

The Hong Kong Polytechnic University 香港理工大學 Department of Computing 電子計算學系

Secondary Major

in

AI and Data Analytics

(人工智能及數據分析)

July 2023

This Document is applicable to students admitted in 2022/23

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

Table of Contents

Part 1:	General Information 1
1.1	Introduction ······1
	1.1.1Programme Title11.1.2Host Department11.1.3Credit Requirements11.1.4Medium of Instruction11.1.5Implementation Date1
1.2	Rationale, Aims and Objectives
	1.2.1Rationale for AIDA11.2.2Aims and Objectives1
1.3	Programme's Intended Learning Outcomes (PILOs) ······2
1.4	Selection Mechanism ······2
Part 2:	Programme Structure and Curriculum
2.1	Programme Structure ······3
2.2	Proposed Study Pattern ······4
2.3	List of Core and Elective Subjects
2.4	Curriculum Map ······ 11
Part 3:	Subject Syllabi 17

Part 1: General Information

1.1 Introduction

1.1.1	Programme Title	:	Secondary Major in Artificial Intelligence and Data Analytics (AIDA)
1.1.2	Host Department	:	Department of Computing
1.1.3	Credit Requirements	:	36
1.1.4	Medium of Instruction	:	English
1.1.5	Implementation Date	:	September 2022

1.2 Rationale, Aims and Objectives

1.2.1 Rationale for AIDA

Data has been characterised as the new oil; it is valuable only if it can be refined into a form that drives profitable and productive activity. Artificial intelligence and data analytics (AIDA) are undoubtedly the most prevailing technologies to carry out such a refinement process and are the most important driving forces in our data-driven society today. Through the rapid technological developments of the 21st Century, big data has become available, and with remarkable success in the past decade. AIDA is thus becoming a de-facto standard approach to enrich business, advance technology and achieve breakthroughs in virtually all fields. Therefore, it is essential for students to possess expertise in AIDA and other underpinning technologies.

PolyU is fully aware of the opportunities and challenges brought about by the new economy and the Fourth Industrial Revolution, and believes that it is indispensable for the next generation of workforce to possess expertise in AIDA and other underpinning technologies such as robotics, the Internet-of-Things (IoT), and blockchain, to name a few.

1.2.2 Aims and Objectives

The AIDA Secondary Major is designed in response to the rapidly developing fields of artificial intelligence and data analytics that are currently gaining unprecedented traction in industry as well as generating demand for qualified professionals in the job market. By integrating within the major discipline of the student, this secondary major aims to produce the next generation of graduates skilled with AI computational thinking and data analytics acumen in their chosen discipline to meet the needs of society, help improve efficiencies and augment human capabilities.

This secondary major comprises interdisciplinary and integrated programmes to equip students with a strong foundation in computer science, statistics and mathematics, so as to nurture them to make use of AIDA techniques to solve contemporary problems in a discipline of their choice.

Each academic programme offering the option of this secondary major will incorporate a block of AIDA subjects (such as programming, mathematics, statistics, big data, AI and machine learning) into the study of the academic programme focusing on a particular discipline or domain. Students will complete their study within the normal programme duration and graduate with their respective bachelor's degree, equipped with technical skills related to AIDA, coupled with the domain knowledge from a block of subjects either specially designed, or chosen from the corresponding academic programme, in addition to the GUR subjects. An Integrated Capstone Project (ICP) will be included, with the aim of developing the capabilities of a student in analysing and solving complex and potential real-life problems, as well as training them in skills related to systematic development and documentation of a significant piece of work.

1.3 Programme's Intended Learning Outcomes (PILOs)

On successful completion of this secondary major in AIDA, students will be able to:

- 1. Understand the fundamentals of AIDA, and have the ability to apply them.
- 2. Design AIDA systems, components and processes to meet given specifications and constraints.
- 3. Identify, formulate and solve problems relevant to AIDA.
- 4. Use modern IT tools appropriate to AIDA practice.
- 5. Know the contemporary issues, and understand the impact of AIDA solutions in a global and societal context.

1.4 Selection Mechanism

Studying a Secondary Major is a free choice by students and not mandatory. Only students with a Cumulative GPA of 2.70 or above may be considered for Secondary Major enrolment. Students must apply to and obtain approval from their programme offering Department, no later than the commencement of the second year of study, to be admitted to the Secondary Major.

Part 2: Programme Structure and Curriculum

2.1 Programme Structure

The programme structure of the Secondary Major in Artificial Intelligence and Data Analytics (AIDA) is as follows:

Artificial Intelligence and Data Analytics (AIDA)	Credits
Core	30-33
Mathematics I for AIDA	(3)
Mathematics II for AIDA	(3)
Programming I: Programming Fundamentals	(3)
Programming II: Data Structures and Algorithms	(3)
Fundamentals of Data Analytics	(3)
Machine Learning	(3)
Artificial Intelligence	(3)
DSR-AIDA Bridging Subject(s)	(3-6)
Integrated Capstone Project	(6)
<u>Electives</u>	3-6
Total	36

2.2 Proposed Study Pattern

Stage	Subjects	Credits
Year 2	Mathematics I for AIDA	3
	Mathematics II for AIDA	3
	Programming I: Programming Fundamentals	3
	Programming II: Data Structures and Algorithms/ Fundamentals of Data Analytics	3
Year 3	Fundamentals of Data Analytics/ Programming II: Data Structures and Algorithms	3
	Machine Learning	3
	Artificial Intelligence	3
	DSR-AIDA Bridging Subject 1	3
Year 4	Integrated Capstone Project	6
	DSR-AIDA Bridging Subject 2 / Elective 1	3
	Elective 2	3

Note that students could swap around:

1. their Fundamentals of Data Analytics/ Programming II: Data Structures and Algorithms

2. their DSR-AIDA Bridging Subjects / Elective

in the proposed study pattern based on their own plan.

2.3 List of Core and Elective Subjects

Below are the tables summarising the core and elective subjects. Note that some students such as BME may need to take slightly more credits (AMA2511/2512 for Mathematics II).

Subject code	Subject title	Credits
Mathematics I	for AIDA (3 credits)	
<u>AMA1110</u>	Basic Mathematics I – Calculus and Probability & Statistics (for FCE and FENG students only)	3
AMA1501	Introduction to Statistics for Business	3
1111111001	(for students from other Faculties/ Schools)	5
AMA2634	Introduction to Statistics (for AMA students only)	3
	(Pre-requisite: AMA1006 / AMA2691)	_
	(Exclusion: AMA2601)	
Mathematics II	for AIDA (3 credits)	
<u>AMA1751</u>	Linear Algebra (for students from other Faculties/ Schools)	3
<u>AMA2111</u>	Mathematics I (for FENG students only)	3
	(Pre-requisite: AMA1007 / AMA1101 / AMA1102 / AMA1120 /	
	AMA1130 / AMA 1500)	
	(Exclusion: AMA2007 / AMA2308 / AMA2380 / AMA2511 /	
AMA2121	Mathematics for Engineers (for CEE students only)	2
AWALIJI	(Pre-requisite: AMA1130 / AMA 1131)	5
	(Exclusion: AMA2007 & AMA2111 & AMA290)	
AMA2511 and	Applied Mathematics I (for BME students only)	2
	(Pre-requisite: AMA1101 / AMA1102 / AMA1120)	
	(Exclusion: AMA2007 & AMA2111)	
AMA2512	Applied Mathematics II (for BME students only)	2
	(Pre-requisite: AMA2511)	
D	(Exclusion: AMA2007)	
Programming	: Programming Fundamentals (3 credits)	2
<u>COMP1012</u>	Programming Fundamentals and Applications	3
	(for students from other Faculties/ Schools than FENG/FB)	
ENICODO	(Exclusion: COMP1011 / ENG2002)	2
<u>ENG2002</u>	Computer Programming (for FENG students only)	3
<u>LG13109</u>	Introduction to Coding for Business with Python	3
	(for FB students only)	
Programming	II: Data Structures and Algorithms (3 credits)	
<u>COMP2013</u>	Data Structures and Algorithms	3
	(Pre-requisite: COMP1011 / COMP1012 / ENG2002 / LGT3109 &	
	$AMAIII0/AMAI301/AMA2034 \otimes AMA1/51/AMA2111)$	
Fundamentals	of Data Analytics (3 credits)	
AMA1611	Data Analytics Fundamentals	3
AMA2233	Data Analytics and Visualization (for AMA students only)	3
	(Pre-requisite: AMA2222)	
<u>COMP1433</u>	Introduction to Data Analytics	3
EIE1003	Foundations of Data Science	3

(a) Core (compulsory subjects)

Subject code	Subject title	Credits
LGT/MM3425	Business Analytics (for FB students only)	3
	(Exclusion: LGT/MM2425 & LGT3425)	
Machine Learn	ing (3 credits)	
<u>AMA4680</u>	Statistical Machine Learning	3
	(Pre-requisite: AMA2222 / AMA2222A & AMA2602 / AMA2631/	
	AMA2091 / AMA3002 & AMA2/01 / AMA2/01A / AMA3001/ AMA3701 / AMA3723)	
COMP4432	Machine Learning (for students from other Faculties/	3
001111152	Schools than EIE)	5
EIE3124	Fundamentals of Machine Intelligence (for EIE students	3
	only)	-
Artificial Intelli	igence (3 credits)	
COMP4431	Artificial Intelligence	3
	(Pre-requisite: COMP1012 / COMP2011 / ENG2002)	-
DSR-AIDA Bri	dging Subject(s) (3-6 credits)	
<u>AF3213</u>	Business Analytics in Accounting and Finance	3
	(Pre-requisite: LGT2425 / MM2425 / LGT3425 / MM3425)	
<u>AMA4602</u>	High Dimensional Data Analysis	3
	(Pre-requisite: AMA2631 / AMA2631A / AMA2602 / AMA2691)	
<u>AP30019</u>	Data Analysis Techniques for Scientists	3
DMT24145	(Pre-requisite: AP20018)	2
<u>BME34145</u>	AIDA for Health Care and Smart Ageing	3
BRF472	Information Technology and Building Information	3
DICLT/2	Modelling for Construction Management	5
BSE3610	Computational Methods in Building Sciences and	3
<u></u>	Engineering	5
BSE4510	Building Automation and Control	3
	[Pre-requisite: BSE2122 & BSE3225 (before 2022/23 cohort) / BSE2124	
	& BSE3227 (from 2022/23 cohort)]	
<u>CBS3947</u>	Programming and Data Analysis for Language Studies	3
<u>CSE30313</u>	Machine Learning Practice in Smart Mobility	3
	(Pre-requisite: One basic mathematics subject and one basic computer	
	programming subject Mathematics	
	AMA2007 / AMA2111 / AMA2131 / AMA2308 / AMA2707 / AMA290	
	Computer Programming	
	AMA2222 / AMA2222A / COMP1011 / COMP1012 / ENG2002)	
<u>EE4014A</u>	Intelligent Systems Applications in Electrical Engineering	3
<u>EIE3127</u>	Artificial Intelligence of Things	3
ENCL 4022	(Pre-requisite: EIE2112 & EIE2113)	2
ENGL4022	Quantitative Literacy for Language Professionals	3
<u>EINGL4020</u>	Language and Social Data Analytics	3 2
<u>H1M3228</u>	Smart Service Design in Lourism and Hospitality (Pre-requisite: HTM2305)	3
HTM4362	Artificial Intelligence in Tourism and Hospitality	3
ISE3018	Logistics Automation	3
SFT304AF	Fashion Design	3
SFT330FR	Fashion Digital Marketing	3
LGT3108	Introduction to Enterprise Resource Planning System	3
	minoraction to Enterprise Resource r famming System	5

Subject code	Subject title	Credits
LSGI3803	Spatial Data Analytics and Mining	3
<u>ME46002</u>	Numerical Methods for Engineers	3
	(Pre-requisite: AMA2111)	
<u>MM3462</u>	Artificial Intelligence and Big Data for Business	3
	(Pre-requisite: MM3425)	
<u>SD3781</u>	Interface Design	3
<u>SD4788</u>	User Experience Design	3
<u>SO4020X</u>	Application of AI and Data Analytics to Manage Ocular	3
	Problems	
Integrated Cap	stone Project (6 credits)	
<u>AF/LGT/</u>	Integrated Capstone Project	6
<u>MM4913</u>	(Exclusion: Any other equivalent capstone project)	
<u>AMA4953</u>	Integrated Capstone Project	6
	(Exclusion: AMA4951, AMA4952 or any other equivalent capstone	
	project)	
<u>AP40020</u>	Integrated Capstone Project	6
<u>BSE4728</u>	Integrated Capstone Project	6
	(Pre-requisite: BSE3716 & any 4 of the below subjects:	
	BSE3124 / BSE3125 / BSE3227 / BSE3228 / BSE3313 / BSE3322)	
	(Exclusion: Any other equivalent capsione project)	6
<u>BKE4001</u>	(Dre requisite: DDE266)	0
	(Exclusion: Any other equivalent canstone project)	
BMF44146	Integrated Canstone Project	6
DIVILITIO	(Pre-requisite/co-requisite: BME31147 & BME34145)	U
	(Exclusion: Any other equivalent capstone project)	
CBS4705	Integrated Capstone Project	6
	(Exclusion: Any other equivalent capstone project)	
CSE49407	Integrated Capstone Project	6
	(Pre-requisite: All CSE subjects in Level 3 and all core subjects in Level	
	1-3 of Secondary Major in AIDA)	
	(Exclusion: Any other equivalent capstone project)	
<u>EE4023</u>	Integrated Capstone Project	6
	(Pre-requisite: Students should complete most of the subjects required of	
	(Co-requisite: FF4014A)	
	(Exclusion: Any other equivalent capstone project)	
EIE4128	Integrated Capstone Project	6
ENGL4027	Integrated Capstone Project	6
	(Pre-requisite: ENGL3002)	-
	(Exclusion: Any other equivalent capstone project)	
HTM4365	Integrated Capstone Project	6
	(Pre-requisite: HTM3205)	
	(Exclusion: Any other equivalent capstone project)	
<u>ISE4001</u>	Integrated Capstone Project	6
	(Pre-requisite: ISE3018) (Evaluation: ISE4008 Individual Project and ISE445 Constant Project)	
SET4217V	Integrated Canstone Project	6
SF1421/A	Exclusion: SET415CP_SET416CP & any other equivalent constant	U
	project)	
LSGI4503	Integrated Capstone Project	6
	(Pre-requisite: COMP1011 & LSGI3803)	ý

Subject code	Subject title	Credits
	(Exclusion: Any other equivalent capstone project)	
<u>ME49006</u>	Integrated Capstone Project	6
	(Pre-requisite: ME31001, ME31002, ME32001, ME33001, ME34002, ME34004, ENG2002 & ME46002)	
	(Exclusion: ME49001)	
<u>SD4470</u>	Integrated Capstone Project - Production Design	6
	(Pre-requisite: SD4466)	
	(Exclusion: Any other equivalent capstone project)	
<u>SD4790</u>	Integrated Capstone Project - Interaction Design	6
	(Pre-requisite: SD4791)	
	(Exclusion: Any other equivalent capstone project)	
<u>SO4039X</u>	Integrated Capstone Project	6
	(Pre-requisite: SO4020X)	
	(Exclusion: Any other equivalent capstone project)	

(b) Electives (3-6 credits)

Subject code	Subject title	Credits
AAE4009	Data Science and Data-driven Optimisation in Airline and	3
	Airport Operations	
AAE4011	Artificial Intelligence in Unmanned Autonomous Systems	3
<u>AMA3201</u>	Computational Methods	3
	(Pre-requisite: AMA2007 / AMA2008 / AMA2111 / AMA2308 /	
	AMA2380 / AMA2512 / AMA2882 / AMA290 / AMA3001)	
<u>AMA3602</u>	Applied Linear Models for Finance Analytics	3
	(Exclusion: AMA2631 / AMA2631A)	
<u>AMA3640</u>	Statistical Inference	3
	(Pre-requisite: AMA2007 / AMA2111 / AMA2308 / AMA2703 /	
	AMA2/03A / AMA2/3 / AMA2882 & AMA1501 / AMA1502 /	
	AMA2004 / AMA2001 / AMA2001A / AMA2034 / AMA2034A /	
AMA3820	Operations Research Methods	3
	(Pre-requisite: AMA1007 / AMA1008 / AMA1101 / AMA1102 /	
	AMA1120 / AMA1130 / AMA2007 / AMA2111 / AMA2701 /	
	AMA2701A / AMA2703 / AMA2703A / AMA2308 / AMA2380 /	
	AMA2512 / AMA2882 / AMA290)	
<u>AMA4602</u>	High Dimensional Data Analysis	3
	(Pre-requisite: AMA2602 / AMA2631 / AMA2631A / AMA 2691)	
AMA4650	Forecasting and Applied Time Series Analysis	3
	(Pre-requisite: AMA2602 / AMA2631 / AMA2631A / AMA364 /	
	AMA4001)	
<u>AMA4670</u>	Modelling of Epidemic and Pandemic	3
	(Pre-requisite: AMA2691 / AMA2702)	
<u>AMA4688</u>	Simulation	3
	(Pre-requisite: AMA1501 / AMA1502 / AMA2104 / AMA2601 /	
	AMA2634 / AMA2634A / AMA2691)	
<u>AMA4840</u>	Decision Analysis	3
	(Pre-requisite: AMA1501 / AMA1502 / AMA2104 / AMA2601 /	
	AMA2634 / AMA2634A / AMA2691)	2
AMA4850	Optimization Methods	3

Subject code	Subject title	Credits
	(Pre-requisite: AMA2007 / AMA2111 / AMA2112 / AMA2308 / AMA2380 / AMA2882 / AMA3001)	
<u>AP40012</u>	Machine Learning in Physics	3
1.0.012	(Pre-requisite: AP20005)	2
<u>AP40013</u>	Energy Conversion and Storage with Machine Learning (Pre-requisite: AP20002)	3
BME34145	AIDA for Health Care and Smart Ageing	3
	(Pre-requisite: ENG2002)	-
<u>BME44144</u>	AIDA for Biosignal Processing and Medical Imaging (Pre-requisite: BME31116)	3
BRE368	AI and Data Analytics for Smart Construction	3
BSE458	Building Performance Diagnosis and Management	3
	[Pre-requisite: BSE3514 (before 2022/23 cohort) / BSE3515 (from 2022/23 cohort)]	
BSE4610	Building Informatics	3
	(Pre-requisite: BSE1610 & BSE2610 & BSE3227)	
<u>CBS3410</u>	Python for Language Analytics	3
CDS4702	(Pre-requisite: UBS3947)	2
<u>CD34702</u>	(Pre-requisite: CBS3947)	3
CBS4703	Social Media and Social Network Analysis	3
<u>CBS4704</u>	Workshop on Language Analytics (Pre-requisite: CBS4958)	3
CBS4844	Machine Aided Translation	3
CBS4954	Statistics for Language Studies	3
CBS4958	Fundamentals of Computational Linguistics	3
	(Pre-requisite: CBS3947)	-
<u>CBS4962</u>	Corpus and Language Technology for Language Studies (Pre-requisite: CBS1902)	3
COMP4434	Big Data Analytics	3
	(Pre-requisite: AMA1104 / AMA1110 & COMP1011 / COMP1012 /	
COMP4436	Artificial Intelligence of Things	3
<u>COM 4430</u>	(Pre-requisite: COMP1011 / COMP1012 / ENG2002)	5
<u>COMP4442</u>	Service and Cloud Computing	3
00520212	(Pre-requisite: COMP2421 & COMP2432)	2
<u>CSE30313</u>	Machine Learning Practice in Smart Mobility (Pre requisite: One basic methematics subject and one basic computer	3
	programming subject	
	Mathematics	
	AMA2007 / AMA2111 / AMA2131 / AMA2308 / AMA2707 / AMA290	
	Computer Programming AMA2222 / AMA2222A / COMP1011 / COMP1012 / ENG2002)	
EE3013B	Transportation Data Analytics	3
	(Pre-requisite: EE2029B)	
<u>EE4014A</u>	Intelligent Systems Applications in Electrical Engineering	3
<u>EIE4121</u>	Machine Learning in Cyber-security	3
<u>EIE4122</u>	Deep Learning and Deep Neural Networks (Pre-requisite: AMA2104/ EIE3124)	3
ENGL4022	Quantitative Literacy for Language Professionals	3
ENGL4026	Language and Social Data Analytics	3

Subject code	Subject title	Credits
<u>HTI3990</u>	Big Data Analytics for Bioinformatics and Genomic	3
	Medicine	
<u>HTI4990</u>	AIDA in Clinical Diagnosis and Radiotherapy	3
<u>HTM4350</u>	Big Data Analytics in Hospitality, Tourism and Events	3
	(Pre-requisite: HTM3205)	
<u>HTM4364</u>	Social Media and Digital Marketing Analytics	3
	(Pre-requisite: HTM2324)	
<u>ISE3011</u>	Applied Quality and Reliability with AIDA	3
<u>ISE3017</u>	Applied AIDA in Operations Research and Management	3
SFT403FI	Smart Textiles for Wearable Applications	3
SFT412FB	Fashion Market Intelligence	3
SFT303AF	AI in Fashion Business	3
LSGI3220	Building Information Modelling & 3D GIS	3
LSGI3801	GeoAI	3
LSGI3802	Spatial Data Science	3
LSGI3803	Spatial Data Analytics and Mining	3
	(Pre-requisite: AMA1751 & COMP1011 / COMP1012)	
LSGI3804	Urban Big Data Analytics	3
LSGI3805	Urban Sensing for Smart City	3
<u>ME41006</u>	Perceptual Robotics	3
	(Pre-requisite: ME31002)	
<u>ME42001</u>	Artificial Intelligence in Products	3
	(Pre-requisite: ME31002 / ME41004)	
<u>ME42011</u>	Fundamentals of Robotics	3
	(Pre-requisite: ME31002 / ME41004)	
SD4772	Interactive Media and Marketing	3

2.4 Curriculum Map

The relationship between Subjects and Programme's Intended Learning Outcomes (PILOs) is given as follows:

Subject		Programme's Intended Learning				
Subject	1	2		4	5	
Mathematics I for AIDA	-	_	-	_	-	
AMA1110 Basic Mathematics I – Calculus						
and Probability & Statistics (for FCE and	\checkmark		\checkmark			
FENG students only)						
AMA1501 Introduction to Statistics for						
Business (for students from other Faculties/	\checkmark		\checkmark			
Schools)						
AMA2634 Introduction to Statistics (for	\checkmark		\checkmark			
AMA students only)						
Mathematics II for AIDA						
AMA1751 Linear Algebra (for students	\checkmark		\checkmark			
from other Faculties/ Schools)						
AMA2111 Mathematics I (for FENG	\checkmark		\checkmark			
students only)						
AMA2131 Mathematics for Engineers (for	\checkmark		\checkmark			
AMA2511 Applied Mathematics I &						
AMA2512 Applied Mathematics I &	1		1			
BME students only)	•		•			
Programming I: Programming Fundament	als					
COMP1012 Programming Fundamentals	a15					
and Applications (for students from other	1					
Faculties/ Schools)	v					
FNG2002 Computer Programming (for						
FENG students only)	~	\checkmark	\checkmark	\checkmark		
LGT3109 Introduction to Coding for						
Business with Python (for FB students only)	v		v		v	
Programming II: Data Structures and Algo	orithms					
COMP2013 Data Structures and Algorithms	\checkmark	\checkmark	\checkmark			
Fundamentals of Data Analytics						
AMA1611 Data Analytics Fundamentals	\checkmark	\checkmark	\checkmark	\checkmark		
AMA2233 Data Analytics and Visualization	\checkmark	\checkmark	1	~		
(for AMA students only)	·	•	•	•		
COMP1433 Introduction to Data Analytics	\checkmark	✓	✓	✓	✓	
EIE1003 Foundations of Data Science	\checkmark				✓	
LGT/MM3425 Business Analytics (for FB			✓			
students only)						

	Programme's Intended Learning						
Subject	1		omes (P.		5		
Maghina Lagraing	ł	2	5		3		
Machine Learning		1	1	T			
AMA students only)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
COMP4432 Machine Learning (for students							
from other Faculties/ Schools than EIE)	\checkmark	~	~	✓	✓		
EIE3124 Fundamentals of Machine	1						
Intelligence (for EIE students only)	~		~				
Artificial Intelligence							
COMP4431 Artificial Intelligence	✓	\checkmark	\checkmark	\checkmark	✓		
DSR-AIDA Bridging Subject							
AF3213 Business Analytics in Accounting	1		1				
and Finance	\checkmark		~	~	~		
AMA4602 High Dimensional Data Analysis	\checkmark		✓	\checkmark	\checkmark		
AP30019 Data Analysis Techniques for	\checkmark		√				
Scientists	•						
BME34145 AIDA for Health Care and		✓	\checkmark	\checkmark	✓		
Smart Ageing							
BRE4/2 Information Technology and Duilding Information Modelling for			1	1			
Construction Management			•				
BSE3610 Computational Methods in							
Building Sciences and Engineering			~	~			
BSE4510 Building Automation and Control		\checkmark	\checkmark	\checkmark	✓		
CBS3947 Programming and Data Analysis	\checkmark		✓	✓			
for Language Studies	·			-			
CSE30313 Machine Learning Practice in	\checkmark	✓	✓	\checkmark	✓		
Smart Mobility							
in Electrical Engineering	\checkmark	\checkmark	\checkmark	\checkmark			
EIE3127 Artificial Intelligence of Things	✓			✓	✓		
ENGL4022 Quantitative Literacy for							
Language Professionals	v		v	v	v		
ENGL4026 Language and Social Data	\checkmark		✓	\checkmark	~		
Analytics					-		
HTM3228 Smart Service Design in Tourism		✓	✓	\checkmark	✓		
and Hospitality							
and Hospitality	\checkmark	✓	✓	✓			
ISE3018 Logistics Automation		✓			✓		
SFT304AF Fashion Design		 ✓ 	 ✓ 	 ✓ 			
SFT330FB Fashion Digital Marketing	 ✓ 			 ✓ 			
LGT3108 Introduction to Enterprise				~	~		
Resource Planning System				•	•		

	Programme's Intended Learning						
Subject	Outcomes (PILOs)						
	1	2	3	4	5		
LSGI3803 Spatial Data Analytics and	\checkmark	\checkmark	\checkmark	~	~		
Mining							
ME46002 Numerical Methods for Engineers				✓			
MM3462 Artificial Intelligence and Big	\checkmark		\checkmark				
Data for Business							
SD3781 Interface Design			\checkmark				
SD4788 User Experience Design			✓		\checkmark		
SO4020X Application of AI and Data			\checkmark	1	~		
Analytics to Manage Ocular Problems			•	-			
Integrated Capstone Project							
AF/LGT/MM4913 Integrated Capstone	1		1				
Project	•		•				
AMA4953 Integrated Capstone Project	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
AP40020 Integrated Capstone Project		\checkmark	\checkmark	\checkmark	\checkmark		
BME44146 Integrated Capstone Project	\checkmark	✓	✓	✓	✓		
BRE4661 Integrated Capstone Project	\checkmark		\checkmark	\checkmark	\checkmark		
BSE4728 Integrated Capstone Project	\checkmark	\checkmark		\checkmark	\checkmark		
CBS4705 Integrated Capstone Project	\checkmark	✓	✓	✓	✓		
CSE49407 Integrated Capstone Project	\checkmark	✓	\checkmark	\checkmark	\checkmark		
EE4023 Integrated Capstone Project	✓	✓	✓	✓			
EIE4128 Integrated Capstone Project		✓	✓	✓			
ENGL4027 Integrated Capstone Project	✓	✓	✓	✓	✓		
HTM4365 Integrated Capstone Project	✓		✓				
ISE4001 Integrated Capstone Project	✓		✓	✓	✓		
SFT4217X Integrated Capstone Project		✓	\checkmark	\checkmark	✓		
LSGI4503 Integrated Capstone Project	✓	✓	✓	✓	✓		
ME49006 Integrated Capstone Project	✓	✓	✓		✓		
SD4470 Integrated Capstone Project -	1						
Production Design	\checkmark		\checkmark	~	~		
SD4790 Integrated Capstone Project -	1						
Interaction Design	\checkmark		\checkmark	~	~		
SO4039X Integrated Capstone Project		✓	\checkmark	✓	✓		
Elective							
AAE4009 Data Science and Data-driven							
Optimisation in Airline and Airport				\checkmark	\checkmark		
Operations							
AAE4011 Artificial Intelligence in							
Unmanned Autonomous Systems			V	~			
AMA3201 Computational Methods		\checkmark	✓	\checkmark			
AMA3602 Applied Linear Models for	1		1				
Finance Analytics	✓		✓	✓	✓		
AMA3640 Statistical Inference	\checkmark	\checkmark	\checkmark				
AMA3820 Operations Research Methods	\checkmark	\checkmark	\checkmark				

		Programme's Intended Learning					
Subject		Outc	omes (P	ILOs)			
	1	2	3	4	5		
AMA4602 High Dimensional Data Analysis	\checkmark		✓	\checkmark	\checkmark		
AMA4650 Forecasting and Applied Time	✓		✓	✓	✓		
Series Analysis	-						
AMA4670 Modelling of Epidemic and		~	✓	✓	✓		
Pandemic		-	-	-	-		
AMA4688 Simulation	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
AMA4840 Decision Analysis	\checkmark		\checkmark		\checkmark		
AMA4850 Optimization Methods	\checkmark	\checkmark	\checkmark				
AP40012 Machine Learning in Physics		✓	✓	\checkmark			
AP40013 Energy Conversion and Storage		1	 ✓ 		1		
with Machine Learning		•	•		•		
BME34145 AIDA for Health Care and	1	1	 ✓ 	1	1		
Smart Ageing	•	•	•	•	•		
BME44144 AIDA for Biosignal Processing	1	1	 ✓ 	1			
and Medical Imaging		•	•	•			
BRE368 AI and Data Analytics for Smart	1		1	1			
Construction			•	•			
BSE458 Building Performance Diagnosis			1	1	1		
and Management			•	•	•		
BSE4610 Building Informatics		\checkmark	\checkmark		\checkmark		
CBS3410 Python for Language Analytics			\checkmark	\checkmark			
CBS4702 Advanced Topics in Quantitative		1	1	1	1		
Language Studies		•	•	•	•		
CBS4703 Social Media and Social Network		1		1	1		
Analysis	•	•	•	•	•		
CBS4704 Workshop on Language Analytics	\checkmark	✓	✓	\checkmark	\checkmark		
CBS4844 Machine Aided Translation	\checkmark		\checkmark	\checkmark	\checkmark		
CBS4954 Statistics for Language Studies	\checkmark		\checkmark	\checkmark	\checkmark		
CBS4958 Fundamentals of Computational	1		1	1	1		
Linguistics	•		•	•	•		
CBS4962 Corpus and Language Technology	1	1	1	1	1		
for Language Studies	v	•	v	•	•		
COMP4434 Big Data Analytics	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
COMP4436 Artificial Intelligence of Things	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
COMP4442 Service and Cloud Computing		\checkmark		\checkmark			
CSE30313 Machine Learning Practice in				1	1		
Smart Mobility		•	•	•	•		
EE3013B Transportation Data Analytics		\checkmark	\checkmark	\checkmark	\checkmark		
EE4014A Intelligent Systems Applications		1	1	<u> </u>			
in Electrical Engineering		v	×	×			
EIE4121 Machine Learning in Cyber-							
security							
EIE4122 Deep Learning and Deep Neural	<u> </u>			<u> </u>			
Networks	•			•			

Subject		Programme's Intended Learning Outcomes (PILOs)					
	1	2	3	4	5		
ENGL4022 Quantitative Literacy for Language Professionals	✓		~	~	~		
ENGL4026 Language and Social Data Analytics	\checkmark		✓	✓	✓		
HTI3990 Big Data Analytics for Bioinformatics and Genomic Medicine	\checkmark		~	~	~		
HTI4990 AIDA in Clinical Diagnosis and Radiotherapy	\checkmark	~		~	~		
HTM4350 Big Data Analytics in Hospitality, Tourism and Events	\checkmark	✓	✓				
HTM4364 Social Media and Digital Marketing Analytics	\checkmark	\checkmark	\checkmark	~	~		
ISE3011 Applied Quality and Reliability with AIDA	\checkmark				~		
ISE3017 Applied AIDA in Operations Research and Management	\checkmark			~	~		
SFT403FI Smart Textiles for Wearable Applications		<mark>√</mark>	✓		✓		
SFT412FB Fashion Market Intelligence	 ✓ 			 ✓ 			
SFT303AF AI in Fashion Business		 ✓ 	 ✓ 	 ✓ 			
LSGI3220 Building Information Modelling & 3D GIS	\checkmark	\checkmark	~	~	~		
LSGI3801 GeoAI	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
LSGI3802 Spatial Data Science	\checkmark	\checkmark		✓	✓		
LSGI3803 Spatial Data Analytics and Mining		~	~	~	~		
LSGI3804 Urban Big Data Analytics		✓	✓	✓	✓		
LSGI3805 Urban Sensing for Smart City		✓		✓			
ME41006 Perceptual Robotics	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
ME42001 Artificial Intelligence in Products	\checkmark	\checkmark	\checkmark				
ME42011 Fundamentals of Robotics	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
SD4772 Interactive Media and Marketing			\checkmark				

Appendix: Planned offering semesters for core subjects

Subject code	Subject title	Sem 1	Sem 2					
Mathematics I for AIDA (3 credits)								
<u>AMA1110</u>	Basic Mathematics I – Calculus and Probability & Statistics	\checkmark	\checkmark					
<u>AMA1501</u>	Introduction to Statistics for Business	\checkmark	\checkmark					
<u>AMA2634</u>	Introduction to Statistics	\checkmark	\checkmark					
Mathematics II	Mathematics II for AIDA (3 credits)							
<u>AMA1751</u>	Linear Algebra	\checkmark	-					
<u>AMA2111</u>	Mathematics I	\checkmark	\checkmark					
<u>AMA2131</u>	Mathematics for Engineers	\checkmark	\checkmark					
<u>AMA2511</u>	Applied Mathematics I	\checkmark	-					
and								
<u>AMA2512</u>	Applied Mathematics II	-						
Programming	: Programming Fundamentals (3 credits)							
<u>COMP1012</u>	Programming Fundamentals and Applications	\checkmark	-					
ENG2002	Computer Programming	\checkmark	\checkmark					
LGT3109	Introduction to Coding for Business with Python	-	\checkmark					
Programming	II: Data Structures and Algorithms (3 credits)							
<u>COMP2013</u>	Data Structures and Algorithms	\checkmark	\checkmark					
Fundamentals	of Data Analytics (3 credits)							
<u>AMA1611</u>	Data Analytics Fundamentals	-	\checkmark					
<u>AMA2233</u>	Data Analytics and Visualization	-	\checkmark					
<u>COMP1433</u>	Introduction to Data Analytics	\checkmark	\checkmark					
<u>EIE1003</u>	Foundations of Data Science	-	\checkmark					
LGT/MM3425	Business Analytics	\checkmark	\checkmark					
Machine Learning (3 credits)								
AMA4680	Statistical Machine Learning	\checkmark	-					
<u>COMP4432</u>	Machine Learning	-	\checkmark					
<u>EIE3124</u>	Fundamentals of Machine Intelligence	-	\checkmark					
Artificial Intell	igence (3 credits)							
<u>COMP4431</u>	Artificial Intelligence	\checkmark	\checkmark					

Remarks: The subject offer arrangement will be reviewed and adjusted when needed.

Part 3: Subject Syllabi

The departments reserve the right to revise and update the syllabi whenever appropriate and deemed necessary.

The latest subject syllabus can be viewed at <u>https://www38.polyu.edu.hk/ePublic/subject-search-details.jsf</u>.

The Hong Kong Polytechnic University

Subject Code	AAE4009
Subject Title	Data Science and Data-driven Optimisation in Airline and Airport Operations
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with
	1. A conceptual and practical foundation in airport and airline operations for knowledge representation and reasoning of artificial intelligence, data mining, soft computing and optimisation methods as problem solving tools;
	2. Research methodology, data interpretation and analytical skills in regard to real-life data and case scenarios of airport and airline operations; and
	3. Experience of conducting proper research experiments and engineering reports for results dissemination.
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	a. Identify and formulate the data-driven engineering problems in airport and airline operations;
	b. Transfer the expert knowledge into knowledge-based system and algorithms via machine learning approaches;
	c. Plan, design and develop appropriate algorithms via soft computing methods and analysis the data and the solution quality with alternatives; and
	d. Review the performance and make judgements based on numerical results and provide off-the-shelf suggestions, profitable solutions and actionable managerial insights.
Subject Synopsis/ Indicative Syllabus	Lectures are used to deliver the fundamental knowledge in relation to various aspects of machine learning, data mining, data analytics, data-driven optimisation and artificial intelligence in airline and airport operations (outcomes a to d).
	Several laboratories will be made available to equip students with the basic knowledge of data mining, soft computing, optimisation and artificial intelligence in solving aviation engineering problems (outcomes a to c).

	Given the basic knowledge of data science, a group mini project will be used to help students deepen their knowledge of a specific topic through literature study, methodology study, analysis of data, dissemination of research findings and report writing (outcomes a to d).
	The subject covers the following topics.
	Machine learning, data mining and artificial intelligence
	The topics include the following elements:
	Supervise and unsupervised learning approach.
	Descriptive methods, including clustering, association.
	Predictive methods, including classification and regression.
	Supervised learning algorithms: Nearest neighbour algorithm, fuzzy logic, gaussian mixture, neural network, linear regression, logistic regression, decision trees, Naïve Bayes, genetic algorithms
	Unsupervised learning algorithms: associate rules, principal component analysis, gaussian mixture
	Data-driven optimisation
	The topics include the following elements:
	Basic mathematical formulation and modelling, convex optimisation, data-driven modelling, airline scheduling planning, crew rostering, runway scheduling, gate assignment problem, air logistics transportation problem
	Optimisation methods and soft computing
	The topics include the following elements:
	Branch and Bound algorithm, heuristics, meta-heuristics, swarm intelligence
Teaching/Learning Methodology	Teaching is conducted through class lectures, case studies, and laboratory exercises. The basic knowledge, research methodology and theoretical models will be introduced. The understanding of how to address and formulate problems by using mathematical programming, artificial intelligence algorithms, and soft computing techniques with modern programming language is emphasised. Research methodology, data analytics skills, algorithm design skills and programme methods are taught in class as well as the related real-life scenarios using data to enhance their research abilities. Laboratory exercises, mini reports, oral disseminations and test are used to make up the course work marks.

Assessment Methods							
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed				
		a		b	с	d	
	1. Laboratory	40%	~	~	~	~	
	2. Mini report	20%			~	✓	
	3. Oral presentation	10%			~	✓	
	4. Test	30%	~	~	~	\checkmark	
	Total	100 %					
	Explanation of the appropriateness of the assessment methods in assessing intended learning outcomes: Overall assessment: 1.0 x continuous assessment The continuous assessment (100%) is aimed at enhancing the study comprehension and assimilation of various topics of the syllabus via ser laboratory teaching and laboratory report, numerical analysis, rea assignment. In particular, mini projects are used to assess the study capacities of self-study and problem-solving and effective communication set in English so as to fulfil the requirements of working in the aviation indu Test will be conducted to evaluate the students performance in mathema problem formulation and algorithm design for a given airport and air						
Student Study	Class contact:	s contact:					
Enort Expected	Lecture/seminar					24 Hrs.	
	Laboratory					15 Hrs.	
	Other student study effort:						
	 Literature review / Scientific finding and analysis / final report writing preparation / presentation 36 material preparation 						
				36 Hrs.			
	Total student study effort				1	11 Hrs.	
Reading List and References	1. Barber, D. (2012). Baye University Press.	esian reasoning a	and mach	ine learni	ing. Cam	bridge	
	2. Boyd, S., Boyd, S. P., & Cambridge university pre	& Vandenberghe ess.	, L. (2004	4). Conve	ex optimi	zation:	
	3. Cormen, T. H., Leiserso	on, C. E., Rivest	, R. L., 8	z Stein, C	C. (2009)		

	Introduction to algorithms: MIT press
4	De Neufrille D. & Odeni A (2002) Aiment sustance alonging design
4.	and management. New York: McGraw-Hill.
5.	Guido, S., & Müller, A. (2016). Introduction to machine learning with
	python (Vol. 282). O'Reilly Media.
6.	Marsland, S. (2015). Machine learning: an algorithmic perspective. CRC press.
7.	Richert, W. (2013). Building machine learning systems with Python. Packt Publishing Ltd.
8.	Wallwork, A. (2016). English for writing research papers: Springer.
9.	Wells, A. T. (2007). Air transportation: A management perspective: Ashgate Publishing, Ltd.
10.	Wu, CL. (2016). Airline operations and delay management: insights from airline economics, networks and strategic schedule planning: Routledge.

The Hong Kong Polytechnic University

Subject Code	AAE4011
Subject Title	Artificial Intelligence in Unmanned Autonomous Systems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide students with
	1. The main concepts, ideas, and techniques of advanced artificial intelligence (AI) in unmanned autonomous systems, e.g. unmanned aerial vehicles (UAV), unmanned ground vehicles (UGV);
	2. The major components of typical unmanned autonomous systems fulfilling a certain function, such as environment inspection using UAVs; and
	3. Experience in conducting proper experiments on unmanned autonomous systems and preparing engineering reports.
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	a. Apply AI algorithms or adopt AI tools in solving engineering problems in unmanned autonomous systems;
	b. Understand the relationship between multiple functions of unmanned autonomous systems, including perception, path planning, decision making, and control;
	c. Design partial of the functions of typical unmanned autonomous systems, such as positioning, and path planning; and
	d. Improve the existing AI algorithms to certain unmanned autonomous systems applications.
Subject Synopsis/ Indicative Syllabus	Lectures are used to deliver advanced knowledge concerning various aspects of AI, data analysis, and its applications in unmanned autonomous systems (outcomes a to d).
	The subject covers the following topics
	Introduction to Artificial Intelligence : The topic mainly includes the basic knowledge of machine learning such as conventional classification and regression together with high-level AI, such as convolutional neural network (CNN) for image segmentation.
	Introduction to Unmanned Autonomous Systems: The topic mainly includes the major existing applications of unmanned autonomous systems, such as UAV and UGV. Meanwhile, the topic will include the basic knowledge of typical unmanned autonomous systems.

	Optimization Algorithm to Unmanned Autonomous Systems : The topic mainly includes the optimization algorithms such as Gauss-Newton used to solve the engineering problems related to unmanned autonomous systems.						
	<u>Sensors for Unmanned Autonomous Systems</u> : The topic mainly introduces the typical sensors applicable to unmanned autonomous systems. The sensors include the LiDAR, inertial measurement unit, and camera. Basic algorithms for sensors-based positioning will be introduced.						
	<u>Navigation for Unmanned Autonomous Systems</u> : The topic mainly include positioning and navigation for the unmanned autonomous system using simultaneous localization and mapping (SLAM) using LiDAR sensors together with point cloud processing, registration,						
	Al-aided Navigation for Unmanned Autonomous Systems: The topic mainly includes the application of AI in LiDAR SLAM using object detection in unmanned autonomous systems.						
	Group Project: A design deployment of AI in unm	gn project wil	ll be carrie mous syste	d out for a ems throug	students to h practice) learn the	
Teaching/Learning Methodology	Teaching is conducted through class lectures and case studies. The basic knowledge, research methodology, and theoretical models will be introduced. The understanding of how to address and formulate problems by using mathematical programming, artificial intelligence algorithms, and optimization techniques in unmanned autonomous systems.						
	Research methodology, data analytics skills, and algorithm design skills are taught in class as well as the related real-life scenarios using data to enhance their research abilities. Mini reports, oral dissemination, and test are used to make up the coursework marks.						
Assessment Mathods in			1				
Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended be assess	subject lea ed	rning outc	omes to	
Outcomes			a	b	с	d	
	1. Examination	40%	~	✓	\checkmark	~	
	2. Assignment	20%	~	✓	✓	~	
	3. Group report	20%	~	✓	✓	~	
	4. Group Presentation	20%		✓	\checkmark	~	
	Total 100 %						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:						
	$0.40 \times \text{End of Subject Ex}$	xamination + ($0.60 \times \text{Cont}$	tinuous As	sessment		
	Examination is adopted ability of applying the c including assignments,	to assess stud oncepts. It is closed-book 1	ents on the supplement tests and g	overall un nted by co group proj	nderstandi ntinuous a ect. The	ng and the assessment continuous	

	assessment is aimed at enhancing the students' comprehension and assimilation of various topics of the syllabus. In particular, group mini-project is used to assess the students' capacities of self-learning and problem-solving and effective communication skill in English so as to fulfill the requirements of being aircraft design engineers.					
Student Study	Class contact:					
Effort Expected	Lecture	33 Hrs.				
	 Tutorial/Case Study 	6 Hrs.				
	Other student study effort:					
	 Literature review / case study / reading 	36 Hrs.				
	Self-study / preparation					
	Total student study effort	111 Hrs.				
Reading List and References	1. Guido, S., & Müller, A. (2016). Introduction to machine learning with python (Vol. 282). O'Reilly Media.					
	 Marsland, S. (2015). Machine learning: an algorithmic perspective. CRC press. 					
	3. Zhang, Tao, Qing Li, Chang-shui Zhang, Hua-wei Liang, Ping Li, Tian- miao Wang, Shuo Li, Yun-long Zhu, and Cheng Wu. "Current trends in the development of intelligent unmanned autonomous systems." Frontiers of information technology & electronic engineering 18, no. 1 (2017): 68-85.					
	4. Barfoot, Timothy D. State estimation for robotics. Ca Press, 2017.	ambridge University				
	 Thrun, S. (2002). Probabilistic robotics. Communicat 45(3), 52-57. 	tions of the ACM,				

Subject Code	AF/LGT/MM4913
Subject Title	Integrated 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:
	 provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to his/her discipline in the Departmental Scheme. develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA. 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: <u>Professional/academic knowledge and skills</u> (a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline in the Departmental Scheme; (b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills; (c) define and specify the problem precisely; (d) assimilate and apply the learnt knowledge to generate good solutions to the problem; (e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and (f) evaluate the final outcome in an objective manner; <u>Attributes for all-roundedness</u> (g) improve presentation and communication skills via oral presentation; (h) enhance technical report writing skills with proper organization of materials; (i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems; (j) manage the project efficiently and effectively through the supervision of supervisor(s); and (k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).
Subject Synopsis/ Indicative Syllabus	 In-depth Study of a Topic Typically Proposed by the Supervisor Project Meeting and Planning Proposal Writing Regular Progress Checking and Reporting Project Documentation Presentation and Demonstration Students are expected to identify a project topic with a supervisor in their chosen discipline, and a co-supervisor with artificial intelligence and data analytics expertise.

