing 4. Regular Progress Checking and Reporting 5. Project Documentation 6. Presentation and Demonstration Capstone Projects are normally proposed by academic staff of the department or in conjunction with external organisations or other departments in the university. However, students may propose a topic along an area of their interest contingent upon the condition that they could find an interested academic staff to supervise the project. Each student will be assigned a supervisor who is in charge of the entire project.

Teaching/ Learning Methodology

The capstone project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and/or other involved parties, guided study of project materials, independent project development work and other project management tasks.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed										
		1	2	3	4	5	6	7	8	9	10	11
Continuous Assessment	**100%**	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total	100 %											

<u>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</u>

The capstone project will be accessed by the supervisor and other assessors. Attributes to be assessed include, but not limited to, Problem Identification, Problem Solving, Communication and Presentation, Project Management, and Self-Discipline.

Capstone Projects should be problem-oriented and there is no restriction to the nature of the problem except that it should be relevant to the student's study programme. The project could be practical, academic or a hybrid in which the student is encouraged but not constrained to have some original contributions. Each student has to submit a proposal, a mid-term checkpoint progress report and a final report. The proposal must be approved by the supervisor before the student can proceed to the capstone project. An oral presentation and demonstration is essential at the end of the project. A mid-term presentation and demonstration may also be required for proper continuous assessment.

Student Study Effort Expected

Class contact:	
▪ Lectures	0 Hour
Other student study effort:	
▪ Searching and reading materials, meeting with supervisor / others, design and system development, testing, documentation, presentation, etc.	210 Hours
Total student study effort	210 Hours

Reading List and References

Reference Books:

1. Kumar, Ranjit, *Research Methodology: A Step-by-step Guide for Beginners*, 3rd Edition, SAGE Publications, 2011.
2. Burns, Robert B., *Introduction to Research Methods*, 4th Edition, SAGE Publications, 2000.
3. Roberts, Carol M., *The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation*, 3rd Edition, Corwin Press, 2007.
4. Mauch, James E. and Park, Namgi, *Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty*, 5th Edition, Marcel Dekker, 2003.
5. Rudestam, Kjell Erik and Newton, Rae R., *Surviving Your Dissertation: A Comprehensive Guide to Content and Process*, 2nd Edition, Sage Publications, 2001.
6. Garson, G. David, *Guide to Writing Empirical Papers, Theses and Dissertations*, Marcel Dekker, 2002.
7. Reinhart, Susan M., *Giving Academic Presentations*, 2nd Edition, University of Michigan Press, 2013.

	8. Oshima, Alice and Hogue, Ann, *Writing Academic English*, 4th Edition, Pearson Longman, 2006. 9. American Psychological Association. *Publication Manual of the American Psychological Association*, 6th Edition, American Psychological Association, 2010. 10. Szuchman, Lenore T., *Writing with Style: APA Style Made Easy*, 5th Edition, Wadsworth/Cengage Learning, 2011. 11. Statistics, simulation, programming, and relevant books. 12. ACM and IEEE magazines, Transactions and Journals. 13. Other International Journals. 14. Relevant conference proceedings and magazines (including ACM and IEEE conferences). 15. Technical reports from universities and major companies.
Last Updated	Jun 2022
Prepared by	COMP

Subject Description Form

Subject Code	EIE4100
Subject Title	Computer Vision and Pattern Recognition
Credit Value	3
Level	4
Pre-requisite	EIE3103 Digital Signals and Systems
Objectives	1. To introduce students the fundamentals of image formation; 2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; 3. To develop an appreciation for various issues in the design of computer vision and object recognition systems; and 4. To provide the student with programming experience from implementing computer vision and object recognition applications.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Comprehend the fundamentals of image formation. 2. Comprehend the major ideas, methods, and techniques of image processing and computer vision. 3. Appreciate typical pattern recognition techniques for object recognition. 4. Implement basic image processing and computer vision techniques. 5. Develop simple object recognition systems. <u>Category B: Attributes for all-roundedness</u> 6. Present ideas and findings effectively. 7. Think critically. 8. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** • <u>Image Formation and Image Models</u> Radiometry; Sources, Shadows and Shading; Colour; Cameras. • <u>Early Vision with One Image</u> Linear Filters; Edge Detection; Texture; Digital Libraries. • <u>Early Vision with Multiple Images</u> The Geometry of Multiple Views; Stereopsis. • <u>Mid-Level Vision</u> Segmentation and Fitting; Tracking with Linear Dynamic Models. • <u>High-Level Vision</u> Correspondence and Pose; Registration in Medical Imaging Systems. • <u>Finding Templates Using Classifiers</u> Classifiers; Building Classifiers from Class Histograms; Feature Selection. • <u>Category-Level Recognition</u> Current Approaches to Object Recognition; Decision Trees; Nearest Neighbour Rule (NNR); Support Vector Machine; Artificial Neural Networks; Deep Learning.
Teaching/Learning Methodology	Lectures: 1. fundamental principles and key concepts of the subject are delivered to students; 2. guidance on further readings, applications and implementation is given.

	Tutorials: 1. supplementary to lectures and are conducted with a smaller class size; 2. students will be able to clarify concepts and to have a deeper understanding of the lecture material; 3. problems and application examples are given and discussed Laboratory sessions: 1. students will make use of the software tools to construct simple computer vision applications.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table below)

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)							
		1	2	3	4	5	6	7	8
1. Continuous Assessment (total: 45%)									
• Tests	25%	✓	✓	✓					
• Assignments	10%	✓	✓	✓			✓	✓	✓
• Lab exercises and lab reports	10%		✓	✓	✓	✓	✓	✓	✓
2. Examination	55%	✓	✓	✓					
Total	100%								

Student Study Effort Expected		
	Class contact (time-tabled):	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignments; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References

Recommended Textbook:

1. D.A. Forsyth and J. Ponce, *Computer Vision: a Modern Approach,* Pearson, 2012.

Reference Books:

1. M. Negnevitsky, *Artificial Intelligence: A Guide to Intelligent Systems*, 3rd Edition, Pearson/Addison Wesley, 2011.
2. C.M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006.
3. L.G. Shapiro and G. Stockman, *Computer Vision*, Prentice-Hall, 2001.
4. R. Schalkoff, *Pattern Recognition – Statistical, Structural & Neural Approaches*, John Wiley, 1992.
5. C.H. Chen and P.S.P. Wang (Editors), *Handbook of Pattern Recognition and Computer Vision*, World Scientific, 2005.

Last Updated	January 2018
Prepared by	Prof. Kenneth Lam and Dr Zheru Chi

Subject Description Form

Subject Code	EIE4102
Subject Title	IP Networks
Credit Value	3
Level	4
Pre-requisite	EIE3333 Data and Computer Communications
Co-requisite/ Exclusion	Nil
Objectives	1. Give a practical treatment on the design, implementation, and management of IP networks. 2. Introduce the variety of facilities, technologies, and communication systems to meet future needs of network services. 3. Evaluate critically the performance of existing and emerging global communication networking technologies.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Describe the operational and functional attributes of different components of IP networks. 2. Evaluate critically the design, implementation, and performance of IP networks with regard to different criteria. Category B: Attributes for all-roundedness 3. Think and evaluate critically. 4. Take up new technology for life-long learning. 5. Work in a team, and collaborate effectively with other members.
Subject Synopsis/ Indicative Syllabus	1. Basic Protocol Functions IP address, IP datagram structure, basic IP operations, delivery and forwarding IP packets 2. Protocols in TCP/IP ARP, RARP, ICMP, IGMP, UDP, TCP 3. Routing Protocols RIP, OSPF, BGP, Multicast Routing 4. Applications Over TCP/IP DNS, TELNET, FTP, Email, HTTP 5. Other Issues About IP IP over ATM, Mobile IP, Multimedia, Voice over IP, SIP, H.323, IPv6, IPSec Laboratory Experiments: 1. Voice over IP Experiment 2. IP Security

Teaching/Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 4, 5	Supplementary to lectures. Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Problems and application examples are given and discussed.
Laboratory sessions	2,3,4,5	Students will conduct practical exercises to reinforce concepts and techniques learned.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Continuous Assessment (total: 50%)						
• Assignments	10%	✓	✓	✓		
• Laboratory reports	10%		✓	✓	✓	✓
• Mid-Term Test	15%	✓	✓	✓	✓	
• End-of-Term Test	15%	✓	✓	✓	✓	
2. Examination	50%	✓	✓	✓	✓	
Total	100%					

Student Study Effort Expected

Class contact (time-tabled):	
• Lecture	24 Hours
• Tutorial/Laboratory/Practice Classes	15 Hours
Other student study effort:	
• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
Total student study effort:	**105 Hours**

Reading List and References

1. Behrouz A. Forouzan, *TCP/IP Protocol Suite*, 3rd ed., McGraw-Hill, 2006.
2. Howser, Gerry, *Computer Networks and the Internet: A Hands-On Approach*, Cham: Springer International Publishing AG, 2019.

Last Updated	July 2020
Prepared by	Dr K.T. Lo

Subject Description Form

Subject Code	EIE4104
Subject Title	Mobile Networking
Credit Value	3
Level	4
Pre-requisite	EIE3333 Data and Computer Communications
Co-requisite/ Exclusion	Nil
Objectives	1. Introduce the basic knowledge of mobile networks. 2. Introduce the variety of facilities, technologies, and communication systems to meet future needs of mobile network services. 3. Evaluate critically the performance of existing and emerging global mobile networking technologies.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Describe the operational and functional attributes of different components of mobile networks. 2. Evaluate critically the design, implementation, and performance of mobile networks with regard to different criteria. Category B: Attributes for all-roundedness 3. Think and evaluate critically. 4. Take up new technology for life-long learning.
Subject Synopsis/ Indicative Syllabus	1. Mobile Communication Systems Handoff schemes, allocation of resources, routing, security 2. Existing Wireless Systems AMPS, GSM, PCS, 3G, GPS, TCP over Wireless 3. Ad Hoc and Sensor Networks Characteristics of Ad Hoc networks, Ad Hoc routing, characteristics of sensor networks, MAC protocol for wireless sensor networks 4. Wireless MANs, LANs, and PANs WMANs, WLANs, WPANs 5. Recent Advances Ultra-wideband technology, multicast in wireless networks, mobility (location) management, Bluetooth networks, threads and security issues Laboratory Experiments: 1. Computing efficiency and throughput of MAC protocols for wireless networks 2. Location determination of a mobile station
Teaching/Learning Methodology	Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions and specially designed classroom activities. Tutorials: During tutorials, students will work on/discuss some chosen problems. This will help strengthen the knowledge taught in lectures. Laboratory/Mini-project and assignments: During laboratory exercises/mini-project, students will perform hands-on tasks to practice what they have

	learned. They will evaluate the performance of various systems and design solutions to problems. The assignments will help students to review the knowledge taught in class. While lectures and tutorials will help to achieve the professional outcomes, the open-ended questions in laboratory exercises/mini-project and assignments will provide the chance to students to exercise their creativity in problem solving.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table below)

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**				
		1	**2**	**3**	**4**	**5**
1. Continuous Assessment (total: 50%)						
• Assignments	8%	✓	✓	✓		
• Laboratories/Mini-Project	14%		✓	✓	✓	✓
• Mid-Term Test	14%	✓	✓	✓	✓	
• End-of-Term Test	14%	✓	✓	✓	✓	
2. Examination	50%	✓	✓	✓	✓	
Total	100%					

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Mini-Project	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	1. D.P. Agrawal and Q. Zeng, *Introduction to Wireless and Mobile Systems*, 4th ed., Cengage Learning, 2016.	
Last Updated	July 2020	
Prepared by	Dr K.T. Lo	

Subject Description Form

Subject Code	EIE4105
Subject Title	Multimodal Human Computer Interaction Technology
Credit Value	3
Level	4
Pre-requisite	For 42477: EIE3103 Digital Signals and Systems or EIE3124 Fundamentals of Machine Intelligence For 42470: EIE3312 Linear Systems
Co-requisite/ Exclusion	Nil
Objectives	This course aims at providing students with the theories and applications of multimodal human-computer interaction (HCI) technologies. In particular, it enables students to understand how machine learning and deep learning can be applied to various HCI systems.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the capability and benefits of various HCI technologies. 2. Understand the theories of machine learning and deep learning. 3. Understand how machine learning and deep learning can be applied to various HCI systems. Category B: Attributes for all-roundedness 4. Understand the creative process when designing solutions to a problem.
Subject Synopsis/ Indicative Syllabus	1. HCI and Their Applications 1.1 Applications of HCI in daily life 1.2 Advantages of multimodal HCI 1.3 Trends in HCI technologies 1.4 Virtual reality, augmented reality, mixed reality, and metaverse 1.5 Real-life examples of HCI 2. Fundamental of Statistical Learning 2.1 Probability and random variables 2.2 Probability densities and distributions 2.3 Sampling distributions 2.4 Expectations and covariance 2.5 Bayes rule and Bayes decision theory 2.6 Curse of dimensionality 3. Machine Learning for HCI 3.1 Structure of pattern recognition systems. 3.2 Unsupervised Learning: principal component analysis; Eigenface, K-means clustering; Gaussian mixture models; hidden Markov models 3.3 Supervised Learning: linear discriminant analysis; support vector machines 3.4 Deep Learning: deep neural networks; backpropagation; gradient-based optimization; convolutional neural networks; representation learning; deep learning development platforms 3.5 Applications to handwriting recognition and face recognition. 4. Voice Computing 4.1 Voice computing: Interacting with computer through voice

<table>
<tr><td></td><td>
4.2 Acoustic features
4.3 HMM and DNN for speech recognition
4.4 Language modelling
4.5 Speaker recognition: GMM-UBM, GMM-SVM, i-vectors, x-vectors, DNN speaker embedding, LDA, and PLDA
4.6 Applications of voice computing: voice search, spoken dialog systems, natural language processing, speech emotion recognition, speaker recognition, voice cloning.
</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>
Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions, and specially designed classroom activities.
Tutorials: During tutorials, students will work on/discuss some chosen topics. This will help strengthen the knowledge taught in lectures.
Laboratory and assignments: During laboratory exercises, students will perform hands-on tasks to practice what they have learned. They will evaluate performance of systems and design solutions to problems. The assignments will help students to review the knowledge taught in class.
While lectures and tutorials will help to achieve the professional outcomes, the open-ended questions in laboratory exercises and assignments will provide the chance to students to exercise their creatively in problem solving.
</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Subject Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific Assessment Methods/Tasks</th><th rowspan="2">% Weighting</th><th colspan="4">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Continuous Assessment (total: 50%)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Homework and assignments</td><td>15%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>• Tests and Quizzes</td><td>20%</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>• Laboratory exercises</td><td>15%</td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="4"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
Assignment, homework, and laboratory exercises will require students to apply what they have learnt to solve problems. There will be open-ended questions that allow students to exercise their creativity in making design.
Examination and tests: They assess students’ achievement of the learning outcomes in a more formal manner.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
</table>
</td></tr>
</table>