	Students need to demonstrate their knowledge in both their chosen discipline and AIDA in the project, receiving advice from both supervisors. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.												
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.												
Assessment Methods		I											
in Alignment with Intended Learning	Specific assessment	% weighting		Intend	led su	ıbject (Plea	learn se tic	ing ou k as a	itcom pprop	es to priate)	be as	sessed	1
Outcomes	methods/tasks		а	b	c	d	e	f	g	h	i	j	k
	Continuous Assessment	100	~	1	~	1	1	1	1	1	1	1	~
	Total	100											
Student Study Effort	 Explanation of the appropriateness of the assessment methods in assessing the intellearning outcomes: The Integrated Capstone Project will be accessed by the supervisor/co-supervisor other assessors. Attributes to be assessed include, but not limited to, Prol Identification, Problem Solving, Communication and Presentation, Project Manager and Self-Discipline. Integrated Capstone Projects should be problem-oriented and there are no restriction the nature of the problem except that it should be relevant to the student's ch discipline and AIDA. The project could be practical, academic or a hybrid in which student is encouraged but not constrained to have some original contributions. I student has to submit a proposal, a mid-term checkpoint progress report and a final re The proposal must be approved by the supervisor/co-supervisor before the student proceed with the Integrated Capstone Project. An oral presentation and demonstrati essential at the end of the project. A mid-term presentation and demonstration may be required for proper continuous assessment. 							or and oblem ment, ons on hosen ch the Each teport. nt can tion is y also					
Expected	Class contact:												
												U	1113.
	Other student st	udy effort:											
	• Searching and reading materials, meeting with supervisor / co-supervisor / others, design and system development, testing, documentation, presentation, etc.							Hrs.					
	Total student stu	udy effort						210 Hrs					Hrs

Reading List and	Reference Books:
References	1. Kumar, Ranjit, <i>Research Methodology: A Step-by-step Guide for Beginners</i> , 3rd Edition, SAGE Publications, 2011.
	2. Burns, Robert B., <i>Introduction to Research Methods</i> , 4th Edition, SAGE Publications, 2000.
	3. Roberts, Carol M., <i>The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation</i> , 3rd Edition, Corwin Press, 2007.
	 Mauch, James E. and Park, Namgi, Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty, 5th Edition, Marcel Dekker, 2003.
	 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, <i>Guide to Writing Empirical Papers, Theses and Dissertations</i> , Marcel Dekker, 2002.
	 Reinhart, Susan M., <i>Giving Academic Presentations</i>, 2nd Edition, University of Michigan Press, 2013.
	8. Oshima, Alice and Hogue, Ann, <i>Writing Academic English</i> , 4th Edition, Pearson Longman, 2006.
	 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.

The Hong Kong Polytechnic University

Subject Code	AF3213
Subject Title	Business Analytics in Accounting and Finance
Credit Value	3
Level	3
Pre-requisite/ Co- requisite/ Exclusion	Pre-requisite: Introduction to Business Analytics (LGT2425/MM2425) or Business Analytics (LGT3425/MM3425)
Objectives	This subject introduces students to the basic concepts, methods and approaches of data analytics in accounting and finance. The growing volume of both structured and unstructured data has pushed forward a more data- driven form of decision making. Future accountants need to be able to collect and work with data. This subject aims to first introduce various accounting and financial research datasets and to provide students various quantitative analysis techniques in developing analytical data models to support decision-making. With the information developed from data modeling, it is crucial to communicate practical implications of quantitative analyses to any kind of audience member. This subject aims to further provide an introduction as well as a hands-on experience in data visualization and visual analytics to help summarize large amount of data effectively. Students will learn to combine analytic and interactive visualization approaches and use them to demonstrate or provide insights into real-world problems and situations.
Subject Learning Outcomes	 Upon completion of the subject, students will be able to: a) know how data analytics are used to drive decisions in accounting and finance contexts; b) have an understanding of summarizing accounting and financial data; c) conduct analysis and presentation of data sets using accounting and finance cases.
Subject Synopsis/ Indicative Syllabus	 Basic Concepts and Methods of Data Analytics Data preparation and cleaning; Data analytics approaches; Data visualization and summarization. Applications of Data Analytics in Accounting and Finance Diagnostic, predictive and prescriptive analytics in managerial and financial accounting and consumer banking. Introduction of XBRL XBRL (extensible Business Reporting Language) for Internet communication among businesses. Data Visualization Communicate results effectively using clear language and visualizations.
Teaching/Learning Methodology	Key concepts and techniques will be introduced through seminars and in-class and after-class exercises. The subject places a lot of emphasis on project work. Students will be required to deliver a project which emphasizes on real-world accounting and finance issues. By completing the project, students should have hands-on experience in using the knowledge they have learnt in class to solve accounting and finance problems in practice. Students are encouraged to share their views and experiences actively with their lecturer and classmates.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks Continuous Assessment 1. Assignment Quizzes 2. Class Report and Presentation 3. Mid-tem test Final Examination Total Explanation of the app intended learning outcor Assignment Quizzes - S online tutorials to compl of the key concepts and Class Report and Present the materials and in ach depth investigation of di Mid-term Test & Final H to test students' overall a	% weighting 10% 30% 10% 50% 100% ropriateness tudents have lete online qu techniques, a ntation - are ieving the ir ifferent topic Examination billity in app	Intend outcon (Pleas a	led sub mes to e tick a b \checkmark \checkmark \checkmark \checkmark assess assess t assign vhich v r applic test st learnin erm tes we know	ject lea be asse is appro	rning ssed opriate)	n assessing the rials and watch r understanding ugh a more in- nation are used he subject.	
Student Study	Class contact:							
Effort Expected	Seminars	39 Hrs.						
	Other student study effort:							
	Reading materials / text	39 Hrs.						
	On average around 16 hours will be spent on the assignment quizzes and around 20 hours for the group project discussion, presentation and written report 36 H						36 Hrs.	
	Total student study effor	rt					114 Hrs.	
Reading List and References	Introduction to Data Ar Terrell, McGraw-Hill. 2018 SEC reporting taxo (https://www.fasb.org/js	nalytics for A ponomy onfFASB/Pag	Account	ting, 20 onPage)21, by &cid=1	Richards	on, Teeter and 00059)	

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 Learning Outcomes	 Upon completion of the subject, students will be able to: (a) apply analytical reasoning to solve problems in science and engineering; (b) make use of the knowledge of mathematical/statistical techniques and adapt known solutions to various situations; (c) apply mathematical modeling in problem solving; (d) demonstrate abilities of logical and analytical thinking. 							
Subject Synopsis/ Indicative Syllabus	 <u>Elementary calculus</u>: Limit and continuity, derivatives and their geometric meaning, rules of differentiation including chain rule, Leibniz's rule and L'Hopital's rule, exponential and logarithmic functions, trigonometric functions and their inverses, hyperbolic and inverse hyperbolic functions, applications of differential calculus. <u>Elementary Probability and Statistics</u>: 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 Learning Outcomes	Specific assessment methods/tasks % Intended subject learning outcomes to be assessed (Please tick as appropriate)							
	1.Assignments and mid-term tests	40%	~	~	~	~		
	2. Examination	60%	~	✓	✓	\checkmark		
	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 examina students' level of understanding of the basic concepts a mathematical techniques in solving problems in science as						
	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	Class contact:						
Expected	Lecture	26 Hrs.					
	Tutorial	13 Hrs.					
	Other student study effort:						
	 Homework and self-study 	81 Hrs.					
	Total student study effort	120 Hrs.					
Reading List and	Chung, K.C. A Short Course in Calculus and Matrices, McGraw Hill 2013						
References	Hung, K.F., Kwan, Wilson, Pong, T.Y. Foundation Mathematics & Statistics, McGraw Hill 2013						
	Larson, R., Edwards, B. Single Variable Calculus, Brooks/Cole 2012						
	Walpole, R.E., Myers, R.H., Myers, S.L. Ye, K. Probability and Statistics J Engineers and Scientists, Prentice Hall, 2012						

Subject Code	AMA1501
Subject Title	Introduction to Statistics for Business
Credit Value	3
Level	1
Pre-requisite	Nil
Objectives	 This subject aims to: (i) provide students with a variety of basic techniques in understanding, interpreting, and analyzing data; (ii) allow students to develop skills in analyzing scenarios and problems in commerce and industry by applying statistical methods. The emphasis will be on applications of elementary statistical methods to commerce and industry.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: a. use a variety of basic techniques in understanding and interpreting data; b. apply elementary statistical methods in analyzing business scenarios and problems; c. think critically and creatively about the uses and limitations of statistical methods in business; d. use statistical package/software and interpret the output, appreciate the applications of information technology for statistical analysis in business.
Subject Synopsis/ Indicative Syllabus	 Descriptive Statistics Presentation of business data in tabular, diagrammatic and graphic forms; misleading presentations. Summary measures of location and spread. Probability Concepts of probability. Probability rules. Bayes' Theorem. Random variables and expected values; uses and limitations in decision making. Common probability distributions: Binomial, Poisson and Normal. Estimation Simple random samples. Sampling distributions: mean, proportion and differences. Confidence intervals: mean, proportion and differences.

	 Hypothesis Testing Hypothesis testing: mean, proportion and differences. Chi-square Test Test of goodness of fit. Test of independence. Relationships between Variables Exploratory data analysis. Linear relationships: ordinary least squares. Correlation coefficients. Multiple Regression Multiple regression equation. Inferences about parameters. Variable selection and its implementation in computer software (such as SPSS or R). 					
Teaching/Learning Methodology	The lectures aim to provide the students with an integrated knowledge required for the understanding and application of statistical concepts and techniques. To develop students' ability for logical thinking and effective communication, tutorial and presentation sessions will be held.					
Assessment Methods in Alignment with Intended Learning Outcomes	effective communication, tutorial and presentation sessions will be held.Specific assessment methods/tasks% weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)abcdabcd1. Assignment and Presentation20% \checkmark \checkmark \checkmark 2. Mid-term Test30% \checkmark \checkmark \checkmark 3. Examination50% \checkmark \checkmark \checkmark Total100 % \checkmark \checkmark \checkmark Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The subject focuses on knowledge, skill and understanding of Business Statistics , thus, Exam-based assessment is the most appropriate assessment method, including 30% test and 50% examination. Moreover, 20% worth of assignments and presentations are included as a component of continuous assessment so as to keep the students in progress					
Student Study	Class contact:					
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Enort Expected	Lecture	26 Hrs.				
	 Tutorial and Student Presentation 	13 Hrs.				
	Other student study effort:					
	 Assignments 	20 Hrs.				
	 Self-study 	61 Hrs.				
	Total student study effort	120 Hrs.				
Reading List and	Study Guide:					
Kelerences	Introduction to Statistics for Business, Department of Applied Mathematics, The Hong Kong Polytechnic University <u>Reference Books</u> :					
	Aczel, A.D., Complete Business Statistics, 7th ed., McGraw-Hill, 2009.					
	Levin, Richard I. and Rubin, David S., <i>Statistics fo</i> ed., Prentice-Hall, 1998.	ard I. and Rubin, David S., <i>Statistics for Management</i> , 7 th -Hall, 1998.				
	David S. Moore, George P. McCabe, Bruce A. Craig, <i>Introduction to the practice of Statistics</i> , 9 th ed., W. H. Freeman and Company, 2017.					
	McClave, J. T., Benson, P. George and Sincich, Terry., A First Course in Business Statistics, 8 th ed., Prentice Hall, 2001.					

Subject Code	AMA1611
Subject Title	Data Analytics Fundamentals
Credit Value	3
Level	1
Pre-requisite and/or Exclusion(s)	Nil
Objectives	This subject is to introduce to students the fundamental concepts of data analytics and some basic skills and tools used in the field.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: (a) apply statistical reasoning to describe and analyze different types of data sets (b) extend their knowledge of statistical techniques and adapt analytical procedures to different situations (c) develop and extrapolate statistical concepts in synthesizing and solving problems (d) search for useful information and use data analytics software in solving problems (e) undertake the formulation of data analytics problems through continuous self-learning (f) demonstrate the abilities of logical and analytical thinking
Subject Synopsis/ Indicative Syllabus	General introduction to data science Data collection, types of data, data structures, selected case studies Data preparation and exploration Data cleaning/processing, data summary, frequency table, density plot, data visualization, computational tools of statistics and data analytics (e.g., R/Python) Basic probability Experiment, event and probability, random variable, distributions, measures of central tendency and dispersion, measures of association

	Statistics Estimation of mean an regression, prediction, cla	d variance, ssification, ba	confid asic tim	ence i es serie	nterval, s	hypot	thesis	testing,
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the basic data analytics concepts of the topics in the syllabus which are then reinforced by learning activities involving demonstration and tutorial exercise.							
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intend be ass (a)	led sub sessed (ject lear Please t	rning of tick as a	utcome appropr (e)	s to iate)
Outcomes	1. Assignments/Test	40%	 ✓ ✓ 					
	2. Examination Total	60% 100%	¥	•	•	•	v	×
	Explanation of the approp intended learning outcome Continuous Assessment co written examination is hel	riateness of tl es: omprises of a d at the end o	he asses ssignmo of the se	ents and	method d/or qui	s in ass zzes, ar	essing t nd test(s	the s). A
Student Study	Class contact:							
Enort Expected	Lecture 26 Hrs.					6 Hrs.		
	Tutorial 13 Hrs.							
	• Solf study	:					6	6 Ura
	Total student study effort						10:	5 Hrs.
Reading List and Reference	Adhikari, A. and DeNero, J. (2019). Computational and Inferential Thinking: The Foundations of Data Science. GitBook.							
	Davy, C., Meysman, A. D Data, Machine Learning, a	. B., and Ali, and More, Us	M. (20 ing Pyt	16) Inti hon To	oducing	g Data nning H	Science Publicat	: Big tions.

Utts, J.M. (2014). Seeing Through Statistics (4th edition). Cengage Learning.
Utts, J. M. and Heckard, R. F. (2015). Mind on Statistics (5th edition). Cengage Learning.

Subject Code	AMA1751
Subject Title	Linear Algebra
Credit Value	3
Level	1
Pre-requisite	Nil
Objectives	This subject aims to introduce students to basic principles and knowledge of elementary linear algebra. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical techniques in solving practical problems.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: (a) Understand the concept of linear algebra and perform basic operations; (b) make use of the knowledge and techniques in linear algebra and adapt known results to various situations; (c) demonstrate abilities of logical and analytical thinking.
Subject Synopsis/ Indicative Syllabus	Matrix algebra Linear equations and matrices, matrix operations, row-reduction, echelon form, determinants.
	<u>Vector spaces</u> Vector space axioms, subspace, spanning sets, linear dependence and independence, bases and dimension.
	<u>Linear transformations</u> Definition of linear transformation, kernel and range, the matrix of a linear transformation, eigenvalues and eigenvectors, complex eigenvalues.
	Inner product spaces Inner product, norm, orthogonality, orthogonal projections, Gram-Schmidt orthogonalization process, diagonalization of symmetric matrices, least square problems, singular value decomposition.
Teaching/Learning Methodology	The subject will mainly be delivered through lectures and tutorials. The lectures will be conducted to introduce the theoretical background, and practical problems / scenarios will be discussed in the tutorial sessions to illustrate how the theory developed can be applied in practice.

Assessment								
Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks		% weighting	Intended su outcomes to (Please tick appropriate	bject learn b be assess as)	oject learning be assessed as		
				a	b	с		
	1. Assignments/Quiz	zzes	20%	✓	✓	✓		
	2. Midterm Test		20%	✓	✓	✓		
	3. Examination		60%	✓		✓		
	Total		100%					
	Continuous Assessm A written examinatio	nent comp on is held	rises of assignn at the end of th	nents and/or ne semester.	quizzes, a	and test(s).		
Student Study Effort Required	lent Study Class contact: ort Required							
	Lecture				26 Hrs.			
	Tutorial					13 Hrs.		
	Other student study effort:							
	 Assignments/Quizzes 					35 Hrs.		
	Self-study					35 Hrs.		
	Total student study eff	fort				109 Hrs.		
Reading List and	References:							
References	Steven Leon	Linear A	lgebra with	Pears	rson 2014			
	David Lav	Applicati	ons 9 th Edition	Pears	on 2014			
Gi	Gilbert Strang	Applications 5th EditionIntroduction to LinearWellAlgebra 5th EditionPres		Welles Press	esley-Cambridge s 2016			

Subject Code	AMA2111				
Subject Title	Mathematics I				
Credit Value	3				
Level	2				
Pre-requisite	Calculus and Linear Algebra (AMA1007) or Calculus I (AMA1101) or Calculus IA (AMA1102) or Basic Mathematics II – Calculus and Linear Algebra (AMA1120) or Calculus for Engineers (AMA1130) or Foundation Mathematics for Accounting and Finance (AMA1500)				
Exclusion	Intermediate Calculus and Linear Algebra (AMA2007) Mathematics for Engineers (AMA2308) Engineering Mathematics (AMA2380) Applied Mathematics I (AMA2511) Mathematics for Scientists and Engineers (AMA2882) Engineering Mathematics (AMA290)				
Objectives	This subject aims to introduce students to the basic principles and techniques of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.				
Intended Learning Outcomes	Upon completion of the subject, students will be able to:				
	 apply mathematical reasoning to analyze essential features of different problems in science and engineering; extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations; develop and extrapolate the mathematical concepts in synthesizing and solving new problems demonstrate abilities of logical and analytical thinking; search for useful information in the process of problem solving. 				
Subject Synopsis/ Indicative Syllabus	 <u>Algebra of complex numbers</u> Complex numbers, geometric representation, complex exponential functions, n-th roots of a complex number. <u>Linear algebra</u> 				
	 Systems of linear equations, vector spaces, inner product and orthogonality, eigenvalues and eigenvectors, applications. <u>Ordinary differential equations</u> ODE of first and second order, linear systems, Laplace transforms, Convolution theorem, applications to mechanical vibrations and simple 				

	4. Differential calculus of functions of several variables							
	Partial derivatives, total differential, chain rule, Taylor's expansion, maxima and minima, directional derivatives, Lagrange multipliers, implicit differentiation, applications.							
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures aim to provide the students with an integrated knowledge required for the understanding and application of mathematical concepts and techniques. Tutorials will mainly be used to develop students' problem solving ability.							
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks% weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)					ase		
Outcomes			1	2	3	4	5	
	1.Homework, quizzes and mid-term test	40%	~	~	~	~	~	
	2. Examination	60%	~	✓	~	✓	~	
	Total	100%		1	1	•	<u> </u>	
	 quizzes and a mid-term test. An examination is held at the end of the Questions used in assignments, quizzes, tests and examinations are use students' level of understanding of the basic concepts and their ab mathematical techniques in solving problems in science and engineerin Explanation of the appropriateness of the assessment methods in as intended learning outcomes: The subject focuses on understanding of basic concepts and app techniques in engineering mathematics. As such, an assessment met mainly on examinations/tests/quizzes is considered appropriate. Fu students are required to submit homework assignments regularly in ord subject lecturers to keep track of students' progress in the course. 					of the se are used eir abilit ineering in asses d applic nt metho e. Furth in order e.	mester. to assess y to use g. ssing the cation of od based hermore, to allow	
Effort Expected	Class contact:							
	Lecture					26 Hours		
	Iutorial 13 Hours							
	Other student study effort							
	Assignments and Self study					78 Hours		
	Total student study effort:					117	Hours	
Reading List and References	 C.K. Chan, C.W. Chan and K.F. Hung, <i>Basic Engineering Mathematics</i>, McGraw-Hill, 2015. Anton, H. Elementam Linear Alashra (11th edition). Wiley, 2014. 			tics,				
	Inton, II. Elementar			- cantion	,, ney	,		

3	B. Kreyszig, E. (2011). Advanced Engineering Mathematics, 10th ed. Wiley.
4	. James, G. (2015). <i>Modern Engineering Mathematics</i> , 5th ed. Pearson Education Limited
5	5. Thomas, G. B., Weir, M. D. & Hass, J. R. <i>Thomas' Calculus</i> , 14th ed. Pearson Education 2017

Subject Code	AMA2131			
Subject Title	Mathematics for Engineers			
Credit Value	3			
Level	2			
Pre-requisite/	AMA1130 Calculus for Engineers AMA1131 Calculus			
Co-requisite/ Exclusion	Exclusion: Intermediate Calculus and Linear Algebra (AMA2007), Mathematics I (AMA2111), Engineering Mathematics (AMA290)			
Objectives	To acquire knowledge of engineering mathematics and to apply these tools for their feasible solution of practical problems in civil engineering.			
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: a. apply mathematical reasoning to analyze essential features of different problems; b. apply the fundamentals of mathematics to formulate problems; c. apply such fundamentals to obtain solutions to problems formulated; d. critically analyze and interpret the models formulated and solutions obtained to support the synthesis of logical and cost-effective solutions; e. communicate solutions logically and lucidly through calculation, sketch, drawing and in writing. 			
Subject Synopsis/ Indicative Syllabus	 Function of several variables, partial derivatives, chain rule for several independent variables, material derivatives, Taylor's formula and Taylor's series, stationary points, maxima, minima and saddle points. Applications to Optimization. Multiple integration, double and triple integrals, change of variables and Jacobian, polar, cylindrical and spherical coordinates. Volume, Centroid and Moment of inertia of a solid. Vector calculus (gradient, curl and divergence), scalar and vectors fields, line integrals, surface integrals, Stokes Theorem, Gauss Divergence Theorem, and Green's Theorem. Applications to fluid flows. Matrix calculation, system of linear equations, eigenvalues and eigenvectors, positive definite matrices and their basic properties, diagonalization of real symmetric matrices. 			

Teaching/Learning Methodology Assessment Methods in	Emphasis is placed on a pro-active learning approach. Fundamental knowledge will be introduced in the lectures, with interspersed questions, exercises and quizzes for class discussion and after class self study. Students will be expected to read up, do exercises and reflect critically on the material covered in class. A companion web site-cum-discussion forum will be available to facilitate questioning and discussion. Additional face-to-face discussion sessions can be arranged on request.						
Alignment with Intended Learning	Specific	% weighting	Intend	led subje	ect learr	ning out	tcomes
Outcomes	methods/tasks	weighting	appropriate)			, 	
			a	b	с	d	e
	1.Coursework	40					
	Examination	00	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
	Total	100 %		•			
Student Study Effort	Class contact:						
Expected	Lectures						26 Hrs.
	Tutorials 13 Hr					13 Hrs.	
	Other student study effort:						
	Coursework and Self Study 78 Hrs.					78 Hrs.	
	Total student study e	effort					117 Hrs.
Reading List and	Kreyszig, E. Advanc	ed Engineerin	g Mathe	ematics,	10th ed	l., Wile	y, 2011.
Kelerences	Zill, D.G. and Wright W.S. Advanced Engineering Mathematics, 5th ed., Sudbury, Mass. : Jones and Bartlett Publishers, 2014.						
	Marsden, J.E. Basic Multivariable Calculus, 3rd ed., Springer Verlag, 2002.				Verlag,		
	Chan, CK, Chan, CV McGraw-Hill, 2015	V, Hung KF E	Basic En	gineerir	ng Math	ematics	8,

Subject Code	AMA2233
Subject Title	Data Analytics and Visualization
Credit Value	3
Level	2
Pre-requisite	Principles of Programming (AMA2222) or equivalent
Objectives	This subject aims to provide students with knowledge and techniques in data visualization, which refers to the process of encoding data or information into visual form including statistical charts or other graphical objects. It aims to enrich students' knowledge in various disciplines such as visual communication, computer programming, logical reasoning, data science and statistics. These knowledges are essential for data analytics and reporting.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: a) understand the principles of visual design and communication; b) acquire information from data using statistical methods and computer programming techniques c) familiarize with various types of diagrams suitable for representing datasets or statistical information under different situations; d) apply computer programming techniques to create computer graphics for data visualization; e) present data in visual form for effective communication and analytics; f) develop innovative ideas using big-data analytics and information technologies
Subject Synopsis/ Indicative Syllabus	 Visual communication Principles of visual design, colour theory, perception. Data analytics Descriptive statistics, correlation and covariance, data processing, data analytics. Foundations of data visualization Basic charts and plots, statistical charts, scatter plots. Visualization of time-oriented data Time-oriented data, time series, real-time data, simulations. Visualization of discrete structures Networks, graphs, trees. Visualization of scientific data Spatial data, geospatial data, scalar and vector field. Interactive data visualization 3D-plots, animations, annotations, transformation, interactive controls.

Teaching/Learning Methodology	This subject emphasizes both the conceptual elements in visual communication and data analytics, and also practical techniques in using computer programming. The lectures will be taught in a workshop mode with hands-on exercises reinforcing taught concepts. Students are required to attend the laboratory sessions, which allows them to consolidate their concepts through laboratory tasks. These tasks involve practical work that help students to reinforce the programming skills learned for applications.									
Assessment Methods in Alignment with	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
Intended Learning			а	b	с	d	e	f		
Outcomes	1. Continuous Assessment (assignments, quizzes, tests laboratory exercises)	s and 30%		√	~	~	√			
	2. Examination	30%	✓	✓	✓	✓				
	3. Project	40%	✓	✓	✓	✓	✓	✓		
	Total	100 %		1			1			
	 intended learning outcomes: The quizzes, tests and final examination will be designed to assess student conceptual knowledge about the subject. The assignments and laboratory exercises will be designed to assess student practical techniques in using the data visualization tools. The project will be designed to assess students' ability to apply their knowledge to analyze, visualize and report data in real-life situation. 									
Student Study Effort Required	Class contact:									
	Lecture				26 Hrs.					
	• Lab				13 Hrs.					
	Other student study effort:									
	Assignments, quizzes, proje	ects, exams					81	Hrs.		
	Total student study effort						120	Hrs.		
Reading List and	Matthew Ward, Georges Grinstein, Daniel Keim	Interactive Data	Visual	izatio	n, C	CRC P	ress, 2	2015		
References	Tamara Munzner	Visualization An Design	alysis	and	(CRC P	ress, 2	2014		
	Calus O. Wilke	Fundamentals of Visualization	Data		C)'Reill	y, 201	9		
	Ashwin Pajankar	Apress, 2021								

Kirthi Raman	Mastering Python Data Visualization	Packt Publishing, 2015
Abha Belorkar, Sharath Chandra Guntuku, Shubhangi Hora, Anshu Kumar	Interactive Data Visualization with Python, 2nd Edition	Packt Publishing, 2020

Subject Code	AMA2511
Subject Title	Applied Mathematics I
Credit Value	2
Level	2
Pre-requisite	Calculus I (AMA1101) or Calculus IA (AMA1102) or Basic Mathematics II –Calculus and Linear algebra (AMA1120)
Co-requisite/ Exclusion	Exclusion: Intermediate Calculus and Linear Algebra (AMA2007), Mathematics I (AMA2111)
Objectives	This subject aims to introduce students to some fundamental knowledge of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.
Intended Learning Outcomes Subject Synopsis/ Indicative Syllabus	 Upon completion of the subject, students will be able to: (a) apply mathematical reasoning to analyze essential features of different problems in their discipline; (b) extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations; (c) develop and extrapolate the mathematical concepts in synthesizing and solving new problems (d) demonstrate abilities of logical and analytical thinking. <i>Complex Numbers:</i> Algebra and geometry of complex numbers; polar form; DeMoivre's theorem; roots of a complex number. <i>Ordinary differential</i> equations: Simple ODE of first and second order; variation of parameters; applications. <i>Laplace Transform:</i> Laplace transform and inverse Laplace transform; properties of Laplace transformation with applications to solving initial value problems. <i>Series:</i> Infinite series; convergence tests; alternating series; power series; Taylor's and Maclaurin's expansion.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures aim to deliver and to explain the concepts, theories and techniques. Tutorials will mainly be used to develop students' problem solving ability. Students are encouraged to enhance their understanding of the subject matters through self-study.

Assessment Methods in	Specific assessment methods/tasks	essment % Intended subje ks weighting assessed (Pleas				ect learning outcomes to be use tick as appropriate)					
Intended Learning		6 6	a	b	b c						
Outcomes	1.Homework, quizzes and mid-term test	40%	~	\checkmark	\checkmark	\checkmark					
	2. Examination	60%	\checkmark	\checkmark	\checkmark	\checkmark					
	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 bas mainly on examinations/tests/quizzes is considered appropriate. Furthermos students are required to submit homework assignments regularly in order to subject lecturers to keep track of students' progress in the course										
Student Study	Class contact:										
Effort Expected	• Lecture		19 Hrs.								
	• Tutorial		7 Hrs.								
	• Mid-term test and		4 Hrs.								
	• Assignments and S		60 Hrs.								
	Total student study effort				90 Hrs.						
Reading List and References	CHAN, C.K., Basic CHAN, C.W., & HUNG, K.F.	Engineering l	Mathematic	s	McGraw Hill 2015						
	Anton, H. Elementary Linear Algebra, 11 th ed				dition John Wiley & Sons 2014						

Kreyszig, E.	Advanced Engineering Mathematics, 10 th edition	Wiley 2011
JAMES, G.	Modern Engineering Mathematics	Pearson 2015
Thomas, G.B., Weir, M.D., & Hass, J.R.	Thomas' Calculus, 14 th edition	Pearson Education 2017

Subject Code	AMA2512										
Subject Title	Applied Mathematics II	Applied Mathematics II									
Credit Value	2										
Level	2	2									
Pre-requisite	AMA2511	AMA2511									
Co-requisite/ Exclusion	Exclusion: Intermediate C	Exclusion: Intermediate Calculus and Linear Algebra (AMA2007)									
Objectives	This subject aims to introduce students to some fundamental knowledge of engineering mathematics. Emphasis will be on the understanding of fundamental concepts as well as applications of mathematical methods in solving practical problems in science and engineering.										
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: (a) apply mathematical reasoning to analyze essential features of different problems in their discipline; (b) extend their knowledge of mathematical and numerical techniques and adapt known solutions in various situations; (c) develop and extrapolate the mathematical concepts in synthesizing and solving new problems (d) demonstrate abilities of logical and analytical thinking 										
Subject Synopsis/ Indicative Syllabus	<i>Linear Algebra</i> : General p elementary matrices; syste determinant; eigenvalues a	properties of n ms of linear e nd eigenvecto	natrices; quations ors; ortho	elementa ; inverse gonality	ry row o of a squa	perations are matrix	8; X;				
	<i>Fourier series</i> : Expansion Identity.	of periodic fu	unctions	by Fouri	er series;	Parseval	's				
	<i>Calculus of several variab</i> . derivatives, maxima & min	<i>les</i> : Revision nima; direction	of calcu nal deriv	lus of on atives, L	e variable agrange i	e; Partial multiplie	r.				
Teaching/Learning Methodology	The subject will be deliver to deliver and to explain th be used to develop student enhance their understandin	ed mainly three e concepts, the s' problem so g of the subject	ough lect leories ar lving abi ect matter	tures and nd techni- lity. Stu rs throug	tutorials ques. Tu dents are h self-stu	. The lec torials w encoura dy.	ctures vill ma ged to	aim ainly o			
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intende assesse a	d subject d (Please b	t learning tick as a c	g outcome ppropria d	es to te)	be			
	and mid-term test	40%	\checkmark	~	~	\checkmark					
	2. Examination	60%	\checkmark	\checkmark	\checkmark	\checkmark					

	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 app intended learning outc	propriateness of the comes:	e assessment metho	ods in assessing the				
	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	19 Hrs.						
	• Tutorial			7 Hrs.				
	• Mid-term test	and examination		4 Hrs.				
	• Assignments a	and Self study	6					
	Total student study eff	fort		90 Hrs.				
Reading List and References	CHAN, C.K., CHAN, C.W., & HUNG, K.F.	Basic Engineering	Mathematics	McGraw Hill 2015				
	Anton, H. Elementary Linear Algebra, 11 th edition			John Wiley & Sons 2014				
	Kreyszig, E. Advanced Engineering Mathematic 10 th edition			s, Wiley 2011				
	JAMES, G.	Modern Engineeri	ng Mathematics	Pearson 2015				
	Thomas, G.B., Weir, M.D., & Hass, J.R.	Thomas' Calculus	, 14 th edition	Addison Wesley 2017				

Subject Code	AMA2634
Subject Title	Introduction to Statistics
Credit Value	3
Level	2
Pre-requisite	Basic Statistics I (AMA1006) or Probability & Distributions (AMA2691) or equivalent
Exclusion	Statistics for Finance Analytics (AMA2601)
Objectives	This subject is to introduce students to the compilation of statistical data, common probability distributions and elements of statistical inference.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a. apply knowledge on descriptive statistics to organize and summarize data; b. find confidence intervals for the sample mean, sample variance and sample proportion; c. discuss the concepts of hypothesis testing, including the type I error, type II error, and one-sided and two sided tests; d. apply the concepts of hypothesis testing to simple statistical problems; e. use the Pearson's chi-square test for goodness of fit; f. carry out nonparametric tests for simple statistical problems; g. use statistical software, such as R, to visually present data and to perform simple statistical analyses for problems in different areas.
Subject Synopsis/ Indicative Syllabus	 Descriptive and Visual Statistics Descriptive statistics: mean, mode, median, percentiles, variance, standard deviation, coefficient of variation. Frequency distributions and cumulative frequency distributions. Use statistical software to produce bar plots, boxplots, histograms, and ogives. Estimation of Parameters Point and interval estimators of mean, proportion, variance, and the difference between two means or two proportions. The normal distribution and the t-distribution. Sample size calculation for a pre-specified estimation accuracy. Applications. Test of Hypotheses Basic concepts in hypothesis testing: statistical hypotheses, type I and type II errors, one-sided and two-sided tests, significance levels, test statistics, and critical regions. Tests for population mean, population proportion, population variance, difference between two means, and difference between two proportions. The chi-square distribution and the Pearson's chi-square test for goodness of fit. Multiple-

	testing correlation: Bonferroni correction. Applications. <i>Nonparametric Tests</i> The sign test, the signed rank test, the rank sum test, and the Kolmogrov-Smirnov test.										
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the basic statistics concepts of the topics in the syllabus, which are then reinforced by learning activities including demonstration, tutorial exercise and assignments.										
Assessment Methods in	Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)								
Alignment with Intended Learning			a	b	с	d	e	f	g		
Outcomes	1. Assignments/Quizzes	15%	✓	✓	✓	✓	✓	✓	✓		
	2. Test	25%	✓	✓	✓	✓					
	3. Examination	60%	✓	✓	√	✓	✓	✓			
	Total	100 %									
	The subject focuses on knowledge, skill and understanding of <u>Intro-Statistics</u> , thus, <u>Exam-based assessment</u> is the most appropriate method, including 25% test and 60% examination. Moreover, 159 assignments and quizzes are included as a component of continuous as as to keep the students in progress. Continuous Assessment comprises of assignments and/or quizzes, a written examination is held at the end of the semester.								ion to sment rth of ent so sts. A		
Student Study	Class contact:										
Effort Expected	Lecture							2	6 Hrs.		
	Tutorial							13 Hrs.			
	Other student study effort:										
	 Assignment/Quiz 							2	6 Hrs.		
	 Self-study 						40 Hrs.		0 Hrs.		
	Total student study effort105 Hrs								5 Hrs.		
Reading List and References	Textbook: Johnson, R., Miller, I. and Freund, J.E.	<u>Textbook:</u> Johnson, R., Miller, I. Miller & Freund's Probability Prentice-Hall and Freund, J.E. 8 th edition									

References:		
Wackerly, D.D., Mendenhall, W., & Scheaffer, R.L.	Mathematical Statistics with Applications 7 th edition	Duxbury Press 2007
Montgomery, D.C. and Runger, G.C.	Applied Statistics and Probability for Engineers 6 th edition	Wiley 2013
Keller, G.	Statistics for Management and Economics 10 th edition	Cengage Learning 2014
Anderson, D.R., Sweeney, D.J., Williams, T.A., Camm, J.D., & Cochran, J.J.	Statistics for Business and Economics 12 th edition	Cengage Learning 2014

Subject Code	AMA3201
Subject Title	Computational Methods
Credit Value	3
Level	3
Pre-requisite	Intermediate Calculus and Linear Algebra (AMA2007) or Introduction to Differential Equations (AMA2008) or Mathematics I (AMA2111) or Mathematics for Engineers (AMA2308) or Engineering Mathematics (AMA2380) or Applied Mathematics II (AMA2512) or Mathematics for Scientists and Engineers (AMA2882) or Engineering Mathematics (AMA290) or Mathematical Methods for Data Science (AMA3001) or equivalent
Objectives	The subject introduces students to some fundamental knowledge of mathematical methods for finding numerical approximations to engineering problems. The emphasis will be on application of numerical methods to solving practical problems. Computer implementation of algorithms by students is emphasized. Computer software, such as Matlab, will be used to solve practical engineering problems.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: apply mathematical reasoning to analyse essential features of different engineering problems; extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations; apply appropriate numerical techniques to model and solve problems in engineering; develop and extrapolate mathematical concepts in synthesizing and solving new problem; search for useful information in solving problems.
Subject Synopsis/ Indicative Syllabus	 Error propagation, solution of linear system and nonlinear equation: Direct methods and iterative methods; Two-point methods and Fixed point iterations. Finite difference, interpolation and numerical differentiation and integration: Lagrange and Newton interpolating polynomials; Aitken's interpolating formula; Composite rules; Gauss quadrature. Numerical solution of ordinary differential equation: Predictor-corrector method; Runge-Kutta method.

	<i>Unconstrained nonlinear optimization:</i> One-dimensional and multi-dimensional search methods; Gradient methods.									
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials classes. The lectures will be conducted to introduce the concepts of various computational methods, which are reinforced by learning activities involving demonstration, example classes, assignments and exercises.									
Assessment Methods in	Specific assessment methods/tasks	v	% weighting	Intende be asses	d subjec ssed (Ple	t learnin ase tick	g outcom as appro	mes to opriate)		
Alignment with				1	2	3	4	5		
Outcomes	a. Continuous Assess	sment	40%	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		
	b. Examination		60%	\checkmark	\checkmark	\checkmark	\checkmark			
	Total		100%							
	Continuous Assessme examination is held at	ent compri t the end o	ises of the of the seme	mid-test ester.	and two	assigni	nents. A	written		
Student Study	Class contact:									
Effort Expected	Lecture						26 Hrs.			
	Tutorial						13 Hrs.			
	Other student study ef	ffort:								
	 assignments 					20 Hrs.				
	 self study 					58 Hrs.				
	Total student study eff	fort					117 Hrs.			
Reading List and	Textbook:					1				
References	Chen, X. & Nu Yamamota, T.	Chen, X. & Numerical Analysis Yamamota, T.				Coror 2008	Coronasha 2008			
	References:									
	Chapra, S.C. & Nu Canale, R.P. Pro Ap	Numerical Methods for Engineers: with Programming and Software Applications 5 th edition					aw Hill			
	Recktenwald,Introduction to Numerical Methods andG.W.Matlab: Implementation and Applications				l Prenti 2000	ice Hall				
	Gerald, C.F. & Wheatley, P.O.Applied Numerical AnalysisA 2Output7 th edition2					Addison Wesley 2004				

Subject Code	AMA3602
Subject Title	Applied Linear Models
Credit Value	3
Level	2
Pre-requisite	Nil [Students are expected to have some basic knowledge of linear algebra]
Exclusion	Applied Statistical Methods (AMA2631/AMA2631A)
Objectives	This subject is to provide students with an overview of linear models and their applications to finance analytics, to understand the principles and assumptions behind linear models, and enable students to perform linear regression analyses on real financial data using statistical software, such as R.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a. gain a basic understanding of the Analysis of Variance (ANOVA) approach and its underlying assumptions; b. report and interpret results of ANOVA analyses; c. formulate and tackle simple/multiple linear regression problems so as to identify appropriate models for given problems, to perform variable selection, estimation and inference on regression parameters, and to perform model diagnosis; d. describe the fixed-effects model and random-effects model and explain their differences; e. develop the competence in the use of appropriate statistical software for the ANOVA and linear regression analyses for problems in finance; f. manage their own learning and make use of appropriate texts, learning materials and relevant websites; g. communicate effectively in a well-structured manner and build up an openminded attitude; h. recognize the ethical and social responsibility of data analytics professionals.
Subject Synopsis/ Indicative Syllabus	 Analysis of variance The ANOVA table; degrees of freedom; partitioning the sum of squares; the F-distribution; expectations of mean squares; the F-test for the global null hypothesis. Applications to finance analytics. Simple linear regression Model specification and assumptions; least squares estimation of parameters; inference on model parameters; coefficient of determination; confidence interval for the mean value of the response variable; prediction interval; test for lack of fit; examination of residuals. Applications to finance analytics.

	 Model specification and assumptions; estimation and inference on the parameters; partial F-tests; polynomial regression; indicator variables for categorical independent variables. Applications to finance analytics, such as the Fama-French three-factor model. <i>Model selection</i> Information criteria: Akaike information criterion; Bayesian information criterion. Stepwise model selection. <i>Multicollinearity</i> The problem of multicollinearity; multicollinearity diagnostics; ridge regression and other solutions to multicollinearity. <i>Random effects model</i> Correlated observations; within groups and between groups sum of squares; maximum likelihood estimation; 									
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the elements of applied statistical methods in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and computer assignments.									
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods 1. Computer Assignments 2. Test 3. Examination Total Explanation of the apprintended learning outcom The subject focuses on I Methods, thus, Exammethod, including 20% computer assignments at to keep the students in p Continuous Assessment data. A written examinate of the students of the s	% weighting 20% 20% 60% 100 % ropriateness of mes: knowledge, sk -based assess test and 60 re included as rogress. comprises of ation is held a	Inter asses a \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark	aded s sed (b v v asses d und is t amin npone s and nd of	ubjec Please c v v ssmer erstar he m ation. ent of comp the se	t lear e tick d v v v t me nding ost a Mon contin	thods of <u>A</u> pproproproprover assig	in as pplied oriate r, 209 sasses	mes to iate) g ✓ ✓ ssessir I Stat asses % wo ssmen ts wit	be h h ✓ h f h h h h h h h h h h h h h

Student Study	Lecture		26 Hrs.
Effort Expected	 Tutorial 		13 Hrs.
	Other student study effort:		
	 Assignment 		33 Hrs.
	 Self-study 		33 Hrs.
	Total student study effort		105 Hrs.
Reading List and	Textbook:		
References	Kutner, M.H., Nachtsheim, C.J., Neter, J, & Li, W.	Applied Linear Statistical Models 5 th edition	McGraw Hill 2005
	References:		
	Bowerman, B.L. & O'Connell, R.T.	Linear Statistical Models, an Applied Approach 2 nd edition	Duxbury Press 2000
	Montgomery, D.C., Peck, E.A.& Vining, G.G.	Introduction to Linear Regression Analysis 5 rd edition	Wiley-Interscience n 2012
	Sclove, S. L.	A Course on Statistics for Finance 1 st edition	CRC Press 2012

Subject Code	AMA3640
Subject Title	Statistical Inference
Credit Value	3
Level	3
Pre-requisite	Intermediate Calculus and Linear Algebra (AMA2007) or Mathematics I (AMA2111) or Mathematics for Engineers (AMA2308) or Mathematical Methods for Finance (AMA2703/AMA2703A) or Advanced Mathematical Methods for Economics and Finance (AMA273) or Mathematics for Scientists and Engineers (AMA2882) or equivalent and Introduction to Statistics for Business (AMA1501) or Introduction to Statistics (AMA1502) or Probability and Engineering Statistics (AMA2104) or Statistics for Finance Analytics (AMA2601/AMA2601A) or Introduction to Statistics (AMA2634/AMA2634A) or Probability and Distributions (AMA2691) or equivalent
Objectives	This subject is to enable students to understand the theory of statistical inference and apply it to data analysis.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a. master the fundamental concepts of point estimation and interval estimation; b. apply methods of estimation, criteria of assessing a good estimator to determine the distribution and statistical properties of an estimator; c. perform tests of hypotheses relating population parameters and to judge the appropriateness and goodness of tests.
Subject Synopsis/ Indicative Syllabus	 Estimation: (17 hours) Statistic, unbiased estimator, consistent estimator. Minimum variance unbiased estimator. Efficiency of an unbiased estimator. Sufficiency, Factorisation theorem. Information matrix. Cramér-Rao lower bound. Relative efficiency. Method of moments. Likelihood, maximum likelihood (ML) estimation. Properties of ML estimators. Iterative solutions of ML estimating equation. Hypothesis testing: (11 hours) Significance test. Types of error, power of test. Neyman-Pearson theorem. Uniformly most powerful test. Generalised likelihood ratio test. Bayesian inference: (11 hours) Bayes' formula, Prior and Posterior distributions. Uniform prior, Conjugate prior. Bayes' solution to decision problem. Loss function, Bayesian estimation. Credible

	interval. Predictive inference.						
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the statistical inference concepts in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments/quizzes.						
Assessment Methods in	Specific assessment methods	% weighting	Intended subject le assessed (Please tic	arning o k as app	outcomes to be propriate)		
Alignment with			a	b	с		
Outcomes	1. Assignments	20%	✓	√			
	2. Quizzes	20%	✓	✓			
	3. Examination	60%	✓	✓	✓		
	Total	100 %					
	Explanation of the apprintended learning outcom The subject focuses Inference, thus, Exam method, including 60% quizzes are included as students in progress. Continuous Assessment examination is held at t	oropriateness of omes: on knowledge n-based assess o examination. s a component of the end of the se	f the assessment me , skill and unders <u>ment</u> is the most a Moreover, 40% wo of continuous assess f assignments and/c emester.	ethods in tanding appropri rth of a ment so or quizz	n assessing the of <u>Statistical</u> ate assessment ssignments and as to keep the es. A written		
Student Study	Class contact:						
Effort Expected	• Lecture		26 Hrs.				
	• Tutorial				13 Hrs.		
	Other student study effe	ort:					
	• Assignment				30 Hrs.		
	• Self-study				36 Hrs.		
	Total student study effo	ort			105 Hrs.		
Reading List and	<u>Textbook</u> :						
References	Hogg, R.V., McKean, J.W. & Craig, A.T.	Introduction t Statistics 7 th e	to Mathematical	Prent 2012	ice Hall		
	<u>References</u> :	.		ь ·	D		
	Bain, L.J. & Engelhardt, M.	Introduction t Mathematical	to Probability and I Statistics 2 nd edition	Duxb n 2000	oury Press		
	Casella, G. & Berger,	Statistical Inf	erence 2 nd edition	Duxb	oury Press		

R.L.		2001
Garthwaite, P., Jolliffe, I. & Byron, J.	Statistical Inference 2 nd edition	Oxford Science Publication 2002
Mood, A.M.	Introduction to the Theory of Statistics 3 rd edition	McGraw-Hill 1974

Subject Code	AMA3820
Subject Title	Operations Research Methods
Credit Value	3
Level	3
Pre-requisite	Calculus (AMA1007) or Calculus and Linear Algebra (AMA1008) or Calculus I (AMA1101) or Calculus IA (AMA1102) or Basic Mathematics II – Calculus and Linear Algebra (AMA1120) or Calculus for Engineers (AMA1130) or Intermediate Calculus and Linear Algebra (AMA2007) or Mathematics I (AMA2111) or Advanced Calculus and Linear Algebra (AMA2701/AMA2701A) or Mathematical Methods for Finance (AMA2703/AMA2703A) or Mathematics for Engineers (AMA2308) or Engineering Mathematics (AMA2380) or Applied Mathematics II (AMA2512) or Mathematics for Scientists and Engineers (AMA2882) or Engineering Mathematics (AMA290) or equivalent
Objectives	This subject is to introduce students to the techniques for solving operations research problems and to enable them to choose the correct techniques to suit a particular problem with applications in resource management, network models, decision analysis, inventory management, queuing management, and project management.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a) implement several basic deterministic and stochastic operations research models; b) synthesize the mathematical knowledge and techniques required in operations research model formulation; c) identify, define and formulate operations research problems in a systemic approach; d) execute and appraise the main algorithms for solving such operations research problems; e) interpret the results of these operations research algorithms; f) evaluate critically for improvement in solutions; g) communicate effectively in a well-structured manner and build up an openminded attitude.
Subject Synopsis/ Indicative Syllabus	Network flow models (8 hours) Shortest path problem, critical path problem (PERT), minimal spanning tree

	prol	problem, maximal flow problem.								
	Inte For excl prol	Integer programming models (8 hours) Formulate operations research problems as integer programming, related decisions, exclusive decisions, contingent decisions, either-or constraints, fixed charge problems, total unimodularity, branch and bound method.								
	Inve Det disc	Inventory management (8 hours) Deterministic inventory model, continuous review, shortage allowed, quantity discounts, periodic review, stochastic inventory model.								
	Queuing theory (6 hours) Structure of queuing models, input source, queuing system, inter-arrival service time, exponential distribution, Poisson distribution, birth-death p steady state, M/M/1 system.					rival th pr	time, ocess,			
	Line Moe	ear Programming (9 houded by the second se	urs) umming; simpl	ex meth	nod; se	ensitiv	vity a	nalysi	s.	
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the basic operation research concepts and techniques of the topics in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments/quizzes.									
Assessment Methods in	Specific assessment % weighting Intended sub			ject le Pleas	ect learning outcomes to Please tick as appropriate)					
Alignment with	incurous			a	b	c	d	e	f	g
Intended Learning Outcomes	1.	Assignments/ Quizzes	15%		✓	✓	✓	✓	✓	<u>∪</u>
	2.	Tests	25%		✓	✓	✓	✓	✓	
	3.	Examination	60%	✓	✓	✓	✓	✓	✓	
	Tot	tal	100 %							
	 Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The subject focuses on knowledge, skill and understanding of <u>Operations</u> <u>Research Methods</u>, thus, <u>Exam-based assessment</u> is the most appropriate assessment method, including 25% test and 60% examination. Moreover, 15% worth of assignments / quizzes are included as a component of continuous assessment so as to keep the students in progress. Continuous Assessment comprises of assignments and/or quizzes, and tests. A written examination is held at the end of the semester. 					ag the ations priate 15% nuous ts. A				
Student Study	Clas	ss contact:								
Effort Expected		• Lecture							2	6 Hrs.

	• Tutorial			13 Hrs.
	Other student study effe			
	• Assignment			15 Hrs.
	• Self-study		55 Hrs.	
	Total student study effo	ort:		109 Hrs.
Reading List and References	Textbook:			
Kererences	Taha, H.A.	Operations Research: An Introduction 10 th edition		Pearson 2017
	Hiller, F.S. &Introduction to Operations ReseaLieberman, G.J.10th edition		arch	McGraw Hill 2015
	Johnson, R., Miller, I. & Freund, J.E.	Probability and Statistics for Eng 9 th edition	gineers	Pearson 2017
	Winston, W.L. & Goldberg J.B.	Operations Research: Application Algorithms 4 th edition	ons and	Thomson/Brook s/Cole 2004
	Nahmias, Steven.	Production and Operations Anal 6 th edition	ysis	McGraw Hill 2009

Subject Code	AMA4602	AMA4602					
Subject Title	High Dimensional Data A	nalysis					
Credit Value	3						
Level	4						
Pre-requisite	Applied Statistical Method Applied Linear Models for Applied Linear Models (A Statistics for Data Science	Applied Statistical Methods (AMA2631/AMA2631A) or Applied Linear Models for Finance Analytics (AMA2602) or Applied Linear Models (AMA3602) or Statistics for Data Science (AMA3631) or equivalent					
Objectives	This subject is to enable st dimensional data analysis software such as R and M and mini-projects.	This subject is to enable students to understand the theory of multivariate and high dimensional data analysis and apply it to real data analysis. The use of computer software such as R and MATLAB will be required in completing the assignments and mini-projects.					
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: a. master the basic techniques for high dimensional data analysis; b. produce presentable statistical analysis for high dimensional data; c. interpret analysis results and make recommendations for actions based on analysis results; 						
Subject Synopsis/ Indicative Syllabus	Multivariate distributions, marginal and conditional distributions, regression function, multiple and partial correlation coefficients.						
	Principal component analysis, Canonical correlation analysis, Discrimination and classification, Clustering.						
	High dimensional linear regression: regularized regression (ridge regression and LASSO); choice of tuning parameters.						
	High dimensional logistic	regression.					
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the concepts of high dimensional data analysis methods in the syllabus, which are then reinforced by learning activities involving self-reading, demonstration, tutorial exercise, assignments and mini-project.						
Assessment Methods in	Specific assessment methods/tasks	% weighting	Intended subj assessed (Plea	ect learning ou ase tick as app	tcomes to be ropriate)		
Alignment with Intended Learning			a	b	с		
Outcomes	1. Assignments/Projects	20%	\checkmark	✓	 ✓ 		

	2 Ouizzos/Mid To	rm	20%		1			
	2. Quizzes/Wild-Te		20%		v	v		
	3. Examination		60%	\checkmark		✓		
	Total		100 %					
	Explanation of the intended learning o The subject focuses Data Analysis , thu method, including individual assignment as to keep the stude semester.	approprior outcomes s on know s, <u>Exam</u> 60% e ents/proj ents in pr	riateness of wledge, skil a-based asse examinatior ject (20%) a rogress. A v	the assessme s and understa essment is the Continuous and quizzes/mic vritten examin	nt methods ir anding of <u>High</u> most appropri Assessment d-term (20%) ation is held a	Dimensional Dimensional fate assessment comprises of are included so t the end of the		
Student Study	Class contact:							
Effort Expected	• Lecture					26 Hrs.		
	• Tutorial					13 Hrs.		
	Other student study effort:							
	• Assignmen	ıt				20 Hrs.		
	• Project					20 Hrs.		
	• Self-study					30 Hrs.		
	Total student study	effort:				109 Hrs.		
Reading List and	References:							
References	Johnson, R.A. & Wichern, D.W.	Applied Analys	d Multivaria is, 6th editio	ate Statistical	Prentice	Hall 2007		
	Hastie, R., Tibshirani, R. & Friedman, J.	The Ele 2 nd edit	ements of S ion	tatistical Learr	ing, Springer Statistics	Series in		
	Bühlmann, P., & Van De Geer, S.	Statistic method	cs for high- ls, theory ar	dimensional da ad applications	ata: Springer Business	Sciences & Media 2011		

Subject Code	AMA4650								
Subject Title	Forecasting and Applied Time Series Analysis								
Credit Value	3								
Level	4								
Pre-requisite	Applied Linear Models for Finance Analytics (AMA2602) or Applied Statistical Methods (AMA2631/AMA2631A) or Statistical Inference (AMA364) or Statistical Modeling for Discovery (AMA4001) or equivalent								
Objectives	This subject is to introduce to students basic concepts and techniques of time series and forecasting. An applied approach will be emphasized.								
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a. state the basic theory of time series analysis and forecasting approaches; b. synthesize the relevant statistical knowledge and techniques for forecasting; c. identify, define and formulate forecasting problem, and use procedures in popular statistical software for the analysis of time series and forecasting; d. interpret analysis results and make recommendations for the choice of forecasting methods; e. produce and evaluate forecasts for given time series; f. present analysis results of forecasting problems. 								
Subject Synopsis/ Indicative Syllabus	 Introduction to forecasting and smoothing models (5 hours) Forecasting and time series, forecasting methods and errors, choosing a forecasting technique, simple exponential smoothing and double exponential smoothing. Nonseasonal Box-Jenkins models and their identification (11 hours) Stationary and nonstationary time series, sample autocorrelation and partial autocorrelation function, tentative identification of ARMA models. Estimation, diagnostic checking, and forecasting for nonseasonal Box-Jenkins Models (14 hours) Estimation, diagnostic checking, forecasting and case study. Conditional heteroscedastic time series models (9 hours) ARCH and GARCH models, estimation and testing. 								
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the concepts of forecasting and applied time series analysis in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments/mini-project.								
Assessment Methods in Alignment with	Specific assessment methods%Intended subject learning ou assessed (Please tick as appr						comes to be opriate)		
--	---	-----------------------------	----------	--------	----------------	--------------------------	----------------------	---	--
Intended Learning			a	b	с	d	e	f	
Outcomes	1. Assignments/ Mini-project	20%	~	✓	✓	*	~	✓	
	2. Tests	20%	✓	✓		✓	✓		
	3. Examination	60%	✓	✓		4	✓	✓	
	Total	100 %							
	 Explanation of the appropriateness of the assessment methods in assessing intended learning outcomes: The subject focuses on knowledge, skill and understanding of Forecasting Applied Time Series Analysis, thus, Exam-based assessment is the mappropriate assessment method, including 20% test and 60% examinate Moreover, 20% worth of assignments /mini-project are included as a compose of continuous assessment so as to keep the students in progress. Continuous Assessment comprises of assignments and/or mini-project, and to A written examination is held at the end of the semester. 							ng and e most ination. ponent nd tests.	
Student Study	Class contact:								
Enort Expected	• Lecture							26 Hrs.	
	• Tutorial							13 Hrs.	
	Other student study effort:								
	Assignment/mini-project/laboratory							30 Hrs.	
	• Self-study							36 Hrs.	
	Total student study effort						1	05 Hrs.	
Reading List and References Textbook: Chatfield, C. & Xing, H. The Analysis of Time Series: An Introduction with R 7 th edition References: References:					n	Chapman and Hall 2019			
	Tsay, R.S. A	nalysis of Fin d edition	ancial T	ime Se	ries	Wiley- 2010	Intersci	ence	
Cryer, J.D. &Time Series Analysis withSChan, K.S.Applications in R 2nd edition2					Spring 2008	Springer-Verlag 2008			

Subject Code	AMA4670
Subject Title	Modelling of epidemic and pandemic
Credit Value	3
Level	4
Pre-requisite	Probability & Distributions (AMA2691) or equivalent and Multivariable Calculus (AMA2702) or equivalent
Objectives	Enables students to understand the history of epidemic and pandemic, theory and methods to model the spread of diseases in populations, including differential equations, demographic noise and measuremental noise, likelihood-based inference and iterated filtering. Enables students to familiarize themselves with disease modeling environments (the statistical software R)
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: (a) Describe the basic principles of risk analysis in epidemiology; Describe the concepts used in the mathematical modeling of infectious diseases (b) Understand essential characteristics of differential equations type of models (c) Understand how models are used to guide control and prevention measures (d) Construct simple dynamic models and apply generic models to specific disease systems (e) Make predictions about controlling disease based on models (f) Using likelihood-based inference and iterated filtering to estimate unknown parameters.
Subject Synopsis/ Indicative Syllabus	Differential equations and characteristics of epidemic models; Simple compartmental (Susceptible-Infectious-Recovered) models; Dynamics of infectious diseases in populations; Basic reproductive number; Effective reproductive number; Herd immunity and Critical vaccination coverage; Likelihood-based inference and iterated filtering.
Teaching/Learning Methodology	A two-hour lecture will be conducted every week to motivate students with risk analysis and disease transmission examples to understand and learn the theory and techniques. A one-hour tutorial is designed to consolidate and develop students' knowledge through practical examples and discussions.

Assessment Methods									
in Alignment with Intended Learning	n Alignment with ntended LearningSpecific assessment methods/tasks%Intended su be assessed						utcome approp	es to riate)	
Outcomes			a	b	c	d	e	f	
	a. Assignments	25%			\checkmark			\checkmark	
	b. Project report	25%			\checkmark	\checkmark		\checkmark	
	c. Examinations	50%	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	
	Total	100 %							
	Explanation of the appro intended learning outcom report component.	opriateness of nes. Students	the ass will be	sessme traine	nt metl d to wi	hods in rite rep	assess orts in	ing the project	
Student Study Effort Expected	Class contact:								
	Lecture					26 Hrs.			
	Tutorial					13 Hrs.			
	Other student study effor	t:							
	 Assignment and rep 	ort				45 Hrs.			
	 Self-study 					36 Hrs.			
	Total student study effort 120 I) Hrs.		
Reading List and References	References: Modeling Infectious Diseases in Humans and Animals, Matt J. Keeling & Pejman Rohani, Princeton University Press, ISBN: 9780691116174								
	Capasso V. Mathematica Heidelberg, 2008: Spring	l Structures of	f Epide	nic Sy	stems.	Second	Printin	ıg.	

Subject Code	AMA4680
Subject Title	Statistical Machine Learning
Credit Value	3
Level	3
Pre-requisite/	Applied Linear Models for Finance Analytics (AMA2602) or Applied Statistical Methods (AMA2631) or Probability & Distributions (AMA2691) or equivalent and Advanced Calculus and Linear Algebra (AMA2701/AMA2701A) or Further Mathematical Methods for Finance (AMA3723) or Mathematical Methods for Data Science (AMA3001) or equivalent and Principles of Programming (AMA2222/AMA2222A) or equivalent
Objectives	To provide a basic introduction to machine learning. To present fundamental concepts and algorithms for selected topics of machine learning, to provide the students with the necessary background for the application of machine learning to real problems, and to provide a starting point for students who are interested in pursuing research in machine learning or related fields.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: a) Demonstrate mastery of the principles of machine learning b) Develop quantitative skills of machine learning and interpret the outcomes of machine learning algorithms. c) Identify, define, and formulate problems of machine learning in real applications and generate workable solutions to problems.
Subject Synopsis/ Indicative Syllabus	 <u>Supervised Learning, Regression and Model Selection:</u> Generalized linear models; ridge regression, model selection, dimension reduction, principal component analysis, lasso; reproducing kernels, kernel ridge regression, regularization; stochastic gradient descent, online learning. <u>Supervised Learning, Classification:</u> Naive Bayes; decision trees; <i>k</i>-nearest-neighbor classifier; logistic regression; support vector machines, kernelized support vector machines; score-based classifiers, the receiver operating characteristic curve, AUC scores, imbalanced data. <u>Unsupervised Learning, Clustering:</u> <i>K</i>-means; agglomerative hierarchical clustering. Other Selected Topics:

	Cross validation; artificial neural networks, back-propagation, introduction to deep learning algorithms; introduction to software packages for machine learning; random forests.							
Teaching/Learning Methodology	The subject will mainly be lab. The theoretical backgro are both emphasized.	The subject will mainly be delivered through lectures and tutorials in computer lab. The theoretical background and the real applications of learning algorithms are both emphasized.						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended su to be assess appropriate	ended subject learning outcom be assessed (Please tick as propriate)				
outcomes			а	b	с			
	1. Assignments/Projects	15%	✓	✓	✓			
	2. Midterm Test	25%	✓	✓	\checkmark			
	3. Final Exam	60%	✓	✓	\checkmark			
	Total	100%						
	 concern important mathematical and statistical background. So it is important and appropriate to set the assignments and a midterm test for continuous assessment and a final exam. This subject emphasizes the practice of statistical machine learning. The project are appropriate for assessing the related intended learning outcomes in the continuous assessment. 							
Student Study Effort Required	Class contact:							
-	Lecture			26 Hrs.				
	Tutorial			13 Hrs.				
	Other student study effort:							
	Assignments/Projects				58 Hrs.			
	Self-study				30 Hrs.			
	Total student study effort				127 Hrs.			
Reading List and	Textbooks:							
References	Han, J., Kamber, M., and Data Mining: Concepts Pei, J. Techniques, 3rd Editio			ts and Morgan on. Kaufmann, 2011				
James, G., Witten, D., Hastie, T., and Tibshirani, R.					r 2013			

References:		
Tan, P.N., Steinbach, M., and Kummar, V.	Introduction to Data Mining	Pearson 2006
Hastie, T., Tibshirani, R, and Friedman, J.	The Elements of Statistical Learning	Springer 2009
Kelleher, J.D., Namee M.B., D'Arcy, A.	Fundamentals of Machine Learning for Predictive Data Analysis	The MIT Press 2015
Steinwart, I., Christmann A.	Support Vector Machines	Springer 2008
Goodfellow I., Bengio Y., Courville A.	Deep Learning	The MIT Press 2016

Subject Code	AMA4688
Subject Title	Simulation
Credit Value	3
Level	4
Pre-requisite	Introduction to Statistics for Business (AMA1501) or Introduction to Statistics (AMA1502) or Probability and Engineering Statistics (AMA2104) or Statistics for Finance Analytics (AMA2601) or Introduction to Statistics (AMA2634/AMA2634A) or Probability and Distributions (AMA2691) or equivalent
Objectives	This subject is to enable students to appreciate the principles and methods of system simulation. Emphasis is placed on the process of translating real-world problems into simulation models, and the model building techniques involved.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a. identify the basic concepts of simulation and its utility in solving real-world problems; b. apply statistical knowledge and modelling techniques required to construct simulation models for real-world systems; c. apply statistical knowledge and techniques to verify and validate simulation models; d. analyze and interpret simulation outputs; e. present results of simulation analysis; f. communicate effectively in a well-structured manner and build up an open-minded attitude.
Subject Synopsis/ Indicative Syllabus	 Fundamental of Simulation Models Principles of mathematical simulation, advantages and disadvantages of simulation, types of simulation models, steps in a simulation study. Discrete-Event Simulation General principles, components and organization of a discrete-event simulation model, simulation examples (e.g. production, queuing and inventory systems), event scheduling, gathering summary statistics. Random Numbers Generation of pseudo-random numbers, mid-square method, congruential methods, statistical tests of randomness. Random Variates Generation of random variates, inverse transformation method, acceptance-

	rejection method, comparison of the methods, generation of random variates of discrete and continuous theoretical distributions, Monte Carlo method and its applications.								
	<i>Tactical Planning in Simulation Models</i> Starting condition and equilibrium, problem of variability, estimation of population parameters, determination of sample size, variance reduction techniques.								
	<i>Validity and Analysis</i> Verification and validation of simulation models, comparisons, appropriate statistical tests, sensitivity analysis, simulation run statistics, replication of runs, elimination of initial bias, batch means, and regenerative techniques.								
	<i>Computer Language for L</i> Learn programming with	Discrete-Eve the statistica	<i>nt Simu</i> 11 comp	<i>lation</i> uting so	oftware	R.			
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the simulation concepts of the topics in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and project.								
Assessment Methods in Alignment with	Specific assessment methods	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
Intended Learning			a	b	с	d	e	f	
Outcomes	1. Project	25%	✓	✓	✓	✓	✓	✓	
	2. Assignments/Tests	25%	✓	✓	✓	✓			
	3. Examination	50%	✓	✓	✓	✓			
	Total	100 %		L		L	L		
	 Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The subject focuses on knowledge, skill and understanding of <u>Simulation</u>, thus <u>Exam-based assessment</u> is the most appropriate assessment method, including 25% test / quizzes and 50% examination. Moreover, 25% project is included as a component of continuous assessment so as to assess students' ability in constructing simulation models for real world problems and presenting results of simulation analyses. Continuous Assessment comprises of a project, quizzes and/or tests. A writter examination is held at the end of the semester. 					ing the <u>n</u> , thus, cluding ded as a ility in sults of written			
Student Study	Class contact:								
Effort Expected	Lecture							26 Hrs.	
	Tutorial					13 Hrs.			

	Other student study	effort:		
	 Project 		56 Hrs.	
	 Self-study 	22 Hrs.		
	Total student study	117 Hrs.		
Reading List and References	<u>Textbook:</u> Ross, S.M.	Simulation 5 th edition	Academic Press 2012	
	Reference Book: Law, A.M. & Kelton, W.D.	Simulation Modelling and Analysis 4 th edition	McGraw Hall 2012	

Subject Code	AMA4840
Subject Title	Decision Analysis
Credit Value	3
Level	4
Pre-requisite	Introduction to Statistics for Business (AMA1501) or Introduction to Statistics (AMA1502) or Probability and Engineering Statistics (AMA2104) or Statistics for Finance Analytics (AMA2601) or Introduction to Statistics (AMA2634/AMA2634A) or Probability and Distributions (AMA2691) or equivalent
Objectives	This subject is to enable students to understand the theory and methods for decision analysis under uncertainty, to appreciate the use of expert judgment and value of information in decision making and risk management, and to apply them in industrial and financial areas.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: a. discuss the basic principles and assumptions for decision analysis; b. synthesize the decision making knowledge and techniques required in solving real-life problems; c. formulate mathematical models for practical decision problems, and assess critically the appropriateness of model used; d. solve decision problems and present decision analysis results; e. make recommendations for actions based on analysis results; f. define, formulate and solve problems in a systematic approach; g. communicate effectively in a well-structured manner and build up an open-minded attitude.
Subject Synopsis/ Indicative Syllabus	 Preliminary probability theory: (6 hours) Review of probability theory, prior and posterior distributions, Bayes' theorem, choice of prior: bets, conjugate families of distributions, vague and improper priors. Structure of decision analysis models: (8 hours) Nature and classification of decision analysis problems, influence diagrams, decision trees, Bayesian intervals for parameters and predictions, decision analysis with sampling, expected value of information (perfect and imperfect), sensitivity analysis. Decision analysis under uncertainty: (6 hours) The maximin/maximax/Laplace criterion, criterion of realism, the minimax regret criterion, minimax decisions and Bayes' solutions including simple results,

	game theory.								
	Decision analysis under risk: (6 hours) Risk attitudes, measures of risk, risk premium, subjective measures and utility theory.								
	Decision analysis with multiattributes: (6 hours) Conflicting objectives, analytic hierarchy process, goal programming, multi- attribute utility models, Pareto optimal, efficient frontier.								
	<i>Applications: (7 hours)</i> Capital investment, inventory control, other industrial and financial applications.								
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the concepts of decision analysis in the syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments.								
Assessment Methods in Alignment with	Specific assessment methods	cific assessment % I hods weighting a		Intended subject learning outcomes to be assessed (Please tick as appropriate)					be
Intended Learning			а	b	c	d	e	f	g
Outcomes	1. Assignments	20%	✓		~				✓
	2. Tests	20%			~	\checkmark			
	3. Examination	60%		\checkmark	✓	\checkmark	✓	✓	
	Total 100 %								
	 Explanation of the appropriateness of the assessment methods in as intended learning outcomes: The subject focuses on knowledge, skill and understanding of Decisio thus, Exam-based assessment is the most appropriate assessment including 20% test and 60% examination. Moreover, 20% worth of a are included as a component of continuous assessment so as to keep in progress. Continuous Assessment comprises of assignments and tests. examination is held at the end of the semester. 					assess ion Ar nent n f assign o the s A	ing the nalysis, nethod, nments tudents written		
Student Study Effort	Class contact:								
Expected	Lecture								26 Hrs.
	 Tutorial 								13 Hrs.
	Other student study eff	fort:							
	 Assignment 							2	40 Hrs.
	Self-study					30 Hrs.			

	Total student stud	109 Hrs.	
Reading List and References	<u>Textbook</u> : Winston, W.L.	Introduction to Probability Models: Operations Research, Volume II 4 th edition	Brooks/Cole 2004
	Pratt, J.W., Raiffa, H. & Schlaifer, R.	Introduction to Statistical Decision Theory	7 The MIT Press 2008
	<u>References</u> : Goodwin, P. & Wright, G.	Decision Analysis for Management Judgment 4 th edition	Wiley 2010
	Clemen, R.T. & Reilly, T.	Making Hard Decisions with Decision Tools 1 st edition	Duxbury Press 2003

Subject Code	AMA4850
Subject Title	Optimization Methods
Credit Value	3
Level	4
Pre-requisite	Intermediate Calculus and Linear Algebra (AMA2007) or Mathematics I (AMA2111) or Mathematics II (AMA2112) or Mathematics for Engineers (AMA2308) or Engineering Mathematics (AMA2380) or Mathematics for Scientists and Engineers (AMA2882) or Mathematical Methods for Data Science (AMA3001) or equivalent
Objectives	To enable students to learn to use more advanced mathematical and computational techniques in optimization, applicable in solving real engineering and management problems.
Intended Learning Outcomes	 Upon satisfactory completion of the subject, students should be able to: 1. Formulate problems in linear programming, convex programming, unconstrained nonlinear programming and constrained nonlinear programming; 2. master optimality conditions and duality theory for continuous optimization; 3. apply the main algorithms for solving linear programming, unconstrained nonlinear programming and constrained nonlinear programming problems.
Subject Synopsis/ Indicative Syllabus	 Linear programming: Formulation and properties, duality, optimality conditions, simplex algorithms. Convex programming: Convex sets, convex functions, conjugate duality, optimality conditions, algorithms and convergence. Unconstrained optimization: One dimensional algorithms: Fibonacci and golden section search. Multidimensional method: steepest descent method; Newton's method; Line search method; conjugate gradient method and quasi-Newton method. Constrained Optimization: First and second optimality conditions; penalty and barrier functions. Unconstrained minimization method, sequential quadratical programming methods, reformulation methods, applications.
Teaching/Learning Methodology	The subject will be delivered mainly through lectures and tutorials. The lectures will be conducted to introduce the concepts of optimization methods in the

	syllabus, which are then reinforced by learning activities involving demonstration, tutorial exercise and assignments.						
Assessment Methods in	Specific assessment me	thods % weigh	Intended subject learning outcomes to b assessed (Please tick as appropriate)				
Alignment with Intended Learning		ing	1	2	3		
Outcomes	a. Computer Assignment	ments 8%			✓		
	b. Tests	32%	✓	~	✓		
	c. Examination	60%	✓	✓	✓		
	Total	100 %					
	 Explanation of the appropriateness of the assessment methods in assistended learning outcomes: The subject focuses on knowledge, skills and understanding of Op <u>Methods</u>, thus, <u>Exam-based assessment</u> is the most appropriate method, including 60% examination. Continuous Assessment conindividual computer assignments (8%) and test (32%) are included so the students in progress. Quizzes and short tests will be used to assess All will be assessed in the exam. 						
Student Study	Class contact:						
Effort Expected	• Lecture		26 Hrs.				
	• Tutorial				13 Hrs.		
	Other student study effor						
	• Assignment				15 Hrs.		
	• Self-study				55 Hrs.		
	Total student study effor	ť			109 Hrs.		
Reading List and References	<u>Textbook</u> : Bazaraa, M.S., Sherali, Nonlinear programming: theory and H.D. and Shetty, C.M. algorithms 3 rd edition				New York: Wiley, 2006		
	Fletcher, R.	Practical Me edition	thod of Optin	nization 2 nd	Wiley, 2000		
	Rockafellar, R.T.	Convex Ana	lysis		Princeton Uni. Press 1996		
	Mangasarian, O.L.	Nonlinear pr	ogramming		SIAM, 1994		
	Dennis, J.E. and Schnabel, R.B. Numerical methods for unconstrained SIAM, 1 optimization and nonlinear equations						

Subject Code	AMA4953
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Exclusion	AMA4951, AMA4952, or any other equivalent capstone project subjects
Objectives	 The objectives of this subject are to: provide students with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to investment science and finance analytics. develop students' capabilities in analyzing and solving complex and substantial problems using AIDA. Train students with skills on systematic development and documentation of a significant piece of work and in presenting the methodology, arguments and findings in a wall documented report.
Intended Learning Outcomes	 Indings in a well-documented report. Upon completion of the subject, students will be able to: <u>Professional/academic knowledge and skills</u> (a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline; (b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills; (c) define and specify the problem precisely; (d) assimilate and apply the knowledge and techniques in various disciplines in the analysis of real-life mathematical and statistical models to generate good solutions to the problem; (e) think critically the appropriateness of mathematical and statistical models and solutions to the problem, in the analysis of analytical methods and approaches to the solution and their implementation; and (f) interpret analysis results of the final outcome in an objective manner and make recommendations for actions based on analysis results;
	 <u>Attributes for all-roundedness</u> (g) improve presentation and communication skills via oral presentation; (h) enhance technical report writing skills for organizing analysis results properly and present analysis results effectively; (i) develop the ability to learn independently and to find/integrate information from different sources required for problem-solving and solution-seeking; (j) manage the project efficiently and effectively through the supervision of supervisor(s); and

	 (k) work both independently and collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).
Subject Synopsis/ Indicative Syllabus	 In-depth Study of a Topic Typically Proposed by the Supervisor Project Meeting and Planning Proposal Writing Regular Progress Checking and Reporting Project Documentation Presentation and Demonstration
	Students are expected to identify a project topic with a supervisor in their chosen discipline, and possibly a co-supervisor with artificial intelligence and data analytics expertise. They need to demonstrate their knowledge in both their chosen discipline and AIDA in the project, receiving advice from both supervisors. They are normally expected to contact local industry for real-life problems and together with the supervisor/co-supervisor to materialize them into project topics.
	The nature of the project should be applied through theoretical research with a practical prospect. The project should represent the requisite effort in analyzing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.
	A project proposal will be required that students identify the theme of the study, suggest the plan of collecting data/information and propose the methodology of analyzing the problem with justification.
	Oral presentation sessions will be arranged for students to report their work and findings. Class participation in the form of questions and discussions will be promoted.
	The final report is expected to include problem identification, relevant data, methodology of analysis, solutions, implementation, interpretations, conclusions, etc. Independent research, critical thinking, and creativity will be encouraged.
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor/co-supervisor at least twice a month, guided study of project materials, independent project development work and other project management tasks. While the basic knowledge and techniques are learned via various subjects, students are required to learn some specific techniques by themselves independently with minimum guidance from the supervisor.

Assessment Methods in	Specific assessment methods/tasks% weighting weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)								be				
Alignment with			a	b	c	d	e	f	g	h	i	j	k
Outcomes	1. Interim report	10%	~	✓	✓	✓	✓			✓	✓	✓	~
	2. Oral presentati	on 30%	~	~	~	✓	~	✓	✓		✓	~	\checkmark
	3. Written report	60%	✓	✓	~	✓	~	✓		✓	~	~	✓
	Total 100 %												
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:												
	The Integrated Capstone Project will be accessed by the supervisor/co-supervisor and an independent assessor who is a staff member not formally involved in the work of the project.										visor n the		
	 The subject focuses on knowledge, skill and understanding of the <u>I</u> <u>Capstone Project</u>. Thus, <u>Project-based assessment</u> is the most a assessment method, including 60% written report. Moreover, 10% worth report and 30% oral presentation are included as components of assessment to assess students' ability in constructing case study model world problems and presenting results of the analyses. Attributes to be assessed include, but are not limited to, Problem Ider Problem Solving, Communication and Presentation, Project Manage Self-Discipline. 								e <u>In</u> apj rth o f co dels dent	tegr prop f int ntin for ifica ent,	ated riate erim uous real- tion, and		
Student Study	Class contact:												
Effort Expected	Lecture										0	Hrs.	
	Other student study effort:												
	Meeting with supervisor / co-supervisor / others								70 Hrs				
	 Searching and reading materials, design and system development, testing, documentation, presentation, etc. 								140 Hrs.				
	Total student stud	y effort										210	Hrs.
Reading List and	References:												
References	Ross, S.M.	Simulation 5 th edit	on						Ao 20	Academic Press 2012			
	Hull, J.C.	Options, futures an 8 th edition	d otł	ner d	leriv	ativ	es		Pr 20	entio 11	ce H	all	
	Greene, W.H.	Econometric Analy	vsis 7	7 th ec	litio	n			Pr	enti	ce H	all	

Kumar, Ranjit	Research Methodology: A Step-by-step Guide for Beginners, 3rd Edition	2011 SAGE Publications 2011
Roberts, Carol M.	The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation, 3rd Edition	Corwin Press 2007
Russell, Stuart and Norvig, Peter	Artificial Intelligence: A Modern Approach, 4th Edition	Pearson 2020
Han, Jiawei and Kamber, Micheline	Data Mining: Concepts and Techniques, 3rd Edition	Morgan Kaufmann 2012
James, G., Witten, D., Hastie, T., and Tibshirani, R.	An Introduction to Statistical Learning	Springer 2013
Giuseppe C. Calafiore, Laurent El Ghaoui	Optimization Models	Cambridge University Press 2014

Subject Code	AP30019
Subject Title	Data Analysis Techniques for Scientists
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	AP20018 Python Programming
Objectives	To introduce basic techniques in numerical computation, data analysis, data modeling, and their applications to practical problems in science and engineering.
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	 (a) formulate problems in science and engineering in mathematical forms; (b) apply numerical methods for solving mathematical problems relevant to science and engineering; (c) demonstrate proficiency with statistical analysis of data; (d) formulate and apply appropriate models of data analysis to solve practical problems.
Subject Synopsis/ Indicative Syllabus	Solution of nonlinear equations : fixed-point iteration method, bisection method, Newton-Raphson method.
	Approximation of data: linear interpolation, Lagrange interpolation, Taylor series, approximation of derivatives using finite difference schemes.
	Random numbers: probability, probability density function, discrete and continuous random variables, uniform and non-uniform pseudo random numbers, exponential variables, Gaussian variables.
	Statistical inference: mean, standard deviation, variance and covariance, sum of random variables, law of large numbers, confidence level, hypothesis testing.
	Regression : linear regression, gradient descent, momentum, stochastic gradient descent, nonlinear regression, logistic regression.
Teaching/Learning Methodology	Lecture : To introduce basic techniques in numerical calculations, data analysis, and data modeling. Demonstrations on solution of practical problems will be conducted. Students are encouraged to raise questions when meeting difficulties.
	Computer laboratory : Students work on given problem sets either individually or through interaction among each other. They are encouraged to raise questions and discuss any issues with the instructor. These problem sets provide the opportunities to apply the knowledge gained from the lectures and to consolidate what have been learned.

Assessment Methods								
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intende to be as (Please	d subject learning outcomes sessed tick as appropriate)				
			a	b	с	d		
	(1) Continuous assessment	40	1	1	1	1		
	(2) Examination	60	1	1	~	1		
	Total	100						
	The continuous assessment is bas term test. The examination is a the questions will be set in both comp	sed on compute hree-hour writte onents to assess	r laborato en final ex s the inten	ries, assign amination. ded learnin	nments a Variou g outcor	and a mid- as kinds of mes.		
Student Study Effort Expected	Class contact:							
L.	• Lecture		26 h					
	Laboratory		18 h					
	Other student study effort:							
	• Self-study			76				
	Total student study effort					120 h		
Reading List and	Textbook:							
Keterences	L. Igual, S. Segu, "Introduction to Techniques and Applications", Sp	Data Science. Apringer (2017).	A Python .	Approach t	o Conce	epts,		
	References:							
	C. Shah, "A Hands-On Introduction to Data Science", Cambridge University Press (2020)							
	C.M. Bishop, "Pattern Recognitio	n and Machine	Learning"	, Springer	(2006).			
	J Zelle, "Python Programming: an Franklin, Beedle & Associates (20	1 Introduction to	Compute	r Science"	, 3rd Edi	tion,		
	A. Scopatz and K.D. Huff, "Effec with Python" O'Reilly Media (20	tive Computatio 15).	on in Phys	ics: Field C	Buide to	Research		

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	AP40012
Subject Title	Machine Learning in Physics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	AP20005/ subject in Programming I pool
Objectives	To introduce the fundamentals of machine learning as applied to problems in physical science.
Intended Learning Outcomes (Note 1)	 Upon completion of the subject, students will be able to: (a) extract, visualize and process data from online databases dedicated to materials scientists and physicists; (b) select machine learning models to solve specific problems; (c) implement various machine learning models in Python; and (d) evaluate and improve the performance of a model.
Subject Synopsis/ Indicative Syllabus (Note 2)	 Linear regression and classification: databases, feature, representation, training set, error functions, gradient descent, univariate and multi-variate regression, logistic regression Neural networks: activation functions, back propagation, feed-forward networks, recurrent networks, deep learning Theory of machine learning: overfitting, validation, regularization, generalization, bias-variance Application in physical science: Materials Project database, bulk modulus, bandgap, energy, force, molecular dynamics
Teaching/Learning Methodology (Note 3)	The course will make use of public cloud computing to enhance the learning using nanoHUB.org as well as its features for collaboration and publishing. Students will learn how to program in Python with IPython notebooks and use external libraries such as Numpy, Scipy, Pandas and Tensorflow. Lecture: The concepts will be presented in class including some illustrative examples and algorithms related to solving problems in physics or engineering. Computer laboratory: During laboratory sessions, students will write small

	programs individually or in groups to gain a deeper understanding of the topics discussed during the lectures. These sessions aim at developing the students' intuition and critical thinking upon discussion and exchange of ideas in order to engage in the proposed activities.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
(Note 4)			а	с	d			
	(1) Continuous assessment	30	۵		۵	0		
	(2) Project	30	Π		Π			
	(3) Final exam	40		۵				
	Total	100 %						
	 Continuous assessment includes participation in the computer laboratory sessions and turning on time the graded quizzes in order to check students' progress throughout the semester. The project consists of a take-home exam and will be assigned during the second half of the semester. Students will use their knowledge gained in the class/lab to design a machine learning program in order to tackle a problem related to physical science. Reports will be graded. The final examination is a 2-hour written final examination. Various questions will be set in both components to assess the intended learning outcomes. 							
Student Study Effort Expected	Class contact:							
Little Expected	• Lecture				26 Hrs.			
	Computer Laboratory	7				13 Hrs.		
	Other student study effort:							
	• Self-study					81 Hrs.		
	• Total student study et	ffort			1	120 Hrs.		
Reading List and References	Hands-on machine learning v tools, and techniques to build Media, Inc., 2017.	vith Scikit-Le intelligent s	earn and T ystems. Gé	<i>ensorFlo</i> éron, Aur	<i>w: conce</i> élien. O'I	<i>pts,</i> Reilly		
	A first course in machine lear Chapman and Hall/CRC, 201	<i>ning</i> . Rogers 6.	s, Simon, a	and Mark	Girolam	i.		
	Machine Learning, MOOC fr	om Stanford	(CS229).	Ng, Andı	rew.			
	Learning From Data, MOOC from Caltech. Yaser S. Abu-Mostafa.							

Subject Code	AP40013
Subject Title	Energy Conversion and Storage with Machine Learning
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Material Science (AP20002)
Objectives	To introduce the concepts, principles and materials applied in the latest technologies for energy conversion and storage processes.
	To introduce basic concepts and techniques used in machine learning for the design of materials and management of device systems for energy conversion and storage.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: a) understand the basic working principles and processes of energy conversion and storage in capacitors, batteries, solar cells, and heterogeneous catalysis; b) identify key materials used in capacitors, batteries, solar cells, and heterogeneous catalysis, and solve corresponding problems associated with those materials; and c) identify research problems that can be solved by machine learning based on judiciously selected datasets from materials or devices for energy conversion and storage.
Subject Synopsis/ Indicative Syllabus	 Materials for Energy Conversion and Storage: Physical principles of and key materials for solar cells, batteries, capacitors and heterogeneous catalysis. Machine Learning in Energy Storage Materials and Devices: Machine learning examples in materials design for solar cells, batteries, capacitors and heterogeneous catalysis; Machine learning examples in lifetime prediction and management of devices.
Teaching/Learning Methodology	Lecture : The working principles of various kinds of energy conversion and storage processes will be explained, with particular emphasis on the key material issues for the latest development in solar cells, batteries, supercapacitors and heterogeneous catalysis. Examples will be used to illustrate how the basic concepts of machine learning can be applied to the design of materials and the management of device systems for better performance in energy conversion and storage processes.

	They are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.					
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	ent % Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			а	b	с	
	1. Continuous assessment	40	~	~	✓	
	2. Examination	60	~	\checkmark	×	
	Total	100				
	mid-term test which aim at checking the progress of student study throughout the course, assisting them in fulfilling the learning outcomes. Assignments, in general, are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach. One oral presentation is used to train the students with the ability to extract useful information from various sources and the ability to present in a clear, logic, and well-organized way. One mid-term test will be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended learning outcomes, and as a means of checking how effective the students digest and consolidate the materials taught in the class. Examination: This is a major assessment component of the subject. It is a closed-book examination. The emphasis of assessment is to test the understanding, analysis and problem solving ability of the students.					
Effort Expected	Class contact:					
	Lecture & Tutoria	al			39 Hrs.	
	Other student study effort	t:				
	 Self-study 				81 Hrs.	
	Total student study effort				120 Hrs.	
Reading List and References	Kathy Lu, Materials in John Wiley & Sons, 20	Energy Co 14.	nversion, Ha	rvesting an	nd Storage,	

C.D.Rahn and CY.Wang, Battery Systems Engineering , John Wiley & Sons, 2013.

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The Hong Kong Polytechnic University Subject Description Form

Subject Code	AP40021
Subject Title	Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	Nil.
Objectives	 The objectives are to exert the student's ability in: organizing a complete scientific, engineering and educational task that integrates the knowledge and skills in physics, materials science/technology, electrical or electronic engineering; conducting systematic studies on physical mechanisms, theoretical analyses, numerical computations, device developments and/or system integrations using applied physics, materials, electrics and/or electronics; critical thinking and problem-solving skills in physics, materials and engineering; communication skills and team working spirits; presenting the project results and writing project reports. developing broad-based problem solving skills for various professions.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: <u>Professional/academic knowledge and skills</u> (a) plan and successfully complete a project relevant to the selected problem area in physics, materials and/or engineering; (b) conduct literature surveys to locate materials and sources, and understand the state of the art and connect the knowledge with the problem to be solved using physics mechanisms, material science and engineering experimental skills; (c) assimilate and apply the learnt knowledge to generate feasible solutions to the problem; (d) think critically the formulation of alternative models and solutions to the problem; (d) think critically the formulation of alternative models and solutions to the problem; (e) evaluate the final outcome in an objective manner. (f) recognize the limitations of the project and make suggestions for further work; (g) developing broad-based problem solving skills for various professions. Attributes for all-roundedness (h) improve presentation and communication skills via oral presentations; (i) enhance technical report writing skills with proper organization of materials; (j) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems; (k) manage the project efficiently and effectively through the supervision of supervisor(s); and (1) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).