Reading List and References	**Reference Materials:** 1. M.W. Mak and J.T. Chien, *Machine Learning for Speaker Recognition*, Cambridge University Press, 2020. 2. I. Goodfellow, Y. Bengio and A. Courville, *Deep Learning*, MIT Press, 2016. 3. S.Y. Kung, M.W. Mak and S.H. Lin, *Biometric Authentication: A Machine Learning Approach*, Prentice Hall, 2005. 4. R. Haeb-Umbach, *et al*. "Speech Processing for Digital Home Assistants: Combining Signal Processing with Deep-learning Techniques", *IEEE Signal Processing Magazine*, Nov. 2019. 5. C.M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006. 6. S.J.D. Prince, *Computer Vision: Models, Learning, and Inference*, Cambridge University Press, 2012. 7. J.P. Thiran, F. Marques and H. Bourlard, *Multimodal Signal Processing, Theory and Applications for Human Computer Interaction*, Elsevier, 2010. 8. S. Greengard, *Virtual Reality*, MIT Press Essential Knowledge Series, 2019.
Last Updated	June 2022
Prepared by	Prof. M.W. Mak

Subject Description Form

Subject Code	EIE4108
Subject Title	Distributed Systems and Cloud Computing
Credit Value	3
Level	4
Pre-requisite	EIE3320 Object Oriented Design and Programming
Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with the principles of distributed systems and cloud computing. It enables students to master the development skills to deliver and construct distributed services on the Web and cloud. Through a series of lab exercises, students will be able to develop interoperable and distributed Web and cloud applications.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the concepts of distributed systems, cloud computing, and big data 2. Identify the key components in distributed systems, cloud services, and big data analytics 3. Build distributed systems. 4. Understand the advantages and limitations of different distributed systems and cloud architectures. 5. Understand the enabling technologies for building distributed systems. 6. Understand the different components of distributed systems. 7. Set up and configure a distributed application. Category B: Attributes for all-roundedness 8. Think critically. 9. Learn independently. 10. Work in a team and collaborate effectively with others. 11. Present ideas and findings effectively.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction to Distributed Systems and Cloud Computing 1.1. Definition and Examples of Distributed Systems; 1.2. Technologies for Network-Based Systems: multi-core and multi-threading; 1.3. Distributed and Cloud Computing Models: client-server; clusters; grids; peer-to-peer; remote procedure call; remote method invocation 1.4. Enabling Technologies: Socket programming; datagram sockets; stream-mode sockets 2. Service-Oriented Architecture for Distributed Computing 2.1. Service and Service-Oriented Architectures 2.2. Web Services: simple object access protocol (SOAP); building web services with SOAP; web services description language (WSDL); role of WSDL in Web services; remote web-services invocation using WSDL; Web service implementation 2.3. RESTful Web Services: architectural principles of REST; REST vs. SOAP; AJAX; RESTful implementation; JAX-RS 3. Cloud Platform Architecture and Programming Environments 3.1. Cloud Concepts Overview 3.2. AWS Global Infrastructure Overview

3.3. AWS Cloud Security
3.4. Networking and Content Delivery
3.5. AWS Compute, Storage, Databases
3.6. Cloud Architecture
3.7. Auto Scaling and Monitoring
3.8. Cloud Programming Environments

4. Big Data Analytics
4.1. Introduction to Big Data: 3Vs to 6Vs; big data use cases; source of big data
4.2. Storing Big Data: unstructured databases; NoSQL; key-value stores; document stores
4.3. Distributed Computing with MapReduce: map and reduce tasks
4.4. Hadoop: Hadoop clusters; Hadoop distributed file systems; implementation examples

Programming Exercises and Laboratory Experiments:

1. Multi-Threading
2. Socket Programming
3. Web Services
4. Cloud Computing

Teaching/ Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1,2,4,5,6	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials/Practice Classes	1,3,4,5,6,8,9	Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Programming exercises will be provided to strengthen students' hands-on experiences.
Laboratory sessions	2,3,6,7,8,9,10, 11	Students will go through the development process of various distributed systems and evaluate their performance.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)										
		1	2	3	4	5	6	7	8	9	10	11
1. Continuous Assessment	60%											
• Assignments	15%	✓	✓		✓	✓	✓		✓	✓		
• Quiz(zes)/Test	15%	✓	✓		✓	✓	✓		✓	✓		
• Lab works	30%		✓	✓			✓	✓	✓	✓	✓	✓
2. Examination	40%	✓	✓		✓	✓	✓		✓	✓		
Total	100 %											

The continuous assessment consists of assignments, laboratory reports, quizzes and/or test.

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

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

<table>
<tr><th>Specific Assessment Methods/Tasks</th><th>Remark</th></tr>
<tr><td>Short quizzes</td><td>Short multiple choice quizzes are conducted to measure the students’ understanding of the theories and concepts as well as their comprehension of subject materials.</td></tr>
<tr><td>Assignments, test and examination</td><td>Assignments are of two types: (1) short questions on distributed systems and cloud computing (2) programming exercises demonstrating the operating principles of different distributed systems. The purposes are to strengthen students’ understanding on the topics they learnt in classes. Students will be assessed based on their ability in applying concepts and skills learnt in the classroom. Students need to think critically and creatively in order to come with an alternate solution for an existing problem.

Test and examination are given to students to assess their competence level of knowledge and comprehension and their ability to apply knowledge and skills in new situations.</td></tr>
<tr><td>Laboratory sessions and lab reports</td><td>Students are required to build two to three distributed systems and web services during the lab sessions. They are also required to write reports to explain the architecture and operating principle of their systems. Students will be assessed based on (1) their ability to apply knowledge that they learn in classes to build distributed systems and (2) their ability to write a clear report that explains the principle of operation and architecture of the systems that they have created.</td></tr>
</table>

</td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>26 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>13 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">

References:

1. S. Mathew (2021, Aug 5). *AWS Whitepaper*. Amazon Web Services. https://docs.aws.amazon.com/whitepapers/latest/aws-overview/introduction.html
2. P. S. Kocher, *Microservices and Containers*, Pearson and Addison-Wesley, 2018.

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

	3. I. Foster and D.B. Gannon, *Cloud Computing for Science and Engineering*", MIT Press, 2017. 4. O. Mendelevitch, C. Stella, and D. Eadline, *Practical Data Science with Hadoop and Spark: Designing and Building Effective Analytics at Scale*, Addison Wesley, 2017 5. H. Luu, *Beginning Apache Spark 2: With Resilient Distributed Datasets, Spark SQL, Structured Streaming and Spark Machine Learning Library*, Apress, 2018. 6. T. Erl et al. *SOA with REST: Principles, Patterns & Constraints for Building Enterprise Solutions with REST*, Prentice Hall 2013. 7. M.P. Papazoglou, *Web Services and SOA: Principles and Technology*, 2nd Edition, Prentice-Hall, 2013. 8. G. Coulouris, *Distributed Systems: Concepts and Design*, 5th ed., Addison-Wesley, 2011. 9. T. Erl, *Cloud Computing: Concepts, Technology and Architecture*, Prentice-Hall, 2013. 10. V. Mayer-Schönberger and K. Cukier, Big Data: A Revolution That Will Transform How We Live, Work, and Think, John Murray Pub., 2013. 11. T. White, "Hadoop: The Definitive Guide", O'Reilly, 3rd Ed. 2012
Last Updated	Nov 2021
Prepared by	Dr Pauli Lai

Subject Description Form

<table>
<tr><td>Subject Code</td><td>EIE4110</td></tr>
<tr><td>Subject Title</td><td>Introduction to VLSI and Computer-Aided Circuit Design</td></tr>
<tr><td>Credit Value</td><td>3</td></tr>
<tr><td>Level</td><td>4</td></tr>
<tr><td>Pre-requisite</td><td>EIE3100 Analogue Circuit Fundamentals</td></tr>
<tr><td>Co-requisite/ Exclusion</td><td>Nil</td></tr>
<tr><td>Objectives</td><td>To enable students to gain knowledge and understanding in the following aspects:

1. Fundamentals of VLSI circuits and systems.
2. VLSI design CAD tools.
3. Hardware Description Languages (VHDL)
4. VLSI design prototyping using Field Programmable Gate Arrays (FPGAs)</td></tr>
<tr><td>Intended Subject Learning Outcomes</td><td>Upon completion of the subject, students will be able to:

<u>Category A: Professional/academic knowledge and skills</u>
1. Understand the fundamentals of CMOS VLSI and associated technologies.
2. Solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
3. Acquire hands-on skills of using CAD tools in VLSI design.
4. Appreciate the design process in VLSI through a mini-project on the design of a CMOS sub-system.

<u>Category B: Attributes for all-roundedness</u>
5. Communicate effectively.
6. Think critically and creatively.
7. Assimilate new technological and development in related field.</td></tr>
<tr><td>Subject Synopsis/ Indicative Syllabus</td><td>Syllabus:

1. <u>Overview of VLSI Design</u>
VLSI design methodology; functional, logic and physical design; gate arrays and standard cells, programmable logic devices; system-on-chip.

2. <u>CMOS Fabrication and Layout</u>
Fabrication processes in CMOS VLSI; latch-up; characteristics of devices in VLSI; mask layout techniques and design rules.

3. <u>CMOS Logic Circuits</u>
Transmission gates; static and dynamic gates and flip flops; domino logic.

4. <u>High Speed CMOS Logic Design</u>
Delay estimation and transistor sizing; device and interconnect capacitance; optimal delay design of buffers

5. <u>Logic Synthesis</u>
Synthesis of Hardware Description Languages (HDL) e.g. VHDL or Verilog into gate-netlists. Timing and area optimizations.

6 <u>High-Level Synthesis</u>
Synthesis of behavioural descriptions e.g. ANSI-C into Register Transfer Level Descriptions (i.e. synthesizable – Verilog or VHDL). Review of three main steps: (1) Resource allocation, (2)scheduling and (3) binding</td></tr>
</table>

	7 <u>Physical Design</u> Logic netlist partitioning methods, floor planning, placement of gate-netlists and routing 8. <u>Power Grid and Clock Design</u> Design of VLSI power grids and clock trees 9. <u>VLSI Power and Thermal Considerations</u> Power (static and dynamic power) estimation. Main factors that impact power consumption and how to reduce them e.g. Clock gating, Dynamic Voltage and Frequency Scaling (DVFS), voltage island. 10 <u>Design for Test (DFT)</u> Testability of ICs, scan chain, boundary scan, ATPG **Laboratory Experiment/Mini-project:** 1. Practice of CAD tools for VLSI design: circuit simulation and FPGA implementation using a FPGA prototyping board 2. Mini-project: design of a VLSI sub-system for computer or communication applications.
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures, supplemented with interactive questions and answers, and short quizzes	1, 2, 6, 7	In lectures, students are introduced to the *knowledge* of the subject, and *comprehension* is strengthened with interactive Q&A and short quizzes. They will be able to *explain* and *generalize* knowledge in VLSI.
Tutorials where design problems are discussed, and are given to students for them to solve	1, 2, 5, 6	In tutorials, students *apply* what they have learnt in analyzing the cases and solving the problems given by the tutor. They will *analyze* the given information, *compare* and *contrast* different scenarios and propose solutions or alternatives.
Laboratory sessions, where students will perform a mini-project on a subsystem design using CAD tools. They will have to write a report on their mini-projects.	2, 3, 4, 5, 6	Students *acquire* hands-on experience in using CAD tools in VLSI design, and *apply* what they have learnt in lectures/tutorials to do a mini-project on the design of a sub-system.
Assignment and Homework	1, 2, 3, 4, 5, 6	Through working assignment and homework, students will develop a firm understanding and *comprehension* of the *knowledge* taught. They will *analyze* given information and *apply* knowledge in solving problem. For some design type of questions, they will have to *synthesize* solutions by *evaluating* different alternatives.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1. Continuous Assessment (total 50%)								
• Min-project	20%	✓	✓	✓	✓		✓	✓
• Individual Assignment	15%	✓	✓			✓		
• Laboratory works and reports	15%		✓	✓	✓	✓		
2. Examination	50%	✓	✓	✓	✓		✓	
Total	100%							

The continuous assessment will consist of a mini-project, a number of laboratory sessions.

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

Specific Assessment Methods/ Tasks	**Remark**
Mini-project	Students are required to conduct one mini-project in teams of 3-4 students. The emphasis is on assessing their ability to apply knowledge and skills learned in designing a complex VLSI system, ability in working with other people and ability to take data and relate the measurement results to theory. Expectation and grading criteria will be given.
Individual assignment	The students will work on a small individual assignment to as demonstrate the development an analytical skills related the design of VLSI circuits.
Laboratory works and reports	Students will be required to perform 6-7 laboratory sessions and write an individual laboratory report. The emphasis is on assessing their ability to *use* VLSI CAD tools effectively to perform VLSI *design*. Expectation and grading criteria will be given as in the case of mini-project.
Examination	There will be an end-of-semester examination to assess students' achievement of all the learning outcomes. Expectation and grading criteria will be given as in the case of mini-project.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. D.A. Hodges, H.G. Jackson and R.A. Saleh, *Analysis and Design of Digital Integrated Circuits,* 3rd ed., New York: McGraw-Hill, 2003. 2. W. Wolf, *Modern VLSI Design: System-on-chip Design*, 3rd ed., Englewood Cliffs: Prentice-Hall, 2002. 3. P. Ashenden, The Designers Guide to VHDL,3rd ed., Morgan Kaufmann, 2008.	
Last Updated	June 2015	
Prepared by	Dr Benjamin CARRION SCHAFER	

Subject Description Form

Subject Code	EIE4113
Subject Title	Wireless and Mobile Systems
Credit Value	3
Level	4
Pre-requisite	For 42480 EIE3120 Network Technologies and Security For 42470 EIE3333 Data and Computer Communications
Exclusion	Mobile Networking (EIE4104)
Objectives	This subject aims to provide students with an understanding of various security concerns in wireless networks (e.g., WiFi and mobile cellular networks) and mobile systems and applications (e.g., Android and iOS).
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the security threats, concerns, and vulnerabilities in wireless and mobile systems, and the corresponding security mechanisms and authentication procedures 2. Understand the strategies for developing secure mobile applications, and the use of mobile security penetration tools for evaluating the robustness of mobile applications 3. Apply the knowledge to develop practical applications that are robust against mobile platform attack tools Category B: Attributes for all-roundedness 4. Understand the creative process when designing solutions to a problem
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction to Mobile and Wireless Networks Mobile cellular networks (3G/4G LTE), IEEE wireless networks (IEEE 802.11, IEEE 802.15), mobile networks (NEMO, MANET). 2. Vulnerability of Wireless Networks Threats and risks to telecommunication systems, vulnerabilities from wired to wireless communications, fundamental security mechanisms. 3. WiFi Security Attacks on wireless networks, security in the IEEE 802.11 standard, security in 802.11i, authentication in wireless networks, layer 3 security mechanisms. 4. Security in Mobile Telecommunication Networks Vulnerability of signaling systems, GSM and GPRS security, 3G security, network interconnection. 5. Mobile Systems and Development Strategies Top issues facing mobile devices, tips for secure mobile application development, mobile HTML security, SMS security, mobile geolocation. 6. Android and iOS Security Android IPC mechanisms, security model, permission review, security tools. iOS security testing, application format, permissions and user controls. Mobile security penetration testing tools.

<table>
<tr><td>Teaching/Learning Methodology</td><td>Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions and specially designed classroom activities.

Tutorials: During tutorials, students will work on/discuss some chosen topics in small group. This will help strengthen the knowledge taught in lectures.

Laboratory and assignments: During laboratory exercises, students will perform hands-on tasks to practice what they have learned. They will evaluate the vulnerability of systems and design solutions to problems. The assignments will help students to review the knowledge taught in class.
While lectures and tutorials will help to achieve the professional outcomes, the open-ended questions in laboratory exercises and assignments will provide the chance to students to exercise their creativity in problem solving.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Subject Learning Outcomes</td><td>
<table>
<tr><th rowspan="2">Specific Assessment Methods/Tasks</th><th rowspan="2">% Weighting</th><th colspan="4">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Continuous Assessment</td><td>(50%)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Homework and assignments</td><td>10%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>• Tests</td><td>10%</td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td>• Laboratory exercises</td><td>30%</td><td></td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>2. Examination</td><td>50%</td><td>✓</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Total:</td><td>100%</td><td colspan="4"></td></tr>
</table>
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Reference Books:

1. H Chaouchi, M Laurent-Maknavicius, Wireless and Mobile Network Security, Wiley, 2009.
2. P. Venkataram, B. Sathish Babu, Wireless and Mobile Network Security, Tata McGraw-Hill, 2010.
3. H. Dwivedi, C. Clark, D. Thiel, Mobile Application Security, McGraw-Hill, 2010.</td></tr>
<tr><td>Last Updated</td><td>November 2014</td></tr>
<tr><td>Prepared by</td><td>Dr Ivan Ho</td></tr>
</table>

Subject Description Form

Subject Code	EIE4114
Subject Title	Digital Forensics for Crime Investigation
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide students with basic concepts about digital forensic techniques for crime investigation 2. To appreciate how different forensic techniques are used for information security
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand different approaches for digital forensics 2. Use different techniques for forensic investigation <u>Category B: Attributes for all-roundedness</u> 3. Present ideas and findings effectively
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Digital and Computational Forensics Context</u> Introduction to digital and computational forensics; Historical aspects in digital and computational forensics; Introduction to techniques for multimedia manipulation; different classes of techniques for forensics: basic idea, framework and applications. 2. <u>Forensics based on Intrinsic/Extrinsic Data</u> Models of digital data capturing device; idea of the use of intrinsic data in digital forensic investigation; introduction to forensics techniques using intrinsic data; applications in source device identification, device linking and integrity verification. Introduction to techniques for multimedia content protection and authentication; attacks modelling. 3. <u>Machine Learning Forensics</u> Different types of ML-based Forensics; Extractive Forensics; Inductive forensics; deductive forensics. Example use cases in ML-based Forensics. 4. <u>Digital Evidence</u> Models of digital evidence; event analytics: surveillance, monitoring, forensic and security; file carving: idea, different classes of techniques; software tools for file carving. 5. <u>Robustness of Forensic Techniques</u> Robustness and security of forensic techniques; adversary model; case studies of reliabilities of forensic techniques. **Laboratory Experiments:** Practical Works: 1. Evaluation of forensic techniques based on intrinsic data. 2. Evaluation of forensic techniques based on extrinsic data. 3. Forensic analysis of digital evidence.

Teaching/Learning Methodology	

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2	Supplementary to lectures; Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Problems and application examples are given and discussed.
Laboratory sessions	2, 3	Students will evaluate different kinds of forensic techniques.
Mini-project	1, 2, 3	Students are required to study a problem in forensic application. Students will need to submit a written report and make a presentation.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**		
		1	**2**	**3**
1. Continuous Assessment (total 50%)				
• Tests	14%	√	√	
• Laboratory sessions	19%		√	√
• Mini-project	17%		√	√
2. Examination	50%	√	√	
Total	100%			

The continuous assessment consists of tests, laboratory exercises and a mini-project.

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

Specific Assessment Methods/Tasks	**Remark**
Tests and examination	end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; students need to think critically in order to come with a solution for a problem.
Laboratory sessions, mini-project	oral examination will be conducted to evaluate student's technical knowledge and communication skills.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	21 Hours
	• Tutorial/Laboratory/Practice Classes	18 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. JoakimKavrestad, "*Fundamentals of Digital Forensics: Theory, Methods, and Real-Life Applications*", Springer, 2020. 2. Darren R. Hayes, "*A Practical Guide to Digital Forensics Investigations*", Pearson IT Certification, 2020. 3. Nihad A Hassan, "*Digital Forensics Basics: A Practical Guide using Windows OS*", Apress 2019. 4. Anders Flaglien, Inger Marie Sunde, AusraDilijonaite, Jeff Hamm, Hens Petter Sandvik, PetterBjelland, Katrin Franke, Stefan Axelsson, "*Digital Forensics: an academic introduction*", John Wiley & Sons, 2018. 5. Husrev Taha Sencar and Nasir Memon (editors), *"Digital Image Forensics"*, Springer, 2013. 6. Frank Y. Shih, *"Multimedia Security Watermarking, Steganography and Forensics"*, CRC Press, 2013. 7. Li Chang-Tsun, "*Emerging Digital Forensics Applications for Crime Protection, Prevention and Security",* IGI Global 2013, doi:10.4018/978-1-4666-4006-1, 2013. 8. Li Chang-Tsun and Anthony T.S. Ho, *"Crime Prevention Technologies and Applications for Advancing Criminal Investigation",* IGI Global 2012, doi:10.4018/978-1-4666-1758-2, 2012.	
Last Updated	November 2021	
Prepared by	Dr Wen Chen and Dr Bonnie Law	

Subject Description Form

Subject Code	EIE4116
Subject Title	Surveillance Studies and Technologies
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This course aims at providing students with thorough understanding of recent surveillance technologies and their emerging trends. They will also learn the pros and cons of various surveillance technologies.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Introduce a brief history to provide context for the evolution of today's surveillance technologies 2. Understand the different surveillance technologies 3. Understand the system design principle of CCTV and other related video security and surveillance technologies Category B: Attributes for all-roundedness 4. Understand professional, ethical, legal, security and social issues and responsibilities
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Overview of Surveillance Studies Brief history, key developments leading to current surveillance technologies; public controversy and accountability. 2. Surveillance Technologies and Techniques Visual surveillance; audio surveillance; aerial surveillance; radio-wave surveillance; GPS surveillance; sensors; computer, Internet and social media surveillance; data cards; biochemical surveillance; animal surveillance; Biometrics; pros and cons of surveillance technologies. 3. Case Study: Video and CCTV Surveillance Video's critical role in the security plan; the evolution of video and CCTV surveillance systems, network videos; cameras – analog, digital and network, cameras technologies; analog and digital video; video compression technologies; video processing equipments; video recorders, servers and storage; video management; video motion detectors; video analytics. 4. Privacy and Legislation Ubiquity of surveillance devices; balance between the needs of law enforcement of the privacy of law-abiding citizens. **Laboratory Experiments:** 1. Analysis of video compression in surveillance systems 2. Critical scene detection in surveillance systems 3. Video signal analysis.

Teaching/Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 4	fundamental principles and key concepts of the subject are delivered to students
Tutorials	1, 2, 3, 4	supplementary to lectures and are conducted with smaller class size; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed
Laboratory sessions	3	students will make use of the software to develop surveillance applications.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Continuous Assessment (total 40%)					
• Short quizzes/ Assignments	10%	✓	✓	✓	✓
• Tests	20%	✓	✓	✓	✓
• Laboratory sessions	10%			✓	
2. Examination	60%	✓	✓	✓	✓
Total	100%				

The continuous assessment will consist of laboratory reports, a number of short quizzes, assignments, and tests.

<table>
<tr><td></td><td colspan="2">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
<table>
<tr><td>Specific Assessment Methods/Tasks</td><td>Remark</td></tr>
<tr><td>Short quizzes</td><td>mainly objective tests (e.g., multiple-choice questions, true-false, and matching items) conducted to measure the students' ability to remember facts and figures as well as their comprehension of subject materials</td></tr>
<tr><td>Assignments, tests and examination</td><td>end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom;
students need to think critically and creatively in order to come with an alternate solution for an existing problem</td></tr>
<tr><td>Laboratory sessions</td><td>Each students is required to produce a written report; accuracy and the presentation of the report will be assessed;
oral examination based on the laboratory exercises will be conducted for each student to evaluate his/her technical knowledge and communication skills</td></tr>
</table></td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reference Books:
1. J.K. Petersen, Introduction to Surveillance Studies, CRC Press, 2013.
2. Vlado Damjanovski, CCTV: Networking and Digital Technology, Elsevier, 2005.
3. Herman Kruegle, CCTV Surveillance: Analog and Digital Video Practices and Technology, Elsevier Butterworth-Heinemann, 2007.
4. Fredrik Nilsson and Axis Communications, Intelligent Network Video: Understanding Modern Video Surveillance Systems, CRC Press, 2009.
5. Daniel Neyland, Privacy, Surveillance and Public Trust, Palgrave Macmillan, 2006.
6. Fredrika Bjorklund and Ola Svenonius, Video Surveillance and Social Control in a Comparative Perspective, Routledge, 2013.</td></tr>
<tr><td>Last Updated</td><td colspan="2">November 2014</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr YL Chan</td></tr>
</table>

Subject Description Form

Subject Code	EIE4117
Subject Title	Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite	Nil
Exclusion	Any other equivalent capstone project
Objectives	Students will be most benefited from doing projects in order to have the chance to practise hands-on application of the knowledge the student has learned through the curriculum, while producing something useful or valuable. On this ground, the Capstone Project (also called Final-Year Project or FYP in short) component in the curriculum is designed that meets the following objectives: 1. To provide the opportunity to the students to apply what they have learned in previous stages in a real-life technological problem 2. To enable the student to acquire and practise project management skills and discipline on pursuing the Capstone Project 3. To enable the student to apply knowledge in information security to analyse problems and synthesize solutions while considering various practical constraints.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the background, requirements, objectives, and deliverables to be produced for the specific project 2. Apply knowledge and skills relevant to information security to achieve the objectives of the project 3. Learn to use new tools and facilities, and to gather new information, for the conduction of the project <u>Category B: Attributes for all-roundedness</u> 4. Work under the guidance of a supervisor while exercising self-discipline to manage the project 5. Communicate effectively with related parties (supervisor, peers, vendors, etc.) 6. Work collaboratively with others (team-partners, outsource company, technical support staff, etc.) 7. Understand the local and global impact of information security on individuals, organisations, and society
Subject Synopsis/ Indicative Syllabus	**Syllabus:** The progression of the project will consist of the following stages: <u>Project Specification</u> In this stage, the student will work in conjunction with the project supervisor to draw up a concrete project plan specifying at least the following: 1. Background of the project 2. Aims and objectives 3. Deliverables 4. Methodology to be adopted 5. Schedule

	Project Execution The project will be pursued so that the objectives are to be met; the deliverables are to be produced in accordance with the schedule. The student and the project supervisor will meet constantly to discuss the progress. In particular the following should be demonstrated: 1. Adherence to the schedule 2. Achievement of objectives by the student's work 3. Initiatives of the student to work, design, and to solve problems 4. Inquisitiveness of the student (e.g. to probe into different phenomena or to try different approaches) 5. Diligence of the student to spend sufficient effort on the project 6. Systematic documentation of data, design, results, etc. during the process of working out the project Project Report It is important that the student is competent in disseminating the results for others to review. Through this dissemination process, project achievements can be communicated, experience can be shared, and knowledge and skills learned can be retained and transferred. The following elements will be important as evidence of achievement: 1. Project log book (documenting the work done over the year) 2. Project report (hardcopy and softcopy) 3. Presentation 4. Performance in a Question-and-Answer session 5. Demonstration

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)						
		1	2	3	4	5	6	7
Continuous Assessment	100%	✓	✓	✓	✓	✓	✓	✓
Total	100%							

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

Specific Assessment Methods/Tasks	Remark
Continuous assessment	The assessment of the project work is done continuously throughout the whole project period. The evidence of the student's achievement will be documented in the log book and reports submitted in various stages. The student will be required to give a presentation and demonstration so that he/she can communicate with other parties about the project achievement.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Structured study	52 Hours
	• Meeting with project supervisor (1 hours per week)	26 Hours
	Other student study effort:	
	• Project development and guided study	102 Hours
	• Reports writing, preparing for presentation and demonstration	30 Hours
	Total student study effort:	**210 Hours**
Reading List and References	**Reference Books:** *To be specified by the project supervisor for each project.*	
Last Updated	December 2014	
Prepared by	Dr Daniel Lun	

Subject Description Form

Subject Code	EIE4118
Subject Title	Intrusion Detection and Penetration Test
Credit Value	3
Level	4
Pre-requisite	For 42480: EIE3120 Network Technologies and Security For 42470: EIE4106 Network Management and Security
Co-requisite/ Exclusion	Nil
Objectives	1. To provide a solid foundation to the students in network security with a focus on intrusion detection and penetration test; 2. To enable the students to master the knowledge about intrusion detection and penetration test in the context of real-life applications; 3. To prepare the students for understanding, evaluating critically, and assimilating new knowledge and emerging technology in network security.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the physical location, the operational characteristics and the various functions performed by the intrusion detection/prevention system 2. Describe how components in different layers inter-operate in the intrusion detection/prevention system 3. Understand the current network security vulnerabilities and effective procedures of penetration test 4. Learn new techniques and to align new security technologies to existing network infrastructure Category B: Attributes for all-roundedness 5. Present ideas and findings effectively 6. Learn independently
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Vulnerabilities and Security Threats to Computer Networks Sources of vulnerabilities, types of attacks, attacks against various security objectives, countermeasures of attacks. 2. Penetration Test Methodologies and Procedures White-box / grey-box testing, security surfaces for evaluation, automated tools for vulnerability scan and penetration test. 3. Intrusion Detection and Prevention Technologies Host-based intrusion detection system (IDS) / intrusion prevention system (IPS), network-based IDS/IPS. Intrusion detection techniques, misuse detection: pattern matching, policy-based and state-based; anomaly detection: statistical based, honeypots-based; hybrid detection. 4. IDS and IPS Architecture Tiered architectures, single-tiered, multi-tiered, peer-to-peer. Sensor: sensor functions, sensor deployment and security. Agents: agent

functions, agent deployment and security. Alert management: alert types, alert manager deployment and security. Information flow in IDS and IPS, defending IDS/IPS.

5. Network Security Monitoring
Network traffic collection and storage, detection mechanisms and indicators of compromise, packet analysis, friendly and threat intelligence.