(m)Subject Synopsis/ Indicative Syllabus	 In-depin study of a topic typically proposed by the supervisor Project meeting and planning Proposal writing Regular progress checking and reporting Project documentation Presentation and demonstration Students are expected to identify a project topic with a supervisor in physics, materials and/or engineering. Students need to demonstrate their knowledge in their chosen discipline in the project, receiving advice from supervisors. The project should represent substantial efforts in analyzing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in physics, materials, engineering and applications. 													
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 the co-supervisor, guided study of project materials, independent project development work and other project management tasks.													
Assessment Methods in Alignment with Intended Learning	Specific assessment	% weighting		Inten	ded s	ubjec (Ple	t lear ase ti	ning ck as	g outcomes to be assessed as appropriate)					
Outcomes	methods/tasks		a	b	с	d	e	f	g	h	i	j	k	1
	Continuous assessment	40	1	1	1	1	1	~	1	1	~	~	1	1
	Project report	30	1	1	1	1	1	1	1	1	1	1	1	✓
	Project presentation	30	1	1	~	~	~	1	1	1	1	1	1	1
	Total	100												
	Total100Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: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, Scientific Merits and Engineering Significance of Project Results, Communication and Presentation, Project Management, and Attitude.Capstone Projects should be problem-oriented and there are no restrictions on the nature of the problem except that it should be relevant to physics, materials and/or engineering. 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 pass a project- starting interview, two progress interviews and a final presentation, and to submit a final project report. The proposal must be approved by the supervisor before the student can proceed with the Capstone Project. An oral presentation and demonstration is essential at the end of the project. Two progress interviews are required for proper continuous assessment.													
	Class contact:													

	• Lecture	0 h					
Star Jan & Star Jan Effernet	Other student study effort:						
Expected	• Searching and reading materials, meeting with supervisor / co-supervisor / others, design and system development, testing, documentation, presentation, etc.	210 h					
	Total student study effort	210 h					
Reading List and	References:						
	 Kumar, Ranjit, Research Methodology: A Step-by-st Edition, SAGE Publications, 2011. Burns, Robert B., Introduction to Research Methods, Publications, 2000. Roberts, Carol M., The Dissertation Journey: A Pract to Planning, Writing, and Defending Your Dissertation 2007. Mauch, James E. and Park, Namgi, Guide to the Succ A Handbook for Students and Faculty, 5th Edition, N Rudestam, Kjell Erik and Newton, Rae R., Surviving Comprehensive Guide to Content and Process, 2nd E 2001. Garson, G. David, Guide to Writing Empirical Paper Marcel Dekker, 2002. Reinhart, Susan M., Giving Academic Presentations, Michigan Press, 2013. Oshima, Alice and Hogue, Ann, Writing Academic F Longman, 2006. American Psychological Association. Publication Ma Psychological Association, 6th Edition, American Ps 10. Szuchman, Lenore T., Writing with Style: APA Style Wadsworth/Cengage Learning, 2011. Statistics, simulation, programming, and relevant boo 2. ACM and IEEE magazines, Transactions and Journa 3. Other International Journals. Relevant conference proceedings and magazines (inc conferences). 	ep Guide for Beginners, 3rd 4th Edition, SAGE tical and Comprehensive Guide on, 3rd Edition, Corwin Press, cessful Thesis and Dissertation: Marcel Dekker, 2003. Your Dissertation: A Edition, Sage Publications, s, Theses and Dissertations, 2nd Edition, University of English, 4th Edition, Pearson anual of the American ychological Association, 2010. Made Easy, 5th Edition, oks. ls.					
	15. Technical reports from universities and major compa	nies.					

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	BME34145					
Subject Title	AIDA for Health Care and Smart Ageing					
Credit Value	3					
Level	3					
Pre-requisite	ENG2002 Computer Programming					
Objectives	The objectives of this subject are to:					
	(1) Introduce the concept of precision medicine in the hospital and community healthcare service models in ageing society					
	(2) Equip the students with the fundamental knowledge of artificial intelligence techniques and machine learning algorithms in clinical applications					
	(3) Master the clinical problem formulation and typical data analytic skills					
	(4) Understand the trend of technical development in medical artificial intelligence					
	(5) Appreciate the ethical and legal issues related to medical artificial intelligence					
Intended Learning Outcomes (Note 1)	 Upon completion of the subject, students will be able to: (a) Understand ideological and theoretical underpinning of precision medicine (b) Describe the emerging and increasing healthcare demands in an ageing society (c) Articulate the major technological approaches of articular intelligence and machine learning to transform current healthcare service model in both hospital and community setting (d) Apply basic articular intelligence techniques and machine learning algorithm to tackle the given medical problem 					
Subject Synopsis/ Indicative Syllabus (Note 2)	 Introduction and overview The unmet needs in healthcare with global ageing Fundamental knowledge and scientific perspectives of ageing and age-related pathologies The concept of precision medicine with 4 "P" principle: predictive, preventive, personalized and participatory 					

	• The trend of artificial intelligence and data technology to transform current healthcare system
	• Artificial intelligence and data technology to address the health problems in both hospital and community settings including but not limited to following aspects:
	 AI and data technologies to transform the healthcare service in the future of hospital Introduction to Hospital Authority Data Sharing Portal AI-enabled patients triage system and surgical planning Big data analytics-based diagnostics and prognostics Brain-machine interface, neural decoding, neuralink Patients data privacy and security
	AI and data technologies to promote healthy ageing in the
	 Community Health and wellness monitoring using wearable sensors, the design of intelligent home for the older adults, such as fall prevention and motion detection Smart devices for food safety and balanced diet, e.g. to monitor salt and sugar intake, and natural extracts Mental health promotion via robotics-assisted speech, facial
	and emotion recognition
	 Laboratory sessions with hand-on experience on dealing various types of clinical tabular, imaging and bio-signal datasets Tabular data retrieval and analysis Compute vision for medical imaging (histopathology) Advanced electrophysiology: practical session
Teaching/Learning Methodology	It is an advanced course for the engineering students, aiming to facilitate students to gain the basic AI knowledge and data analytic skills to tackle healthcare problems.
	In the lectures, experts' experiences in AI and data technology development and applications will be shared. The guided reading and self-study will be further extended students' knowledge in the respective areas. In preparing the guided group discussion in tutorials, students will actively participate in the laboratory session and obtain the first-hand experiences on the cutting-edge AI and data technologies. Students will critically evaluate themselves during the group discussion. The group discussion and students' preparatory work will facilitate their writing of the laboratory reports. In the student group presentation, they will present the basic principles and findings from the lectures, self- study and laboratory sessions. What they learn from the lectures and tutorials will also be reflected in this group discussion and sharing, self-study, and student presentation.

Assessment Methods										
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks% weighting outcomes to be as (Please tick as app						ning sed priate)			
(Note 4)			a b c		d					
	1. Quiz	30%	\checkmark	~	~					
	2. Group presentation	30%	~	~	~	~				
	3. Lab reports	30%			\checkmark	\checkmark				
	4. In-class activities	10%	~	~	~	~				
	Total	100 %		·	·		·			
	Explanation of the ap assessing the intende The basic knowledge will be examined in i presentation. The kno discussion, group pre	propriatenes d learning ou and underst n-class MCC owledge applesentation and	s of th atcom andin (s, qu lication d labo	he ass es: g of A iz, an on wil oratory	essme AIDA d also l be te y repo	in hea group sted in rt.	thods in lthcare) n in-class			
Student Study Effort	Class contact:									
Expected	 Lectures 		30 Hrs.							
	Laboratory		9 Hrs.							
	Other student study e									
	 Reading assignm 		39 Hrs.							
	Open education	resources					9 Hrs			
	 Group project 						39 Hrs.			
	Total student study e	ffort					126 Hrs.			
Reading List and	Textbooks:									
References	 Artificial intelligence in medical imaging: opportunities, applications and risks; Erik R Ranschaert (editor), Sergey Morozov (editor), P. R. Algra (editor); Cham, Switzerland: Springer; 2019 Medical imaging: artificial intelligence, image recognition, and machine learning techniques; K. C. Santosh (editor); Boca Patan, El + CBC Press, 2020 									

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	BME44144
Subject Title	AIDA for Biosignal Processing and Medical Imaging
Credit Value	3
Level	4
Pre-requisite	BME31116 Biosignal Processing
Objectives	To equip students with basic knowledge and opportunities as well as risk of AIDA techniques for biosignal processing and medical imaging, and supply with examples in various application scenes. Thus, the students are capable of using AIDA as an essential tool in biosignal and medical imaging processing and analysis.
Intended Learning Outcomes (Note 1)	 Upon completion of the subject, students will be able to: (a) Understand the potentials and fundamentals of artificial intelligence and big data techniques in biosignal processing and medical imaging (b) Design AIDA systems, components and processes to meet given specifications and constraints in biosignal processing and medical imaging (c) Identify, formulate and solve problems relevant to AIDA in biosignal processing and medical imaging (d) Use modern IT tools appropriate to AIDA practice in biosignal processing and medical imaging (e) Understand the quality, regulatory, and ethical issues related to the use of AIDA in biosignal processing and medical imaging
Subject Synopsis/ Indicative Syllabus (Note 2)	 Landscape changes and opportunities: introduction of artificial intelligence and big data techniques for biomedical signal and imaging processing Characterization of biomedical signals: feature engineering and extraction Supervised and unsupervised learning Neural networks: understanding and applications Basic principles of deep learning and machine learning in imaging Deep learning and machine learning applications with ECG and EEG signals Data/image preparation for deep learning and machine learning; quality and curation of medical images and data; the value of structured reporting and enterprise imaging platform

Teaching/Learning Methodology (Note 3)	 Imaging biomark Applications beyo cardiovascular dis of neurological di Potentials, advant biomedical signal Students will learn th Sufficient laboratory projects/assignments learning outcomes. 	ers, imaging ond image in sease, breast iseases, etc. tages, challe and image e fundamen and tutorial will be adop	y biob nterpr t canc nges, proce tals at hours oted to	anks, etatio er scr and r ssing nd pri s will o asse	and rand rand rand rand rand rand random r random random	adiom th as f g, and of AIE es in l ovideo studo	nics For I evalu DA in ecture d; Prad ents'	uation es; ctice			
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks% weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)										
(Note 4)			a b c		d	e					
	1. In-class quiz	10%									
	2. Assignments (×2)	30%	\checkmark	\checkmark	\checkmark	\checkmark					
	3. Labs (×2)	30%	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark				
	4. Final project (×1)	30%		\checkmark	\checkmark	\checkmark	\checkmark				
	Total	100 %									
	 Note: To pass this subject, students must obtain grade D or all Explanation of the appropriateness of the assessment method assessing the intended learning outcomes: The in-class quiz (multiple times in lectures and tutorials encourage the engagement of the students, and to assess of the understanding the fundamentals of AIDA. Assignments and the final project are used to assess the the students understand the knowledge and ability to app knowledge to solve problems and practice. The lab sessions are focused on testing the student on how they gain practical experience and apply knowledge in provide the student of the student of the student on the student of the student on the student on the student on the student of the student on the student of the student on the stude										
Student Study Effort Expected	Class contact:										
	Lectures							Hrs.			
	Tutorials		20	Hrs.							
	• Labs		9	Hrs.							
	• Assignments lab	ort and f	no1	niest			10	Ura			
	- Assignments, lab l	report, and m	nai pro	oject			48				
 Self-study 								39 Hrs.			

	То	tal student study effort	126 Hrs.
Reading List and References	•	Walid Zgallai (editor), Biomedical Signal Process Artificial Intelligence in Healthcare, Academic Pr <u>https://doi.org/10.1016/C2018-0-04775-1</u>	ing and ress (2020),
	•	Erik R. Ranschaert, Sergey Morozov, and Paul R. Artificial Intelligence in Medical Imaging: Oppo Applications and Risks, Springer (2019), <u>https://doi.org/10.1007/978-3-319-94878-2</u>	Algra, ortunities,

Note 1: Intended Learning Outcomes

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

Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

Note 4: Assessment Method

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

(Form AR 140) 8.2020

Subject Code	BME44146
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	Exclusion: Any other equivalent capstone project Pre-requisite/Co-requisite: BME31147 Biomedical Engineering Innovation for the Community BME34145 AIDA for Health Care and Smart Ageing
Objectives	The objectives of this subject are to:
	 Provide a student with the opportunity to apply and integrate subject matters to which he/she has been previously exposed in the programme as well as the knowledge of artificial intelligence and data analytics (AIDA) to carry out an independent project on a topic relevant to Biomedical Engineering (BME). Develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using BME-related technologies as well as AIDA. 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:
	 (a) Understand the importance and principles of research in BME disciplines as well as related ethical issues;
	(b) Perform literature search, critique, review, and write a detailed and critical account of current knowledge of a selected topic within BME disciplines; and correctly acknowledge sources of information and avoid plagiarism;
	(c) Connect the materials and information obtained to a problem/research question that can be solved using BME technologies and AIDA; and define and specify the problem/question precisely.
	 (d) Integrate the subjects learned including AIDA to plan engineering design work including budget, resources, milestones, deliverables, and timeline;
	 (e) Reflect the ability to apply the knowledge learned before including those related to AIDA to the independent study; (f) Understand the principles of statistics and perform appropriate statistical analysis of data gathered during the progress of the project; (g) Write a report to present and discuss the results to the team of project supervisors and to their own fellow students; (h) Deliver an oral presentation of the project and to provide appropriate answers to the questions.

Subject Synopsis/ Indicative Syllabus	 The project can be a topic either on design or on research. Possible project areas include: Bioinstrumentation Biomaterials Biomechanics Prosthetics and Orthotics Rehabilitation Engineering / Assistive Technology Other BME relevant topics 											
Teaching/Learning Methodology	 Lectures – Principles in general research methodology, statistics and proposal writing will be taught. Tutorial & Independent Project Study – Student can work on a single project or team up with other students to form a group. Each student in the group will be working on a related project area but with different objective(s) / foci. Each student will be guided by a project supervisor who would meet with the student on a weekly basis. The project supervisor will monitor the progress of the student, point out relevant references and resources to the student, and if necessary, assist the student to focus and keep him/her on track. The methods that each student may employ to complete his/her project would of course vary from project to project. It could be empirical data collection, involving physical experiments or interviews with some forms of questionnaires. It could also be some form of theoretical analysis or design some clinical evaluation devices and even construction of prototypes. 											
Assessment Methods in Alignment with	Specific	%	Inte	ended	subjec (Pleas	t learn	ing ou	tcome	s to be			
Outcomes	methods/tasks	weighting	a	b	c	d	e	f	g	h		
	Progress	10%	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark				
	Written proposal/report	45%	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark			
	Oral presentation	45%	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark		
	Total	100%										
	 Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The students will be assessed on their general understanding of the subject matter and the background literature, the clarity of their objectives, the appropriateness of the methodology, the validity of the data collected, and the relevance of the conclusions to their data; or for a design project, the innovativeness, practicality as well as the cost-effectiveness of the design. Assessments will also be made on the process of project execution (interim and final) in both the written reports and the oral presentations. 											
Student Study Effort	Class contact:											
Daptitu	• Lecture							13 H	lrs.			
	• Tutorial	26 Hrs.										
--------------------------------	--	------------------------------	--	--	--	--						
	• Data collection and data analysis	117 Hrs.										
	Other student study effort:											
	Literature review and report writing	78 Hrs.										
	Total student study effort	234 Hrs.										
Reading List and References	• King PH and Fries RC, <i>Design of Biomedical Devices and</i> CRC Press, 2009.	Systems,										
	 Dieter G, Engineering Design: A Materials and Processing 3rd ed., McGraw-Hill, 2000. 	g Approach,										
	• Otto K and Wood K, <i>Product Design</i> , Prentice Hall, 2001.											
	• Fries RC, Handbook of Medical Device Design, Marcel Device	ekker, 2001.										
	 Sanders MM and McCormick EJ, <i>Human Factors in Engineering and Design</i>, 7th ed., McGraw-Hill, 1993. 											
	• Salvendy G, <i>Handbook of Human Factors and Ergonomic</i> John Wiley & Sons, 2006.	s, 3 rd ed.,										
	• Portney LG and Watkins MP, <i>Foundations of Clinical Research:</i> <i>Applications to Practice</i> , 3 rd ed., Pearson/Prentice Hall, 2009.											
	• Polgar S and Thomas SA, <i>Introduction to Research in the Sciences</i> , 5 th ed., Elsevier, 2008.	Health										
	• Norman GR and Streiner DL, <i>Biostatistics: The Bare Esse</i> B. C. Decker, 2008.	ntials, 3 rd ed.,										
	 Beauchamp TL and Childress JF, <i>Principles of Biomedica</i>, 6th ed., Oxford University Press, 2009. 	l Ethics,										
	• Day RA and Gastel B, <i>How to Write and Publish a Scienti</i> 6 th ed., Greenwood Press, 2006.	fic Paper,										
	• Motulsky H, Intuitive Biostatistics, Oxford University Pres	ss, 1995.										
	• Wong KL, <i>Methods in Research and Development of Biom</i> World Scientific, 2013.	edical Devices,										
	• Journal papers from the BME discipline.											

Subject Code	BRE 368
Subject Title	AI and Data Analytics for Smart Construction
Credit Value	3
Level	3
Pre-requisite /Co- requisite/ Exclusion	Nil
Objectives	This subject is intended to:
	1. Equip students with the ability of using data analytics and machine learning in building engineering and management.
	2. Enable the students appreciate the mathematical basis and the applications of the main models and methods used in the analysis of problems in the built environment.
	3. Provide students an understanding of data-driven or AI-supportive building development and optimized operation of efficient building systems as a part of the integrated system of building fabric, building space, occupants, building services and controls.
	 Introduce applications of various digital construction technologies that can benefit from AI and DA, including robotic technologies, Modular Integrated Construction (MIC), and Building Information Modelling (BIM) in building design, construction, maintenances and operations.
Intended Learning Outcomes	Upon completion of the subject, students will be able to:
	a. Apply data analytics and AI tools to building and construction data.
	b. Apply mathematical modelling tools to analyse problems in the built environment.
	 Understand the data-driven decision making process for practical construction engineering and management issues.
	 Evaluate appropriateness of digital technologies in building construction, maintenance and operations.

Subject Synopsis/ Indicative Syllabus	 This multi-faceted subject encompasses technologies in building construction, maintenance and operations. Combined with tools from big data analytics, AI, robotics and BIM, the subject enables better strategic decisions for designers, building managers and property owners to consider the building in the context of smartness and future needs. 1. Introduction to AI and DA applications in construction Importance of big data in construction Theoretical background of AI and DA Concept of data-driven decision making and problem solving Advanced technologies for field data collection and analysis Examples of AI and DA applications in construction Required knowledge and skill sets
	 2. Machine learning theory and tools Introduction to machine learning Supervised and unsupervised learning Mathematical models for machine learning e.g., regression, classification, clustering etc. Machine learning tools e.g., MATLAB machine learning tool box, Weka
	 3. AI and DA applications with construction data Data mining and data analytics for construction management Sensor data analysis for construction safety and health Motion data analysis for unsafe behaviour identification Physiological data analysis for physical and mental fatigue assessment Video analytics Construction activity recognition based on computer vision Construction worker behaviour analysis based on computer vision Construction component defects identification based on computer vision 3D point cloud analysis Object localization, detection, and identification based on 3D point clouds
	 4. Applications of digital construction technologies Robotic technologies for various construction operations (e.g., plastering, rebar installation, curtain wall installation, cleaning and air quality control etc.) Sensing technologies Modular Integrated Construction (MIC) Building Information Modelling (BIM)

Teaching/Learning Methodology	 The concept, theory and applications of AI and DA in construction will be delivered through lectures. Tutorials will provide hands-on exercises on AI and DA tools to learn how to apply these tools with given data. Through a group project, students will explore the use of AI and DA tools for practical problem solving in construction. Students will be also required to study online learning materials. Online learning materials: MATLAB Onramp (about 2hrs): <u>https://www.mathworks.com/learn/tutorials/matlab-onramp.html</u> WEKA Tutorials: <u>https://www.tutorialspoint.com/weka/index.htm</u> 							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks% weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)						s to be	
	1. Individual Assignments (Tutorials)	20	V	V	V			
	2. Focus Study Report (Group project)	30	V	\checkmark	\checkmark			
	3. Written Examination	50	\checkmark	\checkmark	\checkmark			
	Total	100%						
	Explanation of the appropri learning outcomes: Coursework and examinatio subject. The coursework ma project (i.e., a focus study on The examination will be ba covered in the lecture periods projects will be set to assess	ateness of the n will each co rk will be base AI and DA app used on a 2 ho and backgroun the students' ab	assessi onstitute of on the plication ours exa d readin pilities a	nent me 50% c indivins in com ins in com ins. Cou nd skill	ethods in of the ovidual ass idual ass instruction on gearin ursework s require	n assess verall as signmen n practi ng towa by assign d in this	sing the ssessmer ts and o ce). rds the gnment a s subject	intended at for the one group materials and group
Student Study	Class contact:							
Enort Required	• Lecture						2	26 Hrs.
	• Tutorial						1	3 Hrs.
	•							
	Other student study effort:							
	• Self-study, assign	ments, e-lear	ning				4	0 Hrs.
	Group projects		i dan sata ya ka sa sa sa				4	0 Hrs.
	Total student study effort						11	9 Hrs.
		3						

Reading List and References	Recommended:
	• Rafael Sacks, Chuck Eastman, Ghang Lee, Paul Teicholz (2018) BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd Edition. Wiley.
	• Zacharias Voulgaris and Yunus Emrah Bulut (2018) AI for Data Science: Artificial Intelligence Frameworks and Functionality for Deep Learning, Optimization, and Beyond First Edition, Technics Publications
	 Bock, T., & Linner, T. (2016). Construction Robots Elementary Technologies and Single-Task Construction Robots. In Construction Robots: Elementary Technologies and Single-Task Construction Robots (p. I). Cambridge: Cambridge University Press.
	 Wang, D., Dai, F., & Ning, X. (2015). Risk Assessment of Work-Related Musculoskeletal Disorders in Construction: State-of-the-Art Review. <i>Journal of</i> <i>Construction Engineering and Management</i>, 141(6), 04015008. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000979
	 Hou, L., Wu, S., Zhang, G. (Kevin), Tan, Y., & Wang, X. (2020). Literature Review of Digital Twins Applications in Construction Workforce Safety. <i>Applied Sciences</i>, 11(1), 339. https://doi.org/10.3390/app11010339
	 Guo, B. H. W., Zou, Y., Fang, Y., Goh, Y. M., & Zou, P. X. W. (2021). Computer vision technologies for safety science and management in construction: A critical review and future research directions. <i>Safety Science</i>, <i>135</i>, 105130. https://doi.org/10.1016/j.ssci.2020.105130
	 Wang, Q., & Kim, MK. (2019). Applications of 3D point cloud data in the construction industry: A fifteen-year review from 2004 to 2018. Advanced Engineering Informatics, 39, 306–319. <u>https://doi.org/10.1016/j.aei.2019.02.007</u>
	• Fan, H. and Li, H. (2012). "Retrieving similar cases for alternative dispute resolution in construction accidents using text mining techniques ". Automation in Construction, Elsevier, Vol. 34, pp.85-91 (2013).
	• Fan, H., Xue, F. and Li H. (2015). Project-based As-needed Information Retrieval from Unstructured AEC Documents, ASCE Journal of management in Engineering, January 2015, Vol. 31, No. 1.
	• Shen, L., Yan, H., Fan, H., Wu, Y., & Zhang, Y. (2017). An integrated system of text mining technique and case-based reasoning (TM-CBR) for supporting green building design. Building and Environment, 124, 388-401.
	• Yan, H., Yang, N., Peng, Y., & Ren, Y. (2020). Data mining in the construction industry: Present status, opportunities, and future trends. Automation in Construction, 119, 103331.
	https://www.coursera.org/learn/machine-learning/home/welcome
	 <u>https://www.mathworks.com/solutions.html?s_tid=gn_sol</u>

BRE472
Information Technology and Building Information Modelling for Construction Management
3
4
Nil
This subject is intended to develop an understanding of the practical application of computer systems and packages in building life cycle process and the application of building information modelling (BIM) in construction.
 Upon completion of the subject, students will be able to: a. understand and demonstrate knowledge of building life cycle process. b. understand and demonstrate knowledge of the application of computer systems, BIM, Artificial Intelligence (AI), and Big Data analytics in various procurement stages of a building project. c. appraise commercially available and tailor-made computer packages and BIM application in building life cycle process.
 The process of building life cycle. Identifying the benefits of construction IT/ BIM applications. Understanding core values of BIM, and its applicability in construction practice. The appraisal of IT/BIM systems in design, cost planning, procuring, project management and facility management. Understanding the fundamental theories behind AI and Big Data analytics, and existing tools. Exploring the use of AI and Big Data analytics in various construction applications. Exploring the extended use of BIM by combining it with AI and Big Data analytics.

Teaching/Learning Methodology	Lectures and tutorials will be run throughout the semester period. A lecture schedule outlining the topics to be covered will be distributed to students in the first lecture of the semester. During the tutorials, students will be required to assess and use various IT/BIM tools (e.g., Revit, Navisworks, AI/Big Data analytics packages) and to prepare group assignments.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
			а	b	с			
	1. Individual Assignments (Tutorials)	20%	\checkmark	V	\checkmark			
	2. Focus Study Report (Group project)	30%	V	V	\checkmark			
	2. Examination	50%			\checkmark			
	Total	100%			1 1			
	Coursework and examination of the application of the application of the suindividual assignments applications of IT system practical problems duri The examination will the materials covered in the by assignment and ground skills required in the system of	mination wi ubject. The and one gro ems, BIM, A ng the life cy be based on a e lecture period bup projects his subject.	Il each coursewo up projec I, and Bi cle of the a 2 hours iods and will be so	constit ork ma ct (i.e., g Data buildi s exami backgre et to as	tute 50% ark will a focus analytics ng projec ination ge ound read ssess the	6 of the be based study on j s to solve ets). earing tow dings. Cou students'	overall on the potential existing vards the ursework abilities	
Student Study Effort Expected	Class contact:		26 Hrs					
	 Tutorials / Laborat 		13 Hrs					
	Other student study effe							
	 Self learning and r 		00 Hrs					
	Join fourning and focommonated fourning 30 mills.							
	Total student study effo	ort				12	29 Hrs.	

Reading List and References	ASCE Journal of Computing in Civil Engineering (http://www.asce.org).				
Kererences	Automation in Construction. An International Research Journal. (http://www.elsevier.com/locate/autocon).				
	Bryde, D., Broquetas, M. and Volm, J.M. (2013). <i>The Project Benefits of Building Information Modelling (BIM)</i> , International Journal of Project Management, Volume 31, Number 7, pp. 971-980.				
	Construction Industry Council (2014/15), Roadmap / Standard for Building Information Modelling in Hong Kong's Construction Industry.				
	Eastman, C., Eastman, C.M., Teicholz, P., Sacks, R. and Liston, K. (2011). BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, John Wiley & Sons.				
	Electronic Journal of Information Technology in Construction (http://www.itcon.org).				
	Azhar, S. (2011). Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry. Leadership and management in engineering, 11(3), 241-252.				
	Gu, N., & London, K. (2010). Understanding and facilitating BIM adoption in the AEC industry. Automation in construction, 19(8), 988-999.				
	Darko, A., Chan, A. P., Adabre, M. A., Edwards, D. J., Hosseini, M. R., & Ameyaw, E. E. (2020). Artificial intelligence in the AEC industry: Scientometric analysis and visualization of research activities. Automation in Construction, 112, 103081.				
	Bilal, M., Oyedele, L. O., Qadir, J., Munir, K., Ajayi, S. O., Akinade, O. O., & Pasha, M. (2016). Big Data in the construction industry: A review of present status, opportunities, and future trends. Advanced engineering informatics, 30(3), 500-521.				

Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite / Exclusion	Pre-requisite: BRE366 (Analytical Skills and Methods) Exclusion: Any other equivalent capstone project, e.g. BRE466 (Capstone Project)
Objectives	 The primary aim of the Integrated Capstone Project is to provide students with the opportunity of demonstrating research competence by providing them with a vehicle through which they can reveal a full understanding and evaluation of an issue or a topic that they choose to investigate. The Project is in the form of a final year Dissertation, and the issue or the topic should be based on the chosen programme major (i.e. Building Engineering and Management), together with the Artificial Intelligence and Data Analytics (AIDA) scheme as their Secondary Major, relevant to the construction industry with particular concerns to Hong Kong and its neighbouring environments. The specific objectives of this subject are to: provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to his/her chosen discipline of Building Engineering and Management; develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA knowledge and skills; and 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: Generally
	 a) display a culminating set of personal, academic and professional experiences/ learning; b) synthesize, integrate and/or apply previous knowledge instead of solely acquiring new knowledge/skills; c) apply general education principles; and d) engage in an interdisciplinary inquiry of at least two or more disciplines;

	 e) produce a research proposal related to a topic in the field of Building Engineering and Management with the identified problems to be solved using AIDA knowledge and skills; f) apply an appropriate research methodology to the chosen topic; g) conduct a critical and comprehensive literature review; h) identify specific problems, analyse data via AIDA knowledge and skills, evaluate findings and provide solutions via AIDA analytical results; i) communicate their ideas in a clear, concise and precise manner; and j) produce a study report that is based on their research and written in good English.
Subject Synopsis/ Indicative Syllabus	For those students choosing the Building Engineering and Management (BEM) programme as their Major and also opting for AIDA scheme as their Secondary Major, they are expected to identify a project topic in the field of Building Engineering and Management with the identified problems to be solved using AIDA knowledge and skills under the supervision of a supervisor with research expertise in artificial intelligence and data analytics.
	The topic should be engineering-oriented or engineering related area in construction. The Capstone Projects are grouped into a number of study areas within the research themes of the Department such as construction technology and science, production engineering, production and contract management, engineering economics, construction quality in engineering works, application of information or digital technology in the building industry, engineering materials, etc. Occasionally, if a student proposes a topic which is not within the context of engineering orientation, consideration and prior approval need to be sought from the BEM Programme Management Team.
	Students need to demonstrate their knowledge in both their chosen discipline (BEM) and AIDA in the project, receiving advice from the allocated supervisors. The project should represent requisite efforts in analysing and interpreting the data/information obtained, using the principles and techniques learned from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain of AIDA.
Teaching/Learning Methodology	Academic leadership is provided by the Departmental Capstone Project Committee comprising the BRE Undergraduate Scheme Chair and all the Programme Capstone Project Co-ordinators. The Committee is assisted by the supervisors who are BRE academic staff with research experience.
	The Integrated Capstone Project spans across the final year of study for two consecutive semesters (i.e. first semester and second semester). The teaching/learning activities include regular project meetings with the supervisors, guided study of project materials, independent project development work and other project management tasks.
	Each student will work under the guidance of a supervisor. The project supervision is timetabled for one hour per two weeks over the whole project study period, but students are expected to devote about a day per week of their own time to carry out study and research work. Students are encouraged to formulate a testable hypothesis with theoretical model or justifications; carry out an empirical test on the hypothesis; and draw inference(s) on research and practical implications from the findings.

Assessment Methods in Alignment with	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (please tick as appropriate)							sed		
Outcomes			a	b	с	d	e	f	g	h	i	j
	1. Final Proposal	15 %	\checkmark	\checkmark			\checkmark	\checkmark	\checkmark			
	2. Progress and Effort Report	15 %		~				\checkmark	\checkmark	\checkmark		
	3. Final Report	70 %			\checkmark	\checkmark		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
	Total	100 %										

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

Integrated Capstone Project should be problem-oriented and there are no restrictions on the nature of the problem except that it should be relevant to the student's chosen discipline (BEM) and AIDA. 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 Final Proposal, a Progress and Effort Report and a Final Report. The Final Proposal must be approved by the supervisor before the student can proceed with the Integrated Capstone Project. A mid-term progress and effort report may also be required for proper continuous assessment.

The assessment of each of the three tasks (Final Proposal, Progress and Effort Report, and Final Report) will be made based on the established "Assessment Rubrics" that will be adopted and approved by the Capstone Project Committee. The "Assessment Rubrics" will be made available for reference by both students and supervisors on the Dissertation Guide mounted up to the blackboard subject website. The main assessment criteria are underlined below for reference.

Final Proposal

The Final Proposal should include a problem statement, a preliminary literature review, the study's research aim and objectives, an outline of the research methodology, means of data analysis, a reference list, and an outline schedule of work.

- (1) <u>Problem Statement:</u> A concise and precise explanation of the problem that the research intends to address and an outline of the scope of study. This in effect provides the purpose of the study.
- (2) <u>Literature Review:</u> A summary of the relevant theories, research evidence, and descriptive materials bearing on the proposed research, including all information, published or otherwise, that aids in understanding and helps to explain the background to the research.
- (3) <u>Research Aim and Objectives:</u> Linking of the problem statement and literature review should be made through a precise statement of a research aim and a number of specific objectives. If a testable question (hypothesis) is to be used then this should be clearly stated. This section is a critical part of the research proposal because the aim and objectives need to be consistent with the purpose of the study.

(4) <u>Research Methodology</u> : A statement describing the research design and data collection techniques must be provided. The description must be sufficiently detailed to permit an understanding of the proposed study without discussion with the student. If a questionnaire survey is to be conducted, a provisional questionnaire should be included. Sources of data and sampling technique should be identified along with any restrictions on confidentially and possible problems in data collection. The time required for phases of the study should be specified.
(5) <u>Data Analysis:</u> The way in which the data will be analyzed, including any statistical analysis, should be outlined. If a non-standard form of data analysis is to be used, justification should be given. If computer programs are to be used, they should be identified.
(6) <u>Reference and Bibliographic List:</u> All works cited in the text of the Proposal must be listed under a section entitled References at the end of the Proposal immediately before the appendices. References are necessary in order to provide the reader with adequate information for locating cited materials. Students are recommended to use the Harvard referencing system , details of which can be found on websites such as: "https://elc.polyu.edu.hk/Referencing/harvard.aspx". Alternatively, students can refer to the Student Handbook for other referencing systems, provided that consistency is adhered to.
(7) <u>Outline Schedule of Work:</u> Students should include an outline programme in the form of a bar chart showing how they intend to perform the major activities and various tasks in order to meet the key milestone date requirements from inception to completion of their dissertation research, taking into account such intervening disruptions as examinations, study tours and public holidays.
Progress and Effort Report
During the progress of the research, the student and Supervisor will meet for consultation. It is the responsibility of students to arrange meetings with their supervisors in order that they may report and discuss their progress. It is expected that students devote sufficient time to the capstone project bearing in mind the requirements outlined in the subject description form.
Discussions with Supervisors are essential to explore the challenges faced by the student as they learn about the research topic through the whole research process. Thus, students are required to produce evidence of their work at their meetings with their Supervisors, so that the problems encountered can be shared and solved together.
Assessment Proforma for "Final Proposal and Progress Report" (weighted 30% towards the overall grade)

Assessment Components	Assessment Criteria	Weightings
Final Proposal	Adequacy, structure, clarity, originality, length	15%
Progress Report	Consultations, diligence, enthusiasm, planning of work, progress management	15%
	Total	30%

Fina	al Report			
The Final Report should not normally exceed 10,000 words and is expected to include the following items: a declaration, an abstract, an introduction, research aim and objectives, literature review, research methodology, data collection, data analysis, and conclusions.				
For Rep obje cond	the purpose of criterion-based assessment, the assessment of the completed Final ort is divided into six main elements, i.e. overall presentation, research aim and actives, research methodology, literature review, data collection and analysis, clusions and findings, with their corresponding weightings.			
(1)	<u>Declaration</u> : Each student shall print the statement identical to the one shown on Form BREDF4 (Completion Statement) on a fresh page, sign and incorporate in the submitted dissertation report as the first inside page.			
(2)	<u>Abstract:</u> A brief summary (200-400 words) of the research, normally including the main research objectives, the problems studied and the relevant theories, the methods of enquiry, and the most important results.			
(3)	<u>Introduction</u> : A description of the problems, along with detailed coverage of the theories and published research related to the research. This section often includes the reasons why the research merits study.			
(4)	<u>Research Aim and Objectives:</u> A re-statement of the research aim and objectives in the Final Dissertation Proposal (may be included in the Introduction).			
(5)	Literature Review: The literature search should be fully described showing the keywords and scientific databases used. A strong emphasis should be placed on refereed journal papers which can provide evidence of existing knowledge of the selected topic, obtained through scientific methods. The review should not only describe relevant theories, previous research, and descriptive material that have a bearing on the study, but also evaluate its worth. Evidence of independent analysis of the available literature should also be demonstrated. A basis for the chosen research topic should be established.			
(6)	<u>Research Methodology</u> : A clear statement of the planned research methods, as well as reporting of any ways in which the original methodology was modified as a result of constraints imposed in actually conducting the research. Some writers included this in the Introduction.			
(7)	Data Collection: This section should provide a clear and objective picture of the way in which the data was collected, including identification of any problems encountered and an explanation of the outcomes obtained. The data should be summarized and presented in an appropriate form, such as tables and diagrams, and not be evaluated or interpreted. Although some writers include analysis of the data in this section, others prefer to cover it separately.			
(8)	Data Analysis: This section should include the analysis and interpretation of the results of the research. The discussion should explain the degree to which the research objectives were achieved, the possible reasons for non-attainment of some research objectives, the ways in which the theories did or did not help to examine the problems, and an evaluation of the research results. In many reports, this section is the most important and often the longest in terms of words.			
(9)	<u>Conclusions:</u> The conclusions or outcomes of the study should be presented in this section. Included should be the major results that the study has achieved,			

identification of unanswered questions and directions for further study, speculation about the importance of the findings to the body of knowledge in the construction and real estate fields and any other related items that the student wishes to emphasize.

- (10) <u>Reference and Bibliographic Lists</u>: The Reference list should include full details of all publications cited in the Dissertation Report (see Item 4.6 for details), whereas the Bibliographic list (optional) contains details of all publications that have been used in the preparation.
- (11) <u>Appendices:</u> The appendices should include copies of survey questionnaires, lengthy tables, graphs and lists not considered appropriate for inclusion within the main body of the Dissertation Report. Students should see the completed Dissertation Report as a holistic piece of scholarly work. The focus of the study topic should be clearly shown in the title, and throughout each chapter. The student should try to show the linkage between the various stages of the research process. Thus there should be 'signposting' throughout the written contents to explain how the chapters each contribute to the research objectives. For example, the literature review should link to the research methods to the data analysis and explanation of the results; the results to the interpretation and discussion of implications; and finally to the conclusions.

Assessment Proforma for "Final Report" (weighted 70% towards the overall grade)

Assessment Items	Assessment Criteria	Weightings
Overall Presentation	Syntax, clarity, conciseness, preciseness, structure, aesthetics, graphics, length	10%
Research Aim and Objectives	Appropriateness and accomplishment of stated aim and objectives, accuracy of application	5%
Literature Review	Relevant parameters, adequate depth and breadth, accuracy, citations and references	15%
Research Methodology	Appropriateness, achievability, planning of research design, comprehensiveness, description	15%
Data Collection and Analysis	Relevancy, accuracy, adequacy, coherence of data analysis, logicality of interpretation	15%
Conclusions and Findings	Validity, logicality, substantiveness, originality, degree of critique, new ideas or models	10%
	Total	70%

Student Study Effort Required	Class contact:				
	Guided study	10 Hrs.			
	Other student study effort:				
	 Independent study 	260 Hrs.			
	Total student study effort	270 Hrs.			
Reading List and	Essential:				
References	Department of Building and Real Estate of PolyU. <i>Dissertation Guide</i> . (continuously updated).				
	Recommended (General Research Methods and Skills):				
	Bell, J. (1993). Doing Your Research Project, Open Univ	versity Press.			
	Blaikie, N. (2000). Designing Social Research: The Log Polity.	ic of Anticipation. Cambridge:			
	Booth, W.C., Colomb, G.G. and Williams, J.M. (2003). <i>The Craft of Research</i> , 2nd ed. Chicago: The University of Chicago Press.				
	Chau, K.W., Raftery, J. and Walker, A. (1998). The baby and the bathwater: Research methods in construction management. <i>Construction Management and Economics</i> , <i>16</i> (1), 99-104.				
	Fellows, R.F. and Liu, A.M.M. (2015). <i>Research Methods for Construction</i> , 4th edition, Blackwell Science.				
	Harris, R. and Cundell, I. (1995). Changing the property mindset by making research relevant. <i>Journal of Property Research</i> , <i>12</i> , 75-78.				
	Holt, G. (1998). A Guide to Successful Dissertation Study for Students of the Built Environment, 2nd edition. The Built Environment Research Unit, University of Wolverhampton, England.				
	Hussey, J. and Hussey, R. (2003). Business Research: A Practical Guide for Undergraduate and Postgraduate Students, 2nd edition, Basingstoke: Palgrave Macmillian, England.				
	Kennedy, P. (2003). A Guide to Econometrics, 5th edition, USA: Blackwell Publishing.				
	Knight, A. and Ruddock, L. (2008). Advanced Research Methods in the Built Environment. Chichester: Wiley-Blackwell.				
	Kumar, R. (1996). Research Methodology: A Step-by-Step Guide for Beginners. Addison Wesley Longman.				
	Levitt, R.E. (2007). CEM research for the next 50 y environmental, and societal value of the built environ <i>Engineering and Management</i> , 133(9), 619-28.	years: Maximizing economic, ment. <i>Journal of Construction</i>			

Levin, R.I. and Rubin, D.S. (1998). Statistics for Management, 7th edition, PrenticeHall.
Lizieri, C. (1995). Comment: Relevant research and quality research: The researcher's role in the property market. <i>Journal of Property Research</i> , <i>12</i> , 163-166.
Lucey, T. (1992). Quantitative Techniques, ELBS.
Mason, J. (2002). Qualitative Researching. London: Sage.
Naoum, S.G. (1999). Dissertation Research and Writing for Construction Students, Butterworth-Heinemann.
Pindyck, R.S. and Rubinfeld, D.L. (1998). Econometric Models and Economic Forecasts, 4 th Edition, Boston: McGraw-Hill International Editions.
Raftery, J., McGeorge, D. and Walters, M. (1997). Breaking up methodological monopolies: A multiparadigm approach to construction management research. <i>Construction Management and Economics</i> , 15(3), 291-297.
Render, B. and Stair, R.M. Jr (2000). <i>Quantitative Analysis for Management</i> , 7 th Edition. Prentice Hall, New Jersey.
Tan, W. (2002). Practical Research Methods. Pearson Education Asia Pte Ltd., Singapore.
Recommended (Artificial Intelligence and Data Analytics / AIDA):
Bock, T. and Linner, T. (2016). Construction Robots Elementary Technologies and Single-Task Construction Robots. In <i>Construction Robots: Elementary</i> <i>Technologies and Single-Task Construction Robots</i> (p. I). Cambridge: Cambridge University Press.
Darko, A., Chan, A.P.C., Adabre, M.A., Edwards, D.J., Hosseini, M.R. and Ameyaw, E.E. (2020). Artificial intelligence in the AEC industry: Scientometric analysis and visualization of research activities. <i>Automation in Construction</i> , 112, 103081.
Fan, H. and Li, H. (2013). Retrieving similar cases for alternative dispute resolution in construction accidents using text mining techniques. <i>Automation in Construction</i> , 34, 85-91.
Fan, H., Xue, F. and Li H. (2015). Project-based as-needed information retrieval from unstructured AEC documents. <i>Journal of Management in Engineering</i> , January, 31(1).
Guo, B.H.W., Zou, Y., Fang, Y., Goh, Y.M. and Zou, P.X.W. (2021). Computer vision technologies for safety science and management in construction: A critical review and future research directions. <i>Safety Science</i> , <i>135</i> , 105130. https://doi.org/10.1016/j.ssci.2020.105130
Hou, L., Wu, S., Zhang, G. (Kevin), Tan, Y. and Wang, X. (2020). Literature review of digital twins applications in construction workforce safety. <i>Applied Sciences</i> , 11(1), 339. https://doi.org/10.3390/app11010339
Rafael Sacks, Chuck Eastman, Ghang Lee and Paul Teicholz (2018). BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, 3rd Edition. Wiley.