6. Deployment of IDS/IPS
Case study on commercial and open-source IDS.

Possible Laboratory Experiments:

1. Vulnerability scan and penetration test
2. Protocol and traffic analysis
Intrusion detection using Snort

Teaching/Learning Methodology

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 3, 4	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 3, 4, 5, 6	Supplementary to lectures and are conducted with smaller class size; Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Problems and application examples are given and discussed.
Laboratory sessions	3, 5, 6	Students will conduct practical exercises in intrusion detection and prevention to reinforce concepts and techniques learned.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/ Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**					
		1	**2**	**3**	**4**	**5**	**6**
1. Continuous Assessment	70%						
• Quiz	15%	✓	✓	✓		✓	
• Project	30%	✓	✓	✓	✓	✓	✓
• Laboratory demonstration and reports	25%	✓	✓	✓		✓	
2. Examination	30%						
• Practical Test	30%	✓	✓	✓		✓	
Total	100%						

<table>
<tr>
<td></td>
<td>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
<table>
<tr><th>Specific Assessment Methods/Tasks</th><th>Remark</th></tr>
<tr><td>Project</td><td>Students need to think critically and creatively in order to come with a solution for a practical problem.</td></tr>
<tr><td>Quiz</td><td>Mainly objective quizzes conducted to measure the students’ understanding of the theories and concepts as well as their comprehension of subject materials.</td></tr>
<tr><td>Examination (Practical Test)</td><td>Hands-on type problems emulate real-life penetration test and intrusion detection scenarios, which are used to evaluate students’ ability in applying concepts and skills learnt in the classroom.</td></tr>
<tr><td>Laboratory sessions</td><td>Each student is required to produce a real-life demo and/or a written report to evaluate his/her technical knowledge and communication skills.</td></tr>
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<tr>
<td>Student Study Effort Expected</td>
<td>
<table>
<tr><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>1. Lecture</td><td>27 Hours</td></tr>
<tr><td>2. Tutorial/Laboratory/Practice Classes</td><td>12 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>3. Lecture: preview/review of notes; homework/assignment; preparation for test/examination</td><td>24 Hours</td></tr>
<tr><td>4. Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>42 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
</table>
</td>
</tr>
<tr>
<td>Reading List and References</td>
<td>Reference Books:

1. C. Endorf, E. Schultz and J. Mellander, Intrusion Detection & Prevention, McGraw-Hill/Osborne, 2004.
2. Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010.
3. J. M. Kizza, Computer Network Security, Springer, 2005.
4. D. Jacobson, Introduction to Network Security, CRC Press, 2009.
5. Chris Sanders and Jason Smith, Applied Network Security Monitoring: Collection, Detection, and Analysis, Syngress, 2013.
6. Richard Bejtlich, The Practice of Network Security Monitoring: Understanding Incident Detection and Response, No Starch Press, 2013.
7. Peter Kim, The Hacker Playbook 3: Practical Guide To Penetration Testing, May 2018.</td>
</tr>
<tr>
<td>Last Updated</td>
<td>November 2021</td>
</tr>
<tr>
<td>Prepared by</td>
<td>Dr H. Hu</td>
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</table>

Subject Description Form

Subject Code	EIE4119
Subject Title	Mobile Device System Architecture
Credit Value	3
Level	4
Pre-requisite	EIE3311 Computer System Fundamentals and EIE3331 Communication Fundamentals
Co-requisite/ Exclusion	Nil
Objectives	This course aims at providing students with an understanding of the hardware architecture and the techniques for the design and implementation of the computer and communication systems of mobile devices.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. Understand the hardware architecture and design constraints of mobile computers. 2. Understand the functions and features of different sub-systems of a mobile computer. 3. Understand the basic concepts of RF and wireless technologies used in mobile devices. 4. Analyse the performances of RF building blocks and subsystems with practical design parameters.
Subject Synopsis/ Indicative Syllabus	1. Essentials of Mobile Handset Design: Generations of mobile communication capability. Development of mobile handset. Basic functional blocks of mobile handset. 2. Mobile Computers and Their Applications: Mobile computers and their applications in daily life. Complex systems and microprocessors. The embedded system design process. Formalisms for system design. 3. Central Processing Units for Mobile Computers: Instruction set architecture, data operations, flow of control. Programming input and output. Memory system mechanisms. CPU performance. CPU power consumption. Case study: ARM processor. 4. Multiprocessors and co-processors: Why multiprocessors, CPUs and accelerators. Multiprocessor performance analysis. 3D graphics on embedded systems, principle of mobile 3D graphics system design, mobile 3D graphics APIs, real chip implementations. 5. Basic concept of RF and overview of mobile front-end system: frequency, bandwidth, wavelength, electromagnetic waves, electromagnetic spectrum, attenuation, power, decibels (dB) and transmission lines, overview of mobile front-end systems and its hardware architecture. 6 Basic component building blocks in mobile front-end system: Building blocks and components used in RF transmitters and receivers. Functionality and key technical characteristics. Introduction to active components such as power amplifier (PA), low noise amplifier (LNA), and passive components such as filters.

	7. Linearity in mobile front-end systems: Effects of non-linearity in RF blocks and systems. Non-linear behaviour in AM-AM and AM-PM conversion. Intermodulation distortion and spurious emission in RF transceiver systems.

Teaching/Learning Methodology

Method	Remarks
Lectures and quizzes	The subject matters will be delivered through lectures. Students will be engaged in the lectures through quizzes, discussions and specially designed classroom activities.
Tutorials	During tutorials, students will work on/discuss some chosen topics in small group. This will help strengthen the knowledge taught in lectures.
Laboratory and assignments	During laboratory exercises, students will perform hands-on tasks to practice what they have learned. They will evaluate performance of systems and design solutions to problems. The assignments will help students to review the knowledge taught in class.

Teaching/Learning Methodology	Intended Subject Learning Outcomes			
	1	2	3	4
Lectures and quizzes	✓	✓	✓	✓
Tutorials	✓	✓	✓	✓
Laboratory sessions		✓		✓

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Quizzes	5%	✓	✓	✓	✓
2. Tests	18%	✓	✓	✓	✓
3. Assignments	10%	✓	✓	✓	✓
4. Laboratory demonstration and reports	12%		✓		✓
5. Examination	55%	✓	✓	✓	✓
Total	100%				

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

Specific Assessment Methods/Tasks	**Remark**
Quizzes	Small exercises conducted to measure the students' basic understanding of the theories, concepts and the analysis methods taught during the lectures or tutorial classes.
Tests and examination	End-of chapter type problems used to evaluate students' understanding of the theories, concepts and the analysis methods taught in the subject. Their ability in applying them in solving problems will also be assessed.
Assignments	Examination type questions to measure the students' understanding of the theories, concepts and the analysis methods taught during the lectures or tutorial classes.
Laboratory sessions	During the laboratory sessions, students will be given some practical tasks so as to examine their understanding of the functions and features of different sub-systems of a mobile computer. They also require them to analyse the performances of RF building blocks and subsystems. Each student is required to produce a report on the laboratory work they conduct. Each student also needs to make a demonstration on the open-ended question set out in each laboratory work.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture/Tutorial	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Homework and self-study	66 Hours
	Total student study effort	**105 Hours**
Reading List and References	**Reference Book:** 1. Abhi Naha and Peter Whale, *Essential of Mobile Handset Design*, Cambridge University Press, 2012. 2. J. Hennessy and D. Patterson, *Computer Architecture – A Quantitative Approach*, 6th Edition, Morgan Kaufmann, 2017. 3. J.H. Woo, J.H. Sohn, B.G. Nam and H.J. Yoo, *Mobile 3D graphics SoC: From algorithm to chip*, John Wiley & Sons, 2010. 4. Behzad Razavi, *RF Microelectronics*, 2nd ed., Prentice Hall, 2014. 5. John Rogers, *Radio Frequency Integrated Circuit Design*, 2nd ed., Artech House, 2010. 6. David M. Pozar, *Microwave Engineering*, 4th ed., Wiley, 2011.	
Last Updated	January 2019	
Prepared by	Dr Daniel Lun	

Subject Description Form

Subject Code	EIE4121
Subject Title	Machine Learning in Cyber-security
Credit Value	3
Level	4
Pre-requisite	Nil
Co-requisite/ Exclusion	Nil
Objectives	1. To introduce concepts about machine learning techniques in cyber-security 2. To develop skills of using recent techniques for solving practical problems in cyber-security
Intended Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand different machine learning techniques 2. Use different techniques for solving problems in cyber security Category B: Attributes for all-roundedness 3. Present ideas and findings effectively
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Machine learning techniques Introduction to machine learning; Basic concepts and classification; Supervised learning and unsupervised learning; classification; clustering; Neural Networks; Support vector machines; Dimensionality reduction; Deep learning 2. Machine learning development environments Software tools for implementing machine learning techniques; Generalization performance; Issues of over-fitting. 3. Malware Analysis Introduction to malware analysis; Types of malware analysis; static analysis, dynamic analysis; Behavioral vs code analysis; Use of machine learning techniques for malware detection such as K-Means, support vector machines, convolutional neural networks. 4. Phishing detection Introduction to phishing detection; Analysis of email/websites/message features for phishing characterization; Use of techniques such as logistic regression and decision tree for phishing detection. 5. Anomaly Detection Introduction to the anomaly definition; overview of anomaly detection techniques; static rules technique; use of machine learning techniques such as autoencoder for anomaly detection. **Laboratory Experiments:** Practical Works: 1. Introduction to machine learning framework 2. Evaluation of machine learning techniques in malware detection 3. Evaluation of machine learning techniques in phishing detection

Teaching/Learning Methodology	<table><tr><th>Teaching and Learning Method</th><th>Intended Subject Learning Outcome</th><th>Remarks</th></tr><tr><td>Lectures</td><td>1, 2</td><td>Fundamental principles and key concepts of the subject are delivered to students.</td></tr><tr><td>Tutorials</td><td>1, 2</td><td>Supplementary to lectures; Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Problems and application examples are given and discussed.</td></tr><tr><td>Laboratory sessions</td><td>2, 3</td><td>Students will evaluate different kinds of machine learning techniques.</td></tr><tr><td>Mini-project</td><td>1, 2, 3</td><td>Students are required to study the use of machine learning techniques in cyber-security application. Students will need to submit a written report and make a presentation.</td></tr></table>
Assessment Methods in Alignment with Intended Learning Outcomes	<table><tr><th rowspan="2">Specific Assessment Methods/Tasks</th><th rowspan="2">% Weighting</th><th colspan="3">Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)</th></tr><tr><th>1</th><th>2</th><th>3</th></tr><tr><td>1. Continuous Assessment (total 50%)</td><td></td><td></td><td></td><td></td></tr><tr><td>• Tests</td><td>18%</td><td>√</td><td>√</td><td></td></tr><tr><td>• Laboratory sessions</td><td>13%</td><td></td><td>√</td><td>√</td></tr><tr><td>• Mini-project</td><td>19%</td><td></td><td>√</td><td>√</td></tr><tr><td>2. Examination</td><td>50%</td><td>√</td><td>√</td><td></td></tr><tr><td>Total</td><td>100%</td><td></td><td></td><td></td></tr></table> The continuous assessment consists of tests, laboratory exercises and a mini-project. **Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:** <table><tr><th>Specific Assessment Methods/Tasks</th><th>Remark</th></tr><tr><td>Tests</td><td>These can measure students' understanding of the theories and concepts as well as their comprehension of subject materials.</td></tr><tr><td>Examination</td><td>end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; students need to think critically in order to come with a solution for a problem.</td></tr><tr><td>Laboratory sessions, mini-project</td><td>oral examination will be conducted to evaluate student's technical knowledge and communication skills.</td></tr></table>

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	26 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	40 Hours
	Total student study effort:	**105 Hours**
Reading List and References	1. Thomas Tony, Athira P. Vijayaraghavan, Sabu Emmanuel, "Machine learning approaches in cyber security analytics", Springer, 2020. 2. Padmavathi Ganapathi and D. Shanmugapriya, "Handbook of Research on Machine and Deep Learning Application for Cyber security", IGI Global, 2020. 3. Mark Stamp, Introduction to Machine Learning with Applications in Information Security, Chapman and Hall/CRC, 2017. 4. Chiheb Chebbi, Mastering Machine Learning for Penetration Testing, Packt Publishing Ltd, 2018. 5. Monnappa K A, Learning Malware Analysis, Packt Publishing Ltd, 2018. 6. Dipanjan Sarkar, Raghav Bali and Tushar Sharma, Practical Machine Learning with Python, Apress, 2018.	
Last Updated	June 2021	
Prepared by	Bonnie Law	

Subject Description Form

Subject Code	EIE4122
Subject Title	Deep Learning and Deep Neural Networks
Credit Value	3
Level	4
Pre-requisite	**For 42477:** EIE3124: Fundamentals of Machine Intelligence **For 42470:** AMA2104 Probability and Engineering Statistics
Co-requisite/ Exclusion	Nil
Objectives	This course is for students who would like to equip themselves with cutting-edge AI knowledge and know-how to join the AI profession. Students will learn the foundations of deep learning and how to construct deep neural networks for real-world applications and AI systems. Students will also learn the trends in deep learning and deep neural networks.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the benefits of deep learning and deep neural networks. 2. Understand the basic theories in deep learning and deep neural networks. 3. Understand how deep learning and deep neural networks are applied in real-world applications and AI systems. <u>Category B: Attributes for all-roundedness</u> 4. Understand the creative process when designing solutions to a problem.
Subject Synopsis/ Indicative Syllabus	1. <u>A High-Level Perspective of Deep Learning and Deep Neural Networks</u> 1.1 What are neural networks and deep neural networks? 1.2 Relationship among AI, machine learning, deep learning, and DNNs 1.3 Neural networks: From shallow to deep 1.4 How DNNs learn from data? 1.5 Examples of real-life applications: Computer vision, speech, text analysis, and healthcare 2. <u>Machine Learning</u> 2.1 Vectors, matrices, tensors, and vector space 2.2 Random variables and probability distributions 2.3 Bayes theorem and its applications 2.4 Supervised learning versus unsupervised learning 2.5 Overfitting, underfitting, and dimension reduction 2.6 Gaussian mixture models and Support vector machines 3. <u>From ANN to DNN</u> 3.1 Biological Neurons versus artificial neurons 3.2 Perceptrons and multi-layer perceptrons 3.3 Relationship between MLP, GMM, and SVM 3.4 Why going deep? 3.5 DNN for classification and regression 4. <u>Deep Architectures</u> 4.1 Autoencoders and denoising autoencoders 4.2 Convolutional neural networks 4.3 Residual networks and DenseNet 4.4 Recurrent neural networks 4.5 Long short-term memory and gate recurrent unit

	4.6 Sequence-to-sequence models 4.7 Transformer models and attention mechanism 5. <u>Deep Learning</u> 5.1 Loss functions: MSE and cross-entropy (softmax) loss 5.2 Gradient-based optimization: momentum and learning rate schedule 5.3 Backpropagation 5.4 Gradient vanishing 5.5 Batch normalization and layer normalization 5.6 Regularization: Dropout, weight decay, L1 and L2 regularization, data augmentation, and early stopping 5.7 Representation learning: embedding and statistics pooling 5.8 Adversarial learning 5.9 End-to-end training 6. <u>Software and Hardware Tools</u> 6.1 Software stack: CUDA, cuDNN, Tensorflow, PyTorch, and Keras 6.2 Cloud platforms: Amazon EC2, Azure, Google Cloud, Nvidia GPU cloud, Alibaba Cloud, Google Colab, etc. 6.3 Hardware: GPU, TPU, Nvidia Jetson
Teaching/Learning Methodology	Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions and specially designed classroom activities. The background theories on DL and DNNs will be accompanied by various real applications. Tutorials: During tutorials, students will work on/discuss some chosen topics. This will help strengthen the knowledge taught in lectures. Laboratory and assignments: During laboratory exercises, students will perform hands-on tasks to practice what they have learned. They will evaluate performance of systems and design solutions to problems. The assignments will help students to review the knowledge taught in class. While lectures and tutorials will help to achieve the professional outcomes, the open-ended questions in laboratory exercises and assignments will provide the chance for students to exercise their creatively in problem solving.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table and explanation below)

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Continuous Assessment (total: 50%)					
• Homework and assignments	15%	✓	✓	✓	✓
• Tests and Quizzes	20%	✓	✓	✓	
• Laboratory exercises	15%			✓	✓
2. Examination	50%	✓	✓	✓	✓
Total	100%				

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

Assignment, homework, and laboratory exercises will require students to apply what they have learnt to solve problems. There will be open-ended questions that allow students to exercise their creativity in making design.