Shen, L., Yan, H., Fan, H., Wu, Y. and Zhang, Y. (2017). An integrated system of text
mining technique and case-based reasoning (TM-CBR) for supporting green building design. <i>Building and Environment</i> , 124, 388-401.
Wang, D., Dai, F. and Ning, X. (2015). Risk assessment of work-related musculoskeletal disorders in construction: State-of-the-art review. <i>Journal of</i> <i>Construction Engineering and Management</i> , 141(6), 04015008. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000979
Wang, Q. and Kim, M.K. (2019). Applications of 3D point cloud data in the construction industry: A fifteen-year review from 2004 to 2018. Advanced Engineering Informatics, 39, 306-319. https://doi.org/10.1016/j.aei.2019.02.007
Yan, H., Yang, N., Peng, Y. and Ren, Y. (2020). Data mining in the construction industry: Present status, opportunities, and future trends. Automation in Construction, 119, 103331.
Zacharias, Voulgaris and Yunus, Emrah Bulut (2018). AI for Data Science: Artificial Intelligence Frameworks and Functionality for Deep Learning, Optimization, and Beyond. First Edition, Technics Publications.
Machine Learning: https://www.coursera.org/learn/machine-learning/home/welcome
MathWorks: https://www.mathworks.com/solutions.html?s_tid=gn_sol

Subject Code	BSE458
Subject Title	Building Performance Diagnosis and Management
Credit Value	3
Level	4
Pre-requisite Co-requisite Exclusion	BSE3514 Engineering Management and Decision Making in Construction (Before 2022 cohort) or BSE3515 Construction Management for Building Sciences and Engineering (Effective from 2022/23) Nil Nil
Objectives	1. To appreciate that the design of buildings and building services systems need to take full account of user (occupant, operator) and operational requirements.
	2. To examine how systems and equipment may not be compatible with the operating environment.
	3. To learn from the operation and maintenance practices in existing buildings through reviews and surveys to understand why buildings and/or systems fail to deliver on performance.
	4. To examine how design, installation, commissioning and performance diagnosis practices impact on building performance.
	5. To identify good practices for use in the design of building services systems for new buildings, and retrofit and management of existing building services systems.
Intended Learning	Upon completion of the subject, students will be:
Outcomes	a) able to set design aims, objectives and criteria for the design of building services systems;
	b) able to foresee future operation and maintenance problems and prepare solutions for these problems;
	c) able to set aims, objectives and criteria for building services system operation, diagnosis, maintenance and management; and
	d) able to solicit support for system operation and performance management.
Subject Synopsis/ Indicative Syllabus	Purpose of a building in use : purpose of development, building as a long term investment, concept of continuous engineering of building services systems, concept of operational systems, ease of inspection and testing.
	Design for operations and flexibility : integration of building services systems with building fabric and structure, internal layout, space utilisation, access for maintenance, change of usage, strategic response to malfunctions and disasters.
	Reliability of facilities : safety systems, failure modes and effects, availability, reliability, maintainability, back up and standby strategy.
	Operation and maintenance : information and database for building services systems, computerized data recording and mining, vendor support, operation and maintenance contracts, inventory control, maintenance strategy, contingency and disasters management.
	Commissioning and retrofit : statutory requirements on facilities in use, energy/carbon audits, retro- commissioning, renovation, rehabilitation and modernization.
	Performance assessment and benchmarking : condition monitoring, performance assessment tools and methods, types and principles of benchmarking, systematic evaluations.
Teaching/Learning	Delivery of the subject entails a combination of lectures, seminars, tutorials and mini-projects:
Methodology	• Lectures cover introduction of the key subject elements and explanation of the relevant concepts, principles, cases and examples.
	• Seminars involve in-class discussions over questions which are purposely set based on the contents of some selected reading materials.
	• Tutorials allow students to raise any questions they may have in relation to any areas of the subject.
	• Mini-projects require students to demonstrate their ability of applying knowledge to accomplish tasks or tackle problems of the given projects.

Assessment Methods in Alignment with	Specific assessment methods/tasks% weightingIntended subject learning o (Please tick as appropriate)					utcomes t	to be asses	ssed	
Intended Learning Outcomes			а	b	с	d			
	Project	20		~	~	~			
	Test	20	~	~	~				
	End-of-semester examination	60	~	~	~	~			
	Total	100							
	Explanation of the appropriate outcomes: Based on examination (60%), tes	ness of the a	assessmen oject wor	t method k (20%).	s in asso	essing the	e intende	d learning	
Student Study	Class contact:								
Effort Expected	Lectures						27 Hrs.		
	Seminars					6 Hrs.			
	Tutorials					4 Hrs.			
	In class assessment						2 Hrs.		
	Other student study effort:								
	 Self study 						81 Hrs.		
	Total student study effort							120 Hrs.	
Reading List and References	Hensen, J.L.M. and Lamberts, R Spon Press.	., Building per	formance	simulatio	on for des	design and operation, Abingdon:			
	Dhillon, B.S., Maintainability, ma	aintenance and	reliabilit	y for engin	neers. Tay	lor & Fra	ancis.		
	Duffuaa, S.O., Raouf, A. and Campbell, J.D., Planning and Control of Maintenance Syst and Analysis, John Wiley & Sons.				Systems:	Modelling			
	Williams, B., An introduction to Economics Bureau Ltd.	benchmarking	facilities	& justifyi	ng the inv	estment in facilities, Building			
Seaman, A., Condition Based Maintenance – An evaluation guide for building se Guide AG 5/2001, BSRIA.				uilding services, Application					
	CIBSE Guide M: Maintenance Engineering and Management, The Ch Services Engineers.					nt, The Chartered Institution of Build			
	Preiser, W. and Vischer, J., Asses	sing Building	Performar	nce, Routl	edge.				

The Hong Kong Polytechnic University

Subject Description Form

Please read the notes at the end of the table carefully before completing the form.

Subject Code	BSE3610
Subject Title	Computational Methods in Building Sciences and Engineering
Credit Value	3
Level	3
Pre-requisite Co-requisite Exclusion	Nil Nil Nil
Objectives	 Introduce students to the common mathematical idealisations used in building sciences and engineering, usually in the form of linear and non- linear ODEs, PDEs, Integral and Integro-differential equations; Introduction to numerical solution methods based on discretisation of continua using finite difference and finite element methods (FDM/FEM); Introduction to the solution of homogenous and non-homogenous linear systems arising from FDM/FEM discretisations. Introduction to MATLAB for solving problems in building sciences and engineering using native MATLAB capabilities and by programming user
	functions and algorithms. This will provide students with the requisite computing knowledge to support their study in later stage, e.g., project work and elective subjects in the final year.
Intended Learning Outcomes (Note 1)	Upon completion of the subject, students will be able to: a) apply mathematical reasoning to analyze essential features of different problems in building sciences and engineering; b) extend their knowledge of mathematical and numerical techniques and adapt known solutions to different situations in building sciences and engineering; c) analyze and model application problems using computational methods and fundamental knowledge in building sciences and engineering; d) write computational code using Matlab for solving problems in application and explain the computation results based on fundamental knowledge in building sciences and engineering.
Subject Synopsis/ Indicative Syllabus (Note 2)	The syllabus will be organised in four sections of equal weighting as follows: <i>Taxonomy of mathematical models in Building Sciences and Engineeering</i> Introduction to the idea of mathematical and computational modelling based on governing equations (ODEs/PDEs etc.); sub-models such as constitutive equations; and finally assumptions and constraints, such as initial and boundary conditions. Introduction to methods of solution including analytical methods and their limitations and how they can be overcome by numerical and computational approaches such the finite difference method and the finite element method.

	Mathematical Equations of Building Sciences and Engineering This subject introduces students to the fundamental theory of computational approaches used to as a general tool for numerically solving elliptic, parabolic and hyperbolic differential equations for a wide range of building sciences and engineering problems. Field problems described by the Laplace, Poisson equations are presented first and including analytical and computational approaches to solve them in the context of heat and mass transfer problems. Time dependent problems and time integraton schemes are presented in the context of transient heat transfer and solution of Fourier Equations. Wave equation is then introduced in the context of acoustics and electromagnetism. Incompressible flow problems are introduced through Euler and Navier-Stokes equations. BSE applications will include: acoustics and vibration; HVACR; indoor environment quality modelling and simulation including propagation of pollutants and pathogens; lighting and electrical sciences and ; and fire sciences and .							
	<i>Finite Difference Method (FDM) and the Finite Element Method (FEM)</i> Theory and application of FDM and FEM based discretisation to selected mathematical representations of Building Sciences and Engineering problems introduced in the second section. Introduction to Strong and weak formulations of a problem and discretisation using FDM and variational and weighted residual approaches used in FEM. Methods for solving discretised linear systems; Solutions of non-linear equations; Newton-Raphson methods;							
	Matlab programming Introduction to Matlab; F Matlab; Visualization of creation using Matlab; A	Realization of computation pplications.	compu results	tationa in Mat	ıl meth lab; Co	ods intr omputat	oduced ional c	d using code
Teaching/Learning Methodology (Note 3)	Lectures –13sessions of 2-hour lecture are provided. Lectures are to introduce the basic concepts and associated theories. Tutorials – 13 sessions of 1-hour tutorial help students solve difficult exercises in which the students cannot solve by themselves. Students are encouraged to prepare and complete the tutorial exercises at home. It helps enhance their learning outcomes. Assignment – Provide opportunities to test students' understanding (formative & indemental)							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	be assessed (Please tick as appropriate)						
(Note 4)			а	b	c	d		
	1. Class quizzes/tests	20%	✓	✓	✓	✓		
	2. MATLAB Projects	30%	 ✓ 	✓	~	 ✓ 		
	3. Examination	50%	~	✓	~	 ✓ 		
	Total	100 %					•	·
	Explanation of the appro- intended learning outcom Quizzes and tests (week	priateness of t nes: 4 to 7) – Facil	the asso	essmen can hav	it metho ve a bet	ods in a tter und	erstand	ng the ding of

	 individual student / students' weaknesses or strength so that remedial actions can be taken timely. MATLAB Projects (week 8 to 12) – Introductory and advanced programming projects with increasing level of difficulty based on taught and computing tutorial classes will be set to ensure students develop sufficient confidence in using MATLAB for computational work. Examination – Held at the end of the unit with questions aligned with the intended subject learning outcomes. 				
Student Study Effort	Class contact:				
Expected	 Lectures 		26 Hrs.		
	 Tutorials and 	Computing Lab	13 Hrs.		
	Other student study et				
	Tutorial exerc	28 Hrs.			
	Self-study and	50 Hrs.			
	Total student study effort117 Hrs				
Reading List and References	References: Kreyszig, E.	ics John Wiley 2011			
	Germund Numerical Methods in Scientific Dahlquist and Åke Computing, Volumes I and II Björk		SIAM 2007		
	E. G. Thompson.	npson. Introduction to the Finite Element John Wi Method - Theory, Programming and and Son Applications 2004			
	Palm, W.J.	McGraw Hill, 2011			

Subject Code	BSE4510
Subject Title	Building Automation and Control
Credit Value	3
Level	4
Pre-requisite	(BSE2122 Electrical Technology and BSE3225 HVACR I (Before 2022 cohort)) or (BSE2124 Electrical Engineering Fundamentals and BSE3227 Heating, Ventilation, Air Conditioning and Refrigeration I (Effective from 2022/23))
Co-requisite Exclusion	Nil Nil
Objectives	The Building Automation (BA) system is an essential system of smart buildings. Dynamic performance and control of building services systems are important for the systems to meet the design objectives. This subject provides students with an opportunity to understand the principles and application of Building Automation system and building process control, so that they can explore the relevant knowledge and applications of the Building Automation system and the control of building services systems in smart buildings.
	Lecture and student-centred learning, such as seminar, laboratory tests, etc., are used allowing the student to be explored on the following issues:
	• The network of building automation (BA) and intelligent building (IB) systems, and the configuration of BA and IB systems.
	• Interfacing BA system with building services systems.
	• The dynamic performance of building processes/systems, control fundamentals and building process control.
	• Control strategies for better energy efficiency and building environmental performance.
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	a) undertake architectural design and specify the requirements for building automation systems and intelligent building technologies taking into account successful integration and flexibility to meet future demands;
	b) assess the impact of using different architectures, LAN protocols/standards in BA system design and selection;
	c) design and analyze the control of typical and non-typical building processes and manage the stability and tuning issues of process control;
	d) specify supervisory control and management strategies and assess their impact on indoor environmental quality, energy efficiency and reliability of systems and equipment; and
	e) integrate and apply in-depth understand of the integration/interface of building automation systems with building services systems and integration between different intelligent building systems.
Subject Synopsis/ Indicative Syllabus	Concepts and features of intelligent building: definitions and features of IB; building purpose; functions, flexibility and adaptability, building automation (BA), communication automation (CA) and office automation (OA).
	Digital control stations : binary data, microcomputer, data acquisition, input and output units, processor operation and software, sensor and actuator
	LAN and BA network: LAN and WAN, network architectures, LAN protocols, transceiver, medium interface, LAN interface, signal encoding and decoding, Lontalk, Ethernet, BA communication standards.
	System dynamics and feedback control : dynamic system, transfer function of linear systems, block diagram of dynamic system, open-loop and closed-lop controls, characteristics of feedback control systems, stability of feedback control systems, stability theory of linear feedback control systems.

	PID control : proportional control, integral control and derivative control, tuning of PID loops, open loop test method, closed loop test method, digital PID and direct digital control (DDC).								
	Local and supervisory cont sequential control, compensati point reset, demand-controllec optimal control of heat rejection	Local and supervisory control : tuning of local control loops and adaptive control; cascade and sequential control, compensation and sequencing control; on-line temperature and static pressure set- point reset, demand-controlled ventilation and economiser control, chilled water temperature reset, optimal control of heat rejection system, peak demand limiting and demand response control.							
Teaching/Learning Methodology	Text books, published journal to explore students to the plan as well as the control and o Students will undertake smal control of building services sy studies on real building autom configuration, architecture, op and to identify problem areas a	Text books, published journal articles, physical and computer simulation test facilities, etc. are used to explore students to the planning, design, operation and problems of building automation systems, as well as the control and operational performance and problems of building services systems. Students will undertake small projects on relevant topics and practise the online operation and control of building services system in lab besides lectures and tutorials. They will also conduct case studies on real building automation and intelligent building systems and equipment to understand the configuration, architecture, operation and management, interfacing with building services systems, and to identify problem areas and possible solutions.							
Assessment Methods in Alignment with Intended Learning	Specific assessment % Intended subject learning outcomes to be assessed methods/tasks weighting (Please tick as appropriate)						sessed		
Outcomes			a	b	c	d	e		
	Coursework	40		~	~	~			
	End-of-semester examination	60	~	~	~	~	~		
	Total	100	¹				1	L	
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The coursework consists of one in-class test, seminar presentation and report. Students are required to undertake small projects on relevant topics. They need to present their findings in the projects in a						ng ed a		
Student Study Effort	Class contact:								
Expected	Lectures 20 Hi						20 Hrs.		
	Seminar					4 Hrs.			
	Tutorial						10 Hrs	;	
	In-class test 2						2 Hrs	;	
	Other student study effort:								
	 Self study 						4	0-55 Hrs.	
	• Preparation for seminar, la	aboratory repo	rt, etc.					44 Hrs.	
	Total student study effort						120	-135 Hrs.	
Reading List and References	Wang S.W., Intelligent Buildir ASHRAE, ASHRAE Handboo Boed V., Networking and Integ CIBSE Guide H – Building Co	ngs and Buildin ok – HVAC Ap gration of Faci	ng Autom pplications lities Auto 2009.	ation, Tay s 2019. omation S	ylor & Fr Systems,	rancis (U CRC Pre	(K), 2009 ess, 2000.		

The Hong Kong Polytechnic University

Subject Code	BSE4610
Subject Title	Building Informatics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	BSE1610, BSE2610, BSE3227 Nil Nil
Objectives	 This subject aims to introduce the transition of the building industry in the pervasive big data and AI era, with the focus on how big data and AI technologies fundamentally change building operations; introduce typical techniques and technologies of building informatics; equip students with basic data analytics skills for smart buildings; and enable students to address energy, environment and safety issues in smart buildings by adopting the interdisciplinary approach
Intended Learning Outcomes (Note 1)	 Upon completion of the subject, students will be able to: a. understand the technical foundations of building informatics; b. be familiar with typical applications of IoT and AI technologies in buildings; c. possess basic skills and experiences on using machine learning algorithms to analysing building data; d. apply the insights discovered from building data to improve building energy efficiency, built environment quality and building safety; and e. be able to communicate and work with IT and AI professionals to address the challenges facing buildings.
Subject Synopsis/ Indicative Syllabus (Note 2)	 IoT for smart buildings: sensors, network, protocols Application of IoT in building environment and safety monitoring; Conventional data-driven methods: modelling, optimization, fault diagnosis Big building data: data sources, format, characteristics, data pre-processing Machine learning: clustering, regression and prediction Application of machine learning in building data analytics Smart building management: energy, environment and safety.
Teaching/Learning Methodology (Note 3)	Lectures teach students on the main concepts, methods and applications of building informatics, together with rich examples. Tutorials provide the opportunity for students to review and consolidate the lecture and reference materials through problem solving exercises.

Assessment Methods in	Specific accomment	0/	Into	adad a	which	1.0000				
Intended Learning Outcomes	methods/tasks	weighting	outc tick	omes t as app	to be a ropria	tearni te)	essed (Please)			
(Note 4)			a	b	c	d	e			
	1. Written assignment	15%	~	~			~			
	2. min-project	20%	\checkmark		\checkmark	\checkmark	\checkmark			
	3. Seminar presentation	15%	~	~			~			
	4. final examination	4. final examination 50% \checkmark \checkmark \checkmark		\checkmark	\checkmark					
	Total	100 %								
	 Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Written assignment helps students to develop a good understanding of IoT technologies and their applications in smart buildings. Mini-projects gives students the opportunity to gain hand-on experiences on using data analytics to solve practical problems. Seminar presentation assesses students' oral communication ability wi IT and data science professions regarding applications in smart buildings. 							g of y with		
Student Study Effort Expected	Class contact:									
r	Lecture							20 Hrs.		
	Tutorials/Mimi-projects/presentations 19 Hr					Hrs.				
	Other student study effo	dy effort:								
	 Preparation of assignmentation 	ussignments, mini-project and 41 Hrs.					Hrs.			
	Self-study 40 Hrs.						Hrs.			
	Total student study effo	rt					120	Hrs.		
Reading List and References	 Ron Bakker, Smart E Built Environment, F 	Buildings: Te Routledge (Ta	chnol aylor a	ogy an & Fran	d the lacis G	Desigi roup),	n of th 2019.	e		
	2. James Sinopoli, Adv House, 2016.	anced Techn	ology	for Sn	nart B	uildin	gs, Ar	tech		
	3. Wang S.W., Intellige Press (Taylor & Fran	ent Buildings acis Group), l	and E Londo	Buildin n and	g Aut New Y	omatio York, 1	on, Sp Nov. 2	on 2009		
	 McGowan, John J., Energy and Analytics: Big Data & Building Technology Integration, The Fairmont Press, Inc., 2015. 									

5. K. Hwang and M. Chen, Big Data Analytics for Cloud, IoT and
Cognitive Computing, John Wiley Publisher, U. K., 2017.
6. Zhou, Zhi-hua. Machine Learning, Springer Singapore, 2021.

Subject Code	BSE4728
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite:BSE3716 Research Methods in Building Sciences and EngineeringAny 4 of the below subjectsBSE3124BSE3125Optics and LightingBSE3227Heating, Ventilation, Air Conditioning and Refrigeration IBSE3228Heating, Ventilation, Air Conditioning and Refrigeration IIBSE3313Hydraulic SystemsBSE3322Fire Safety SystemsExclusion:Any other equivalent capstone project
Objectives	 Research project is undertaken by students with the aim of developing the skills and abilities to undertake, independently, a major piece of investigation in a specialist subject area in building sciences and engineering. The objectives are to: provide a student with the opportunity to apply and integrate the previous and current academic studies of artificial intelligence and data analytics (AIDA) to the discipline of building sciences and engineering. develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using various building sciences and engineering approaches with AIDA. 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: <u>Professional/academic knowledge and skills</u> (a) conduct literature surveys to locate materials and sources relevant to the selected problem area in building sciences and engineering; (b) understand the materials obtained and connect the materials with the problem to be solved using various building sciences and engineering knowledge and skills of AIDA; (c) define and specify the problem precisely; (d) assimilate and apply the learnt knowledge to generate good solutions to the problem; (e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and (f) evaluate the final outcome in an objective manner; <u>Attributes for all-roundedness</u> (g) communicate and present clearly and concisely the progress and outcome of the study via oral presentation; (h) enhance technical report writing skills with proper organization of materials; (i) develop the ability to learn independently and to find/integrate information from different sources required in solving building sciences and engineering real-life problems;

	 (j) manage the project efficiently and effectively through the supervision of supervisor(s); and (k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.); (l) demonstrate good time management for the project.
Subject Synopsis/ Indicative Syllabus	The tasks to be accomplished by the students in this subject include, but are not limited to below,
	 Project Planning Focus a) based on the developed methodology, acquire the necessary skills and abilities for the execution of the project; b) make necessary arrangements for the research work; and c) conduct preliminary investigations.
	 d) conduct investigation and data collection in a critical and professional manner; e) demonstrate the ability to critically evaluate information and data; f) communicating clearly and concisely the progress and final outcome of the study; and g) demonstrate good management of time and resources available for the project.
	Students are required to confirm facts, reaffirm the results of previous work, solve new or existing problems, or develop new theories based on substantial literature review, concise methodology of experiments, survey, literature review, simulations, AIDA in the following building sciences and engineering areas. The research outcome will make practical applications.
	 Acoustic and noise control Building automation Built environment Electrical engineering Energy saving for buildings Facilities engineering and management Fire and safety Indoor environmental quality Refrigeration Renewable energy Ventilation and air-conditioning Water supply and drainage
	Students are expected to identify a project topic with a supervisor in building sciences and engineering, artificial intelligence and data analytics expertise. Students need to demonstrate their knowledge in building sciences and engineering and AIDA in the project, receiving advice from supervisor(s). The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.

<u>Project Planning</u> The student shall take account of available resources, site access, time, etc., when refining aims and objectives when determining a project plan. Students are expected to acquire the required abilities and skills for the project work.
<u>Project Plan Refining</u> The student shall have taken account of available resources, site access, time, etc., when refining aims, objectives and project plan, where deemed necessary in the execution of the work.
<u>Record of Meetings and Activities</u> A record of all activities is to be maintained by the student. It shall record time spent at meetings, on self-study, on site investigations, etc. The supervisor shall check the record periodically. It should be brought to all meetings, updated regularly and submitted with the Project File.
Intermediate Presentation At the end of 1st Semester, an intermediate presentation takes place before a group of academic staff. Each student is required to give a presentation on his or her works done and to answer questions in front of an assessment panel. Assessment by each member of the group is rationalised to a single score.
 <u>Project Execution</u> Students must obtain the approval of their supervisor before embarking on any site surveys or physical measurements. Relevant approval shall be obtained from governing bodies (e.g. human ethic, animal ethic, laboratory safety) for sensitive data. The methodology must be clearly defined and resources identified. Students must gain proper permission to enter sites for conducting surveys or measurements. Where the department initiates a project, the department will help arrange access. Where equipment is to be transferred for use on site, an Equipment Loan Form must be completed. Students must gain approval from the Department for survey questionnaires before they are issued.
 Project File Each student maintains a file containing all relevant information and data for the project: Record of meetings and activities, feedback from supervising staff, correspondence etc. Interim review, project proposal, project paper and comments from assessors. Copies of major references used (except copyright material). Project notes, site and survey data, summary of equipment, software, etc. Any site/system/equipment drawings, catalogues, etc. Site/laboratory measurement data. Summary of hours spent in meetings with supervising staff and clients, self-study, practical work, etc.
<u>Files on Disk</u> All text, graphics and data files relevant to the project are submitted with the Project File. This includes the Paper. These will be electronically submitted via Blackboard in the end of the 2nd Semester and/or format deemed appropriate.
Dissertation At the end of the 2nd Semester, it is required to submit a dissertation. The dissertation should cover the complete research work and to be written in a style suitable for reading by research professionals. The content of the dissertation should include an abstract, an

introduction, a literature review, the methods (survey/experiment/simulation), results/analysis and discussion, conclusions and any others deemed appropriate. The introduction part should give the backgrounds and justification of the proposed investigations, supported with a literature review, and the aims and objectives of the project; the methods part shall present the methods used, such as site survey, laboratory experiments or computer simulation, and list the scopes of the work to be undertaken. The result part shall include findings and data analysis, such as a comparison with relevant standards, verification, application or rejection of a theory, model or guidance, identification of the cause of a problem, etc. In this part, table/graphs shall preferably be used. At the end of the report, conclusions should be given.
 The format of the paper shall be: The body of the paper is a maximum of 40-60 pages A4. Single column text. Font size12 pt. Double-line spacing. The pages of text and diagrams /graphs can be mixed. Only references, which are clearly mentioned in the text, shall be listed. Full citation to be given. Figures, charts and tables, including all labels, to be clearly legible. Minimum font size 8 pt, e.g., Helvetica. Acknowledgements are to be included The paper shall include a disclaimer signed by the author declaring the originality of the work. The paper shall go through similarity check, e.g. by Turnitin, given a similarity index must not be more than 30%. The checking report shall be submitted together with the paper.
<u>Final Presentation</u> At the end of the 2nd Semester, a final presentation takes place before a group of academic staff, and may include outsiders. Each student is allocated a presentation period for their findings and then followed with a question and answer session. Assessment by each member of the group is rationalised to a single score.

Assessment Methods																				
in Alignment with Intended Learning	Specific assessment	% weighting		Inter	nded	subje (Pl	ct lea ease 1	rning tick a	g outc s app	ome: ropri	s to b .ate)	e asso	k 1							
Outcomes	methods/tasks		а	b	с	d	e	f	g	h	i	j	k	1						
	Report	10	1	1	1	1	1	1	1	1	1	1	1	✓						
	PresentationsDissertationContinuousAssessmentTotal	30	1	1	1	1	1	1	1	1	1	1	1	✓						
		40	1	1	1	1	1	1	1	1	1	1	1	1						
		20	1	1	1	1	1	1	1	1	1	1	1	1						
		100																		
	The Integrated Capstone Project will be accessed by the supervisor/co-supervisor and other assessors. Attributes to be assessed by regular meetings for project development & execution with project file, presentations and dissertation.																			
	Assessment Key																			
	<u>1st Semester</u>																			

	Sem. Week	Assessment Element	Assessors	Assessment Element	s	Weighting	
	13	Progress Report	Supervisor	Solving research pro literacy, Analyzing d conclusion, Gramma presentation.	blem, Quantitative ata, Drawing r, spelling and	10%	
	13	Intermediate Presentation	Group of staff	Supporting material, Delivery, Subject know	Organization, owledge	15%	
	1-13	Project Development with Project File	Supervisor	Problem solving skil Initiative	Problem solving skills, Critical thinking, Initiative		
	2nd Sem	<u>nester</u>					
	Sem. Week	Assessment Element	Assessors	Elements		Weighting	
	13	Dissertation	Group of staff	Solving research prol literacy, Analyzing d conclusion, Grammar presentation	blem, Quantitative ata, Drawing r, spelling and	40%	
	13	Presentation	Group of staff	Supporting material, Delivery, Subject kno	Organization, owledge	15%	
	1-13	Project Execution with Project File	Supervisor	Problem solving skill Initiative	Problem solving skills, Critical thinking, nitiative		
	The mathematical the assignades The ag	arking scheme essment rubrics between group gregate percent	used by the as The grades r s by the Resea age will be co	assessors for various assessment elements are given is may be subject to overall review and rationalisation of earch Project subject examiner. converted to the appropriate subject grade.			
Student Study Effort Expected	Class c	contact:					
	• Gr • Ex	oup/Individual periment/Site s	meeting urvey/Simula	lation 52			
	Other s	student study ef	fort:				
	 Sea sup sys pre 	arching and rea pervisor / co-suj tem developme esentation, etc.	ding materials pervisor / othe ent, testing, do	ls, meeting with hers, design and locumentation, 162 Hr			
	Total s	tudent study ef	fort			240 Hrs	
Reading List and References	1. JH ar	K Jesson, L Ma ad systematic te	theson, FM L chniques. LA	acey 2011. Doing yo , Calif.: SAGE.	our literature review	: traditional	
	2. K Sy	Williamson, G ystems, and Con	Johanson, 20 ntexts. Chand	17. Research Method	s−2nd Ed. Informati √IER.	on,	

3. Roberts, Carol M., <i>The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation</i> , 3rd Edition, Corwin Press, 2007.

Subject Code	CBS3410
Subject Title	Python for Language Analytics
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	CBS3947 Programming and Data Analysis for Language Studies
Objectives	This subject introduces Python programming techniques for language analytics. Students will learn about the basics of language data analytics, major text processing tasks (e.g. tokenization and segmentation, syntactic and semantic preprocessing), and more advanced techniques of natural language processing (e.g. feature engineering, text classification, text summarization, sentiment analysis, etc.). Students will also be familiarized with the Python environment and resources for natural language processing tasks.
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: Category A: Professional/academic knowledge and skills a. Demonstrate a deep understanding of the basics of natural language processing and the main issues of text processing; b. Set up a Python environment for text processing tasks; c. Comprehend, compose, and adapt Python codes for text processing; d. Get familiar with Python resources for natural language processing; e. Develop an understanding of advanced techniques of natural language processing; and f. Conduct an analytic study of corpus data on an advanced issue of natural language processing g. Develop skills of critical thinking, logical analysis and real-life problem solving.
Subject Synopsis/ Indicative Syllabus	 Basics of natural language processing Setting up Python for natural language processing Text preprocessing a) Segmentation and tokenization b) Semantic preprocessing c) Syntactic preprocessing Feature engineering Text summarization Sentiment analysis

Teaching/Learning Methodology	The subject will be taught through a combination of lecturing and laboratory exercises. Lectures will introduce concepts, theories and existing technologies. Laboratory exercises are designed to provide hands- on experience of using and developing computer programs and scripts for linguistic data analysis.									
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed							
			a	b	c	d	e	f	g	
	1. Programming Assignments	60%	~	~	~	\checkmark			\checkmark	
	2. Analytics project	30%	~	~	~	\checkmark	~	~	\checkmark	
	3. Classroom participation and exercises	10%	~	~	~	~	~	<		
	Total	100%		1						
	The subject is assessed continuously through a series of programming assignments, a corpus project, an R exercise report, and classroom participation. Students are expected to attend all classes and finish all inclass laboratory exercises.									
Student Study Effort Expected	Class contact:									
	• Lectures 26Hrs.									
	 Laboratory seminars 						13Hrs.			
	Other student study effort:									
	Self-access lab activities						30Hrs.			
	• Other private study	у							40Hrs.	
	Total student study effo	ort							109Hrs.	
Reading List and References	Bird, S., Klein, E., & Loper, E. (2009). <i>Natural Language Processing</i> <i>with Python: Analyzing Text with the Natural Language Toolkit.</i> O'Reilly.						cessing Toolkit.			
	Sarkar, D. (2019). Text Analytics with Python: A Practitioner's Guide to Natural Language Processing. Apress.									
	Natural Language Toolkit. https://www.nltk.org/.									
	The Python Tutorial. h	nttps://docs.p	ytho	n.org	g/3/tu	itoria	ul/.			

Subject Code	CBS3947										
Subject Title	Programming and Data Analysis for Language Studies										
Credit Value	3										
Level	3										
Pre-requisite / Co-requisite/ Exclusion	Nil										
Objectives	This subject introduces the use of programming and data analysis techniques in language studies. Students will learn about the fundamentals of text processing with open-source packages in Python and the general ideas of major NLP (natural language processing) tasks. Students will also be familiarized with the conceptualization and compilation of linguistic corpora, as well as the use of corpora in computational linguistics. Furthermore, the course will also introduce R (and RStudio) as tools of data analysis and visualization, with a special focus on the analysis and reporting of language data.										
Intended Learning Outcomes	 Upon completion of the subject, students will be able to: Category A: Professional/academic knowledge and skills a. Get familiar with basic programming skills and the programming environment in Python; b. Get familiar with programming skills for text processing and the NLTK package in Python; c. Understand the concept of linguistic corpora and use linguistic corpora for finding out information about language usage; d. Design and create a linguistic corpus, and create computer programs to query linguistic corpora; e. Get familiar with basic skills in language data processing with R and RStudio; and f. Perform basic functions of data visualization and data reporting in R Category B: Attributes for all-roundedness g. Demonstrate a good understanding of language processing on computers; and h. Develop skills of critical thinking, logical analysis and real-life problem solving. 										
Subject Synopsis/ Indicative Syllabus	 Basics of programming with Python Text processing in Python and NLTK a) Developing scripts for tokenization, lemmatization, POS processing, etc. b) Developing scripts for calculating word frequency, collocation, 										
	and predictability from a corpus										
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	3. Linguistic corpora										
	a) History and definition of linguistic corpora										
	 b) Varieties of corpora and their applications c) Linguistic annotation d) Using a second seco										
									~~~~		
	d) Using corpora: word frequency, concordances and other usage								sage		
	4. Linguistic data a	inarysis using	g K a ith lie	nu r	tic d	110 ata					
	b) Visualizatio	n and report	com	nilat	ion	ala					
	5. Advanced langu	age-related of	comp	uter	tech	nologi	es				
	a) Speech reco	gnition	mp				•••				
	b) Machine tra	inslation									
	c) Computer-a	ssisted trans	latio	n							
	d) Computer-a	ssisted langu	uage	teacl	ning	and le	arnir	ıg			
	e) Other applie	cations									
Teaching/Learning	The subject will be	taught thro	ough	a c	omb	inatio	n of	lect	turing	g and	
Methodology	laboratory exercises.	Lectures v	vill	intro	duce	conc	cepts	, the	eories	and	
	existing technologies	. Laborator	у ех	ercis	ses a	are de	esign	ed t	to pr	ovide	
	hands-on experience	of using an	nd de	velo	ping	comp	outer	pro	gram	s and	
	scripts for linguistic d	ata analysis.									
Assessment											
Methods in	Specific	%	ject le	ct learning outcomes							
Alignment with	assessment	weighting	to b	be ass	sesse	d					
Intended Learning	methods/tasks	-	a h		0	4	o f		a	h	
Outcomes			a	U	C	u	C	1	g	11	
	1. Programming	4007									
	Assignments	40%	v	v					v	v	
	2. Corpus project	30%			~	~			~	~	
	3. R exercise report	25%					~	~	~	$\checkmark$	
	4. Classroom										
	participation and	5%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	exercises	• • •									
	Total	100%		I	I				1	<u> </u>	
	The subject is assess	ed continuo	uslv	thro	ugh	a seri	es of	f nro	oram	mino	
	assignments, a corpu	us project,	an F	ex ex	ercis	e repo	ort,	and	class	sroom	
	participation. Students	s are expecte	ed to	atter	nd al	l class	es ar	nd fi	nish a	all in-	
	class laboratory exerc	ises.									
Student Study	Class contact:										
Enort Expected	<ul> <li>Lectures</li> </ul>								24	Hrs.	
	<ul> <li>Laboratory seminars</li> </ul>						15Hrs.				

	Other student study effort:			
	<ul> <li>Self-access lab activities</li> </ul>	27Hrs.		
	Other private study	39Hrs.		
	Total student study effort	105Hrs.		
Reading List and References	Baayen, H. R. (2008). Analyzing linguistic data: a practical introduction to statistics using R. Cambridge University Press.			
	Johnson, K. (2011). <i>Quantitative methods in linguistics</i> . John Wiley & Sons.			
	Kennedy, G. (1998). An Introduction to Corpus Linguistics. London: Longman.			
	McEnery, T., Xiao, R. and Tono, Y. (2006). Con Studies: An advanced resource book. Oxford: Re	<i>pus-Based Language</i> outledge.		
	Natural Language Toolkit. https://www.nltk.org/.			
	The Python Tutorial. https://docs.python.org/3/tuto	rial/.		

[Syllabus revised by Dr YAO Yao]

Subject Code	CBS4702				
Subject Title	Advanced Topics in Quantitative Language Studies				
Credit Value	3				
Level	4				
Pre-requisite/ Co-requisite/ Exclusion	re-requisite: BS3947 Programming and Data Analysis for Language Studies				
Objectives	This subject will focus on the introduction of advanced topics in omputational linguistics (such as word embeddings and distributional emantics, Transformer models, or dialogue systems), both from a neoretical and from an applicative perspective.				
	The main objective is to familiarize students with the current advanced rends of research in Natural Language Processing, and to give them the analytical and practical skills to work on their own corpus data.				
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>a) Acquire skills to build computational models from corpus data;</li> <li>b) Think critically about how to adapt the models to predictive tasks on linguistic data and how to evaluate them;</li> </ul> </li> <li>Category B: Attributes for all-roundedness <ul> <li>c) Develop critical thinking and problem-solving skills.</li> </ul> </li> </ul>				
Subject Synopsis/ Indicative Syllabus	<ul> <li>Theoretical introduction</li> <li>Working with code <ul> <li>Python libraries</li> <li>Text pre-processing</li> <li>Algorithm testing</li> <li>Evaluation of vector space models</li> </ul> </li> <li>Applications to concrete Natural Language Processing tasks</li> <li>Current research trends</li> </ul>				

Teaching/Learning Methodology	<ul> <li>Lectures</li> <li>Hands-on class activities and discussion</li> <li>Out-of-class work: carrying out projects and assignments using the techniques practiced in class</li> </ul>						
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	Specific assessment methods/tasks% weightin					
Outcomes		g	а	b	с		
	1. In-class exercises	30%	√	~	✓		
	2. Take-home tests	30%	$\checkmark$	~	$\checkmark$		
	3. Project	40%	✓	~	✓		
	Total	100 %				-	
	Student will have to pass an in-class assignment and a take-home test. addition, they will complete a small independent project in which the analyse a specific linguistic problem using the framework discussed class.						
Student Study	Class contact:						
Effort Expected	Lectures		39	9 Hrs.			
	Other student study effort:						
	<ul> <li>Reading and other pre-class preparation (including worksheets)</li> </ul>				4(	6 Hrs.	
	<ul> <li>Projects</li> </ul>				20	) Hrs.	
	Total student study effort				10	Hrs.	
Reading List and References	Books: Bird, Steven and Klein, Ewan and Loper, Edward. 2009. Natural Language Processing with Python. O'Reilly.					nguage	
	Pilehvar, Mohammad Taher and Camacho-Collados, Jose, 2020. Embeddings in Natural Language Processing: Theory and Advances in Vector Representations of Meaning. In <i>Synthesis Lectures in Natural</i> <i>Language Processing Series</i> , Morgan & Claypool.					2020. nces in <i>Natural</i>	

Subject Code	CBS4703					
Subject Title	Social Media and Social Network Analysis					
Credit Value	3					
Level	4					
Pre-requisite / Co-requisite/ Exclusion	Nil					
Objectives	Social Network Analysis (SNA) is a field of data analytics that centers around relations between individuals, organizations, and society using networks and graph theory. Social media sites, such as Facebook and Instagram, use core elements of SNA to identify and recommend potential pages and profiles to follow. This subject aims to provide students with an overview of theoretical and methodological literature in the field of SNA with special reference to social media. Students will also gain hands-on experience with collecting network data from social media, and with constructing their own social network graphs using computer tools.					
Intended Learning Outcomes	<ul> <li>On successfully completing the subject, students will be able to:</li> <li>a. Demonstrate a good understanding of the theoretical and the methodological foundations of SNA</li> <li>b. Recognize different types of network data, and describe how they can be collected from social media</li> <li>c. Conduct basic analyses of social network data using different analytical tools</li> <li>d. Apply core concepts of SNA to theoretical and methodological research issues</li> </ul>					
Subject Synopsis/ Indicative Syllabus	<ol> <li>Fundamentals of Social Network Analysis</li> <li>Network Structure</li> <li>Network Data Collection</li> <li>Node Centrality</li> <li>Community Detection</li> <li>Network Visualization</li> <li>Social Media Mining</li> <li>Case Studies: Facebook and Instagram</li> </ol>					
Teaching/Learning Methodology	The mode of learning will consist of lectures, seminars, and lab activities. This will include discussions of readings from both textbooks and research papers related to specific aspects of SNA and social media.					

Assessment Methods in Alignment with	Specific assessment methods/tasks% weightingIntended to be ass a		Intended to be ass	subject le essed	ubject learning outcomes sed				
Intended Learning			а	b	c	d			
Outcomes	1. Quiz	20%	✓	$\checkmark$					
	2. Assignment 1	20%	✓	√	✓				
	3. Assignment 2 20% ✓ ✓		✓						
	4. Project	4. Project 40% ✓ ✓		$\checkmark$	✓	$\checkmark$			
	Total	100%		I		L			
	There will be an in-class quiz, two take-home assignments project. The quiz is to assess students' understanding of the the methodological concepts. The two assignments will allow apply the concepts and techniques introduced in class to s problems. The final project will require students to constru- social network graph including project design, data implementation, and data analysis.								
Student Study	Class contact:								
Effort Expected	<ul> <li>Lectures</li> </ul>		26 Hrs.						
	<ul> <li>Seminars/Laborato</li> </ul>		13 Hrs.						
	Other student study eff								
	<ul> <li>Reading and study</li> </ul>		78 Hrs.						
	Total student study effo	117 Hrs.							
Reading List and References	Total student study effort117 HrsRecommended ReadingScott, J. (2017). Social Network Analysis. Los Angeles: SAGE. 4 edition.Newman, M.E.J. (2012). Networks: An Introduction. UK: Oxfor University Press.Aggarwal, Charu C. (Ed.) (2011). Network Data Analytics. Springer.Wasserman, S., and K. Faust. (1994). Social Network Analysis: Methor and Applications. Cambridge University Press.BibliographyBastian, M, S. Heymann, and M. Jacomy. (2009). Gephi: An Open Sour Software for Exploring and Manipulating Networks. ICWSM.Butts, C.T. (2008). Social Network Analysis: A Methodologic Introduction. Asian Journal of Social Psychology, 11: 13–41.Butts, C. T. (2009). Revisiting the foundations of network analys Science, 325(5939): 414.Easley, D. and J. Kleinberg. (2010). Networks, Crowds and Marke Reasoning about a highly connected world. Cambridge University					AGE. 4th : Oxford nger. <i>Methods</i> en Source <i>SM.</i> dological 41. analysis. <i>Markets:</i> Jniversity			

Faust, K. (2007). Very Local Structure in Social Networks. Sociological
Methodology, 37:209–256.
Kolaczyk, E. and G. Csardi. (2014). Statistical Analysis of Network Data
with R (UseR!). Springer.
Moody, J. and D. R. White (2003). Structural Cohesion and
Embeddedness: A Hierarchical Conception of Social Groups.
American Sociological Review, 68:103–127.
Steen, M. van. (2010). Graph Theory and Complex Networks. An
Introduction. Amsterdam.
Tsvetovat, M. and A. Kouznetsov. (2011). Social Network Analysis for
Startups. O'Reilly Media.
Zafarani, R., M. A. Abbasi, H. Liu. (2014). Social Media Mining: An
Introduction. Cambridge University Press.

Subject Code	CBS4704						
Subject Title	Workshop on Language Analytics						
Credit Value	3						
Level	4						
Pre-requisite/ Co-requisite/ Exclusion	<b>Pre-requisite:</b> CBS4958 Fundamental of Computational Linguistics						
Objectives	This subject aims to achieve the following goals:						
	• To allow the students to develop computational skills by investigating possible solutions to NLP problems and by practicing on real-world datasets						
	• To introduce the students to a "shared task" setting, where they have to organize their work in a group, develop a NLP system and prepare a demo for the rest of the class						
Intended Learning	Upon completion of the subject, students will be able to:						
Outcomes	Category A: Professional/academic knowledge and skills						
	(a) Familiarize with NLP literature and NLP resources to find possible solutions to a computational problem;						
	(b) Working in a structured way on a project using NLP tools;						
	Category B: Attributes for all-roundedness						
	(c) Problem solving using systematic ways and group working.						
Subject Synopsis/	• Introduction and overview of the tasks						
Indicative Syllabus	• Seminars for literature discussion						
	• Project presentation						
Teaching/Learning	The workshop will include three types of activities:						
Methodology	<ul> <li>lectures/tutorials, in which the teacher will introduce the tasks to the students</li> <li>research seminars prepared by the students</li> <li>discussion of the projects, where the students prepare a demo of</li> </ul>						

	the system the class	at they deve	loped and p	resent it to th	he rest of the		
Assessment Methods in Alignment with Intended Learning	Specific assessment methoda/taska	% weighting	Intended st to be asses	ubject learnin sed	ng outcomes		
Outcomes	methods/tasks		а	b	c		
	1. Research Seminars	30%	$\checkmark$		~		
	2. Group Project	70%		$\checkmark$	~		
	Total	100 %					
	All the above assessment methods are appropriate for evalua students' understanding of course materials, their programming problem-solving skills. The group project will be used to assess students' capacity to work in a coordinated way within a team, which an essential requirement for working on Natural Language Proces applications in the industry.						
Student Study Effort Expected	Class contact:						
<b>F</b>	Lecture		13 Hrs.				
	Tutorial/Lab				26 Hrs.		
	Other student study e	ffort:					
	Group work on	the project			45 Hrs.		
	Research Semir	nars			25 Hrs.		
	Total student study ef	fort			109 Hrs.		
Reading List and References	<b>Text Book:</b> Steven Bird, Ewan K with Python, O'l	lein, Edward Reilly, 2009.	l Loper, Nat	tural Languag	ge Processing		

Subject Code	CBS4705
Subject Title	Integrated 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:
	<ul> <li>provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to language data analysis.</li> <li>develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA and language processing techniques.</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	<ul> <li><u>Professional/academic knowledge and skills</u></li> <li>(a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills and language processing techniques;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> <u>Attributes for all-roundedness</u> <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems; </li> <li>(j) manage the project efficiently and effectively through the supervision of supervision of</li></ul>
	<ul> <li>supervisor(s); and</li> <li>(k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> <li>Presentation and Demonstration</li> <li>Students are expected to identify a project topic with a supervisor in their chosen discipline, and a co-supervisor with artificial intelligence and data analytics expertise. Students need to demonstrate their knowledge in both language data analysis and AIDA</li> </ol>

	in the project, receiving advice from both supervisors. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.												
Teaching/Learning Methodology	The Integrated ( semesters. The t supervisor and t development wo	he Integrated Capstone Project spans across the academic year for two consecutive emesters. The teaching/learning activities include regular project meetings with the upervisor and the co-supervisor, guided study of project materials, independent project evelopment work and other project management tasks.											
Assessment Methods													
in Alignment with Intended Learning	Specific assessment	% weighting		Inten	ded su	ıbject (Plea	learn se tic	ing ou k as a	utcom pprop	ies to oriate)	be as	sessec	1
Outcomes	methods/tasks		a	b	c	d	e	f	g	h	i	j	k
	Continuous Assessment	100	1	1	1	1	1	1	1	1	1	1	1
	Total	100											
Student Study Effort	Explanation of the appropriateness of the assessment methods in assessing the inter learning outcomes: The Integrated Capstone Project will be accessed by the supervisor/co-supervisor other assessors. Attributes to be assessed include, but not limited to, Prob Identification, Problem Solving, Communication and Presentation, Project Managem and Self-Discipline. Integrated Capstone Projects should be problem-oriented and there are no restriction the nature of the problem except that it should be relevant to the student's chosen are language data analysis and AIDA. The project could be practical, academic or a hybri which the student is encouraged but not constrained to have some original contributi Each student has to submit a proposal, a mid-term checkpoint progress report and a treport. The proposal must be approved by the supervisor/co-supervisor before the stu can proceed with the Integrated Capstone Project. An oral presentation and demonstrat is essential at the end of the project. A mid-term presentation and demonstration may be required for proper continuous assessment.						ended or and oblem ement, ons on rea in orid in ations. a final cudent ration y also						
Expected												0	Ura
												0	1113.
	Other student st	udy effort:											
	• Searching as supervisor / system deve presentation	nd reading n co-supervise elopment, tes a, etc.	nateria or / of sting,	als, m thers, docur	eeting desig nenta	g witł n and tion,	1					210	Hrs.
	Total student stu	udy effort										210	Hrs.