Examination and tests: They assess students' achievement of the learning outcomes in a more formal manner.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Materials:** 1. I. Goodfellow, Y. Bengio and A. Courville, *Deep Learning*, MIT Press 2016 2. M.W. Mak and J.T. Chien, *Machine Learning for Speaker Recognition*, Cambridge University Press, 2020. 3. C.M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006. 4. J. Langr and V. Bok, *GANs in Action*: *Deep Learning with Generative Adversarial Networks (GANs)*, Manning Publications, 2018. 5. F. Chollet, *Deep Learning with Python*, Manning Publications, 2018.	
Last Updated	March 2022	
Prepared by	Prof. M.W. Mak	

Subject Description Form

Subject Code	EIE4123
Subject Title	Healthcare Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	EIE3311 Computer System Fundamentals / EIE3343 Computer Systems Principles EIE3124 Fundamentals of Machine Intelligence
Objectives	This subject aims at providing students with the theory, practice, and applications of advanced technologies (such as AI, blockchain, virtual reality, and 5G) in healthcare and healthcare systems. In particular, the subject enables students to understand how advanced technologies transform the healthcare systems and healthcare services.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand how advanced technologies# can be applied to healthcare 2. Understand the benefit of using various technologies in healthcare 3. Understand the role of information technologies and data security in healthcare systems Category B: Attributes for all-roundedness 4. Understand the creative process when designing solutions to a problem #Advanced technologies include AI, blockchain, AR/VR, 5G, etc.
Subject Synopsis/ Indicative Syllabus	**Part I – Core** 1. Health Informatics 1.1. Healthcare data, information, and knowledge 1.2. Healthcare data analytics 1.3. Electronic health records 2. AI in Healthcare 2.1. Introduction to medical applications of AI 2.2. Computer vision: motion tracking; fall detection 2.3. Speech technologies: diagnosis of neurocognitive disorders and autism spectrum disorders; speech therapy; stress and depression detection; voice pathology detection; speech impairment 2.4. Diagnostic imaging **Part II – Selected Topics (2–3 out of 5 topics)** 3. Blockchain and Privacy in Healthcare 3.1. Key characteristics of blockchain architecture 3.2. Example Blockchain-based applications in healthcare industry: smart contracts, fraud detection, identity verification, drug traceability. 4. VR/AR for Healthcare 4.1. Advantages of using VR/AR for healthcare 4.2. Example VR/AR applications: Behavioural therapy, virtual and augmented surgery, virtual anatomy, training 5. Mobile Healthcare 5.1. ECG monitoring and recognition 5.2. Personalized mobile/wearable devices and apps 5.3. Remote patient monitoring

	6. Telemedicine and Telehealth 6.1. Robotic surgery; physical therapy via digital monitoring instruments 6.2. 5G for telehealth and remote monitoring 7. Internet of Medical Things (IoMT) 7.1. Introduction and technological aspects of IoMT. 7.2. Biomedical sensors 7.3. Example use cases of IoMT: post-surgery care, virtual home assistance, smart real-time patient monitoring, implantable sensors and cameras, diagnosis, and treatment planning
Teaching/Learning Methodology	Lectures: The subject matters will be delivered through lectures. Students will be engaged in the lectures through Q&A, discussions, and specially designed classroom activities. Tutorials: During tutorials, students will work on/discuss some chosen topics. This will help strengthen the knowledge taught in lectures. Mini-project (or labs) and assignments: During laboratory exercises, students will perform hands-on tasks to practice what they have learned. They will evaluate performance of systems and design solutions to problems. The assignments will help students to review the knowledge taught in class. While lectures and tutorials will help to achieve the professional outcomes, the open-ended questions in laboratory exercises and assignments will provide the chance to students to exercise their creativity in problem solving.
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see table and explanation below)

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)			
		1	2	3	4
1. Continuous Assessment					
• Homework and assignments	20%	✓	✓	✓	
• Test and quizzes	20%	✓	✓	✓	
• Lab or mini-project	20%	✓	✓		✓
2. Examination	40%	✓	✓	✓	
Total	100%				

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

Assignment, homework, and laboratory exercises (or mini-project) will require students to apply what they have learnt to solve problems. There will be open-ended questions that allow students to exercise their creativity in making design.

Examination and tests: They assess students' achievement of the learning outcomes in a more formal manner.

<table>
<tr><td rowspan="8">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lectures</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reference Materials:

1. D. Jude Hemanth, J. Anitha, and George A. Tsihrintzis, “Internet of Medical Things: Remote Healthcare Systems and Applications”, Springer, 2021. ISBN 978-3-030-63937-2.
2. Kelvin Chen, “Wearable Medical Technologies”, Royal Collins Publishing Company.
3. V. Emilia Balas and Souvik Pal, “Healthcare Paradigms in the Internet of Things Ecosystem”, Academic Press, 2020.
4. Deepak Gupta, Moolchand Sharma, Vikas Chaudhary, and Ashish Khanna, “Robotic Technologies in Biomedical and Healthcare Engineering”, CRC Press, 2021.
5. Robert E. Hoyt and Ann K. Yoshihashi, “Health Informatics: Practical Guide for Healthcare and Information Technology Professionals”, 7th Edition, Informatics Education, 2018.
6. Shuyun Shi, et al. “Applications of blockchain in ensuring the security and privacy of electronic health record systems: A survey”, Computer Security, vol. 97, Oct. 2020.
7. Arvin Agah, “Medical Applications of Artificial Intelligence”, CRC Press, 2014.
8. Arjun Panesar, “Machine Learning and AI for Healthcare”, Apress, 2021.
9. C.M. Hayre, D.J. Muller, and M.J. Scherer, “Virtual Reality in Health and Rehabilitation”, CRC Press, 2020.</td></tr>
<tr><td>Last Updated</td><td colspan="2">June 2021</td></tr>
<tr><td>Prepared by</td><td colspan="2">Prof. M.W. Mak, Dr. N.F. Law, and Prof. Changyuan Yu</td></tr>
</table>

Subject Description Form

Subject Code	EIE4124
Subject Title	Modern Robotics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	<To be confirmed after considering the revised curriculum>
Objectives	Robots have been in our daily lives, integrating seamlessly into many fields. They pay significant roles in the new technological revolution. This subject objective is to introduce in a systematic manner the advanced technologies used for modern robotic applications.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Appreciate modern control techniques for robots. 2. Appreciate visual servoing techniques for autonomous robots. 3. Understand some technologies for human-robot interaction. <u>Category B: Attributes for all-roundedness</u> 4. Communicate effectively with others on the acquired knowledge. 5. Appreciate the importance of staying abreast of the state-of-the-art technologies.
Subject Synopsis/ Indicative Syllabus	1. <u>Introduction of Robot Platforms and Relevant Tools</u> • Examples of robot platforms, sensor devices, and software toolkits. • Robot Operating System (ROS). 2. <u>Robot Kinematics and Dynamics Modeling</u> • End-effector's position, orientation, and motion of all the joints. • Analysis and synthesis of the dynamic behaviour of robots. 3. <u>Intelligent Control of Robot Manipulator</u> • Methods for impedance and force control, and for tracking of desired robot trajectories. 4. <u>Object Detection and Tracking</u> • Object recognition and tracking with visual sensors: single or multiple moving objects. 5. <u>Visual Servoing Control of Robot Manipulator</u> • Visual servoing applications for human-robot cooperation. • Stereo camera-based tracking control 6. <u>Robot Teleoperation Technologies</u> • Body motion tracking with a Kinect sensor. • Haptic interaction with a 3D joystick. 7. <u>Obstacle Avoidance for Robot Manipulator</u> • Obstacle avoidance strategy and collision prediction algorithm. 8. <u>Human-Robot Interaction Interface</u> • Technologies of human–robot interaction, e.g., visual sensors, electroencephalography (EEG) signals, etc. • Hand gesture-based robot control system.

Teaching/Learning Methodology

Lectures and Tutorials: The subject matters will be delivered through lectures. Students will be engaged in the tutorials through Q&A, discussions, and other activities.

Laboratory Activities: Students will do experiments using software tools. Students will appreciate the technologies in modern robotics that they have learned from lectures and put them into practice in simulation environments.

Assignment: Students will finish class exercises by doing self-studies.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Continuous Assessment						
• Laboratory activities	15%	✓	✓	✓	✓	✓
• Exercises	16%	✓	✓	✓		✓
• Tests	19%	✓	✓	✓		
2. Examination	50%	✓	✓	✓		
Total	100%					

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

Laboratory activities will require students to apply what they have learned to solve problems. There will be open-ended questions that allow students to exercise their creativity in solution design, improve the design through discussions and practicing, and appreciate the need for knowing the newest technologies.

Exercises, Tests, and Examination assess students' achievement of the learning outcomes in a more formal manner.

100% of the assessment is individual assessment.

Student Study Effort Expected

Class contact (time-tabled):	
• Lectures	22 Hours
• Tutorial/Laboratory/Practice Classes	17 Hours
Other student study effort:	
• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	36 Hours
• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
Total student study effort:	**105 Hours**

Reading List and References	**Reference Materials:** 1. C. Yang, H. Ma, and M. Fu, *Advanced Technologies in Modern Robotic Applications*. Singapore: Springer Singapore Pte. Limited, 2016. 2. R. Murphy, *Introduction to AI Robotics (2nd Ed.)*. Cambridge, Massachusetts: The MIT Press, 2019. 3. A. Koubaa (editor), *Robot Operating System (ROS): The Complete Reference (Volume 5)*. Cham: Springer International Publishing: Imprint: Springer, 2021.
Last Updated	June 2021
Prepared by	F. Leung

Subject Description Form

Subject Code	EIE4125
Subject Title	Power Conversion Technology for Energy Harvesting
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	EIE2110 Basic Circuit Analysis and Electronics EIE3123 Dynamic Electronic Systems
Objectives	**To enable students to gain knowledge and understanding in the following aspects:** 1. Fundamentals of different types of energy transducers. 2. Basic power conversion circuits for energy harvesting. 3. Fundamentals of different energy storage technologies for energy harvesting. 4. Design and implementation of practical energy harvesting systems. Internet-of-Things (IoT) is a fast developing field which has already found many useful applications in our daily lives. However, powering IoT devices remains as one of the greatest challenges towards large-scale deployment of IoT devices. This subject aims to equip students with the fundamental knowledge on the main components of practical energy harvesting systems that are aimed to ensure continuous power supply to IoT devices.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the fundamentals of the main components of practical energy harvesting systems. 2. Design practical energy harvesting systems to meet given specifications and constraints. 3. Use appropriate engineering tools to analyse, design, and build hardware prototype of practical energy harvesting systems. 4. Understand the importance of energy harvesting technologies to the sustainable development of IoT and related smart technologies. <u>Category B: Attributes for all-roundedness</u> 5. Communicate effectively. 6. Assimilate new technological developments in energy harvesting technologies.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Overview of Energy Harvesting Systems for IoT Devices</u> Energy sources. Energy transducers. Power converters. Power management unit. Energy storages. Load devices. 2. <u>Energy Transducers</u> Piezoelectric transducers. Electromagnetic transducers. Electrostatic transducers. Thermoelectric transducers. Solar cells. Wind turbines. RF antenna. 3. <u>Components of Power Converters</u> Power semiconductor devices. Magnetic design. Voltage and current sensors. Power management IC. Feedback controller design.

	4. <u>Power Converter Topologies</u> DC-DC converters (linear regulators, non-isolated/isolated switching converters, switched-capacitor converters). AC-DC converters (voltage doubler, rectifier with voltage doubler, direct discharge circuit). Computer simulation of power converters. 5. <u>Energy Storages</u> Fuel cells. Electrochemical batteries. Supercapacitors. 6. <u>Power Management</u> Single-source systems. Multi-source systems. Load matching. Maximum power point tracking. Power saving design. 7. <u>Applications of Energy Harvesting Systems for IoT Devices</u> Building automation. Environmental monitoring. Condition monitoring. Structural health monitoring. Automotive. Logistics. Consumer electronics.
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures, supplemented with interactive questions and answers, and short quizzes.	1, 2, 3, 4, 5, 6	In lectures, students are introduced to the *knowledge* of the subject, and *comprehension* is strengthened with interactive Q&A and short quizzes. They will be able to *explain* and *generalize* knowledge in the design of energy harvesting systems.
Tutorials where design problems are discussed, and are given to students for them to solve.	1, 2, 3, 4, 5, 6	In tutorials, students *apply* what they have learnt in analyzing the cases and solving the problems given by the tutor. They will *analyze* the given information, *compare* and *contrast* different scenarios and propose solutions or alternatives.
Laboratory sessions, where students will complete a mini-project by systematic computer simulation and experimental prototyping. They are required to write a report on the mini-project.	1, 2, 3, 4, 5, 6	Students *acquire* hands-on experience in using computer-aided design (CAD) tools in energy harvesting system design, and *apply* what they have learnt in lectures/tutorials to complete a mini-project on the design of an energy harvesting system to meet given specifications and constraints.
Assignment/Homework	1, 2, 3, 4, 5	Through working on assignment and homework, students will develop a firm understanding and *comprehension* of the *knowledge* taught. They will *analyze* given information and *apply* knowledge in solving problems. For some design type of questions, they will have to *synthesize* solutions by *evaluating* different alternatives.