Reading List and	Reference Books:							
Kelerences	<ol> <li>Kumar, Ranjit, Research Methodology: A Step-by-step Guide for Beginners, 3rd Edition, SAGE Publications, 2011.</li> </ol>							
	<ol> <li>Burns, Robert B., Introduction to Research Methods, 4th Edition, SAGE Publications, 2000.</li> </ol>							
	3. Roberts, Carol M., <i>The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation</i> , 3rd Edition, Corwin Press, 2007.							
	<ol> <li>Mauch, James E. and Park, Namgi, Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty, 5th Edition, Marcel Dekker, 2003.</li> </ol>							
	<ol> <li>Rudestam, Kjell Erik and Newton, Rae R., Surviving Your Dissertation: A Comprehensive Guide to Content and Process, 2nd Edition, Sage Publications, 2001.</li> </ol>							
	6. Garson, G. David, <i>Guide to Writing Empirical Papers, Theses and Dissertations</i> , Marcel Dekker, 2002.							
	<ol> <li>Reinhart, Susan M., <i>Giving Academic Presentations</i>, 2nd Edition, University of Michigan Press, 2013.</li> </ol>							
	8. Oshima, Alice and Hogue, Ann, <i>Writing Academic English</i> , 4th Edition, Pearson Longman, 2006.							
	<ol> <li>American Psychological Association. Publication Manual of the American Psychological Association, 6th Edition, American Psychological Association, 2010.</li> </ol>							
	<ol> <li>Szuchman, Lenore T., Writing with Style: APA Style Made Easy, 5th Edition, Wadsworth/Cengage Learning, 2011.</li> </ol>							
	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.							
	16. Guidelines for projects on language data analytics [available on Blackboard and departmental websites].							
	17. Readings for individual projects suggested by the supervisor.							

Subject Code	CBS4844
Subject Title	Machine Aided Translation
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject aims to help students acquire fundamental knowledge and useful skills in the application of computer tools and resources for Chinese, English and multilingual translation. In addition to computer assisted human translation, students will also learn to take advantage of automatic computer translation by effective editing of source and target texts. More attention is given to advanced translation technology rather than elementary and general-purpose computer skills.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will:</li> <li>a. understand the important concepts of computer-aided translation and automatic machine translation;</li> <li>b. be able to effectively use computer tools and resources to support human translation;</li> <li>c. be able to make good use of machine translation through pre-editing and post-editing;</li> <li>d. be able to create simple software tools or resources to support Chinese and English translation;</li> <li>e. have the basic ability to perform research in computer assisted translation.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>Introduction to computer-aided translation</li> <li>Automatic machine translation (i.e., computer translation)         <ul> <li>The history of computer translation</li> <li>Rule-based and corpus-based computer translation</li> <li>Important computer translation systems on the Web</li> <li>Evaluation and application of computer translation systems</li> </ul> </li> <li>Texts editing for computer translation         <ul> <li>Pre-editing</li> <li>Interactive editing</li> <li>Semi-automatic editing</li> </ul> </li> <li>Terminology management         <ul> <li>Terminology and terminology resources</li> <li>Building your own terminology resources</li> </ul> </li> <li>Translation units and translation memory         <ul> <li>Using existing translation memories</li> </ul> </li> </ol>

	Building	g your own tra	anslati	on mer	nories			
	SDL Tra	udos, Wordfas	st, Goo	gle Tra	anslate,	etc.		
	6. Bilingual alignm	ent of transla	tion ur	its				
	• Sentenc	es, words and	l transl	ation u	inits			
	• Recogni	tion of transl	ation u	nits				
	• Alignme	ent of translat	ion un	its				
	7. Software localiza	ation and user	· interf	ace tra	nslation	l		
	Product:	s localization	and gl	obaliza	ation			
	• Softwar	e localization	and us	ser inte	erface tr	anslatio	n	
	• Comput	er assisted lo	calizati	ion				
	8. Corpora as transl	ation tools	. 1	• • • • • •				
	• Introduc	tion to corpu	s lingu	1Stics				
	• Using e	xisting corpor	a					
	<ul> <li>Duiluing</li> <li>Databases as trar</li> </ul>	slation tools	прога					
	• Introduc	ction to databa	ases					
	• Using ex	xisting databa	ises					
	Building	your own da	ntabase	s				
	10. Term projects	(grouned or	indiv	idual):	to de	esion at	nd cre	eate a
	valuable softw	are tool or	resour	ce (e.	g.ac	orpus,	an on	-lined
	dictionary or a t	ranslation me	emory)	to sup	port lar	nguage t	ransla	tion.
Methodology	Lectures enhanced with both online and offline demonstrations will introduce students to important concepts and valuable skills in Computer- Aided Translation. Laboratory seminars will provide students with hands-on training in computer tools application and software resources development for translation purposes. The language of instruction is English, aided by					y will puter- nds-on pment ed by		
Assessment Methods	Specific assessment methods/tasks	% weighting	Inten	ded su	bject lea	arning essed		
Intended Learning								-
Outcomes			а	b	c	d	e	
	1. Two assignments involving in-class activities.	60%	~	~	~	~	~	
	2. One project	40%				~	$\checkmark$	
	Total	100%						
	Assessment							
	The subject will be as find or select a probl software tool/resource are designed to conso skills in the application	ssessed by th em in langua to help solve lidate and in	ree ass age tra the pro nprove	signme inslatio oblem. stude	ents, incon and The others' un	create create ner two derstane	a proj an eff assign ding c anslati	ect to ective ments of and

Student Study Effort	Class contact:					
Expected	<ul> <li>Lectures</li> </ul>	26 Hrs.				
	<ul> <li>Laboratory seminars</li> </ul>	13 Hrs.				
	Other student study effort:					
	<ul> <li>Self-access lab activities</li> </ul>	27 Hrs.				
	<ul> <li>Other private study</li> </ul>	39 Hrs.				
	Total student study effort	105 Hrs.				
Reading List and	References					
References	Teacher's lecture notes and practical work notes (to b on the Web).	e delivered in class or				
	Austermuhl, F. (2001). <i>Electronic Tools for Transle</i> Jerome Publishing.	ators. Manchester: St.				
	Bhattacharyya, Pushpak (2015). <i>Machine translation</i> . Boca Raton : CRC Press					
	Michał Kornacki (2018). Computer-assisted translation (CAT) tools in the translator training process. Berlin : Peter Lang					
	McEnery, T., Xiao, R. and Tono, Y. (2006). Corpus-Based Language Studies: An advanced resource book. Oxford: Routledge.					
	O'Hagan, Minako (2020). <i>Routledge Handbooks in Translation and Interpreting Studies</i> . Abingdon, Oxon : Routledge.					
	Rodrigo, E. Y. (Ed.). (2008). <i>Topics in Language Resources for Translation and Localisation</i> . Amsterdam: John Benjamins.					
	Samuelsson-Brown, G. (2010). <i>A Practical Guide for Translators</i> , 5th edition. Bristol: Multilingual Matters.					
	Somers, H. (Ed.). (2003). Computers and Translation: A translator's guide. Amsterdam: John Benjamins. (Ch. 16: Post-editing)					
	Thierry Poibeau (2017). Machine Translation. Boston: MIT Press.					
	Wilks, Y. (2009). Machine Translation: Its scope and limits. New York: Springer.					
	Zhang, X. (2016). Keeping the Meanings of the Source Text: An introduction to Yes Translate. In Sun, M. et al. (Eds.). <i>Chinese Computational Linguistics and Natural Language Processing Based on Naturally Annotated Big Data</i> : Lecture Notes in Artificial Intelligence, LNAI 10035, pp. 64–75. Switzerland: Springer. (EI indexed)					
	Zhang, X. (2016). Computational Linguistics. In C Routledge Encyclopedia of the Chinese Lan	Chan S. (edited), <i>The guage</i> , pp. 420–437.				

Oxford: Routledge. ISBN: 978-0-415-53970-8.
Zhang, X. and Li X. (2018). Achieving All-Correct Chinese Word Segmentation by Human-Computer Cooperation: A Study on Intersection Ambiguities. In Li, X., Sun, J. and Xu, J. eds. (李晓琪,孙建荣,徐娟主编), <i>Digital Teaching</i> <i>of Chinese Language 2018 (数字化汉语教学 2018)</i> . Beijing: Tsinghua University Press. (清华大学出版社), pp 165-176.
Zhang, X., Li, X. and Lun, C. (editors, 2015). The YES-CEDICT Chinese Dictionary (一二三漢英大詞典, Trial Edition, Version T: sorted by Traditional Chinese). <i>The Journal of Modernization of Chinese Language Education</i> (中文教学现代化学报), Vol.4, No.1 (Total No. 7), June, 2015. ( <u>http://xuebao.eblcu.com/</u> )
馮志偉(2004). 機器翻譯研究. 北京: 中國對外翻譯出版公司.
海峽兩岸資訊科學技術名詞工作委員會 編 (2008). 海峽兩岸信息科學技術名詞. 北京:科學出版社.
黄昌寧,李涓子 (2002). 語料庫語言學. 北京: 商務印書館.
王华树(2015). 计算机辅助翻译实践. 北京: 国防工业出版社
俞士文(2003,主編). 計算語言學概論. 北京: 商務印書館.
張小衡 (1999). 粤-普機器翻譯中的詞處理. 中文資訊學報, No. 3, Vol. 13, pp. 40 - 47.
張小衡 (2005). 上下文索引程式 ABCD 及其在語言翻譯中的應用. 載于 李亞舒,趙文利, 晏勤 (編). 科技翻譯資訊化. 北京: 科學出版社, pp. 241-245.
張小衡 (2011). 一個支持人工校對的中文簡繁體轉換工具. 發表於《全國第九届計算語言學學術會議論文集》.
张小衡,李笑通 (2013). 一二三笔顺检字手册. 北京: 语文出版社.
张小衡, 李笑通 (2016).《一二三汉英大词典》的计算机辅助修订. In (李晓 琪,金铉哲,徐娟主编), <i>数字化汉语教学 2016</i> . 北京:清华大学出版社, pp 147-152.
[Syllabus prepared by Dr ZHANG Xiaoheng]

[Syllabus prepared by Dr ZHANG Xiaoheng]

Subject Code	CBS4954
Subject Title	Statistics for Language Studies
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Statistical methods are used in the subfields of linguistics extensively, which helps linguists to discover language structures and patterns in processing languages. This is an introductory course to statistical analysis used in language studies. This course includes fundamental concepts in statistics, methods of descriptive and inferential statistics with application in analyzing quantitative linguistic data and solving linguistic problems. In particular, we focus on experimental designs, simple linear regression, hypothesis testing and statistical modeling of linguistic data. It offers hands-on experience with statistical analysis software, and provides students with theoretical background in statistics enough to understand the software output, and make a critical review of the results in a qualitative study. Students are also trained to report statistical results of linguistic data for their own projects.
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	Category A: Professional/academic knowledge and skills:
	<ul> <li>a) make intelligent and informed judgments concerning the statistical outputs of quantitative linguistic studies;</li> <li>b) identify linguistic problems and solve them using statistical methods;</li> <li>c) govern language structures from a statistical perspective;</li> <li>d) comprehend basic statistical terms, and perform simple analysis;</li> <li>e) report statistical results based on analysis of linguistic data.</li> </ul>
	Category B: Attributes for all-roundedness
	<ul><li>f) improve learning skills involving collaboration with peer students</li><li>g) foster critical thinking in solving linguistic problems</li></ul>

Subject Synopsis/ Indicative Syllabus	Statistical concepts: An Introduction What is statistics? Why do we need statistics in language studies?
	<u>Frequency distribution</u> Classification of linguistic data; Histograms; Shapes of distributions
	Introduction to statistical software Statistical software introduction
	<u>Descriptive statistics</u> Measures of central tendency and variability
	Normal distribution Characteristics of normal distribution; Data plotting
	<u>Population estimation</u> Sampling distribution of the mean; Confidence interval
	<u>Hypothesis testing</u> Design of investigation; The null hypothesis and the alternative hypothesis
	Parametric tests of significance Test statistic; Independent samples; Paired samples
	<u>Chi-square test</u> Basic characteristics of Chi-square test
	<u>Correlation</u> Nature of correlation; The Pearson product-moment correlation coefficient
	Simple linear regression Concepts of linear regression; Fitting data
	<u>Multiple linear regression</u> Concepts of multiple linear regression; Fitting more complex data
	ANOVA Introduction to one-way and two-way ANOVAs
Teaching/Learning Methodology	Besides face-to-face lectures, web-based study materials and in-class practice will be made. Assignments are closely related to the use of statistical software in analyzing linguistic data, and thus students are

	strongly encouraged to ap to solve real-world linguis	pply the cond stic problems	cepts 5.	and	meth	odolo	ogies	they	learn	
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Inte	nded	l subj es to l	bject learning be assessed				
Outcomes		а	b	c	d	e	f	g		
	1. Exercises & small assignments	30%	~		~	~		~	~	
	2. Project/essay	70%	~	~	✓	✓	✓	✓	$\checkmark$	
	Total	100%		I	I	1				
	<ul> <li>linguistic data analysis. Topics covered vary from basic state concepts, distributions, hypothesis testing, simple linear regression etc. It would be difficult to evaluate stulearning outcome with one or two single assignment(s) in term of papers. Therefore, a number of exercises and small assignments with different focus and covering specific topics, will be give students to help them grasp the basic concepts and to develop abilities in handling statistical analysis.</li> <li>Towards the end of the study period, students will be required to covered in this class. This final piece of work would require students was achieved the interded learning automatic.</li> </ul>					stati regress stuc m of ents, give relop to con techn studen	stical ssion, lent's term each en to their nduct iques nts to e that			
Student Study Class contact:										
Effort Expected	• Lectures: 3 x 13					39 Hrs.				
	Other student study effort	:								
	<ul> <li>Assignments</li> </ul>					40 Hrs.				
	Reading					30 Hrs.			Hrs.	
	Total student study effort							109 ]	Hrs.	
Reading List and References	<b>Essential Reading:</b> Gries, S. T. (2013). St	atistics for	ling	uisti	cs u	vith 1	R: a	pra	ctical	

introduction. Walter de Gruyter.
Selected Reference List:
Gómez, P. C. (2013). Statistical methods in language and linguistic research. Equinox.
Lowie, W., & Seton, B. (2012). <i>Essential statistics for applied linguistics</i> . Palgrave Macmillan.
Rasinger, S.M. (2008). <i>Quantitative Research in Linguistics</i> . New York, Continuum International Publishing Group

[Syllabus prepared by Dr CHEN Si]

Subject Code	CBS4958					
Subject Title	Fundamentals of Computational Linguistics					
Credit Value	3					
Level	4					
Pre-requisite/ Co-requisite/ Exclusion	<b>Pre-requisite:</b> CBS3947 Programming and Data Analysis for Language Studies					
Objectives	This subject aims to achieve the following goals:					
	• To introduce the field of computational linguistics and its history.					
	• To introduce how linguistic structures can be automatically extracted and analyzed using computational methods.					
	• To introduce the applications of computational linguistics and the basic technologies for such applications.					
	• To provide hands-on experience of computational tools for text analysis.					
Intended Learning	Upon completion of the subject, students will be able to:					
Intended Learning Outcomes	Upon completion of the subject, students will be able to: Category A: Professional/academic knowledge and skills					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> </ul> </li> </ul>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> <li>(b) Understand the complicated nature of human language and the challenges facing computational linguists;</li> </ul> </li> </ul>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> <li>(b) Understand the complicated nature of human language and the challenges facing computational linguists;</li> <li>(c) Understand the scientific principles behind the various systems using natural language processing techniques;</li> </ul> </li> </ul>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> <li>(b) Understand the complicated nature of human language and the challenges facing computational linguists;</li> <li>(c) Understand the scientific principles behind the various systems using natural language processing techniques;</li> <li>(d) Understand the principles of language resource annotation and information extraction;</li> </ul> </li> </ul>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> <li>(b) Understand the complicated nature of human language and the challenges facing computational linguists;</li> <li>(c) Understand the scientific principles behind the various systems using natural language processing techniques;</li> <li>(d) Understand the principles of language resource annotation and information extraction;</li> <li>(e) Apply the above principles in analysis of data and acquire intended information through the use of tools;</li> </ul> </li> </ul>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> <li>(b) Understand the complicated nature of human language and the challenges facing computational linguists;</li> <li>(c) Understand the scientific principles behind the various systems using natural language processing techniques;</li> <li>(d) Understand the principles of language resource annotation and information extraction;</li> <li>(e) Apply the above principles in analysis of data and acquire intended information through the use of tools;</li> <li>(f) Design simple programs for data extraction in different applications.</li> </ul> </li> </ul>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Category A: Professional/academic knowledge and skills <ul> <li>(a) Understand and appreciate the development of the field of computational linguistics and its significance in modern applications;</li> <li>(b) Understand the complicated nature of human language and the challenges facing computational linguists;</li> <li>(c) Understand the scientific principles behind the various systems using natural language processing techniques;</li> <li>(d) Understand the principles of language resource annotation and information extraction;</li> <li>(e) Apply the above principles in analysis of data and acquire intended information through the use of tools;</li> <li>(f) Design simple programs for data extraction in different applications.</li> </ul> </li> <li>Category B: Attributes for all-roundedness</li> </ul>					

Subject Synopsis/	• Introduction and overview								
Indicative Syllabus	• Review on programming and regular expressions and state transition diagrams								
	• Annotation of language resources								
	Morphological analysis and processing								
	• Segmentation and	l syntactic ar	nalysi	s					
	• Semantics represe	entation and	analy	sis					
	• Statistical models	s in natural la	angua	ge pro	ocessi	ng			
	<ul> <li>Applications usin retrieval, informa learning.</li> </ul>	ng computat ation extracti	ional ion, n	lingu nachir	istics ne tra	such nslatio	as ir on an	nform d ma	ation chine
Teaching/Learning Methodology	This subject will be taught in a combination of lectures, tutorials and lab sessions. Lectures will cover concepts, algorithms and models with illustrative examples. Tutorials and lab sessions are designed to help students further their understanding of the materials covered in lectures and learn to apply the acquired knowledge to practical use.								
	assignments and lab e	exercises, and	d atter	nd qu	izzes	and te	ests.	•••	prote
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					mes	
Outcomes			а	b	c	d	e	f	g
	1. Assignments and lab exercises	40%	~	✓	~	~	~	~	~
	2. Tests	60%	~	~	~	~	~	~	$\checkmark$
	Total	100 %							
	All the above asses students' understandin and problem solving provide assessment of self-monitoring for understanding of the mastery of basic prog	ssment mething of course results. Individual skills. Individual skills in a regular lestudents. concepts an gramming ski	nods mater vidual basis, Tests d algo ills.	are a ials an assig whic will orithm	pprop nd the gnme h also asse ns lea	priate ir pro nts ar serv ess st ernt in	for gramm nd lab e as a rudent i class	evalu ming exen a mea s' ov s and	ating skills cises ns of verall their

Student Study	Class contact:					
Effort Expected	Lecture	26 Hrs.				
	<ul> <li>Tutorial/Lab</li> </ul>	13 Hrs.				
	Other student study effort:					
	<ul> <li>Study lecture/text book materials for understanding of concepts</li> </ul>	35 Hrs.				
	<ul> <li>Assignments, online QA, and preparation for the tests</li> </ul>	40 Hrs.				
	Total student study effort	114 Hrs.				
Reading List and References	Text Book: Dan Jurafsky and James H. Martin, Speech and Language Processing, 2 nd Edition, Prentice Hall, 2008 References:					
	Christopher Manning and Hinrich Schuetze, Found Natural Language Processing, MIT Press, 1999	Foundations of Statistical , 1999.				
Ruslan Mitkov, The Oxford Handbook of Computational Ling Oxford University Press, 2005.						
	Christopher Manning, Prabhakar Raghavan, and Introduction to Information Retrieval, Cambrid 2008.	Hinrich Schuetze, ge University Press,				
	Steven Bird, ewan Klein, and Edward Loper, Natural Language Processing with Python, O'Reilly Media, 2009					
	Sun, M., Liu, T., Wang, X., Liu, Z., Liu, Y. (Eds.) Chinese Computational Linguistics and Natural Language Processing Based on Naturally Annotated Big Data, Springer, 2018					
	Hopcroft, J.E. and Ullman, J.D., Introduction to Automata, Theory and Languages, Addison-Wesley, 1979.					
	International Journal of Computational Lingui Language Processing (IJCLCLP)	stics and Chinese				

Subject Code	CBS4962				
Subject Title	Corpus and Language Technology for Language Studies				
Credit Value	3				
Level	4				
Pre-requisite/ Co-requisite/ Exclusion	<b>Pre-requisite:</b> CBS1902 Introduction to Linguistics				
Objectives	This subject introduces corpus linguistics and other tools useful for linguistic analysis, with a focus on Chinese languages.				
	The main objective is to familiarize students with the conceptual underpinning and recent developments in corpus linguistics, and give them experience in how to use corpora for various kinds of analysis, how to extract data from a corpus, and how to build a linguistic corpus.				
Intended Learning	Upon completion of the subject, students will be able to:				
Outcomes	Category A: Professional/academic knowledge and skills				
	a) Acquire skills to use corpora and perform in-depth linguistic analysis based on empirical data;				
	b) Demonstrate knowledge of important issues in corpus linguistics in general and Chinese corpus linguistics in particular;				
	c) Think critically about how to apply appropriate methodological techniques to cross-disciplinary studies of language;				
	Category B: Attributes for all-roundedness				
	d) Develop critical thinking and problem-solving skills.				
Subject Synopsis/ Indicative Syllabus	<ul> <li>Introduction to corpus linguistics <ul> <li>Overview of corpus linguistics</li> <li>Related research topics</li> </ul> </li> <li>Corpus use <ul> <li>Types of corpora</li> <li>Factors to consider when choosing a corpus</li> <li>Lexical statistics</li> <li>Concordancers, n-grams</li> <li>Regular expressions</li> <li>Basic statistical methods</li> </ul> </li> </ul>				

Teaching/Learning	<ul> <li>Segmentation (especially in Chinese)</li> <li>Annotations/tagging and metadata</li> <li>Chinese-specific issues like encoding</li> <li>Applications (e.g. sentiment analysis)</li> <li>Theoretical issues and current trends/developments in corpus linguistics</li> <li>Other online tools/technology for language sciences (such as MRD/Lexicon, Grammar, WordNet/Ontology, TreeBank)</li> <li>Lectures</li> </ul>						
Methodology	<ul> <li>Hands-on class activities and discussion</li> <li>Out-of-class work: carrying out projects and assignments using the techniques practiced in class</li> </ul>						
Assessment Methods in Alignment with	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed			arning essed	
Outcomes			a	b	c	d	
	1. Out-of-class exercises	30%	~		✓	~	
	2. Take-home tests	30%	~	~	$\checkmark$	~	
	3. Corpus analysis project	30%	~	~	✓	~	
	4. In-class participation	10%	~		✓		
	Total	100 %					
	Most weeks' discussion will be paired with a worksheet or problem set to complete at home. In addition, students will complete one independent project in which analyze an aspect of language or examine a theoretical question about language by using corpus data.						
Student Study Effort Exported	Class contact:						
Enort Expected	Lectures     39 Hrs.						
	Other student study effort:						
	<ul> <li>Reading and other pre-class preparation (including worksheets)</li> <li>46 Hrs.</li> </ul>					6 Hrs.	
	<ul> <li>Projects</li> </ul>				2	0 Hrs.	
	Total student study effort				10	5 Hrs.	
Reading List and References	Including, but not limited to, sele <b>Books:</b>	cted excerpts	s from	the foll	owing	texts:	

McEnery, Tony, Richard Xiao & Yukio Tono. 2006. Corpus-based Language Studies: An Advanced Resource Book. London: Routledge. ISBN 0415286239.
Wynne, M. 2005. Developing Linguistic Corpora: A Guide to Good Practice. Oxford: Oxbow Books.
Articles:
Chen, Keh-Jiann and Chu-Ren Huang. To Appear. Sinica Treebank. In Nancy Ide and James Pustejovsky (Eds.), <i>Handbook of Linguistic</i> <i>Annotation</i> . Springer.
Chen, Keh-Jiann, and Chu-Ren Huang. 2015. Modern Chinese Balanced Corpus of Academia Sinica. In Rint Sybesma (Ed.), <i>Encyclopedia of</i> <i>Chinese Language and Linguistics</i> . Brill.
<ul> <li>Huang, Chu-Ren, Hong Jiafei, Weiyun Ma, and Petr Šimon. 2015. From Corpus to Grammar: Automatic Extraction of Grammatical Relations from Annotated Corpus. In Benjamin T'sou and Olivia Kwong (Eds.), <i>Linguistic Corpus and Corpus Linguistics in the Chinese Context</i>. Pp. 192-221. Journal of Chinese Linguistics Monograph. Hong Kong: Chinese University of Hong Kong Press.</li> </ul>
Huang, Chu-Ren, and Qi Su. 2015. Chinese Computational Linguistics: The State of the Art. In Rint Sybesma (Ed.), <i>Encyclopedia of Chinese</i> <i>Language and Linguistics</i> . Brill.
Huang, Chu-Ren, Shu-Kai Hsieh, and Keh-Jiann Chen. 2017. Mandarin Chinese Words and Parts of Speech: A Corpus-based Study. London: Routledge.
Huang, Chu-Ren, and Yao Yao. 2015. Corpus Linguistics. In James D. Wright (Ed.), <i>International Encyclopedia of the Social &amp; Behavioral Sciences</i> (2 nd edition), Volume 4 (pp. 949–953). Oxford: Elsevier.

### The Hong Kong Polytechnic University

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject TitleProgramming Fundamentals and ApplicationsCredit Value3Level1Pre-requisite/ Co-requisite/ ExclusionExclusion: COMP 1011/ENG 2002ObjectivesThe objectives of this subject are to: • provide students with knowledge on the fundamental elements in computer programming; and • introduce students to the application of computer programming in solving practical problems in different application domains.Intended LearningUpon completion of the subject, students will be able to:					
Credit Value       3         Level       1         Pre-requisite/ Co-requisite/ Exclusion       Exclusion: COMP 1011/ENG 2002         Objectives       The objectives of this subject are to: <ul> <li>provide students with knowledge on the fundamental elements in computer programming; and</li> <li>introduce students to the application of computer programming in solving practical problems in different application domains.</li> </ul> Intended Learning       Upon completion of the subject, students will be able to:					
Level       1         Pre-requisite/ Co-requisite/ Exclusion       Exclusion: COMP 1011/ENG 2002         Objectives       The objectives of this subject are to: <ul> <li>provide students with knowledge on the fundamental elements in computer programming; and</li> <li>introduce students to the application of computer programming in solving practical problems in different application domains.</li> </ul> Intended Learning       Upon completion of the subject, students will be able to:					
Pre-requisite/ Co-requisite/ ExclusionExclusion: COMP 1011/ENG 2002ObjectivesThe objectives of this subject are to: • provide students with knowledge on the fundamental elements in computer programming; and • introduce students to the application of computer programming in solving practical problems in different application domains.Intended LearningUpon completion of the subject, students will be able to:					
ObjectivesThe objectives of this subject are to:• provide students with knowledge on the fundamental elements in computer programming; and• introduce students to the application of computer programming in solving practical problems in different application domains.Intended LearningUpon completion of the subject, students will be able to:	Exclusion: COMP 1011/ENG 2002				
<ul> <li>provide students with knowledge on the fundamental elements in computer programming; and</li> <li>introduce students to the application of computer programming in solving practical problems in different application domains.</li> </ul>					
<ul> <li>introduce students to the application of computer programming in solving practical problems in different application domains.</li> <li>Intended Learning</li> <li>Upon completion of the subject, students will be able to:</li> </ul>					
<b>Intended Learning</b> Upon completion of the subject, students will be able to:					
Outcomes         Professional/academic knowledge and skills	Professional/academic knowledge and skills				
(Note 1) (a) understand the programming elements for solving computing-related problems;					
<ul> <li>(b) possess the ability to design and develop computer program for solving problems in different application domains;</li> </ul>	ams				
<ul><li>(c) possess the ability to learn other high level programming languages independently;</li></ul>					
Professional/academic knowledge and skills					
(d) develop skills in general problem solving;					
(e) identify and develop problem solutions in a logical mann and	er;				
(f) solve problems in groups and develop group work.					
Subject Synopsis/ Topic					
Indicative Syllabus (Note 2)1. Fundamentals of computing Basic concepts of computers and computing, elementary programming constructs, elementary data types.21/2					

		Sending output to flow control: sele	o screen, ge ection, repet	tting i ition a	nput f and fu	from l inctio	ceybo n.	ard, b	pasic
	3.	Data collection Sequences, lists,	tuples, sets,	string	gs and	l dicti	onarie	es.	
	4.	File operation Creating and ope	ening files, r	es, reading from file, writing to file.					
	5.	<ol> <li>Program design Modular program design using functions, testing and debugging.</li> </ol>							
	6.	Applications Sorting and search functions, element matrices, problem	ching: progr ntary data m ns in differe	ammi anipu ent app	ng vs lation plicati	built- 1, Nur Ion do	in Py nPy a main	thon rrays s.	and
	7.	Other programm Elementary data	ing languag manipulatio	es on in F	R, inte	rfacir	ng to I	Pythor	n.
<b>Teaching/Learning</b> <b>Methodology</b> (Note 3)	Thi pro lect Stu Con com assi Pro pro	s subject emphasis gramming and pra- tures and hands-or dents should atten ntinuous assessme icepts and skills le ignments provide ject(s) allow stude blems. Quizzes m	zes both the actical exper- a Lab exerci- d both lectu nt helps to r arned in dev additional p ents to work andate stude	oth the conceptual elements in computer al experiences. Teaching includes both o exercises reinforcing taught concepts. th lectures and laboratory sessions. Alps to reinforce the programming d in developing applications. Individual ional practices to programming. o work in group to solve more practical te students to recap their knowledge and					
	Fin stud pro	al examination pro dent performance blems in various a	ovides a sun in applying applications.	nmative assessment of overall programming skills in solving					
Assessment Methods in Alignment with Intended Learning Outcomes	Sp	ecific assessment ethods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
(Note 4)				а	b	c	d	e	f
	Co As	ontinuous ssessment	65%						
	As	ssignments		$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$
	Qı	uizzes		$\checkmark$	$\checkmark$			$\checkmark$	
	Pr	oject(s)				$\checkmark$			$\checkmark$
	Fi	nal Examination	35%						
	Tc	otal	100 %			_	_		

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The continuous assessment and the final examination are designed to assess the specified learning outcomes. The formats may include written questions, programming exercises, projects and quizzes.				
Student Study Effort	Class contact:				
Expected	Lecture	39 Hrs.			
	• Lab	13 Hrs.			
	Other student study effort:				
	<ul> <li>Assignments, Quizzes, Projects, Exam, Self- study</li> </ul>	68 Hrs.			
	Total student study effort	120 Hrs.			
Reading List and References	1. David J. Pine. Introduction to Python for Science Engineering, CRC Press, 2019.	ce and			
	2. Claus Führer, Jan Erik Solem and Olivier Verdi with Python: An Introduction to Python for Scie Engineering. Pearson, 2014.	ier. Computing ence and			
	3. William F. Punch and Richard Enbody. <i>The Pro</i> <i>Computing Using Python</i> . 3rd Edition, Addison 2017.	actice of Wesley,			
	4. Jaynal Abedin and Kishor Kumar Das. <i>Data Mawith R</i> , 2nd Edition, Packt Publishing, 2015.	anipulation			
	<ol> <li>J.<u>D.</u>Long and Paul Teetor. <i>R Cookbook: Prove Data Analysis, Statistics, and Graphics</i>. 2nd Ed O'Reilly, 2019.</li> </ol>	<i>n Recipes for</i> lition,			

### Note 1: Intended Learning Outcomes

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

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

#### (Form AR 140) 8.2020

Subject Code	COMP1433
Subject Title	Introduction to Data Analytics
Credit Value	3
Level	1
Pre-requisite / Co-requisite / Exclusion	Nil
Objectives	The objectives of this subject are to:
	• understand data analytics concepts
	• apply data analytics tools
	• strengthen students' mathematics background for computing
Intended	Upon completion of the subject, students will be able to:
Outcomes	Professional/academic knowledge and skills
	(a) understand basic data analytics concepts
	(b) manipulate, analyze and visualize data
	(c) understand and apply related mathematics operations
Subject Synonsis/	Торіс
Indicative	1. Data Analytics Basics
Synabus	Defining data requirements, collecting data, processing data, cleaning data and analyzing data
	2. Data Processing
	Data manipulation, data analysis, data visualization
	3. Statistical Analysis
	Basic statistical functions, linear regression, time series analysis
	4. Linear Algebra and Calculus
	Vector basics, matrix basics, differentiation, integration, finding maxima and minima
	The aforementioned topics will be taught with the aid of a suitable programming language such as R.

Teaching/ Learning Methodology	Lectures on data analytics and mathematics concepts (e.g., using R) will be given through lectures. There will be in-class activities for active learning. Hands-on lab/exercises will be arranged for students to practice data analytics tools. Students will also be required to study e-learning materials.							
Assessment Methods in Alignment with Intended	Specific assessment methods/tasks% weightingIntended subject learning ou be assessed (Please tic appropriate)				ing outcomes to ase tick as te)			
Learning Outcomes			a	b	c			
	Continuous Assessment							
	1. Assignments, Test, Quizzes	55%	~	~	~			
	Examination	45%	~	~	~			
	Total	100%						
	The assignments/test/quizzes (individual assessment) are used to assess learning outcomes (a) – (c) (e.g., how to apply R). Finally, students are assessed by a formal examination, covering learning outcomes (a) – (c).							
Student Study	Class contact:							
Effort Expected	Class/ Learning Activities     39 Hrs.							
	Other student study effort:							
	Self-study, Assignments, e-Learning				66 Hrs.			
	Total student study effort105 Hrs.					105 Hrs.		
Reading List	Reference Books:				1			
and References	1. Beecher, K., Computatio	onal Thinking	, BCS, 2	2017.				
	2. Teetor, P., <i>R Cookbook</i> ,	O'Reilly Me	dia, 201	1.				
	3. Wickham, H. and Groler	mund, G., <i>R f</i>	or Data	Science,	O'Reil	ly Media, 2017.		
	4. Boyd, S. and Vandenberghe, L., <i>Introduction to Applied Linear Algebra</i> , Cambridge University Press, 2018.					Linear Algebra,		
	5. Stewart, J., <i>Calculus: Ed</i> 2015.	arly Transce	ndentals	, 8 th Edi	ition, Co	engage Learning,		

### The Hong Kong Polytechnic University

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	COMP2013				
Subject Title	Data Structures and Algorithms				
Credit Value	3				
Level	2				
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite:COMP1011 / COMP1012 / ENG2002 / LGT3109 and AMA1110 / AMA1501 / AMA2634 and AMA1751 / AMA2111				
Objectives	To introduce students to data structures and algorithms, and how to use them to solve computational problems.				
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) understand the properties of basic data structures, and their strengths and weaknesses;</li> <li>(b) understand how to analyze and compare the efficiency of algorithms;</li> <li>(c) possess the knowledge of common algorithms, and common techniques for designing algorithms;</li> <li>(d) understand the basic steps in designing and implementing efficient data structures and algorithms for solving computational problems efficiently in a high-level programming language; and</li> <li>(e) get familiar with critical thinking for computational efficiency.</li> </ul>				
Subject Synopsis/ Indicative Syllabus (Note 2)	<ol> <li>Analysis of algorithms         <ul> <li>Asymptotic notations.</li> <li>Efficiency analysis.</li> </ul> </li> <li>Data Structures         <ul> <li>Linear structures: linked-lists, stacks, queues.</li> <li>Tree structures: binary trees, balanced trees, tree traversals.</li> </ul> </li> <li>Searching and Sorting         <ul> <li>Greedy sorting algorithms: bubble sort, insertion sort, selection sort.</li> <li>Sorting algorithms based on divide and conquer: quicksort and mergesort.</li> <li>Heapsort and related data structures: priority queues, heaps.</li> </ul> </li> </ol>				

	<ul> <li>4. Graphs</li> <li>Definition and representation.</li> <li>Depth-first search and breadth-first search.</li> <li>5. Algorithmic Design Techniques</li> </ul>							
	<ul><li>Greedy and dynamic programming.</li><li>Divide-and-conquer.</li><li>Recursion.</li></ul>							
	<ul> <li>6. Applications</li> <li>Practical program multiple data struct</li> </ul>	n developm stures and al	nent Igorith	using 1ms.	com	binati	on of	
<b>Teaching/Learning</b> <b>Methodology</b> (Note 3)	The course material will be lectures and small group sessions.	be delivered supervised t	lelivered as a combination of mass ervised tutorial and laboratory					
	Lectures will provide the required knowledge while tutorial and laboratory sessions allow students to acquire hands-on experience on programming with different algorithms.						and ience	
	Both written and program course. Written assignmen design skills, whereas pro implementation skills.	ming assign nts help stud gramming a	nment lents d assign	s will develc ments	be uti op ana emph	lized i lysis a asize	n the ınd on	
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
(Note 4)			a	b	с	d	e	
	Continuous Assessment	60%						
	1. Exercises	20%	~	~	~	~	✓	
	2. Programming Project	20%	~	~	~	~	✓	
	3. Test	20%	~	~	~		✓	
	Examination	40%	~	✓	✓		✓	
	Total	100 %						
Student Study Effort	Class contact:							
Expected	Lecture					26 Hrs.		
	<ul> <li>Tutorial/Lab</li> </ul>					13	Hrs.	

	Othe	er student study effort:				
	•	Assignments, Quizzes, Projects, Self-study     101 Hrs.				
	Tota	ll student study effort	140 Hrs.			
Reading List and References	1.	Goodrich, Michael T., Tamassia, Roberto, and Michael H., <i>Data Structures and Algorithms in</i> Edition, Wiley, 2014.	Goldwasser, <i>Java</i> , 6 th			
	2.	Goodrich, Michael T., Tamassia, Roberto, and Michael H., Data structures and algorithms in 1 2013.	Goldwasser, Python, Wiley,			
	3.	Sedgewick, Robert and Wayne, Kevin, <i>Algorit</i> Edition, Addison-Wesley, 2011.	hms, 4 th			
	4.	Cormen, Thomas H., Leiserson, Charles E., Riv and Stein, Clifford, <i>Introduction to Algorithm</i> MIT Press, 2009.	vest, Ronald L. <i>is</i> , 3 rd Edition,			

### Note 1: Intended Learning Outcomes

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

<u>Note 2: Subject Synopsis/Indicative Syllabus</u> The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

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

(Form AR 140) 8.2020

Subject Code	COMP4431
Subject Title	Artificial Intelligence
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	Pre-requisite: COMP1012 / COMP2011 / ENG2002
Objectives	The objectives of this subject are to:
	• introduce the fundamental concepts of artificial intelligence;
	• equip students with the knowledge and skills in programming of artificial intelligence techniques;
	• master the problem formulation and the typical intelligent algorithms
	• understand the technical development of artificial intelligence
	• aware the ethical issues related to artificial intelligence.
Intended	Upon completion of the subject, students will be able to:
Outcomes	Professional/academic knowledge and skills
	(a) understand the history, development, and technical trend of artificial intelligence;
	(b) understand the important concepts in artificial intelligence and the problem addressed by intelligent techniques;
	(c) familiarize with typical programming language and tool to implement artificial intelligence techniques;
	(d) master the characters of intelligent agent, knowledge based agent, problem solving agents, multiagent, and the typical examples.
	(e) learn the design rationale and the typical algorithms of problem-solving agents, in particular, search algorithms and their applications in real world;
	(f) master the skills and techniques in machine learning, such as decision tree induction, support vector machine, and artificial neural networks;
	(g) understand the ethical issues related to artificial intelligence.
	Attributes for all-roundedness
	(h) explore the nature of human intelligence and its role in problem solving;

	(i) deepen thoughts and understanding of human abilities such as learning, reasoning and planning; and											
	(j) appreciate the rooted philosophical arguments in artificial intelligence and its impact on human thoughts.											
Subject	Торіс											
Indicative	1. Introduction to Artificial Intelligence											
Syllabus	Definition of artificial intelligence; basic concepts of human intelligence; scope of classical artificial intelligence problem; the birth, golden time, and the winter of artificial intelligence.											
	2. Agent and Knowledge Base											
	Definition of agents and rationality; design an intelligent agent; knowledge- based agents and knowledge representation language; inference using forward chain and backward chain; uncertainty and Bayesian networks.											
	3. Problem-solving Agents											
	Problem-solving agents; uninformed search strategies and typical algorithms; informed search strategies and typical algorithms; heuristic functions; hill- climbing search, simulated annealing search, genetic algorithms; constraint satisfaction problem and game problem.											
	4. Machine Learning											
	Supervised learning, unsupervised learning, and reinforcement learning; classification, clustering, and regression; decision tree; support vector machine, artificial neural networks.											
	5. Applications and Ethical Issues											
	Latest development of artificial intelligence; typical applications; ethical issues of artificial intelligence techniques and applications; benefits and risk to human society.											
Teaching/ Learning Methodology	During the lecture, students will come across the concepts, algorithms and applications in artificial intelligence, and will be supplemented by exercises, labs, and project.											
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks%Intended subject learning outcomes to be a (Please tick as appropriate)								asses	ssessed		
--------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------	-------------------	---------------	---------	-------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------	---------	---------	---------	--------	-----------------------------
	methods/tasks		a	b	c	d	e	f	g	h	i	j
Outcomes	1. Continuous Assessment	55%	~	~	~	~	~	~	~	~	~	~
	2. Final Examination	45%	~	~	~	~	~	~	~			
	Total	100 %										
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:											
	Continuous assessments consist of a project, lab exercises, and quizze designed to facilitate students to achieve intended learning outcomes. La designed to encourage students to acquire good understanding of knowledge, practice in order to enrich their hands-on experience with var tools. The project is designed to enhance students' ability to acquire the u and using different knowledge, principles, techniques, tools to solve a through team. Quizzes are to ensure the students understand the concept					izzes, . Lab of th varione und e a re cepts.	es, which are ab exercise is the relevant rious software inderstanding real problem ts.					
Student Study	Class contact:	intact:										
Effort Expected	Class activities including lecturers, tutorial, and labs     39 Hrs.										Hrs.	
	Other student study effort:											
	Coursework and Project								80 Hrs.			
	Total student study effort119 Hrs										Hrs.	
Reading List and References	It       Textbooks:         1.       Russell, Stuart and Norvig, Peter, Artificial Intelligence: A Modern 3 rd Edition, Pearson, 2009.         Reference Books:					odern	Appr	oach,				
	1. Pal, Sankar <i>Reasoning</i> , Jo	K. and Shi ohn Wiley, 2	iu, Si 004.	imon	C. F	K., Fo	oundc	itions	of S	Soft (	Case-1	Based
	2. Negnevitsky, Edition, Addi	Michael, Ar son Wesley,	tificia , 2005	al Inte 5.	elliger	ıce: A	Guid	le to I	ntelli	gent S	System	<i>is</i> , 2 nd

Subject Code	COMP4432
Subject Title	Machine Learning
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	Nil (but students are preferred to have some previous exposure to introductory Artificial Intelligence/Data Analytics concepts and be familiar with basic notions in linear algebra and probability)
Objectives	The objectives of this subject are to:
	• present the basic principles, concepts and models of modern machine learning; and
	• introduce recent advances of machine learning technology with impactful applications in pattern recognition, computer vision and other areas.
Intended	Upon completion of the subject, students will be able to:
Outcomes	(a) understand the major concepts of machine learning models and algorithms;
	(b) develop basic intuitions into the effectiveness of machine learning techniques;
	(c) gain knowledge of applying machine learning techniques to various cutting- edge applications; and
	(d) design machine learning solutions to solve new challenging problems in practice.
Subject	Торіс
Synopsis/ Indicative Syllabus	<ol> <li>Part I: Machine Learning Fundamentals         <ul> <li>Linear algebra and probability</li> <li>Numerical computation and optimization</li> <li>Learning tasks: Regression, classification, etc.</li> <li>Performance issues: Cross-validation, Overfitting and curse of dimensionality, Bias-variance dilemma, etc.</li> </ul> </li> </ol>

	2. Part II: Models and Te	chniques					
	<ul> <li>Supervised learning:         <ul> <li>Parametric vs non-parametric methods</li> <li>Decision tree based methods</li> <li>Bayesian models</li> <li>Neural networks and support vector machines</li> </ul> </li> <li>Unsupervised learning:         <ul> <li>k-means and hierarchical clustering</li> <li>Spectral clustering and density-based clustering</li> <li>Advanced models: autoencoder, embedding techniques, etc.</li> </ul> </li> <li>Regression and boosting</li> <li>Feature selection and dimensionality reduction</li> </ul>						
	3. Part III: Applications						
	<ul> <li>Handwriting recognit</li> <li>Object detection, recognite</li> <li>Object feature description</li> <li>Object feature description</li> <li>Object detection</li> <li>Object recognite</li> <li>features</li> <li>Object tracking</li> </ul>	tion challenge ognition and t lescriptions: E n examples, o tion example examples, e.	e, e.g. M tracking Engineer e.g. pixe es, e.g. f g. humar	NIST ing appro- el cluster face rec n motion	oach vs f ring for ognition tracking	feature l face de via ei	earning tection, genface
Teaching/ Learning Methodology	39 hours of class activities i together with applicational laboratory works and student will be assigned, whenever ap	ncluding lect case studies, presentation propriate.	ures on tutoria s. Addit	the mai ls and o ional rea	n conce class/gro ading of	pts and oup disc researc	models, cussions, h papers
Assessment Methods in Alignment with Intended	Specific assessment methods/tasks	% weighting	Intende b	ed subjeo be assess ap	ct learnin ed (Plea propriat	ng outco se tick a e)	omes to as
Learning Outcomes			а	b	с	d	
	Continuous Assessment						
	1. Assignments	55%	✓	✓	✓		
	2. Tests/Quizzes		✓	✓	✓		
	3. Project				$\checkmark$	$\checkmark$	
	Examination	45%	✓	$\checkmark$	$\checkmark$	$\checkmark$	
	Total	100%					
	Explanation of the appropria intended learning outcomes: Assignment: After-class asses issues, models and application to given questions.	ateness of th sment of the c is of machine	e assess continuo learning	ment m us under techniqu	ethods i standing ues by pr	in asses g of the c oviding	concepts, answers

	Test/Quiz: In-class assessment of the understanding of the concept, issues, models and applications of machine learning techniques by providing answers to given questions.				
	Project: Assessment of problem solving ability in dealing we problems by written reports and oral presentations.	vith practical application			
	End-of-term Assessment: Assessment of the overall per examination.	formance by a written			
Student Study	Class contact:				
Effort Expected	Lecture/Tutorial/Lab	39 Hrs.			
	Other student study effort:				
	<ul> <li>Self-study</li> </ul>	83 Hrs.			
	Total student study effort	122 Hrs.			
Reading List	Reference Books:				
and References	1. Hastie, T., Tibshirani, R. and Friedman, J., The <i>Learning</i> , 2 nd Edition, Springer, 2009.	Elements of Statistical			
	2. Shalev-Shwartz, S. and Ben-David, S., Understanding Machine Learning: <i>From Theory to Algorithms</i> , 2014.				
	3. Bousquet, O., Boucheron, S. and Lugosi, G., Introduction to Statistical Learning Theory, Advanced Lectures on Machine Learning.				
	4. Mohri, M., Rostamizadeh, A. and Talwalkar, A., <i>Foundations of Machine Learning</i> . USA, Massachusetts: MIT Press, 2012.				
	5. Vapnik, V. N., The Nature of Statistical Learning Theo	ory. Springer, 2000.			
	6. Bishop, Christopher, <i>Pattern Recognition and Mach</i> 2006.	ine Learning, Springer,			
	7. To be amended and updated at the beginning of the ser	mester.			