Assessment Methods in Alignment with Intended Learning Outcomes	

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment (total 60%)							
• Assignment	10%	✓	✓	✓	✓	✓	
• Mini-project	30%	✓	✓	✓	✓	✓	✓
• Mid-semester test	20%	✓	✓	✓	✓	✓	
2. Final Examination	40%	✓	✓	✓	✓	✓	
Total	100 %						

The continuous assessment consists of assignments/homework, quizzes, one mini-project, one mid-semester test, and one final examination.

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

Specific Assessment Methods/Tasks	Remark
Assignment/Homework	Assignment/Homework and case study reports are given to students to assess their competence level of *knowledge* and *comprehension*, ability to *analyze* given information, ability to *apply* knowledge and skills in new situation, ability to *synthesize* structure, and ability to evaluate given data to make judgment. The rubrics (i.e. *what* to be demonstrated) and level (i.e. the *extent*) of achievement will be graded according to 12 levels: (A+, A, and A-), Good (B+, B, and B-), Satisfactory (C+, C, and C-), Marginal (D+ and D) and Failure (F). These will be made known to the students before an assignment/homework is given. Feedback about their performance will be given promptly to students to help them improvement their learning.
Mini-project and report	Students will be required to perform a mini-project and submit a report. The emphasis is on assessing their ability to *use* CAD tools effectively to perform *energy harvesting system design* and *hands-on skills* on hardware design and prototyping. Expectation and grading criteria will be given as in the case of assignment/homework.
Mid-semester test	There will be a mid-semester test to evaluate students' achievement of all the learning outcomes and give feedback to them for prompt improvement. Expectation and grading criteria will be given as in the case of assignment/homework.
Final examination	There will be an end-of-semester examination to assess students' achievement of all the learning outcomes. These are mainly summative in nature. Expectation and grading criteria will be given as in the case of assignment/homework.

<table>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>26 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practical Classes</td><td>13 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>39 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practical Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>108 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reference Books:

1. P. Spies, L. Mateu, and M. Pollak, Handbook of Energy Harvesting Power Supplies and Applications, Jenny Stanford Publishing, 2015.
2. M. Di Paolo Emilio, Microelectronic Circuit Design for Energy Harvesting Systems, Springer, 2016.
3. S. Priya and D. J. Inman, T. Morey, Energy Harvesting Technologies, Springer, 2010.
4. M. Alhawari, B. Mohammad, H. Saleh, and M. Ismail, Energy Harvesting for Self-Powered Wearable Devices, Springer, 2017.
5. N. Bizon, N. Mahdavi Tabatabaei, F. Blaabjerg, and E. Kurt, Energy Harvesting and Energy Efficiency: Technology, Methods, and Applications, Springer, 2017.
6. Y. K. Tan, Energy Harvesting Autonomous Sensor Systems: Design, Analysis, and Practical Implementation, CRC Press, 2013.</td></tr>
<tr><td>Last Updated</td><td colspan="2">Jun 2021</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr K.H. Loo</td></tr>
</table>

Subject Description Form

Subject Code	EIE4126
Subject Title	Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Engineering is the science of solve problems by applying scientific principles and technology in order to improve human life. This may take the form of invention, design, implementation, so on and so forth. It is important for students to have the chance to design and implement solutions to existing problems while considering various constraints. They will also have the chance to apply the knowledge they have learned throughout the curriculum. The Capstone Project (also called Final-Year Project or FYP in short) in the curriculum is designed with the following objectives: 1. To provide the opportunity to the students so that they can apply what they have learnt in previous stages in a real-life engineering context. 2. To enable the students to acquire and practise project management skills and discipline while pursuing the Honours Project. 3. To enable the student to apply engineering knowledge in analysis of problems and synthesis of solution while considering various constraints.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the background, the requirements, objectives, and deliverables to be produced for the specific project. 2. Apply knowledge and skills relevant to electronic and information engineering to achieve the objectives of the project. 3. Learn to use new tools and facilities, and to gather new information, for the conduction of the project. <u>Category B: Attributes for all-roundedness</u> 4. Work under the guidance of a supervisor while exercising self-discipline to manage the project. 5. Communicate effectively with related parties (supervisor, peers, vendors, ..etc.). 6. Work with others (team partners, outsource company, technical support staff, ...etc.) collaboratively. 7. Realize different constraints when designing solutions.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** The progression of the project will consist of the following stages. <u>Project Specification</u> In this stage, the student will work in conjunction with the project supervisor to draw up a concrete project plan specifying at least the following: 1. Background of the project 2. Aims and objectives 3. Deliverables 4. Methodology to be adopted 5. Schedule

	Project Execution After the specification is done, the project will be pursued so that the objectives are to be met; the deliverables are to be produced in accordance with the schedule. The student and the project supervisor will meet constantly to discuss the progress. In particular the following should be demonstrated: 1. Adherence to the schedule 2. Achievement of objectives by the student's work 3. Initiatives of the students to work, design, and to solve problems 4. Inquisitiveness of the student (e.g. to probe into different phenomena or to try different approaches) 5. Diligence of the students to spend sufficient effort on the project 6. Systematic documentation of data, design, results, …etc. during the process of working out the project Project Report After the project is finished, it is important that the student is competent in disseminating the results for others to review. Through this dissemination process, project achievements can be communicated, experience can be shared, knowledge and skills learnt can be retained and transferred. The following elements will be important as evidence of students' achievement: 1. Project log book (documenting the work done over the year) 2. Project report (hardcopy and softcopy) 3. Presentation 4. Performance in a Question-and-Answer session 5. Demonstration
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see tables below)

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)						
		1	2	3	4	5	6	7
Continuous Assessment	100%	✓	✓	✓	✓	✓	✓	✓
Total	100%							

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

Specific Assessment Methods/Tasks	Remark
Continuous assessment	The assessment of the project work is done continuously throughout the whole project period. The evidence of students' achievement will be documented in log book and the reports submitted in various stages. The student will be required to give a presentation and demonstration so that he/she can communicate the project design, methodology, and achievement to other parties.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Structured Study (regular meetings with supervisor)	78 Hours
	Other student study effort:	
	• Guided Study/Reading/Experiment	90 Hours
	• Reports	30 Hours
	• Presentation and demonstration	12 Hours
	Total student study effort:	**210 Hours**
Reading List and References	**Reference Books and Papers:** *To be specified by the project supervisor for each project.*	
Last Updated	June 2015	
Prepared by	Dr. C.K. Leung	

Subject Description Form

Subject Code	EIE4127
Subject Title	Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Students will be most benefited from doing projects in order to have the chance to practise hands-on application of the knowledge the student has learned through the curriculum, while producing something useful or valuable. On this ground, the Capstone Project (also called Final-Year Project or FYP in short) component in the curriculum is designed that meets the following objectives: 1. To provide the opportunity to the students to apply what they have learned in previous stages in a real-life technological problem 2. To enable the student to acquire and practise project management skills and discipline on pursuing the Honours Project 3. To enable the student to apply knowledge in internet and multimedia technologies to analyse problems and synthesize solutions while considering various practical constraints.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the background, requirements, objectives, and deliverables to be produced for the specific project 2. Apply knowledge and skills relevant to internet and multimedia technologies to achieve the objectives of the project. 3. Learn to use new tools and facilities, and to gather new information, for the conduction of the project Category B: Attributes for all-roundedness 4. Work under the guidance of a supervisor while exercising self-discipline to manage the project 5. Communicate effectively with related parties (supervisor, peers, vendors, etc.) 6. Work collaboratively with others (team-partners, outsource company, technical support staff, etc.) 7. Realize different constraints, and to make appropriate compromise, when creatively designing the solution to a technical problem.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** The progression of the project will consist of the following stages: Project Specification In this stage, the student will work in conjunction with the project supervisor to draw up a concrete project plan specifying at least the following: 1. Background of the project 2. Aims and objectives 3. Deliverables 4. Methodology to be adopted 5. Schedule

	<u>Project Execution</u> The project will be pursued so that the objectives are to be met; the deliverables are to be produced in accordance with the schedule. The student and the project supervisor will meet constantly to discuss the progress. In particular the following should be demonstrated: 1. Adherence to the schedule 2. Achievement of objectives by the student's work 3. Initiatives of the student to work, design, and to solve problems 4. Inquisitiveness of the student (e.g. to probe into different phenomena or to try different approaches) 5. Diligence of the student to spend sufficient effort on the project 6. Systematic documentation of data, design, results, etc. during the process of working out the project <u>Project Report</u> It is important that the student is competent in disseminating the results for others to review. Through this dissemination process, project achievements can be communicated, experience can be shared, and knowledge and skills learned can be retained and transferred. The following elements will be important as evidence of achievement: 1. Project log book (documenting the work done over the year) 2. Project report (hardcopy and softcopy) 3. Presentation 4. Performance in a Question-and-Answer session 5. Demonstration
Assessment Methods in Alignment with Intended Subject Learning Outcomes	(see tables below)

Specific Assessment Methods/ Task	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)						
		1	2	3	4	5	6	7
Continuous Assessment	100%	✓	✓	✓	✓	✓	✓	✓
Total	100%							

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

Specific Assessment Methods/Tasks	Remark
Continuous assessment	The assessment of the project work is done continuously throughout the whole project period. The evidence of the student's achievement will be documented in the log book and reports submitted in various stages. The student will be required to give a presentation and demonstration so that he/she can communicate with other parties about the project achievement.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Structured study	52 Hours
	• Meeting with project supervisor (1 hours per week)	26 Hours
	Other student study effort:	
	• Project development and guided study	102 Hours
	• Reports writing, preparing for presentation and demonstration	30 Hours
	Total student study effort:	**210 Hours**
Reading List and References	**Reference Books:** *To be specified by the project supervisor for each project.*	
Last Updated	June 2015	
Prepared by	Dr Frank Leung	

Subject Description Form

Subject Code	EIE4413
Subject Title	Digital Signal Processing
Credit Value	3
Level	4
Pre-requisite	EIE3312 Linear Systems
Co-requisite/ Exclusion	Nil
Objectives	This is an essential subject to provide fundamental digital signal processing (DSP) techniques important to many communications and multimedia subjects. Both theory and practical realisation are stressed.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the basic concepts of Fourier analysis of digital signals and apply them to practical problems. 2. Design and realize simple digital filters for practical applications. 3. Understand the importance of random signal processing in DSP, and its application in statistical measures, prediction and data modelling. 4. Design and simulate simple DSP systems. Category B: Attributes for all-roundedness 5. Think critically. 6. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction 1.1 Why DSP? Typical DSP system. Typical steps to construct a DSP system. 2. Discrete Fourier Transform and Convolution 2.1 Fourier series and continuous-time Fourier transform, Gibbs phenomenon, Shannon sampling theorem. Discrete Fourier transform (DFT), properties of DFT, Fourier analysis using DFT. The fast Fourier transform (FFT) algorithm. 2.2 DSP systems. Linear convolution and its implementation. Convolution theorem. Convolution by section. 3. Design of Finite Impulse-response (FIR) and Infinite Impulse-response (IIR) Digital Filters 3.1 Design stages for FIR filters. Design method – Windowing. Designing low-pass, band-pass, and high-pass FIR filters. Linear phase response filters and their design. 3.2 Difference equation, impulse response and transfer function of IIR filters. IIR filter implementation. Poles, zeros and stability of IIR filters. Frequency response of IIR filters. Case study: first and second order IIR filter design. Designing higher order IIR filters. 4. Random Signal Processing 4.1 Revision on Random Processes, probability distribution function, expected values, variance and standard derivation. Application – Finding correlation: covariance, cross correlation, unbiased cross correlation, auto-correlation. Application – Denoising: white and coloured noises, power spectral density, periodogram, Welch's method.

	5. Advanced DSP and Applications To discuss not less than one of the following topics: 5.1 Architectures of digital signal processors and DSP chips. 5.2 Denoising using the Wiener filter: Basic Wiener filter theory, Wiener filter in frequency domain. Application example. 5.3 Multirate digital signal processing: Concepts of multirate signal processing, design of practical sampling rate converters. Application examples. **Laboratory Experiments:** The student will carry out at least three laboratory exercises on the topics below: 1. Laboratory 1: MATLAB for DSP laboratory exercises. 2. Laboratory 2: FIR filter analysis and design. 3. Laboratory 3: IIR filter analysis and design. 4. Laboratory 4: Properties of DFT and the fast Fourier transform. 5. Laboratory 5: Statistical digital signal processing.
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3, 5	Fundamental principles and key concepts of the subject are delivered to students
Tutorials	1, 2, 3, 5	Supplementary to lectures, tutorials are conducted with smaller class size. Students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed.
Laboratory sessions	1, 2, 3, 4, 5, 6	Students will make use of the software tool to simulate the various theories and visualize the results.

Assessment Methods in Alignment of Assessment and Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)					
		1	2	3	4	5	6
1. Continuous Assessment (total 40%)							
• Short exercises	5%	✓	✓	✓		✓	
• Tests	20%	✓	✓	✓		✓	
• HW Assignment	5%	✓	✓	✓		✓	✓
• Laboratory sessions	10%	✓	✓	✓	✓	✓	✓
2. Examination	60%	✓	✓	✓		✓	
Total	100%						

The continuous assessment will consist of a number of assignments, laboratory reports, short exercises, and two tests.

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

Specific Assessment Methods/Tasks	**Remark**
Short exercises	Small exercises conducted to measure the students' basic understanding of the theories, concepts and physical meanings of subject materials during the lectures or tutorial classes.
Tests and examination	End-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom, and their comprehension of subject materials. Students need to think critically in order to come with a good solution for the problem given.
Assignment	Students have to learn independently, to search, digest and analyze data.
Laboratory sessions	Each student is required to produce a report on the laboratory work they conduct. Each student also needs to make a demonstration on the open-ended question set out in each laboratory work.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	26 Hours
	• Tutorial/Laboratory/Practice Classes	13 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/ assignment; preparation for tests/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**

Reading List and References	**Textbooks:** 1. S.K. Mitra, *Digital Signal Processing*, McGraw-Hill Education (Asia), 3rd ed., 2009. 2. E.C. Ifeacher and B.W. Jervis, *Digital Signal Processing - A Practical Approach,* Prentice-Hall (Pearson Education), 2002. **Reference Books:** 1. J.G. Proakis and D.G. Manolakis, *Digital Signal Processing: Principles, Algorithms and Applications*, 4/e., Pearson International Edition, 2007. 2. *Ulrich Karrenberg, An Interactive Multimedia Introduction to Signal Processing,* 2nd ed., Springer, 2007.
Last Updated	January 2018
Prepared by	Dr Daniel P.K. Lun

Subject Description Form

Subject Code	EIE4428
Subject Title	Multimedia Communications
Credit Value	3
Level	4
Pre-requisite	EIE3333 Data and Computer Communications
Co-requisite/ Exclusion	Nil
Objectives	To study the technical issues and system solutions for providing multimedia communications on the Internet.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the current state-of-the-art developments in Internet technologies for multimedia communications. 2. Appreciate the principles used in designing multimedia protocols, and so understand why standard protocols are designed the way that they are. 3. Understand the system design principles of multimedia communications systems. 4. Solve problems and design simple networked multimedia systems. Category B: Attributes for all-roundedness 5. Think critically and learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Terminal/Codec Support for Multimedia Communications Scalable Coding: SNR Scalability, Spatial Scalability, Temporal Scalability and Fine Granularity Scalability (FGS) Error Control: Error Propagation, Error Resilience Coding Techniques Rate Control: Concepts for Rate Control, MPEG TM5 Rate Control Algorithms 2. Transport Layer Support for Multimedia Communications TCP congestion control, TCP Delay Analysis, TCP Throughput Analysis, Bandwidth Allocation. Media transport protocols: Real Time Protocol (RTP) and Real Time Control Protocol (RTCP); Signalling Protocols: Real-Time Streaming Protocol (RTSP) 3. Quality of Services (QoS) Integrated services (intserv): Architecture and Service Model, Resource Reservation Protocol (RSVP), Packet Scheduling Disciplines in the Internet Differentiated Services (diffserv): Framework and Concept, Assured and Expedited Services, Packet Classification, Routers Internals and Packet Dropping Techniques 4. Multimedia Streaming Systems Streaming architecture: Real-time Streaming and On-demand Streaming, Content Delivery Network (CDN), Data Sharing Techniques, Support of Interactive Operations, Peer-to-Peer (P2P) video streaming techniques, Case Studies on Video on Demand and IPTV **Laboratory Experiments/Mini-projects:** 1. Multimedia networking 2. Multimedia streaming

Teaching/ Learning Methodology

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3	fundamental principles and key concepts of the subject are delivered to students
Tutorials	1, 2, 3, 4, 5	supplementary to lectures and are conducted with smaller class size; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed
Laboratory sessions/Mini-projects	4, 5	students will make use of network simulators to simulate various types of communication networks and evaluate their performance, or students will develop a simple multimedia streaming system by integrating different components together using some existing tools.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Continuous Assessment (total 50%)						
• Assignments	8%	✓	✓	✓		✓
• Mid-Term Test	13%	✓	✓	✓	✓	✓
• End-of-Term Test	13%	✓	✓	✓	✓	✓
• Mini-Project	16%				✓	✓
2. Examination	50%	✓	✓	✓	✓	✓
Total	100%					

<table>
<tr><td></td><td colspan="2">Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
<table>
<tr><th>Specific Assessment Methods/Tasks</th><th>Remark</th></tr>
<tr><td>Assignments, tests and examination</td><td>end-of chapter type problems used to evaluate students’ ability in applying concepts and skills learnt in the classroom;
students need to think critically and creatively in order to come with an alternate solution for an existing problem</td></tr>
<tr><td>Laboratory sessions / mini-projects</td><td>each group of students are required to produce a written report;
accuracy and the presentation of the report will be assessed.</td></tr>
</table></td></tr>
<tr><td rowspan="7">Student Study Effort Expected</td><td>Class contact (time-tabled):</td><td></td></tr>
<tr><td>• Lecture</td><td>24 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes</td><td>15 Hours</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</td><td>36 Hours</td></tr>
<tr><td>• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</td><td>30 Hours</td></tr>
<tr><td>Total student study effort:</td><td>105 Hours</td></tr>
<tr><td>Reading List and References</td><td colspan="2">Reference Books:
1. J.K. Kurose, Computer Networking: A Top-down Approach Featuring the Internet, 6th ed., Pearson, 2012.
2. Ze-Nian Li and Mark S. Drew and J. Liu, Fundamentals of Multimedia, Springer, 2nd Edition, 2014.
3. K.R. Rao, Z.S. Bojkovic and D.A. Milovanovic, Multimedia Communication Systems: Techniques, Standards, and Networks, Prentice-Hall PTR, 2002.</td></tr>
<tr><td>Last Updated</td><td colspan="2">July 2020</td></tr>
<tr><td>Prepared by</td><td colspan="2">Dr K.T. Lo</td></tr>
</table>

Subject Description Form

Subject Code	EIE4431
Subject Title	Digital Video Production and Broadcasting
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject provides a broad knowledge of digital video production and broadcasting.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the fundamentals of digital video systems with emphasis on production and broadcasting. 2. Work with digital video editing tools. 3. Understand the system design principles of video broadcasting. 4. Design simple systems related to video broadcasting. 5. Facilitate for further development in advanced digital video production and broadcasting. Category B: Attributes for all-roundedness. 6. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Introduction to Video Production and Broadcasting Elements of a video production and broadcasting system. Video services in Hong Kong. Video production and broadcasting standards and current development. 2. Fundamental of Video Production Production process, pre-production, production and post-production. Digital video editing. 3. Video Production Equipment Digital camera and video camera, image sensors, sensor architectures. 4. Fundamental of Digital Video Coding Digital video representation, digital video compression, intraframe coding, motion estimation and compensation. 5. Fundamental of Digital Video Broadcasting Digital video coding standards and video codecs – MPEG-2, H.264, HEVC, VP9 and AV1. Video transport layer. Transmission layer. 6. Transport Protocol for Digital Video Data encapsulation, multiplexing and de-multiplexing. Transmission protocols: packet structure: Program Association Table (PAT), Program Map Table (PMT) and Conditional Access Table (CAT), MPEG-2 Transport Stream (MPEG-2 TS), MPEG-2 Program Stream (MPEG-2 PS). Conditional access for digital TV. Real-time Transport Protocol (RTP) 7. Error Control for Digital Video Quality of service requirements for video communications. Error resilience and concealment techniques for digital video.

	8. Digital Video Broadcasting Techniques and Standards Channel coding for error control in digital TV, block and convolution codes, concatenated coding in digital TV. Digital modulation, different modulation schemes – APSK, BPSK, QPSK, QAM, Coded Orthogonal Frequency Division Multiplexing. 9. Internet Protocol Television (IPTV) and Over-the-Top (OTT) TV IPTV versus OTT. Video streaming over the Internet. Content Delivery Network (CDN), OTT platform, OTT business operation, OTT advertising. **Laboratory Experiments:** 1. Digital video editing – Basic tools and visual effects 2. Digital video editing – Layering and keying clips 3. Digital video coding for broadcasting systems
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 3, 4, 5, 6	fundamental principles and key concepts of the subject are delivered to students
Tutorials	1, 3, 4, 5, 6	supplementary to lectures and are conducted with smaller class size; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed
Laboratory sessions	2, 6	students will make use of digital video editing tools

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**					
		1	**2**	**3**	**4**	**5**	**6**
1. Continuous Assessment (total 40%)							
• Short quizzes/ Assignments	10%	✓		✓	✓	✓	✓
• Tests	20%	✓		✓	✓	✓	✓
• Laboratory sessions	10%		✓				✓
2. Examination	60%	✓		✓	✓	✓	✓
Total	100%						

	The continuous assessment will consist of laboratory reports, a number of short quizzes, assignments, and tests. **Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:**	

Specific Assessment Methods/Tasks	Remark
Short quizzes	mainly objective tests (e.g., multiple-choice questions, true-false, and matching items) conducted to measure the students' ability to remember facts and figures as well as their comprehension of subject materials
Assignments, tests and examination	end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; students need to think critically and creatively in order to come with an alternate solution for an existing problem
Laboratory sessions	each group of students are required to produce a written report; accuracy and the presentation of the report will be assessed; oral examination based on the laboratory exercises will be conducted for each group member to evaluate his technical knowledge and communication skills

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. Sanjoy Paul, *Digital Video Distribution in Broadband, Television, Mobile and Converged Networks: Trends, Challenges and Solutions*, Wiley, 2011 2. U. Reimers, *DVB: The Family of International Standards for Digital Video Broadcasting*, Springer, 2005. 3. Vijay K. Adhikari, Yang Guo, Fang Hao, Volker Hilt, Zhi-Li Zhang, Matteo Varvello, and Moritz Steiner, "Measurement Study of Netflix, Hulu, and a Tale of Three CDNs" IEEE Transactions on Networking, pp.1984-1997 vol. 23, no. 6, Dec. 2015	
Last Updated	July 2020	
Prepared by	Dr Y.L. Chan	

Subject Description Form

Subject Code	EIE4432
Subject Title	Web Systems and Technologies
Credit Value	3
Level	4
Pre-requisite	ENG2003 Information Technology
Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with the principles and practical programming skills of developing Internet and Web applications. It enables students to master the development skill for both client-side and server-side programming, especially for database applications. Students will have opportunity to put into practice the concepts through programming exercises based on various components of client/server web programming.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the enabling technologies for building Internet and Web database applications. 2. Understand the different components for developing client/server applications. 3. Apply the techniques and features of the client/server development languages to construct a database application based on Internet. 4. Develop the web database applications through programming exercises. <u>Category B: Attributes for all-roundedness</u> 5. Present ideas and findings effectively. 6. Think critically. 7. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Introduction to Client/Server Computing</u> The basic principles of client/server computing; Distinguished characteristics of client/server systems and application areas; Comparison of two tier versus three tier client/server solutions; Web programming model; Interactive web. 2. <u>Web Programming</u> Client-Side Web Programming: Benefits and limitation of client-side web programming. Basic concepts and development based on Java applet / JavaScript / dynamic HTML (DHTML). Server-Side Web Programming: Approaches to server-side programming. Benefits and limitations of server-side web programming. Development framework for server-side programming based on PHP / Servlet / JSP. Web application development. Development of a web application using synchronous and asynchronous techniques 3. <u>Web Database</u> Database Design and Implementation: Relation model; Mapping an ER model to relational model; Foundations of relational implementation; Structured query language.

Web Database Applications: Multi-tier architecture; Principle of web database applications: store, manage and retrieve data.

4. <u>Data Analysis</u>
   Introduction to data mining; Concepts of data analysis; web data mining; Introduction to big data analysis; Techniques of big data analysis.

Laboratory Experiments:

Practical Works:
1. Client-side web application programming.
2. Server-side web application programming.
3. Database-driven web design.
4. Web database Applications.

Teaching/ Learning Methodology

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1, 2, 6	fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1, 2, 6	supplementary to lectures; students will be able to clarify concepts and to have a deeper understanding of the lecture material; problems and application examples are given and discussed.
Laboratory sessions	3, 4, 6, 7	students will develop client-side and server-side web applications.
Project	3, 4, 5, 6, 7	students in groups of 2/3 are required to develop a database-driven web application. Each group is required to perform a detailed study and make a presentation.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
1. Continuous Assessment (total 45%)								
• Tests	18%	✓	✓	✓	✓		✓	
• Quiz	18%	✓	✓	✓	✓		✓	
• Laboratory sessions	9%			✓	✓		✓	✓
2. Project	55%	✓	✓	✓	✓	✓	✓	✓
Total	100%							

The continuous assessment consists of tests, quiz, and laboratory exercises.

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: **Specific Assessment Methods/Tasks** — **Remark** Tests, quiz — end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; students need to think critically and creatively in order to come with an alternate solution for an existing problem. Laboratory sessions, Project — oral examination based on the laboratory exercises will be conducted to evaluate student's technical knowledge and communication skills.

Specific Assessment Methods/Tasks	Remark
Tests, quiz	end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; students need to think critically and creatively in order to come with an alternate solution for an existing problem.
Laboratory sessions, Project	oral examination based on the laboratory exercises will be conducted to evaluate student's technical knowledge and communication skills.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Reference Books:** 1. Max Bramer, *Web Programming with PHP and MySQL: A Practical Guide*, Springer, 2015. 2. Mike O'Kane, *A Web-based Introduction to Programming: Essential Algorithms, Syntax, and Control Structures using PHP, HTML and MariaDB/MySQL*, 4th ed., Carolina Academic Press, 2017. 3. Robin Nixon, *PHP: 20 Lessons to Successful Web Development*, McGraw-Hill Education, 2015. 4. Kevin Tatroe, Peter MacIntyre, *Programming PHP: Creating Dynamic Web Pages*, O'Reilly Media, 2020.	
Last Updated	July 2020	
Prepared by	Dr Ye Qingqing	

Subject Description Form

Subject Code	EIE4435
Subject Title	Image and Audio Processing
Credit Value	3
Level	4
Pre-requisite	EIE3312 Linear Systems or EIE3103 Digital Signals and Systems
Co-requisite/ Exclusion	Nil
Objectives	To provide a broad treatment of the fundamentals in image and audio processing.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** <u>Category A: Professional/academic knowledge and skills</u> 1. Understand the fundamentals of image and audio signal processing and associated techniques. 2. Understand how to solve practical problems with some basic image and audio signal processing techniques. 3. Have the ability to design simple systems for realizing some multimedia applications with some basic image and audio signal processing techniques. <u>Category B: Attributes for all-roundedness</u> 4. Present ideas and findings effectively. 5. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. <u>Image processing</u> 1.1 Fundamentals of digital image: Digital image representation and visual perception, image sampling and quantization. 1.2 Image enhancement: Histogram processing; Median filtering; Low-pass filtering; High-pass filtering; Spatial filtering; Linear interpolation, Zooming. 1.3 Image coding and compression techniques: Scalar and vector quantizations; Codeword assignment; Entropy coding; Transform image coding; Wavelet coding; Codec examples. 1.4 Image analysis and segmentation: Feature extraction; Histogram; Edge detection; Thresholding. 1.5 Image representation and description: Boundary descriptor; Chaincode; Fourier descriptor; Skeletonizing; Texture descriptor; Moments. 2. <u>Audio processing</u> 2.1 Fundamentals of digital audio: Sampling; Dithering; Quantization; psychoacoustic model. 2.2 Basic digital audio processing techniques: Anti-aliasing filtering; Oversampling; Analog-to-digital conversion; Dithering; Noise shaping; Digital-to-analog Conversion; Equalisation. 2.3 Digital Audio compression: Critical bands; threshold of hearing; Amplitude masking; Temporal masking; Waveform coding; Perceptual coding; Coding techniques: Subband coding and Transform coding. 2.4 Case Study of Audio System/Codecs: MP3; MP3-Pro; CD; MD; DVD-Audio; AC-3; Dolby digital; Surround; SRS Surround system; Digital Audio Broadcasting, etc.

	Laboratory Experiments: 1. Image processing techniques 2. Image compression 3. Audio compression 4. Psychoacoustic behaviour
Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	Intended Subject Learning Outcome	Remarks
Lectures	1, 2, 3	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	2, 3, 5	These are supplementary to lectures and are conducted with smaller class sizes; students will be able to clarify concepts and to gain a deeper understanding of the lecture material; problems and application examples are given and discussed.
Laboratory sessions	4, 5	Students will make use of software to simulate the various theories and visualize the results.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	% Weighting	Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)				
		1	2	3	4	5
1. Continuous Assessment	40%					
• Short quizzes	10%	✓	✓	✓		
• Tests	16%	✓	✓	✓		
• Laboratory sessions	14%	✓			✓	✓
2. Examination	60%	✓	✓	✓	✓	✓
Total	100 %					

The continuous assessment will consist of a number of assignments, laboratory reports, and two tests.