Subject Code	COMP4434
Subject Title	Big Data Analytics
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	Pre-requisites: AMA1104 / AMA1110 & COMP1011 / COMP1012 / ENG2002 & COMP2011 / COMP2013
Objectives	The objectives of this subject are to:
	• introduce students the concept and challenge of big data (3 V's: volume, velocity, and variety); and
	• teach students in applying skills and tools to manage and analyze the big data.
Intended	Upon completion of the subject, students will be able to:
Learning Outcomes	(a) understand the concept and challenge of big data and why existing technology is inadequate to analyze the big data;
	(b) collect, manage, store, query, and analyze various form of big data;
	(c) gain hands-on experience on large-scale analytics tools to solve some open big data problems; and
	(d) understand the impact of big data for business decisions and strategy.
Subject Synopsis/	Торіс
Indicative Syllabus	1. Introduction to Big Data
Synabus	The 3 V's, their challenges and application domains.
	2. Collection of Big Data
	Eventual Consistency and NoSQL systems MongoDB, Google BigTable.
	3. Large-Scale Data Analytics Systems
	Auto-Parallel Data Programming; MapReduce, Hive, and Parallel Databases
	4. Basic Statistical Analysis
	Fruad and Benfords Law, Bayesian Introduction, Heteroskedasticity
	5. Machine Learning Systems for Big Data
	6. Graph Analytics
	Graph structures (diameter, connectivity, centrality), PageRank, Triangle counting

	7. Sentiment Analysis							
	8. Data Visualization							
	Data types and dimensions; Visual encoding and perception							
Teaching/ Learning Methodology	A mix of lectures and lab Lectures are conducted to data. Students are given to source and commercial bi	sessions is use o initiate stude the opportunity g data analytics	d to deliver nts with the to gain ha s software c	the vario e concept nds-on ex during the	bus topics in ts and techni xperience on e laboratory s	this subject. ques of big both open- sessions.		
Assessment Methods in Alignment	Specific assessment methods/tasks	% weighting	Intended assesse	ded subject learning outcomes to be sessed (Please tick as appropriate)				
with Intended Learning			a	b	с	d		
Outcomes	Continuous Assessment							
	1. Lab Exercises / Assignments	60%	~	~	~	~		
	2. Project		~	~	~	~		
	3. Quiz		~	✓				
	Examination	40%	$\checkmark$	$\checkmark$		$\checkmark$		
	Total	100 %						
	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing intended learning outcomes:</li> <li>Continuous assessments consist of a project, assignments, lab exercises, and quizz which are designed to facilitate students to achieve intended learning outcomes. I exercise is designed to encourage students to acquire deep understanding of relevant knowledge, practice in order to enrich their hands-on experience with varies software tools. The project is designed to enhance students' ability to acquire understanding and using different knowledge, principles, techniques, tools to solv real problem through team. Quizzes are to ensure the students understand the concept.</li> </ul>					sessing the		
						ind quizzes, comes. Lab ding of the with various acquire the ls to solve a he concepts.		
	Examination will evaluate	e student's unde	erstanding a	nd usage	of big data te	chnologies.		
Student Study Effort	Class contact:							
Expected	<ul> <li>Lectures</li> </ul>					26 Hrs.		
	Tutorials/Laboratory					13 Hrs.		
	Other student study effort							
	• Review the lecture					28 Hrs.		
	• Review the lab					14 Hrs.		

	•	Work on the project	15 Hrs.
	•	Prepare the quizzes	9 Hrs.
	•	Prepare the examination	11 Hrs.
	Tota	al student study effort	116 Hrs.
Reading List	Ref	erence Books:	
and References	1.	Dolan, J.C.B., Dunlap, M., Hellerstein, J.M. and Wel Analysis Practices for Big Data, 2009.	ton, C., MAD Skills: New
	2.	Rajaraman, Anand and Ullman, Jeffery David, Min. Chapters 1-2, 2011.	ing of Massive Datasets,
	3.	Stonebraker, M., Abadi, D., DeWitt, David J., Madde A. and Rasin, A., "MapReduce and Parallel DBM <i>Communications of the ACM</i> , January 2010.	en, S., Paulson, E., Pavlo, IS's: Friends or Foes?",
	4.	Dean, Jeffrey and Ghemawat, Sanjay, "MapReduce: A Tool", <i>Communications of the ACM</i> , January 2010.	Flexible Data Processing
	5.	Lin, Jimmy and Dyer, Chris, <i>Data-Intensive Text Pro</i> Morgan and Claypool, 2010.	cessing with MapReduce,
	6.	Cattell, Rick, "Scalable SQL and NoSQL Data Stores" Volume 39, Issue 4, December 2010.	', ACM SIGMOD Record,
	7.	Elmagarmid, Ahmed K., Ipeirotis, Panagiotis G. and "Duplicate Record Detection: A Survey", <i>IEEE Transa</i> <i>Data Engineering</i> , Volume 19, Issue 1, January 2007.	d Verykios, Vassilios S., actions on Knowledge and
	8.	Koudas, N., Sarawagi, S. and Srivastava, D., "Rec Measures and Algorithms", <i>Proceedings of the ACM</i> <i>Conference on Management of Data</i> , June 2006.	ord Linkage: Similarity A SIGMOD International
	9.	Hothorn, Torsten and Everitt, Brian S., A Handbook of $R$ , 3 rd Edition, Chapter 3, CRC Press, 2014.	Statistical Analyses Using
	10.	Gregory Park on overfitting to the leaderboard in a Ka	ggle Competition.
	11.	Wu, X.D., Kumar, V., Quinlan, J. Ross, Ghosh, J., Ya Algorithms in Data Mining, Knowledge and Informat <i>knowledge and Information Systems</i> , Volume 14, Is (Read C4.5)	ng, Q. and et al., "Top 10 tion Systems", <i>Journal of</i> ssue 1, page 1-37, 2007.
	12.	Domingos, Pedro, "A Few Useful Things to Know a Communications of the ACM, Volume 55, Issue 10, 20	bout Machine Learning", )12.
	13.	Alpaydin, Ethem, Introduction to Machine Learning 2015.	, 3 rd Edition, MIT Press,
	14.	Haykin, Simon, <i>Neural Networks and Learning Mach</i> 2016.	ines, 3 rd Edition, Pearson,

15. I	Hanaran, Pat, Tools for Data Enthusiasts.
16. I	Heer, J., Bostock, M. and Ogievetsky, V., "A Tour through the Visualization Zoo", <i>Communications of the ACM</i> , Volume 53, Issue 6, June 2010.

## The Hong Kong Polytechnic University

Subject Code	COMP4436
Subject Title	Artificial Intelligence of Things
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	COMP1011 / COMP1012 / ENG2002
Objectives	Students will learn the concepts and principles of AI empowered IoT. This subject teaches students the fundamentals and AIoT technology, covering concepts, methods, techniques, systems and applications.
	Students are expected to have preliminary background in computer programming, and AI.
	Students will be able to understand the fundamentals of AIoT, develop AIoT systems and apply AIoT to real-world applications.
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) Understand the fundamental concepts, technical challenges, and the state-of-the-art technology development and applications of AIoT;</li> <li>(b) Understand the protocols and platforms for sensing, networking and data analytics in IoT systems;</li> <li>(c) Learn and deploy the AI models, algorithms and techniques for IoT operation efficiency, cost reduction, event detection, and predictive maintenance in practice.</li> <li>(d) Discover potential AI-oriented usage scenarios in IoT and apply AIoT methods and techniques to solve various challenging IoT problems for practical applications with innovative solutions.</li> </ul>
Subject Synopsis/ Indicative Syllabus (Note 2)	<ul> <li>Fundamentals         <ul> <li>Introduction to IoT: IoT applications, sensor systems, IoT sensing techniques, IoT networking, IoT Data analytics, IoT platforms and systems</li> <li>Introduction to AIoT: AIoT concepts and issues, Technologies behind AIoT, AIoT application segments.</li> </ul> </li> <li>Advanced topics         <ul> <li>Technical architecture of AIoT</li> <li>Smart sensors and devices; Wearables; Smart object and human sensing</li> <li>Challenges of AI in networks for IoT</li> <li>AI for IoT data analytics and automation</li> </ul> </li> </ul>

	<ul> <li>Distributed intelligence at the edge of IoT systems (edge computing; blockchain, etc.)</li> <li>Debatics for AIoT</li> </ul>							
	• Robolics for Alo	• RODOTICS FOR A101						
	Intelligent manufactorial     construction.	<ul> <li>Intelligent manufacturing; Smart health; Smart infrastructure and construction.</li> </ul>						
Teaching/Learning Methodology	The course is comprise students are taught the drive the development of	The course is comprised of lectures, tutorials, and labs. During lectures, students are taught the important concepts, principles and technologies that drive the development of AIoT.						
(Note 3)	During tutorials and labs, students will be presented with both theoretical questions and practical scenarios of AIoT, and are required to study, analyze and propose solutions. Small group discussions will be encouraged and students will need to present their results and solutions in the form of reports and presentations.							
Assessment Methods			1					
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	becific assessment % Intended subject learning outcomes to be assessed (Please tick as appropriate)				ies to		
(Note 4)			а	b	c	d		
	1. Assignments	35%	~	~	~			
	2. Project	25%	✓	$\checkmark$	✓	✓		
	3. Exam	40%	~	$\checkmark$	~	~		
	Total	100 %						
	Explanation of the appro intended learning outcom Students will be as assignments, project, a Assignments are writte assess students' abiliti algorithm design, and p Projects involve a grou for a practical AIoT ap to apply what they hav The results are to b	priateness of thes: esessed by nd examination homework es for comporoblem solv up of student pplication. So we learned in one presented	the asse their ion. and/ or rehens ing. ts to do tudent the cla in th	perfor perfor pr prog ion of esign a s colla ass to ne for	t metho rmance gramm conce and im borativ solve j m of	ods in a e in ing ho pts an pleme vely w practic report	ssessir three mewo d prin nt a so ork to al pro ts and	g the parts: rk that ciples, olution ogether blems. d / or
	presentations. Exam is designed to assess students for their critical thinking skills and independent problem-solving ability.							
Student Study	Class contact:							
Effort Expected	Lecture						20	5 Hrs.

	Tutorial / Seminar / Lab	13 Hrs.		
	Other student study effort:			
	<ul> <li>Self-study &amp; reading, etc.</li> </ul>	83 Hrs.		
	Total student study effort	122 Hrs.		
Reading List and	Reference Books:	·		
References	<ol> <li>"Rethinking the Internet of Things: A Scalable A Connecting Everything", by Francis DaCosta. Pu 2013.</li> </ol>	Approach to ublisher: Apress.		
	2. "Internet of Things", by Vlasios Tsiatsis Stamati Holler David Boyle Catherine Mulligan. Publish edition. 2018.	is Karnouskos Jan her: Elsevier. 2 nd		
	3. "Big-Data Analytics for Cloud, IoT and Cognitive Computing", by Kai Hwang and Min Chen. Publisher: Wiley. 2017.			
	4. "Hands-On Artificial Intelligence for IoT: Exper and deep learning techniques for developing sma Amita Kapoor. Publisher: Packt Publishing Ltd.	rt machine learning arter IoT systems", by 2018.		
	5. "AIoT Innovation", ed. Fadi AI-Turjman. Publis	her: Springer. 2020		
	<ol> <li>"The Future of Artificial Intelligence, the Internet Blockchain: From AI to AIoT to AIoTB". By Eu Publisher: Amazon. 2019.</li> </ol>	et of Things, and igene Chang.		

#### Note 1: Intended Learning Outcomes

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

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

Subject Code	COMP4442
Subject Title	Service and Cloud Computing
Credit Value	3
Level	4
Pre-requisite / Co-requisite / Exclusion	<b>Pre-requisite</b> : 2421 Computer Organization & COMP 2432 Operating Systems, or equivalent subjects
Objectives	<ul> <li>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 include:</li> <li>To provide students with a broad view of the theoretical and technological aspects that has led to the evolution of service and cloud computing;</li> <li>To 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;</li> <li>To equip students with the underlying technologies of service and cloud computing including service-oriented architecture, cloud architecture and service models, virtualization, and cloud management; and</li> <li>To equip students with the knowledge and skills for the planning, design and programming of cloud systems and software services for real-world applications.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) understand and appreciate the technological impact of service and cloud computing for future enterprises, and the technologies underpinning it;</li> <li>(b) apply systematic and principled practices to designing, implementing and deploying service and cloud-oriented computing; and</li> <li>(c) review and assess the risks, opportunities, costs and steps towards migrating existing systems to service and cloud computing.</li> </ul> </li> <li>Attributes for all-roundedness <ul> <li>(d) systematic and incremental approach to resolving practical enterprise computing problems and challenges;</li> <li>(e) learn to work effectively as a team member; and</li> </ul> </li> </ul>

	(f) write technical reports and present solutions.						
Subject							
Subject Synopsis/							
Indicative Syllabus	1. Overview						
Synabus	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; Virtualization and Containerization; 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/	The course is comprised of lectures, tutorials and laboratory exercises. During						
Learning Methodology	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, analyze 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	Specific assessment methods/tasks	% Intended subject learning outcomes to be assessed (Please tick as appropriate)						to be ate)	
Intended Learning			a	b	c	d	e	f	
Outcomes	1. Continuous Assessments	55%	✓	✓	~	~	~	~	
	2. Final Examination	45%	~	$\checkmark$	~	✓			
	Total	100%							
	Explanation of the appro intended learning outcome	priateness c	of the a	ssessm	ent met	hods in	n assess	sing the	
	<ul> <li>Students taking the subject will be assessed by performance in two parts: continuous assessments and examination. Continuous assessment may include in-cla discussions / quizzes, assignments, and tests.</li> <li>The in-class discussions and quizzes engage students to actively participate learning during lectures and tutorials. Students are to collaboratively work togeth 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 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 a presentations. Tests and assignments are designed to help students reinforced th understanding of concepts and principles that are taught in the class. They a conducted to assess independent problem solving and critical thinking skills.</li> </ul>						ntinuous in-class		
							ipate in together ignment her in a epts that orts and red their hey are		
Student Study	Class contact:								
Enori Expected	<ul> <li>Lectures, Tutorials / Labs</li> </ul>						39 Hrs.		
	Other student study effort:								
	<ul> <li>Assignments, Projects</li> </ul>	, Reading an	nd Exam	1			e	66 Hrs.	
	Total student study effort						10	)5 Hrs.	
Reading List and References	<ul> <li><b>Reference Books:</b></li> <li>1. Chellammal Suriana <i>Computing</i>, Springer</li> <li>2 Arshdeen Bahga and</li> </ul>	rayanan and , 2019. Vijay Madis	Pethur	ru Raj	Chellial	n, Esser	ntials o	f Cloud	
	Hands-On Approach	, Arshdeep E	Bahga &	Vijay	Madiset	ti, 2019			

Subject Code	CSE30313
Subject Title	Machine Learning Practice in Smart Mobility
Credit Value	3
Level	3
Pre-requisite	One basic mathematics subject* and one basic computer programming subject^
	*AMA2007 Intermediate Calculus and Linear Algebra/ AMA2111 Mathematics I/ AMA2131 Mathematics for Engineers/ AMA2308 Mathematics for Engineers/ AMA2707 Intermediate Calculus and Linear Algebra/ AMA290 Engineering Mathematics
	^AMA2222 Principles of Programming/ AMA2222A Principles of Programming / COMP1011 Programming Fundamentals/ COMP1012 Programming Fundamentals and Applications/ ENG2002 Computer Programming
Objectives	This subject aims to help students to learn the basic concepts in smart mobility, fundamentals in machine learning, and to obtain hands-on experience in developing smart mobility applications using emerging machine learning methods. Emphasis will be given to increase students' interest in smart mobility-related research on real-world scenarios.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) Understand the general concepts of smart mobility.</li> <li>(b) Apply emerging quantitative and machine learning technologies/ skills in smart mobility applications and develop solutions to smart mobility problems by applying the engineering research process.</li> <li>(c) Develop active learning, self-learning, and peer learning skills through project-based research inquiries.</li> <li>(d) Develop professional skills such as professional communication, teamwork, and time management.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>This subject covers the following contents:</li> <li>1. <u>Smart Mobility Concepts (1 week)</u> Overview of the concepts of smart mobility, emerging technologies in the era of big data analytics and urban informatics, and the state-of-the-art progress in smart mobility development in both Hong Kong and the rest of the world. This section mainly achieves the learning outcome (a).</li> <li>2. Review of Quantitative Methods (2 weeks)</li> </ul>

	Review of the basic the section mainly achieves	eory of opting the learning	nization g outcom	and statiste (b).	tical meth	ods. This		
	3. <u>Practical Implementation of Machine Learning Methods (4 week</u> Understand and implement existing machine learning algorithms su classification, regression, detection, and clustering with Jupyter Noted describe and analyze the performance of machine learning mo understand the practical implications in smart mobility. This se mainly achieves the learning outcome (b).							
	4. <u>Hands-on Projects (</u> Project-based learning perspectives in smart r crowd-sensing. The ha outcomes (b)(c)(d). Bo without machine learnin project is as follows:	<u>6 weeks)</u> for hand nobility, suc nds-on projects oth projects ng backgrou	s-on pro h as em ects parti are desi nds, and	ojects that erging mo icularly ac igned for one exam	at cover obility ser chieve the students ple of the	different vices and e learning with and hands-on		
	<ul> <li>Autonomous dra develop a frame along the roads. programs to con algorithms as ob collaborate with</li> </ul>	iving with m work that ca The projec ntrol the mA oject detection teammates	AVs: th n automa t require Vs, to f on and cl in differe	is task cha tically cor s the skills formulate assification ent backgro	allenges s ntrol mAV s to write road lane on probler ounds.	tudents to Vs to drive computer detection ns, and to		
	mAVs: mini-sized au	tonomous veł	nicles					
Teaching/Learning Methodology	The subject is delivered used to explain basic co- machine learning appli- integrate the previously familiarize the students and research questions Students need to comple- course project progress used to evaluate the pro-	l using both oncepts and cations. The learned sub s with state- in smart mol ete a set of as report, dem ject outcom	lectures a theories projects jects with of-the-an bility. ssignmen onstratio es.	and projec in smart n are used n hands-or t machine ts during t n, as well	ets. The le nobility a to train s n experien e learning the lecture as presen	ctures are nd related tudents to ce, and to 5 methods es, and the tation are		
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks%Intended subject learning outcomes to be assessed (Please tick as appropriate)							
Guilling	1 1 1	200/	a	0		u		
	1. Assignments	20%	<b>v</b>	<b>▼</b>				
	2. Test	30%	<b>√</b>	<b>√</b>				
	3. Course Project	50%	✓	✓	✓	✓		
	Total	100 %						
	Explanation of the a assessing the intended	ppropriater learning ou	less of t tcomes:	the assess	sment m	ethods in		

	<ul> <li>Students will be assessed with continuous assessment. The continuous assessment consists of a set of assignments (20%), test (30%) and one course project (50%).</li> <li>Each assignment is designed to cover a particular aspect of quantitative skills and machine learning methods.</li> <li>The course project will be carried out in a group, but the performance of each student will be assessed individually. The performance assessment is based on progress updates, project demonstration, and oral presentation.</li> </ul>					
Student Study	Class contact:					
Enort Expected	<ul> <li>Lecture</li> </ul>	26 Hrs.				
	<ul> <li>Tutorials / Project meeting</li> </ul>	13 Hrs.				
	Other student study effort:					
	<ul> <li>Reading and studying</li> </ul>	20 Hrs.				
	<ul> <li>Assignments</li> </ul>	20 Hrs.				
	Course Project	40 Hrs.				
	Total student study effort119 Hrs.					
Reading List and References	<ol> <li>(1) Goldsmith, S., &amp; Crawford, S. (2014). The response communities through data-smart governance. John V (2) Bishop, B. (2006). Pattern Recognition and Mac Springer.</li> <li>(3) Hong Kong Smart City Blueprint: <u>https://www.s</u></li> <li>(4) Transport Department: <u>https://www.td.gov.hk/en</u></li> <li>(5) Sidewalk Labs Toronto <u>https://www.sidewalktor</u></li> </ol>	onsive city: Engaging Wiley & Sons hine Learning. smartcity.gov.hk/ n/home/index.html ronto.ca/documents/				

Subject Code	CSE49407
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite	All CSE subjects in level 3 and all core subjects in level 1-3 of AIDA (Secondary Major)
Exclusion	Any other equivalent capstone project
Objectives	The objectives of this subject are to:
	<ul> <li>provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to his/her discipline.</li> <li>develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA.</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> </li> <li>Attributes for all-roundedness <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(j) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> <li>Presentation and Demonstration</li> <li>Students are expected to identify a project topic with a supervisor in their chosen discipline, and a co-supervisor with artificial intelligence and data analytics expertise.</li> <li>Students need to demonstrate their knowledge in both their chosen discipline and AIDA</li> </ol>

	in the project, receiving advice from both supervisors. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.												
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.												
Assessment Methods		_	-										
in Alignment with Intended Learning	Specific assessment	% weighting		Intend	ied su	ıbject (Plea	learn ise tic	ing ou k as a	itcom pprop	es to riate)	be as	sessec	1
Outcomes	methods/tasks		a	b	c	d	e	f	g	h	i	j	k
	Continuous Assessment	100	1	1	1	1	1	1	1	1	1	1	1
	Total	100											
Student Study Effort	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing the interval learning outcomes:</li> <li>The Integrated Capstone Project will be accessed by the supervisor/co-supervisor a other assessors. Attributes to be assessed include, but not limited to, Probl Identification, Problem Solving, Communication and Presentation, Project Manageme and Self-Discipline.</li> <li>Integrated Capstone Projects should be problem-oriented and there are no restrictions the nature of the problem except that it should be relevant to the student's cho discipline and AIDA. The project could be practical, academic or a hybrid in which student is encouraged but not constrained to have some original contributions. Eastudent has to submit a proposal, a mid-term checkpoint progress report and a final rep. The proposal must be approved by the supervisor/co-supervisor before the student or proceed with the Integrated Capstone Project. An oral presentation and demonstration may a be required for proper continuous assessment.</li> </ul>							ended or and oblem ment, ons on hosen ch the Each eport. nt can tion is y also					
Expected													
	• Lecture											0	Hrs.
	Other student st	udy effort:											
	• Searching and reading materials, meeting with supervisor / co-supervisor / others, design and system development, testing, documentation, presentation, etc.							210	Hrs.				
	Total student stu	udy effort										210	Hrs

Reading List and	Reference Books:
Keterences	1. Kumar, Ranjit, <i>Research Methodology: A Step-by-step Guide for Beginners</i> , 3rd Edition, SAGE Publications, 2011.
	2. Burns, Robert B., <i>Introduction to Research Methods</i> , 4th Edition, SAGE Publications, 2000.
	3. Roberts, Carol M., <i>The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation</i> , 3rd Edition, Corwin Press, 2007.
	<ol> <li>Mauch, James E. and Park, Namgi, Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty, 5th Edition, Marcel Dekker, 2003.</li> </ol>
	<ol> <li>Rudestam, Kjell Erik and Newton, Rae R., Surviving Your Dissertation: A Comprehensive Guide to Content and Process, 2nd Edition, Sage Publications, 2001.</li> </ol>
	6. Garson, G. David, <i>Guide to Writing Empirical Papers, Theses and Dissertations</i> , Marcel Dekker, 2002.
	<ol> <li>Reinhart, Susan M., <i>Giving Academic Presentations</i>, 2nd Edition, University of Michigan Press, 2013.</li> </ol>
	8. Oshima, Alice and Hogue, Ann, <i>Writing Academic English</i> , 4th Edition, Pearson Longman, 2006.
	9. American Psychological Association. <i>Publication Manual of the American</i> <i>Psychological Association</i> , 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.

### The Hong Kong Polytechnic University

Subject Code	EE3013B
Subject Title	Transportation Data Analytics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Co-requisite: EE2029B
Objectives	1. To introduce various types of transportation data and ways to use the data to assess, analyze, and assist the modeling of transportation systems.
	2. To equip the students with modeling and analysis techniques for transportation data.
	3. To enable the students to understand problems and issues in real-world transportation data and methods to deal with them.
	4. To prepare the students for tackling real-world transportation problems using data, with a combination of deep understanding of data issues and solid analytical skills.
Intended Learning	Upon completion of the subject, students will be able to:
Outcomes	a. Demonstrate theoretical knowledge of transportation data analytics
	b. Apply appropriate data analytics methods and tools to various types of transportation data and interpret the results
	c. Understand problems and issues in real-world data and ways to tackle those problems and issues
Subject Synopsis/ Indicative Syllabus	1. Diagnosis of roadway traffic using fixed-location sensor data and floating vehicle sensor data, bottleneck detection, and delay calculation
	2. Estimation of vehicle queue length and delay at traffic signals
	3. Modeling passenger and vehicle traffic using Bluetooth and Wi-Fi sensor data
	4. Understanding transit passenger behavior using ridership data, travel time estimation
	5. Modeling travel behavior using travel survey data, discrete choice model, regression

Teaching/Learning Methodology	Delivery of the subject is mainly through formal lectures and complemented by tutorials. Assignments and projects provide students hands-on experience in data modelling, estimation, and analysis of practical transportation problems, while report-writing enables students to practise writing skill.						
	Teaching/Learning Method	ology		Outcomes	Outcomes		
			a	b	с		
	Lectures		✓	✓	✓		
	Tutorials		✓	~	$\checkmark$		
	Assignments and Projects		$\checkmark$	✓	$\checkmark$		
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended su outcomes t	ubject learnin o be assessed	ng 1		
Outcomes			a	b	с		
	1. Individual assignments	60%	~	~	✓		
	2. Group projects	40%	~	~	$\checkmark$		
	Total	100 %					
	Individual assignments and group projects enable students to explore and analytical and tool-based data modelling techniques to evaluate transpo systems' characteristics and performance. Report-writing (for both indi assignments and group projects) enables students to interpret the data and results, link them to practical issues in transportation systems and solutions.						
Student Study	Class contact:						
Effort Expected	Lecture/Tutorial	39 Hrs.					
	Other student study effort:						
	Individual assignment	nts and Group	Projects	35 Hrs.			
	Self-study				33 Hrs.		
	Total student study effort				107 Hrs.		
Reading List and References	<ol> <li>Richard J. Larsen and Morris L. Marx, An Introduction to Mathematical Statistics and Its Applications, 5th Edition, Prentice Hall, 2012.</li> <li>Robert S. Pindick and Daniel L. Rubinfeld, Econometric Models and</li> </ol>						
	<ul> <li>Economic Forecasts, 4</li> <li>Jeremy Watt, Reza Bor Learning Refined: Fou Cambridge University</li> </ul>	th Edition, Ir hani and Ag ndations, Alg Press, 2016.	win/McGra gelos K. Ka gorithms, ar	w-Hill, 199 tsaggelos, N nd Applicati	8. Aachine ons,		
	4. Marco Gori, Machine I Morgan Kaufmann, 20	Learning: A ( 17.	Constraint-H	Based Appro	oach,		

# The Hong Kong Polytechnic University

Subject Code	EE4014A
Subject Title	Intelligent Systems Applications in Electrical Engineering
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce students to the fundamentals of intelligent systems and their applications in Electrical Engineering.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Have acquired a good understanding of the fundamental concepts and characteristics and methodologies of intelligent systems.</li> <li>b. Be able to appreciate the power and usefulness of intelligent systems.</li> <li>c. Be able to understand various intelligent system techniques such as expert systems, evolutionary computation, and neural network.</li> <li>d. Be able to integrate the intelligent system approaches in real-life problems.</li> <li>e. Have acquired skills in presentation and interpretation of mini-project results and communicate in written form.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>Knowledge-based intelligent system: Concepts. Knowledge representation techniques. Structure of a rule-based expert system. Forward and backward chaining inference techniques.</li> <li>Artificial neural network: Concepts. Perceptron. Multi-layer neural network. Training of neural networks. Recurrent and convolutional neural network. Supervised and unsupervised learning.</li> <li>Evolutionary computation: Concepts. Genetic algorithm. Particle swarm optimization.</li> <li>Applications of intelligent systems.</li> <li>Mini-project:         Apply the introduced intelligent system techniques to solve an engineering problem     </li> </ol>

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through mini-projects, in which the students are expected to solve the engineering problems using intelligent techniques with critical and analytical thinking. Mini-projects are designed to supplement the lecturing materials so that the students are encouraged to take extra readings and to look for relevant information.							ts ns ne al 30 nt		
	Teaching/Learning			Out	comes	5			ך	
	Methodology	а	b		c	d		e		
	Lectures	$\checkmark$	✓		$\checkmark$	$\checkmark$				
	Tutorials	$\checkmark$	✓		✓	$\checkmark$				
	Mini-projects	$\checkmark$	$\checkmark$		✓	$\checkmark$		$\checkmark$		
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks % Inter weighting a						ended subject learning tcomes to be assessed			
	1. Examination	4	0%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	2. Class Test	2	5%	✓	$\checkmark$	$\checkmark$				
	3. Mini-project Report and Presentation	2	5%	✓	~	✓	~	✓		
	4. Exercises	1	0%	✓	$\checkmark$	✓				
	Total	10	0%							
	The outcomes on concepts, design and applications are assessed by the usual means of examination, test and exercises. Mini-projects and written report assess those on analytical skills, problem-solving techniques and practical considerations of intelligent system applications, as well as technical reporting teamwork and presentation skills.						al rt al g,			
Student Study	Class contact:									
Effort Expected	<ul> <li>Lecture/Tutorial</li> </ul>						33	B Hrs.	,	
	<ul> <li>Mini-project presentation</li> </ul>						(	5 Hrs.		
	Other student study effort:									
	<ul> <li>Mini-project preparation/report</li> </ul>						16	5 Hrs.		
	<ul> <li>Self-study</li> </ul>						5(	) Hrs.		
	Total student study effort						105	5 Hrs.		
Reading List and References	<ul> <li>Reference books:</li> <li>1. K.Y. Lee and M.A. El-Sh Techniques: Theory and App Press, 2008</li> <li>2. M. Negnevitsky, Artificial Intr Addison-Wesley, 2011</li> <li>3. S. Samarasinghe, Neural Netw from Fundamentals to Co Publications, 2016</li> </ul>	arkawi, dication elligence orks for omplex	Mode s to F e - A ( Applie Patter	ern I Power Guide ed Sci rn R	Heuris Syst to In ences Recogn	stic ( ems, tellige and hition.	Dptim Wiley ent Sy Engin Au	izatic y-IEE /stem eerin erbac	)n Æ s, g: ch	

Subject Code	EE4023
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	<b>Exclusion</b> : Any other equivalent capstone project <b>Pre-requisite:</b> The student should have completed most of the subjects required in previous years of the programme before taking this subject. <b>Co-requisite:</b> EE4014A
Objectives	The objectives of this subject are to:
	<ul> <li>provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) in electrical or transportation engineering.</li> <li>develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA.</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> </li> <li><u>Attributes for all-roundedness</u> <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(j) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(k) work collaboratively with related parties.</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> <li>Presentation and Demonstration</li> <li>Students are expected to identify a project topic with a supervisor in their chosen discipline. Students need to demonstrate their knowledge in both their chosen discipline and AIDA in the project, receiving advice from the supervisor. The project should</li> </ol>

	represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.												
Teaching/Learning Methodology	The Integrated ( semesters. The t supervisor, guid and other projec	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor, guided study of project materials, independent project development work and other project management tasks.											
Assessment Methods in Alignment with Intended Learning	Specific	% weighting		Intend	led su	ıbject (Plea	learn se tic	ing ou k as a	itcom	es to riate)	be ass	sessec	l
Outcomes	methods/tasks	, eighting	a	b	с	d	e	f	g	h	i	i	k
	Continuous Assessment	100	1	1	1	1	~	1	✓	1	1	<i>√</i>	1
	Total	100		•			•			•			•
Stadawt Stadaw be Effered	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing the intellearning outcomes:</li> <li>The Integrated Capstone Project will be accessed by the supervisor/co-supervisor other assessors. Attributes to be assessed include, but not limited to, Pro Identification, Problem Solving, Communication and Presentation, Project Manager and Self-Discipline.</li> <li>Integrated Capstone Projects should be problem-oriented and there are no restriction the nature of the problem except that it should be relevant to the student's ch discipline and AIDA. The project could be practical, academic or a hybrid in whic student is encouraged but not constrained to have some original contributions. student has to submit a proposal, a mid-term progress report and a final report. proposal must be approved by the supervisor/co-supervisor before the student can prowith the Integrated Capstone Project. A mid-term oral presentation and demonstrati required for proper continuous assessment. An oral presentation and demonstrati essential at the end of the project.</li> </ul>						ended or and oblem ment, ons on hosen ch the Each The occeed ion is ion is						
Expected	Class contact:     Briefing											2	Hrs.
	Other student st	udy effort:											
	• Searching and reading materials, meeting with supervisor / co-supervisor / others, design and system development, testing, documentation, presentation, etc.					208	Hrs.						
	Total student stu	udy effort										210	Hrs
Reading List and References	Reference Bool	ks: To be ad	vised	by su	pervi	sor							

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	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Category A: Professional/academic knowledge and skills</u></li> <li>1. Understand the basic concepts and technologies of data science.</li> <li>2. Acquire the basic technical know-how on data analytics.</li> <li><u>Category B: Attributes for all-roundedness</u></li> <li>3. Understand the data-driven process for problem solving.</li> <li>4. Demonstrate how to harness and process data for decision-making.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>Introduction to Data Science         <ul> <li>Data science vs. big data vs. data analytics</li> <li>Benefits of data science</li> <li>Skill sets required</li> <li>Privacy, security and ethics</li> <li>Example applications and case studies</li> </ul> </li> <li>Technologies for Data Science         <ul> <li>Basic concepts in summary statistics</li> <li>Graphs and plots for data analytics, e.g., box plots, scatter plots, histograms, run charts, etc.</li> <li>Example case studies of exploratory data analytics for data science</li> <li>Fundamental of machine learning for data science</li> <li>Cloud technologies</li> </ul> </li> <li>Tools for Data Science         <ul> <li>Data cleaning, e.g., OpenRefine</li> <li>Machine learning tools, e.g., Google Chart, Tableau</li> </ul> </li> <li>Applications with Case Studies         <ul> <li>Recommendation systems</li> <li>Spam filtering</li> <li>Stock prediction</li> <li>Social networks</li> <li>Sentiment analysis</li> </ul> </li> </ol>
Teaching/Learning Methodology	<b>Lectures</b> : 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. <b>Tutorials and Workshops</b> : Students will work on data analytics projects using

	software tools. Students will sta of the subject. In the second ha that solves real-world problems, have learnt from the small proje	rt from small a lf, students wil using the kno cts.	and easy pro I work on a r wledge and I	jects in the nore realist know-hows	first half ic project that they
	Assignment: Students will nea	ed to do a gr	oup-based r	mini-project	on data
Assessment Methods in Alignment with Intended Subject Learning Outcomes	Specific Assessment Methods/Tasks	% Weighting	Intended S Outcomes (Please tic appropriat	arning essed	
-			1 :	2 3	4
	1. Continuous Assessment (total: 100%)				
	Mini-project (proposal, report and presentation)	30%	× ,	/ /	~
	Exercises	16%	✓ ·	/	
	Tests	24%	× ,	/	
	Laboratory activities	30%	✓ ·	/ /	~
	Total	100%			
	Explanation of the appropr assessing the intended learning Laboratory exercises and mini- have learnt to solve problems, students to exercise their creative Tests and Exercises assess stur a more formal manner. Mini-project is group-based and the 30% weight, 7% is for pro- presentation (in the form of a 1 total) are evaluated based on individually. Each group member in the mini-project. The mini-pr such as Microsoft Azure Mach programming knowledge is a background is assumed. Studer machine learning models, analy tool to solve data science proble based API to perform more com Tests and Exercises weight 40%	iateness of ng outcomes: project will req There will be vity in solution dents' achieve weights 30% of posal, 13% is 0-minutes vide group, while r will present to oject will mak ine Learning kept to a m to will perform tic methods, a ems. Enthusias plex tasks.	the assess juire students open-ended design. ment of the I of the whole a for final rep eo). Proposa presentation the part he/si e use of pul Studio so th inimum, i.e. n drag and d and evaluatio stic students	ment met s to apply v questions t earning out assessmen ort, and 10 l and repor (10%) is e he is respo blicly availa nat requirer , no prog rop of data n methods could use the sessments.	hods in what they hat allow comes in t. Among 0% is for t (20% in evaluated nsible for able tools nents on ramming sources, from the he cloud-
	Laboratory activities weight 30%	and they are	individual as	sessments.	
	Overall, 80% of the assessmer based assessment.	nt is individual	assessment	and 20%	is group-
Student Study Effort	Class contact (time-tabled):				
Expected	Lectures (In-person and onli	ne)			22 Hours
	Tutorial/Laboratory/Practice	Classes			17 Hours
	Other student study effort:				
	Lecture: preview/review of n homework/assignment; prep	otes; paration for tes	t/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	<ol> <li>Reference Materials:</li> <li>L. Cao, Data Science Thinking: The Next Scientific, Economic Revolution. Cham: Springer International Public</li> <li>L. Igual and S. Sequi, Introduction to Data Science : a F Concepts, Techniques and Applications. Cham, Switt 2017.</li> <li>S. Alan and V. Torra, Data Science in Practice. C Springer 2019.</li> <li>G. Rebala, A. Ravi, and S. Churiwala, An Introduction to Cham, Switzerland: Springer 2019.</li> <li>P. Kromer and R. Jurney, Big Data for Chimps. O'Reilly, 2 014.</li> <li>A. Adhikari and J. DeNero, Computational and Inferent Foundations of Data Science. https://www.inferentialthink</li> </ol>	Technological and shing, 2018. Python Approach to zerland: Springer, ham, Switzerland: Machine Learning. 2016. ckt Publishing Ltd, ntial Thinking: The ting.com/

Subject Code	EIE3124
Subject Title	Fundamentals of Machine Intelligence
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	<ol> <li>To introduce basic knowledge about various algorithms that forms the foundation of machine intelligence.</li> <li>To develop practical knowledge about machine intelligence.</li> </ol>
Intended Subject	Upon completion of the subject, students will be able to:
Learning Outcomes	Category A: Professional/academic knowledge and skills 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	<ol> <li>Syllabus:         <ol> <li>Introduction to machine intelligence Ideas of machine intelligence; Use of statistics in various phases of machine intelligence including data preparation, model selection, model evaluation, model presentation and prediction.</li> <li>Use of statistics in machine intelligence Descriptive statistics; inferential statistics; Important findings in statistics for machine intelligence such as the Law of Large Numbers and Central Limit Theorem.</li> </ol> </li> <li>Parametric estimation Introduction to parametric estimation; classical parametric estimation such as Bayes Theorem, hypothesis testing and significance tests; Application examples of parametric estimation in machine intelligence including data pre-processing, parametric identification, model generation, validation and selection criteria.</li> </ol> <li>Linear approaches Introduction to basic ideas of linear approaches for regression in machine intelligence; Introduction to techniques such as univariate linear model, least-squares estimation and maximum likelihood estimation. Application examples of linear regression techniques.</li> <li>Monlinear approaches Introduction to basic ideas of nonlinear approaches for regression in machine intelligence; Introduction to techniques such as artificial neural networks and radial basis functions. Application examples of nonlinear approaches for regression.</li> <li>Laboratory experiments:         <ol> <li>Lab 1: Use of statistics in machine intelligence</li> <li>Lab 2: Parametric estimation</li> <li>Lab 3: Linear approaches for regression in machine intelligence</li> </ol> </li>

Teaching/ Learning Methodology	Teaching and Learning Method	and Intended Subject Learning Outcome		Remarks				
	Lectures	1, 2		Fundame concepts students.	ntal princi of the sub	ples and ke ject are de	ey livered to	
	Tutorials	1, 2		Suppleme	entary to le	ectures:		
				Students and to ha the lecture	will be ab ive a deel e material	le to clarify per unders s;	concepts tanding of	
				Problems discussed	and appli	cations are	given and	
	Laboratory sessions	2, 3		Students of machin	will evalua ie intellige	ate different nce.	t methods	
Assessment Methods in Alignment with Intended Subject	Specific Assessm Methods/ Task	ient	w	% /eighting	Intendeo Outcom (Please	_earning ssessed propriate)		
Learning					1	2	3	
Catoonioc	1. Continuous Assessment (total 40%)							
	• Tests			18%	$\checkmark$	$\checkmark$		
	Short quizzes			10%	$\checkmark$			
	Laboratory sessions			12%		$\checkmark$	$\checkmark$	
	2. Examination			60%	$\checkmark$	$\checkmark$		
	Total	Γotal						
	Explanation of th assessing the inter Specific Assessm Methods/Tasks	ne approp Inded learn Inent Rer	propriateness of the assessment methods earning outcomes: Remark					
	Short quizzes and assignments	The the con	They can measure the students' understanding of the theories and concepts as well as the comprehension of subject materials.					
	Tests and examina	ntion Enc eva and	End-of-chapter-type problems are use evaluate the students' ability in applying con and skills learned in the classroom;					
		Sturinde inde alte nee sys	Students need to think critically and to lear independently in order to come up with a alternative solution to an existing problem. The need to present their solutions logically an systematically in the tests and the examination					
	Laboratory session	ora will kno	Oral examination based on laboratory exercises will be conducted to evaluate student's technical knowledge and communication skills.					