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

Specific Assessment Methods/Tasks	Remark
Short quizzes	These can measure the students' understanding of the theories and concepts as well as their comprehension of subject materials.
Assignments, tests and examination	End-of chapter type problems are used to evaluate the students' ability in applying concepts and skills learnt in the classroom; students need to think critically and to learn independently in order to come up with an alternative solution to an existing problem.

	Laboratory sessions	Students are required to conduct some laboratory works, and produce the written reports; The accuracy and presentation of the report will be assessed; the emphasis is on assessing the students' ability to apply knowledge and skills learned in lectures, and their ability to relate the taken data and results to the most relevant theory.	
Student Study Effort Expected	**Class contact (time-tabled):**		
	• Lecture		24 Hours
	• Tutorial/Laboratory/Practice Classes		15 Hours
	Other student study effort:		
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination		36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing		30 Hours
	Total student study effort:		**105 Hours**
Reading List and References	**Textbooks:** 1. R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, 2nd ed., Prentice-Hall, 2002. 2. Ken C. Pohlmann, *Principles of Digital Audio*, 4th ed., McGraw-Hill, 2000. **Reference Books:** 1. Ze-Nian Li and Mark S. Drew, *Fundamentals of Multimedia*, Pearson Prentice-Hall, 2004. 2. M. Mandal, *Multimedia Signals and Systems,* Kluwer Academic Publishers, 2003.		
Last Updated	January 2018		
Prepared by	Dr Chris Chan		

Subject Description Form

Subject Code	EIE4449
Subject Title	Optical Communication Systems and Networks
Credit Value	3
Level	4
Exclusion	EIE581 Optical Wavelength Division Multiplexing Networks
Objectives	To provide students with the design and operating principles of modern optical communication systems and networks. Upon completion of the subject, students should be familiar with commonly used components and subsystems in optical communication and network systems and be able to design a simple optical communication link.
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** Category A: Professional/academic knowledge and skills 1. Understand the basic operating principles of single mode and multimode fibres. 2. Understand the basic operating principles of light sources, detectors and amplifiers. 3. Understand the basic operating principles of passive optical devices. 4. Have the ability to design a simple optical communication link. 5. Appreciate the principles of optical communication networks. Category B: Attributes for all-roundedness 6. Present ideas and findings effectively. 7. Think critically. 8. Learn independently.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Optical Fibre 1.1 Principles of optical waveguiding, single mode and multimode fibres and their transmission characteristics. 2. Active and passive components 2.1 Light emitting diodes (LEDs) and semiconductor lasers: operating principles and characteristics. Semiconductor optical detectors: PINs and APDs. Optical amplifiers: Erbium doped fibre amplifiers (EDFAs). 2.2 Coupler, isolator, circulator, wavelength division multiplexer and demultiplexer. 3. Optical communication systems 3.1 Transmission impairments: noise, dispersion, nonlinearity and crosstalk. Bit error rate (BER), Q factor and receiver sensitivity. 3.2 Point to point link design: power budget and power penalty. 3.3 Wavelength division multiplexing (WDM). Design of multi-span WDM links. 4. Optical communication networks 4.1 WDM add/drop multiplexer, WDM optical crossconnect, Basic architecture of a WDM optical network. Passive optical networks (PONs). **Laboratory Experiments:** Practical Works: 1. Optical fibre passive component measurement 2. Common fibre optic test and measurement techniques

Teaching/ Learning Methodology	(see table below)

Teaching and Learning Method	**Intended Subject Learning Outcome**	**Remarks**
Lectures	1,2,3,4,5	Fundamental principles and key concepts of the subject are delivered to students.
Tutorials	1,2,3,4,5,7,8	Supplementary to lectures and are conducted with smaller class size; Students will be able to clarify concepts and to have a deeper understanding of the lecture material; Assignments and application examples are given and discussed.
Laboratory sessions	1,2,3,6,7	Students will enhance their understanding of the concepts learnt through measuring the characteristics of various fibre components. Students are given the opportunity to analyze results obtained and to solve practical problem encountered.

Assessment Methods in Alignment with Intended Subject Learning Outcomes

Specific Assessment Methods/Tasks	**% Weighting**	**Intended Subject Learning Outcomes to be Assessed (Please tick as appropriate)**							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1. Continuous Assessment (total 40%)									
• Tests	20%	✓	✓	✓	✓	✓			
• Assignments	10%	✓	✓	✓	✓	✓		✓	✓
• Laboratory sessions	10%	✓	✓	✓			✓	✓	
2. Examination	60%	✓	✓	✓	✓	✓		✓	✓
Total	100 %								

The continuous assessment consists of a number of assignments, laboratory reports and tests.

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: **Specific Assessment Methods/Tasks** — **Remark** Tests — Objective tests (e.g., multiple-choice questions, true-false, and matching items) conducted to measure the students' ability to remember facts and figures as well as their comprehension of subject materials and end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom Assignments and examination — End-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; Students need to think critically and creatively in order to come with an alternate solution for an existing problem. They need to find additional information independently in order to solve a given problem Laboratory sessions — Each group of students are required to produce a written report; Accuracy and the presentation of the report will be assessed.

Specific Assessment Methods/Tasks	Remark
Tests	Objective tests (e.g., multiple-choice questions, true-false, and matching items) conducted to measure the students' ability to remember facts and figures as well as their comprehension of subject materials and end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom
Assignments and examination	End-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom; Students need to think critically and creatively in order to come with an alternate solution for an existing problem. They need to find additional information independently in order to solve a given problem
Laboratory sessions	Each group of students are required to produce a written report; Accuracy and the presentation of the report will be assessed.

Student Study Effort Expected	**Class contact (time-tabled):**	
	• Lecture	24 Hours
	• Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	• Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination	36 Hours
	• Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing	30 Hours
	Total student study effort:	**105 Hours**
Reading List and References	**Text Books:** 1. G. Kaiser, *Optical Fiber Communications*, 5th ed., McGraw-Hill, 2015. 2. John Senior, *Optical Fiber Communications: Principles and Practice*, 3rd ed., Pearson Education, 2009. **Reference Books:** 1. Jeff Hecht, *Understanding Fiber Optics,* 4th ed., Prentice-Hall, 2002.	
Last Updated	June 2015	
Prepared by	Prof. C. Lu	

Different types of GPA, and their calculation methods

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) IC training subjects will be included in the GPA calculation while WIE/Sandwich Training will not. (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) Only academic subjects will be counted towards the Weighted GPA. (3) For retake subjects, only the last attempt will be taken in the Weighted GPA calculation. (4) A weighting of 2 for Level 1 and 2 subjects, and a weighting of 3 for Level 3, 4 and 5 subjects, will be included in the calculation to determine the Honours classifications for Bachelor's degree programmes. (5) 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 (including the Major/Secondary Major option)/ Minor GPA* (1) Only subjects inside the curriculum of the Major/Minor Programmes will be taken in the Major/ Minor GPA calculation. (2) Only academic subjects will be counted towards the Major/Minor GPA. (3) For retake subjects, only the last attempt will be taken in the Major/Minor GPA calculation. (4) Up to 6 credits from the Major/GUR [including Language Communication Requirements (LCR) subjects at proficiency level] can be counted towards the chosen Minor. Nevertheless, students must take at least 6 credits from their chosen Minor programme in order to satisfy the residential requirement of their chosen Minor. In addition, to be eligible for the Major and Minor awards, the total number of credits taken by the students for their Major-Minor studies must not be lower than the credit requirement of the single discipline Major programme. *Major GPA* (5) Level weighting will only be included in the calculation for weighted assessment scheme. *Minor GPA* (6) 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 programmes with level weightings: Award GPA = Weighted GPA (2) For Major/Minor programmes: Award GPA = Major GPA If students have taken more subjects than required, refer to Section 28.3.

^ For students taking the Major/Secondary Major study route, there is no separate “Secondary Major GPA”. The Major GPA is the weighted GPA of all subjects contributing to the Major and Secondary Major. Students may count up to 12 credits of their Major/GUR subjects towards the Secondary Major. Nevertheless, students must take at least 12 credits from their chosen Secondary Major in order to satisfy the residential requirement of the chosen Secondary Major. Students who have completed more than 12 credits of subjects that are eligible for double counting will need to apply for graduation and indicate the subjects intended for double counting. Notwithstanding the above, students must meet the minimum credit requirements of the “X + Secondary Major” concerned, i.e. 132 credits.

Appendix 2

University Graduation Requirements for 4-year Full-time Undergraduate Degree Programmes Offered from 2022/23 Onward

All candidates qualifying for a 4-year Full-time Undergraduate Degree offered from 2022/23 onward must meet:

1. the University Graduation Requirements, and
2. the specific graduation requirements of their chosen programme of study.

The minimum University Graduation Requirements are explained in the sections below. For the graduation requirements of specific programmes of study (Majors and Minors), candidates should refer to the relevant section of the Programme Requirement Document or consult the programme-offering Departments concerned.

Summary of University Graduation Requirements for Normal Year 1 Intake

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

1. Complete successfully a minimum of 120 credits.
2. Earn a cumulative GPA of 1.70 or above at graduation.
3. Complete successfully the mandatory Work-Integrated Education (WIE) component as specified by their programme/Major.
4. Satisfy the following GUR requirements:

(a)	Language and Communication (LCR) Requirements[1]	9 credits
(b)	Artificial Intelligence and Data Analytics (AIDA) Requirement	2 credits
(c)	Innovation and Entrepreneurship (IE) Requirement	1 credit
(d)	Leadership Education and Development (LEAD)	3 credits
(e)	Service-Learning (SL)	3 credits
(f)	Cluster Areas Requirement (CAR)	12 credits [3 credits from each of the cluster areas]
(g)	Healthy Lifestyle[2]	Non-credit bearing
		Total = 30 credits

[1] Non-Chinese speakers and those students whose Chinese standards are at junior secondary level or below will by default be exempted from the DSR - Chinese and CAR - Chinese Reading and Writing requirements. However, this group of students would still be required to take one Chinese LCR subject to fulfil their Chinese LCR.
[2] Students admitted to the programmes as Senior Year Intakes are not required to take the Healthy Lifestyle Programme. Advanced Standing students are required to take HLS (except for those who are HD/AD holders who follow the Senior Year/Articulation Degree programme GUR curriculum).

Summary of University Graduation Requirements for Senior Year Intake

Area and Credit Requirement	Curriculum Requirement
Cluster-Area Requirements (CAR) [6 credits from the following two Cluster Areas: 1) English Language (CAR - English Language) 2) Chinese History and Culture (CAR M)]	• Students should take one 3-credit subject from both CAR M and a specially-designed CAR A with English Language (CAR – English Language). • Students need to fulfill the English and Chinese reading and writing requirements. • Students may apply for a waiver if they have fulfilled the English and Chinese reading and writing requirements in their previous studies. However, students still need to take one 3-credit subject from the specially-designed CAR A with English Language (CAR – English Language) even they have been waived from English reading and writing requirements.
Service Learning [3 credits]	-

No further credit transfer will be given to the required GUR unless the student is admitted on qualification more advanced than Associate Degree/Higher Diploma [3] and had also completed comparable components in their earlier studies.

Regarding Language and Communication Requirements (LCR), this is normally not required. Only those students not meeting the equivalent standard of the Undergraduate Degree LCR (based on their previous studies in AD/HD programmes and their academic performance) will be required to take degree LCR subjects on top of the normal curriculum requirement. The Programme offering department will refer to the guidelines provided by the Language Centres (ELC and CLC) to determine whether a new student has met the equivalent standard. Non-Chinese speakers and those students whose Chinese standards are at junior secondary level or below will by default be exempted from the DSR - Chinese and CAR - Chinese Reading and Writing requirements. However, this group of students would still be required to take one Chinese LCR subject to fulfil their Chinese LCR.

(a) Language and Communication Requirements (LCR)

English

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

Students entering the University with specified attainment grades in certain public examinations can be given credit transfer or exemption for one or both LCR English subjects.

Table A: English LCR subjects (each 3 credits)

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

[3] The admission of students to UGC-funded Articulation Degree programmes and Senior Year intakes on the basis of qualification(s) more advanced than Associate Degree/Higher Diploma is subject to the conditions stipulated by UGC governing the UGC-funded Senior Year places.

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

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

(The above framework will also apply to students on articulation degree programmes, Senior Year curriculum and Higher Diploma programmes, where applicable.)

<u>Chinese</u>

All undergraduate students are required to successfully complete <u>one</u> 3-credit Chinese language subject as stipulated by the University, according to their Chinese language proficiency level (**Table C**).

Table C: Chinese LCR subjects

Categories of students	Required subject
For Chinese speaking students	A Chinese LCR subject
For non-Chinese speakers or students whose Chinese standards are at junior secondary level or below	One subject from **Table D** below

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

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

Students who have obtained verified qualifications or certain results in some public examinations [e.g. HKDSE, HKALE, JEE, GSAT(Taiwan)] may be granted credit transfer/exemption for the Chinese LCR subject.

(The above framework and exemption arrangements will also apply to students on articulation degree programmes, Senior Year curriculum and Higher Diploma programmes, where applicable.)

Writing Requirement in CAR Subjects

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

Reading Requirement in CAR Subjects

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

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

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

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

(b) Artificial Intelligence and Data Analytics (AIDA) Requirement

All students must successfully complete Artificial Intelligence and Data Analytics (AIDA) Requirement. Artificial Intelligence and Data Analytics aims to introduces the basic knowledge in the concept and design of Data Analytics methods and how they benefit varying Artificial Intelligence applications.

A list of AIDA subjects can be found at: https://www.polyu.edu.hk/ous/GURSubjects/AIDAR.php

(c) Innovation and Entrepreneurship (IE) Requirement

All students must successfully complete Innovation and Entrepreneurship (IE) Requirement. Innovation and Entrepreneurship aims to prepare the first-year students with an entrepreneurial mindset and apply innovative strategies to find creative solutions that benefit both organizations and society in the age of digital transformation.

A list of IE subjects can be found at: https://www.polyu.edu.hk/ous/GURSubjects/IER.php

(d) Leadership Education and Development (LEAD)

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

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

(e) Service-Learning

All students must successfully complete one 3-credit subject designated to meet the Service-Learning Requirement, in which they are required to (i) participate in substantial community service or civic engagement activities that will benefit the service users or the community at large in a meaningful way, (ii) apply the knowledge and skills acquired from their Major or other learning experiences at the University to the community service activities, and (iii) 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 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) within the Major/Minor with all the required features and components to meet the Service-Learning Requirement.

Students who have satisfied the Service-Learning Requirement via a customised DSR subject will be required to take another 3-credit subject to make up for the total credit requirement.

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

(f) Cluster Areas Requirement (CAR)

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

- CAR (A): Human Nature, Relations and Development
- CAR (D): Science, Technology and Environment
- CAR (M): Chinese History and Culture
- CAR (N): Cultures, Organisations, Societies and Globalisation

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

(g) Healthy Lifestyle

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

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

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

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