Student Study	Class contact (time-tabled):						
Lifert Expected	Lecture	24 Hours					
	Tutorial/Laboratory/Practice Classes	15 hours					
	Other student study effort:						
	<ul> <li>Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</li> </ul>						
	<ul> <li>Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</li> <li>30 He</li> </ul>						
	Total student study effort:	105 Hours					
Reading List and References	<ol> <li>Jose Unpingco, Python for Probability, Statistics, and second edition, Springer, 2019.</li> <li>Steven W. Knox and Hoboken NJ, Machine learning: a Wiley 2018.</li> <li>James D. Miller, Statistics for Data Science: leverage th for data analysis, classification, regression, machine networks, Packt Publishing, 2017.</li> <li>Pratap Dangeti, Statistics for machine learning: unsupervised, and reinforcement learning models using Packt Publishing, 2017.</li> <li>Machine Learning: a Probabilistic Perspective by Press, 2012.</li> </ol>	d Machine Learning, concise introduction, ne power of statistics learning, and neural build supervised, g both Python and R, Kevin Murphy, MIT					

Subject Code	EIE3127
Subject Title	Artificial Intelligence of Things
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	EIE2112 Foundation Techniques in Artificial Intelligence EIE2113 Introduction of IoT
Objectives	<ol> <li>To introduce major application scenarios of artificial intelligence of things (AloT) and their societal impacts.</li> <li>To introduce AI techniques for AloT applications.</li> <li>To introduce communication, networking, and computing technologies for AloT.</li> </ol>
Intended Subject Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Category A: Professional/academic knowledge and skills</u></li> <li>1. Understand key features of AloT systems and design principles.</li> <li>2. Understand AI techniques, cloud/edge computing platforms, and wireless communication and networking techniques for AloT.</li> <li>3. Understand key application scenarios of AloT and their social impacts.</li> <li><u>Category B: Attributes for all-roundedness</u></li> <li>4. Think critically and creatively.</li> <li>5. Assimilate new technological development in related field.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li><u>AloT Basics</u>: Key features of AloT; Applications of AloT; Market and ecosystem of AloT.</li> <li><u>Communication and Networking for AloT</u>: Wireless communications and networking for AloT; Communication standards and protocols for AloT.</li> <li><u>Machine Learning for IoT</u>: Introduction of basic machine learning techniques for AloT.</li> <li><u>AloT Devices</u>: Onboard processors; Onboard sensors; Communication modules; Al accelerators.</li> <li><u>Cloud/edge Computing for AloT</u>: Cloud computing platforms; edge computing platforms.</li> <li><u>Techniques for Resource-constrained AloT Devices</u>: Neural network compression; Edge computing-assisted inference.</li> <li><u>AloT application scenarios</u>: Smart City; Industrial automation; Smart health; Internet of Vehicles.</li> </ol>

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/Learnin Methodology	ng		Intend	led Subj	ect Learn	ing Outco	omes
		· / <del>-</del> /		1	2	3	4	5
	Lectures / Tutoria	ls / l est			v	<b>√</b>	v	
	Laboratory					√	$\checkmark$	$\checkmark$
Assessment Methods in Alignment with Intended Subject Learning Outcomes	Specific assessment methods/tasks	% weight	Intended subject learnin ting be assessed (Please tick appropriate)				ing outco ick as	omes to
				1	2	3	4	5
	1. Assignments	25%	)	√	✓	✓	√	
	2. Test	15%	)	~	✓	✓		
	3. Laboratory	20%	)			✓	✓	✓
	4. Examination	40%	)	~	✓	✓		
	Total	100%	6					
	Explanation of t assessing the inter- Assignments, test, do further reading to problems for AloT s Laboratory requires develop AloT applie	he appr anded lea and exa for deepe systems. s students cations.	<b>copria</b> arning minat er lear s to d	atenes g outo tion le rning a lo furtl	es of the comes: and apply her readin	ne assess ts review the learn ng, search	sment m the taugh t material: n for inforr	ethods in t materials, s to solving nation, and
Student Study Effort	Class contact (time-tabled):							
Expected	Lectures							27 Hours
	Tutorial/Labora	tory						12 Hours
	Other student stu	dy effort	:					
	Lecture: preview preparation for	w/review test/exar	of no ninati	tes; as on	ssignmer	ıt;		36 Hours
	Tutorial/Labora     and/or reports v	tory: pre\ writing	/iew c	of mate	erials, rev	vision		30 Hours
	Total student stud	dy effort:						105 Hours

Reading List and References	Textbook:
	<ol> <li>Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos and David Boyle, <i>From Machine-To-Machine to the Internet of</i> <i>Things: Introduction to a New Age of Intelligence</i>, Academic Press, 2014.</li> <li>Gurjit Kaur, Pradeep Tomar, and Marcus Tanque, <i>Artificial Intelligence to</i> <i>Solve Pervasive Internet of Things Issues</i>, Academic Press, 2020.</li> <li>Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin, <i>Learning</i> <i>from Data</i>, AMLBook, 2017.</li> </ol>
	Reference Materials:
	<ol> <li>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.</li> <li>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.</li> </ol>
Last Updated	June 2021
Prepared by	ZHANG, Jun
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	Upon completion of the subject, students will be able to:
Outcomes	<ul> <li><u>Category A: Professional/academic knowledge and skills</u></li> <li>1. Understand different machine learning techniques</li> <li>2. Use different techniques for solving problems in cyber security</li> </ul>
	Category B: Attributes for all-roundedness
	3. Present ideas and findings effectively
Subject Synopsis/ Indicative Syllabus	Syllabus:
	<ol> <li><u>Machine learning techniques</u> Introduction to machine learning; Basic concepts and classification; Supervised learning and unsupervised learning; classification; clustering; Neural Networks; Support vector machines; Dimensionality reduction; Deep learning</li> </ol>
	<ol> <li>Machine learning development environments Software tools for implementing machine learning techniques; Generalization performance; Issues of over-fitting.</li> </ol>
	<ol> <li><u>Malware Analysis</u> 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.</li> </ol>
	<ol> <li><u>Phishing detection</u> 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.</li> </ol>
	5. <u>Anomaly Detection</u> 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:
	<ul> <li>Practical Works:</li> <li>1. Evaluation of machine learning techniques in malware detection</li> <li>2. Evaluation of machine learning techniques in phishing detection</li> <li>Forensic analysis of digital evidence.</li> </ul>

Teaching/Learning Methodology	Teaching and Learning Method	Intendeo Subject Learning Outcom	d F g e	Remarks					
	Lectures	1, 2	F	Fundamental principles and key concepts of the subject are delivered to students.					
	Tutorials	1, 2	S S h r a	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	S	Students will eva earning techniqu	aluate differ ies.	ent kinds o	of machine		
	Mini-project	1, 2, 3	S le S n	Students are required to study the use of machin learning techniques in cyber-security application Students will need to submit a written report an make a presentation.					
Assessment Methods in Alignment with Intended Learning	Specific Asse Methods/Task	ssment s	% Intended Subject Learnin Weighting Outcomes to be Assesse (Please tick as appropria						
Outcomes					1	2	3		
	1. Continuous (total 50%)	s Assessm )	nent						
	Tests			17%	$\checkmark$	$\checkmark$			
	Short quizz	zes		10%	$\checkmark$	$\checkmark$			
	Laboratory	sessions		5%		$\checkmark$	$\checkmark$		
	Mini-project	:t		18%		$\checkmark$	$\checkmark$		
	2. Examinatio	on		50%		$\checkmark$			
	Total			100%					
	The continuous and a mini-proje Explanation of assessing the in Specific Asse	assessme ect. intended ssment	sment consists of tests, short quizzes, laboratory exercises appropriateness of the assessment methods in led learning outcomes:						
	Nethods/Task	s	Thee		atudanta'	understand	ing of the		
	Short quizzes		<ul> <li>These can measure students' understanding of the theories and concepts as well as their comprehension of subject materials.</li> <li>end-of chapter type problems used to evaluate students' ability in applying concepts and skills learnt in the classroom;</li> </ul>						
	Tests and examination								
			stude soluti	nts need to thin on for a problem	k critically ir ı.	n order to co	ome with a		
	Laboratory ses mini-project	sions,	oral stude skills.	examination w nt's technical	vill be cor knowledge	nducted to and com	evaluate munication		

Student Study	Class contact (time-tabled):					
	Lecture	24 Hours				
	Tutorial/Laboratory/Practice Classes	15 Hours				
	Other student study effort:					
	<ul> <li>Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</li> </ul>	26 Hours				
	<ul> <li>Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</li> </ul>	40 Hours				
	Total student study effort:	105 Hours				
Reading List and References	<ol> <li>Mark Stamp, Introduction to Machine Learning Security, Chapman and Hall/CRC, 2017.</li> </ol>	with Applications in Information				
	2. Chiheb Chebbi, Mastering Machine Learning Publishing Ltd, 2018.	Eearning for Penetration Testing, Packt				
	<ol> <li>Sumeet Dua and Xian Du, Data Mining and Mar Auerbach Publications, 2011.</li> </ol>	ian Du, Data Mining and Machine Learning in Cybersecurity, ons, 2011. arning Malware Analysis, Packt Publishing Ltd, 2018.				
	4. Monnappa K A, Learning Malware Analysis, Pac					
	<ol> <li>Dipanjan Sarkar, Raghav Bali and Tushar Shar with Python, Apress, 2018.</li> </ol>	ma, Practical Machine Learning				

	<ul> <li>4. <u>Convolutional Neural Networks (CNNs)</u> <ul> <li>4.1 Structure of CNNs</li> <li>4.2 Why convolution</li> <li>4.3 Internal representation of CNNs</li> <li>4.4 Applications of CNNs: object recognition, speech recognition, ECG classification, etc.</li> <li>4.5 Interpretability and visualization of CNNs</li> <li>4.6 Time-delay neural networks</li> </ul> </li> <li>5. <u>Recurrent Neural Networks (RNNs)</u> <ul> <li>5.1 Structure of RNNs</li> <li>5.2 Purpose of recurrent connections</li> <li>5.3 Long-short term memory (LSTM)</li> <li>5.4 Gated recurrent unit (GRU)</li> <li>5.5 Applications of RNNs: machine translation, sentiment analysis, etc.</li> <li>5.6 Attention in RNN</li> </ul> </li> </ul>							
	<ul> <li>6. <u>Applications of Deep Learning</u></li> <li>6.1 Healthcare</li> <li>6.2 Finance</li> <li>6.3 Computer vision</li> <li>6.4 Natural Language Processing</li> <li>6.5 Marketing and advertising</li> <li>6.6 Self-driving cars</li> </ul>							
	<ol> <li>Software and Hardware Tools         <ol> <li>Software stack: CUDA, cuDNN, Tensorflow, PyTorch, and Keras</li> <li>Cloud platforms: Amazon EC2 P3, Azure, Google Cloud, Nvidia GPU cloud, Alibaba Cloud, etc.</li> <li>Hardware: GPU, TPU, Nvidia Jetson</li> </ol> </li> </ol>							
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	Specific Assessment Methods/Tasks% WeightingIntended 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%	✓	$\checkmark$	✓	$\checkmark$		
	Total	100%						

	Explanation of the appropriateness of the assessm assessing the intended learning outcomes: Assignment, homework and laboratory exercises will require what they have learnt to solve problems. There will be oper that allow students to exercise their creativity in making desig Examination and tests: They assess students' achievement outcomes in a more formal manner.	ent methods in students to apply n-ended questions n. nt of the learning
Student Study Effort	Class contact (time-tabled):	
Expected	Lecture	24 Hours
	Tutorial/Laboratory/Practice Classes	15 Hours
	Other student study effort:	
	<ul> <li>Lecture: preview/review of notes; homework/assignment; preparation for test/quizzes/examination</li> </ul>	36 Hours
	<ul> <li>Tutorial/Laboratory/Practice Classes: preview of materials, revision and/or reports writing</li> </ul>	30 Hours
	Total student study effort:	105 Hours
Reading List and References	<ol> <li>Reference Materials:</li> <li>I. Goodfellow, Y. Bengio and A. Courville, Deep Learning,</li> <li>M.W. Mak and J.T. Chien, Machine Learning for Spectrum Cambridge University Press, 2020.</li> <li>C.M. Bishop, Pattern Recognition and Machine Learning,</li> <li>J. Langr and V. Bok, GANs in Action: Deep Learning Adversarial Networks (GANs), Manning Publications, 201</li> <li>F. Chollet, Deep Learning with Python, Manning Publication</li> </ol>	MIT Press 2016 eaker Recognition, Springer, 2006. g with Generative 8. ons, 2018.

Subject Code	EIE4128
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>provide students with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to their discipline.</li> <li>develop the capabilities of students in analyzing and solving complex and possibly real-life problems using AIDA.</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> </li> <li><u>Attributes for all-roundedness</u> <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(j) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(k) work collaboratively with related parties (e.g. vendors, sponsor companies, technical support staff, team-partners, research students, etc.).</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	Students are expected to identify a project topic with a supervisor in their chosen discipline, and a co-supervisor with artificial intelligence and data analytics expertise. Students need to demonstrate their knowledge in both their chosen discipline and AIDA in the project, receiving advice from both supervisors. The project should represent requisite effort in analyzing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain. The progression of the project will consist of the following stages. <b>Project Specification</b> 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. Method 5. Schedu	<ul><li>4. Methodology to be adopted;</li><li>5. Schedule.</li></ul>											
	<ul> <li>Project Execution</li> <li>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: <ol> <li>Adherence to the schedule;</li> <li>Achievement of objectives by the student's work;</li> <li>Initiatives of the students to work, design, and to solve problems;</li> <li>Inquisitiveness of the student (e.g. to probe into different phenomena or to try different approaches);</li> <li>Diligence of the students to spend sufficient effort on the project;</li> <li>Systematic documentation of data, design, results, etc. during the process of working out the project.</li> </ol> </li> </ul>												
	Project ReportAfter the project is completed, 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 												
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.												
Assessment Methods													
in Alignment with Intended Learning	Specific assessment	% weighting	Int	ende	d sub (	ject l Pleas	learni se tic	ing oi k as a	utcon appro	nes to priat	o be a e)	isses	sed
Outcomes	methods/ tasks		а	b	С	d	е	f	g	h	i	j	k
	Continuous Assessment	100	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
	Total	100											
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: The assessment of the project work is conducted continuously throughout the whole project period. The evidence of students' achievement will be documented in logbook 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. The Integrated Capstone Project will be assessed by the supervisor/co-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.												
	the nature of the	he problem e	exce	ot tha	it it s	hould	be r	eleva	nt to	the s	tuder	nt's c	nosen

	discipline and AIDA. 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/co-supervisor before the student can proceed with the Integrated 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:							
	Structured Study (regular meetings with supervisor)							
	Other student study effort:							
	<ul> <li>Guided Study/Reading/Experiment</li> <li>Reports</li> <li>Presentation and Demonstration</li> </ul>	132 Hours						
	Total student study effort	210 Hours						
Reading List and References	Reference Books:							
	To be specified by the project supervisor for each project.							

Subject Code	ENG2002
Subject Title	Computer Programming
Credit Value	3
Level	2
Pre-requisite/Co- requisite/Exclusion	Nil
Objectives	<ul> <li>(i) To introduce the fundamental concepts of computer programming</li> <li>(ii) To equip students with sound skills in C/C++ programming language</li> <li>(iii) To equip students with techniques for developing structured and object- oriented computer programs</li> <li>(iv) To demonstrate the techniques for implementing engineering applications using computer programs.</li> </ul>
Intended Subject Learning Outcomes	<ol> <li>Upon completion of the subject, students will be able to:</li> <li>Familiarize themselves with at least one C/C++ programming environment.</li> <li>Be proficient in using the basic constructs of C/C++ to develop a computer program.</li> <li>Develop a structured and documented computer program.</li> <li>Understand the fundamentals of object-oriented programming and be able to apply it in computer program development.</li> <li>Apply computer programming techniques to solve practical engineering problems.</li> </ol>
Subject Synopsis/ Indicative Syllabus	<ol> <li>Syllabus:</li> <li>Introduction to programming - Components of a computer; Programming environment; Process of application development.</li> <li>Bolts and Nuts of C/C++ - Preprocessor; Program code; Functions; Comments; Variables and constants; Expressions and statements; Operators.</li> <li>Program Flow Control - Branching and looping; Function parameters passing; Return values; Local and global variables; Scope of variables.</li> <li>Program Design and Debugging - Structured program design; Debugging a program. Case study: Using the Visual C++ debugger.</li> <li>Basic Object Oriented Programming - Objects and classes; Private versus public; Implementing class methods; Constructors and destructors.</li> <li>Pointer and Array - Stack and Free store; Create and delete objects in the free store; Pointer arithmetic; Passing function arguments by pointer; Returning values by pointer; Array of objects; Array and pointer; Array of pointers; Pointer of array; Character array; Command-line processing.</li> <li>Stream I/O - Input and output as streams; File I/O using streams.</li> </ol>

Teaching/Learning								
Methodology	Teaching and Learning Method	Intended Subject Learning Outcome	Remarks					
	Lectures, supplemented with short quizzes	2,3,4	Studen knowled program and Compre- is stren Studen skills of techniq structur applica	ts are dge illustra ehensio gthened ts will b using ( ues red tions.	introd of through ative n of th d with s e able f C/C++ of ol	uced con expla exa ne knov short qu to mon and ap deve bject-ol	to the mputer anation mples. wledge uizzes. itor the ply the eloping riented	
	Laboratories/tutorials where problems are given to students for them to solve	1,2,3,4	Student learnt problen purpose capture Tutors helping exercis take pla	at they and ises. student rtant lectu finishi ctive Q	have solve The s have points. rer in ng the &A will			
	Assignment, tests and final examination	1,2,3,4,5	By doing assignment, students of develop a firm understanding a comprehension of the knowled taught. They will analyse giv C/C++ applications and app knowledge to solve problem They will have to design solution by evaluating different alternative To enhance the students' problem solving skill in a giv programming environment, oper book programming tests a arranged regularly. To assu- students' understanding fundamental concepts, a close book final examination is arrange					
Assessment Methods in Alignment with	Specific Assessment Methods/Tasks	% Weighting	g outo	Intended subject learning outcomes to be assessed				
Outcomes			1	2	3	4	5	
	1. In-class exercises	10%	~	✓	~	~		
	2. Short-quizzes	10%		✓	✓	✓		
	3. Programming tests	30%	✓	✓	~	✓	~	
	4. Assignment	20%	✓	✓	~	✓	✓	
	5. Final examination	30%	~	✓	~	✓	$\checkmark$	
	Total	100%			_			
			ı					

	Explanation of the appropriateness of the assess assessing the intended learning outcomes:	sment methods in	
	The short-quizzes are for assessing the understand concepts. The in-class exercises are conducted to help with the programming language and skills. The progra assessing the ability of students on solving compute programming within a specified period. Through doing a will be able to experience how to solve computer problems by using a systematic approach. The final examination students' ability on using the programming language and programs.	ling of fundamental students familiarized amming tests are for er problems through assignment, students and design solutions is for assessing the d analysing computer	
Student Study Effort	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	<ol> <li>Reference Books:</li> <li>S. Rao, Sams Teach Yourself C++ in One Hour a Day IN: Sams, 2017.</li> <li>P. Deitel and H. Deitel, C++ How to Program : Introdu Standard, 10th ed. Boston, MA: Pearson, 2017.</li> <li>R. Cadenhead and J Liberty, Sams Teach Yourself C+ Indianapolis, IN: Sams, 2017.</li> </ol>	r, 8 th ed. Indianapolis, <i>ucing the New C++14</i> ++ <i>in 24 hours,</i> 6 th ed.	

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	ENGL4022
Subject Title	Quantitative literacy for language professionals
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	N.A.
Objectives	<ul> <li>Quantitative literacy is the ability to solve real world problems with mathematical skills, and is valuable even in language-related professions such as language teaching, sales and marketing, and media and journalism. This subject equips future language professionals with practical quantitative skills for describing and analyzing language-relevant information, thereby adding value to their primary skillset. Students will learn how these skills complement verbal persuasion, analysis, and presentation in real life contexts where a strong emphasis is placed on quantifiable facts. No extensive mathematics background is required.</li> <li>The subject adopts a thematic and problem-based approach to meet the following objectives.</li> <li>1. Introduce general quantitative skills to frame and solve problems which arise in the context of language professions</li> <li>2. Equip students to address quantitative issues in language teaching, including student assessment and evaluation of teaching and learning processes</li> <li>3. Equip students to address quantitative issues in sales and marketing, including the analysis of market surveys and sales trends</li> <li>4. Equip students to address quantitative issues in media and journalism, including the critical understanding of opinion polls, metrics and rankings</li> <li>Students will benefit from an interactive pedagogical approach with balanced assessment tasks. Classroom and independent learning will be further supported by open-source statistical analysis software (JASP) and Microsoft Excel.</li> </ul>
Intended Learning Outcomes (Note 1)	Upon completion of the subject, students will be able to: (Professional/academic knowledge) a. Apply basic statistical knowledge to describe and make inferences with language-related information

	<ul><li>(Literacy skills)</li><li>b. Recognize and produce quality work reflecting the complementary nature of verbal and numerical literacy in the workplace</li></ul>
	(Higher order thinking skills)
	c. Integrate verbal and numerical modes of reasoning to define and solve real world problems in different language-related contexts
	(Life-long learning skills)
	d. Develop critical and enduring awareness of the applicability of quantitative skillsets in language professions
Subject Synopsis/ Indicative Syllabus	Introduction Week 1-4
(Note 2)	<ul> <li>What quantitative literacy means to language professionals</li> <li>Basic descriptive statistics (e.g. data presentation, variables, levels of measurement)</li> <li>Basic inferential statistics (e.g. hypothesis testing for comparisons and correlations)</li> </ul>
	<ul> <li><u>Theme 1: Quantitative literacy in language teaching</u></li> <li>Week 5-6</li> <li>Describing student characteristics</li> <li>Monitoring student performance</li> </ul>
	<ul> <li>Evaluating effectiveness of pedagogical practices</li> <li><u>Theme 2: Quantitative literacy in sales and marketing</u></li> <li>Week 7-8 <ul> <li>Designing and analyzing verbal-numerical customer feedback surveys</li> <li>Presenting quantitative information in sales reports</li> <li>Combining rhetoric with statistics for persuasion</li> </ul> </li> </ul>
	<ul> <li><u>Theme 3: Quantitative literacy in the media</u></li> <li>Week 9-10</li> <li>Critically evaluating media information like opinion polls, metrics, and rankings</li> </ul>
	<ul> <li>Summary and assessment</li> <li>Week 11-13 <ul> <li>Course summary</li> <li>Individual presentations on applying quantitative skills to address a real-life problem in language professions</li> </ul> </li> </ul>
Teaching/Learning Methodology	The maximum class size of 30 allows for an interactive pedagogical approach. Each weekly session will last three hours, with a two-hour lecture immediately followed by a one-hour tutorial.
(Note 3)	In the lecture, the instructor will impart concepts supported by regular small group activities. This will be the main channel for transmitting <b>professional and academic knowledge</b> (intended learning outcome a.)
	In the tutorial, students will work on and present solutions to challenging discussion questions related to the lecture. While consolidating knowledge, they also reflect practical and realistic scenarios students are likely to face in the

	future, thus encouraging the development of <b>higher order thinking skills</b> and <b>life-long learning</b> (intended learning outcomes c. and d.). Tutorial learning will be supported by open-source computer software (e.g. JASP) and Microsoft Excel. Assessment also comprises an important part of the teaching and learning methodology. There will be one individual take-home assignment and one in- class quiz which encourages independent research and allows room for critical thought. There will also be an individual project and presentation where students apply quantitative analytical skills to frame and solve a hypothetical but realistic problem in a language profession. This supports development of teamwork and <b>literacy skills</b> (intended learning outcome c.)								
	Assessment methods and o	components r	nay vary a	according	to class s	ize.			
Assessment Methods in Alignment with	Specific assessment methods/tasks	% weighting	Intended be asses	l subject l sed (Plea	earning o se tick as	outcomes to s appropriate)			
Outcomes			а	b	c	d			
(Note 4)	1. Take-home assignment	35	/	/	/	/			
	(short questions on first half of the subject)								
	2. In-class quiz	35	/	/	/	/			
	(short questions on second half of the subject)								
	3. Individual project presentation	30	/		/	/			
	Total								
	The take-home assignment and in-class quiz require students to demonstrate the attainment of all four intended learning outcomes (professional knowledge, literacy skills, higher order thinking skills, and life-long learning) with both verbal and numerical analysis and output. Accordingly, they are each weighted 35%.								
	While the individual project is a culmination of the whole semester's learning will be delivered as a verbal presentation with less emphasis on writing skill is accordingly weighted 30%.								
Student Study	Class contact:								
Effort Expected	• Lecture + tutorial	(3 hours x 13	8 weeks)			39 Hrs.			
	Other student study effort	:							
	<ul> <li>Independent readi</li> </ul>		39 Hrs.						

	<ul> <li>Independent research (2 hours x 13 weeks)</li> </ul>	26 Hrs.					
	<ul> <li>Doing assignments (2 hour x 13 weeks)</li> </ul>	26 Hrs.					
	Total student study effort	130 Hrs.					
Reading List and References	Background on QL These provide background information on QL and argue for in general tertiary education.	its importance					
	<b>Steen, L. A.</b> (2001). The case for quantitative literacy. In L. (Ed.), Mathematics and democracy (pp.1–22). Princeton,NJ: Wilson National Fellowship Foundation.	A. Steen Woodrow					
	<u>Technical knowledge</u> These are taken from textbooks and focus on statistical analy concepts rather than their social applications. They will stren understanding but are not strictly necessary if you can follow and use JASP. They can also be replaced with other statistics textbooks/guides on the same topics.	ysis/other ngthen your v the lectures s					
	Boslaugh, S. (2012). Statistics in a Nutshell. Sebastopol: O'Reilly.						
	Jones, S. (2010). Statistics in Psychology. Explanations without equations. Basingstoke: Palgrave Macmillan.						
	Walker, I. (2010). <i>Research Methods and Statistics</i> . Basingstoke: Palgrave Macmillan.						
	Longaker, M. G., & Walker, J. (2010). <i>Rhetorical Analysis. A Brief Guide for Writers</i> . London: Longman.						
	<u>Reports</u> These are real life reports and/or datasets on various social issues which will be discussed and used as examples in class.						
	<b>The Economist Intelligence Unit.</b> (2018). <i>Making space: Surviving Sprawl</i> .						
	<b>Sustainable Solutions Development Network</b> . (2018). World Happiness Report.						
	<u>Further readings</u> These offer further information to enrich your understanding beyond the subject. They are optional but highly recommended if you continue to develop an interest for quantitative literacy.						
	<b>Crauder, B., Evans, B., Johnson, J., &amp; Noell, A.</b> (2015). <i>Q</i> <i>Literacy: Thinking Beyond the Lines</i> . New York: W. H. Free	<i>Juantitative</i> eman.					

Figures. Briston: Multilingual Matters.
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### Revised by Dennis Tay, March 2022

#### Note 1: Intended Learning Outcomes

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

#### Note 2: Subject Synopsis/ Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time over-crowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	ENGL4026
Subject Title	Language and social data analytics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	N.A.
Objectives	Digital data like social media, news archives, and various kinds of sentiments, trends and demographics pervade our world. They often seem messy and unstructured but play an increasingly important role in the media, marketing, and education industries in today's digital economy. With appropriate analytical approaches, they can provide key insights into human behavior and optimize professional decision-making.
	Building upon their primary competencies like critical thinking and communication, this subject teaches future professionals in linguistic and social contexts how to derive and communicate insights from such data. Students will learn how to use the Python programming language to implement analytic techniques based on basic statistics and machine learning. Ethical issues arising from the rapid growth of the digital economy will also be critically discussed. No background in programming, data analytics, or statistics is assumed.
	The subject adopts a thematic and problem-based approach to meet the following objectives.
	1.Introduce basic data analytic techniques and their implementation in Python
	2.Train students to collect, analyze, interpret, and communicate data-driven insights for problem-solving and decision-making
	3.Raise awareness of ethical challenges faced by today's digital economy
	An interactive pedagogical approach will be adopted with balanced assessment tasks. Classroom and independent learning will be supported by open-source software and other online resources.

Intended Learning	Upon completion of the subject, students will be able to:							
Outcomes	Category A: Professional/academic knowledge and skills							
(Note 1)	a. Understand basic data analytic techniques							
	b. Collect and analyze data in linguistic and social contexts with self-written programming code							
	c. Communicate data analytic insights to the general public and professional audiences							
	Category B: Attributes for all-roundedness							
	d. Appreciate the growing importance and relevance of machine- assisted data analysis in linguistic and social contexts							
	e. Weigh the benefits and potential pitfalls of data analytics along practical and ethical dimensions							
Subject Synopsis/ Indicative Syllabus (Note 2)	<ul> <li>Introduction</li> <li>Contemporary data in linguistic and social contexts</li> <li>The nature and scope of data analytics</li> <li>Programming languages</li> </ul>							
	<ul> <li>Data management, visualization, and communication</li> <li>Data collection from online sources</li> <li>Spreadsheets and dataframes</li> <li>Visualizing patterns and relationships in data</li> </ul>							
	<ul> <li>Data analytics #1: Working with numbers</li> <li>The general(ized) linear model <ul> <li>linear regression</li> <li>logistic regression</li> </ul> </li> <li>Prediction, classification, and clustering</li> </ul>							
	<ul> <li>Data analytics #2: Working with words</li> <li>Natural Language Processing and text analytics</li> <li>Document classification</li> <li>Sentiment analysis</li> <li>Topic modelling</li> </ul> Data ethics: a critical perspective							
	• Privacy, discrimination, and social inequalities							
Teaching/Learning	Each weekly session will combine lecture and seminar activities.							
Methodology (Note 3)	During lecture activities, the instructor will impart concepts and facilitate class activities. This will be the main channel for transmitting professional and academic knowledge (ILO a, b, e).							
	Seminar activities are student-led. Students will work in groups to analyze data and present solutions to practical problems. They prepare students for the workplace and develop higher order thinking skills and life-long learning (ILO c, d, e).							

	Teaching and learning is supported by the open-source programming language <i>Python</i> and online resources. Students will be expected to read the prescribed materials and revise previous lessons before each session. There are two individual take-home assignments and an individualproject. The take-home assignments require conceptual understanding of data analytic techniques, writing basic programming code, and interpreting the analyses in context. The project requires students to apply these techniques and communicate insights and solutions in simulated professional settings.								
Assessment Methods in Alignment with Intended Learning Outcomes (Note 4)	Specific methods/tasksassessment weighting% weightingIntended subjectsubject learning outcomes to be a ssessed (Please tick as appropriate)abcde1. Take-home assignment 135 $\checkmark$ $\checkmark$ $\checkmark$ $\checkmark$								
	3. Individual project	30	×   √	×   √		v √	$\checkmark$		
	Total	100 %		-		-			
	The take-home assignments (35% each) require individual students to demonstrate the intended learning outcomes by combining data analytic with critical thinking and writing skills. The group project (30%) requires students to work in groups to demonstrate the same skills, with an emphasis on verbal communication and presentation.								
Student Study Effort	Class contact:	Class contact:							
Expected	Lecture (3 hours x 13 weeks)     39 Hrs.								
	Other student study effort:								
	<ul> <li>Independent reading (3 h</li> </ul>	ours x 13 we	eeks)			39	Hrs.		
	<ul> <li>Independent research (21)</li> </ul>	hours x 13 w	reeks)			26	Hrs.		
	• Assignments (2 hour x 1)	3 weeks)				26	Hrs.		
	Total student study effort					130	Hrs.		
Reading List and References	Beysolow II, T. (2018). <i>Applied Natural Language Processing with</i> <i>Python</i> . Berkeley: Apress. Brookes, G., & McEnery, T. (2019). The utility of topic modelling for discourse studies: A critical evaluation. <i>Discourse Studies</i> , <i>21</i> (1), 3–21.								

Bruce, P., Bruce, A., & Gedeck, P. (2020). <i>Practical Statistics for</i> <i>Data Scientists: 50+ Essential Concepts Using R and Python.</i> Sebastopol: O'Reilly.
Hai-Jew, S. (Ed.). (2017). <i>Data Analytics in Digital Humanities</i> . Cham: Springer.
Norton, P. et al. (2005). Beginning Python. Indianapolis: Wiley.
O'Neil, C. (2016). Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. New York: Crown Books.
Sarkar, D. (2016). Text Analytics with Python. Cham: Springer.
Tay, D. (2020). A computerized text and cluster analysis approach to psychotherapy talk. <i>Language &amp; Psychoanalysis</i> , 9(1), 1–22.
Xu, W., & Zhang, C. (2018). Sentiment, richness, authority, and relevance model of information sharing during social Crises—The case of #MH370 tweets. <i>Computers in Human Behavior</i> , 89, 199–206.
Python libraries and user guides
<ul> <li>Pandas: <u>https://pandas.pydata.org/</u></li> <li>Scikit-learn: <u>https://scikit-learn.org/stable/</u></li> <li>Seaborn: <u>https://seaborn.pydata.org/index.html</u></li> <li>Statsmodels: <u>www.statsmodels.org/stable/user-guide.html</u></li> <li>Numpy: <u>numpy.org/doc/stable/</u></li> <li>Scipy: <u>https://www.scipy.org/docs.html</u></li> </ul>
Other resources
<ul> <li><u>datacamp.com</u></li> <li><u>kaggle.com</u></li> <li>towardsdatascience.com</li> </ul>

Revised by Dennis Tay, March 2022

#### Note 1: Intended Learning Outcomes

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

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

(Form AR 140) 8.2020

Subject Code	ENGL4027
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	<b>Pre-requisite</b> : ENGL3002 Research Methods for Language Studies <b>Exclusion</b> : Any other equivalent capstone project
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>provide students with the opportunity to apply and integrate knowledge of artificial intelligence and data analytics (AIDA) to the study of English, communication, and applied linguistics.</li> <li>develop the capabilities of students in analyzing and solving complex and possibly real-life problems using AIDA, preferably in professional contexts, including educational contexts.</li> <li>train students with the skills necessary for the systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>Professional/academic knowledge and skills <ul> <li>(a) demonstrate a high level of professional communicative competence in English, communication, and applied linguistics through a final project;</li> <li>(b) conduct literature surveys to locate materials and sources relevant to the selected problem in the area of English, applied linguistics, or communication to tackle topics selected for the project;</li> <li>(c) understand the materials obtained and connect the materials with the problem to be solved using knowledge and skills in AIDA, English, communication, or applied linguistics;</li> <li>(d) identify and analyse language-related issues systematically and logically;</li> <li>(e) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(f) critically consider the formulation of alternative models and solutions to the problem in the analysis of approaches to the solution and their implementation; and</li> <li>(g) evaluate and present the final outcome in a clear, objective, effective, and convincing manner with the knowledge and skills acquired;</li> </ul> </li> <li>Attributes for all-roundedness <ul> <li>(h) enhance technical reporting skills with proper organization of materials;</li> <li>(i) develop the ability to work critically, learn independently, and find/integrate information from different sources required in solving real-life problems;</li> <li>(j) exercise sound judgement and develop intellectual curiosity;</li> <li>(k) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(a) apply problem-solving skills to careers, personal development, and life-long learning.</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-Depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> </ol>

	6. Presentation and/or Demonstration													
	Students are expected to identify a project topic with a supervisor from the Department of English and Communication, and a co-supervisor with expertise in artificial intelligence and data analytics. Through the project, students need to demonstrate their knowledge in both English and applied linguistics and AIDA while receiving advice from both the supervisor and co-supervisor. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in both AIDA and English, applied linguistics, or communication.													
	With advice from the Capstone Project Coordinator and project supervisors, students select, justify, and apply techniques learnt from Research Methods for Language Studies and other related subjects to design, conduct, and produce a Capstone Project for submission by the end of Semester 2, Year 4. Detailed guidelines for conducting the Capstone Project will be made available to students at the beginning of Semester 1, Year 4.													
	The project may consist of either a 6,000-word dissertation or an alternative medium/format project (e.g., poster with presentation, advertising campaign, video, programming code, and/or application) accompanied by a 500-1000-word written document.													
	In conceptualising and designing the project, students can consider one of the following directions:													
	<ol> <li>Students can follow usual approaches to designing and conducting a research project, applying skills and knowledge learnt from the subject Research Methods for Language Studies and other subjects.</li> <li>Students may wish to consider conducting the project in the context of professional workplaces. For example, they can design and conduct the project at the organization where they completed their Work-Integrated Education (WIE) placements or Service Learning course, with permission from their workplace supervisors. In this case, students are encouraged to consider designing a project for solving a practical problem related to the actual workplace/profession/industry/community.</li> </ol>													
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work, and other project management tasks.													
Assessment Methods in Alignment with Intended Learning	Specific assessment	% Weightin		Inter	nded :	subje (Ple	ct lea ease t	rning ick a	g outc s app	come: propri	s to b ate)	e ass	essed	
Outcomes	methods/tasks	g 00	a	b	c	d	e	f	g	h	i	j	k	1
	Project	90	~	~	•	•	•	~	•	•	•	~	•	~
	2. Proactiveness and time management	10									1	1	1	
	Total	100												
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:													

	The Integrated Capstone Project will be assessed by the supervisor and co-supervis Attributes to be assessed include, but are not limited to, Problem Identification, Proble Solving, Communication and Presentation, Project Management, and Self-Disciplin 10% of the supervisor's mark is based on the supervisor's holistic evaluation of the student's performance throughout the project. Integrated Capstone Projects should be problem-oriented, and there are no restrictions the nature of the problem except that it should be relevant to both the BAEAL Program and AIDA. The project could be practical, academic, or a hybrid in which the student encouraged but not constrained to have some original contributions. This project work w not only contribute to the fulfilment of the subject's intended learning outcomes but a to the student's long-term development of their professional and academic knowledge a skills, as well as a variety of generic attributes, especially their ability to lear independently, think critically and analytically, and solve real-world problems with wh they have learned from the programme. Each student has to submit a proposal, a mid-term checkpoint progress report and a fin report. The proposal must be approved by the supervisor and co-supervisor before student can proceed with the Integrated Capstone Project. A final project submission some sort (e.g., in the form of an oral presentation, paper, or other demonstration) essential at the end of the project. A mid-term presentation and demonstration may a be required by the supervisor and/or co-supervisor for progress assessment.						
Student Study Effort	Class contact:						
Expected	• Lecture	0 Hrs.					
	Other student study effort:						
	• Searching and reading materials, meetings with supervisor/co-supervisor/others, design and system development, testing, documentation, presentation, etc.	210 Hrs.					
	Total student study effort	210 Hrs					
Reading List and	Reference Books:						
Kererences	1. Burns, R. (2000). Introduction to research methods (	4 th ed.). SAGE Publications.					
	2. Creswell, J. W. (2018). <i>Research design: Qualitative, quantitative, and mixed methods approaches</i> (5 th ed.). SAGE Publications.						
	3. Dörnyei, Z. (2007). <i>Research methods in applied linguistics</i> . Oxford University Press.						
	4. Garson, G. D. (2002). <i>Guide to writing empirical papers, theses, and dissertations</i> . Routledge.						
	5. Kumar, R. (2011). <i>Research methodology: A step-by</i> ed.). SAGE Publications.	-step guide for beginners (3 rd					
	6. Mauch, J. E., & Park, N. (2003). <i>Guide to the success handbook for students and faculty</i> (5 th ed.). Marcel D	<i>sful thesis and dissertation: A</i> Dekker.					
	<ol> <li>Merrigan, G., &amp; Huston, C. (2019). Communication Oxford University Press.</li> </ol>	research methods (4 th ed.).					

<ol> <li>Reinhart, S. M. (2013). <i>Giving academic presentations</i> (2nd ed.). University of Michigan Press.</li> </ol>
<ol> <li>Roberts, C. M., &amp; Hyatt, L. (2018). The dissertation journey: A practical and comprehensive guide to planning, writing, and defending your dissertation (3rd ed.). Corwin.</li> </ol>
10. Rudestam, K. E. & Newton, R. R. (2014). <i>Surviving your dissertation: A comprehensive guide to content and process</i> (4 th ed.). SAGEPublications.
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.
Additional papers and books relevant to the student's specific project topic will be identified by the student or recommended by the supervisor and/or co-supervisor.

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	HTI3990				
Subject Title	Big Data Analytics for Bioinformatics and Genomic Medicine				
Credit Value	3				
Level	3				
Pre-requisite/ Co-requisite/ Exclusion	N/A				
Objectives	<ul> <li>This subject aims to:</li> <li>a. Instil in students the foundation knowledge of human genomics;</li> <li>b. Expose students to the data analytic algorithms in bioinformatics;</li> <li>c. Introduce students to the challenges and clinical applications of bioinformatics and genomic medicine; and</li> <li>d. Offer students hands-on experience in conducting bioinformatics analyses and data interpretation.</li> </ul>				
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Explain the concepts in human genomics;</li> <li>b. Understand various bioinformatics algorithms, identify their advantages and drawbacks, and offer possible solutions to problems;</li> <li>c. Discuss the challenges and applications of data analytics in bioinformatics and genomic medicine; and</li> <li>d. Apply the data analytic techniques to perform bioinformatics analyses, and interpret the data obtained.</li> </ul>				
Subject Synopsis/ Indicative Syllabus (Note 2)	<ul> <li>Fundamentals of human genomics</li> <li>DNA</li> <li>RNA</li> <li>Protein</li> <li>Genes</li> <li>Genetics of human diseases</li> </ul> Commonly used bioinformatics tools, algorithms, and analyses <ul> <li>Biological databases</li> <li>Sequence alignment</li> </ul>				
	<ul> <li>Phylogenetic analysis</li> <li>Genome-wide association studies</li> <li>Next-generation sequencing</li> </ul>				

	RNA-seq analyse	S				
	• Sequence-based predictive methods, such as prediction of motifs and domains, protein structure, protein function, etc.					
	Omics Genomics Transcriptomics Proteomics Other omics, such Challenges and ap pharmacogenomic	as metabolo oplications in cs, genetic tes	mics genom sting, et	iic med c.	icine,	such as
Teaching/Learning Methodology	Lectures to introduce the algorithms and analyses of explain their potential approximation of the second se	fundamentals commonly us plications in g	Ils of human genomics, tools, used in bioinformatics, and to a genomic medicine.			
	Computer practical to guide the students to use the latest IT strategy to conduct bioinformatics analyses. The practical repo aim to enhance their skills in data interpretation and report writing.					
	Case studies to critically applied in different scena are highly encouraged.	examine the l rios. Exchan	bioinfoi ge of id	matics eas amo	techni ong stu	ques idents
Assessment Methods in Alignment with Intended Learning Outcomes (Note 4)	Specific assessment methods/tasks 60% continuous; 40%	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
	examination		а	b	c	d
	1. Continuous Assessment	60%				
	Computer Practical	45%		V	$\checkmark$	$\checkmark$
	Case Studies and Presentation	15%	$\checkmark$	1	V	
	2. Examination	40%	V	$\checkmark$	$\checkmark$	$\checkmark$
	Total	100 %				
	Computer practical will algorithms and their abili with the appropriate tools test their data interpretati	assess studen ty to conduct and paramet on skills.	ts' unde basic bi ers. The	erstandi oinforn e practic	ing on natics a cal repo	various analysis orts will

	Case studies require the students to examine real-life scenarios, critically review if the appropriate bioinformatics techniques have been applied, and explain the rationale during the presentation. The case studies and presentation will assess students' knowledge, ability in critical thinking and data interpretation. Discussion and exchange of ideas during the Questions & Answers Section will be encouraged. Examination will comprise MCQs, short questions and essays to evaluate the students' ability in understanding the basic concepts in human genomics, the bioinformatics algorithms, various bioinformatics tools and analyses, challenges and the applications in genomic medicine. The examination will also assess their data interpretation skills.				
Student Study Effort	Class contact:				
Expected	<ul> <li>Lectures</li> </ul>	27 Hrs.			
	Computer practicals	9 Hrs.			
	<ul> <li>Presentation of case studies</li> </ul>	3 Hrs.			
	Other student study effort:				
	<ul> <li>Preparation of practical reports</li> </ul>	15 Hrs.			
	<ul> <li>Preparation of case studies</li> </ul>	10 Hrs.			
	<ul> <li>Self study</li> </ul>	53 Hrs.			
	Total student study effort	117 Hrs.			
Reading List and References	Bexevanis, A.D., Bader, G.D. and Wishart, D.S. (2020) Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (4 th Edition). Wiley. ISBN: 9781119335955.				
	Lesk, A. (2019) Introduction to Bioinformatics (5 th Edition). Oxford University Press. ISBN: 9780198794141.				
	Strachan, T., Goodship, J., Chinnery P.F. (2015) Genetics and Genomics in Medicine. Garland Science. ISBN: 9780815344803.				
	Various online biological databases and bioinformatics tools.				

#### Note 1: Intended Learning Outcomes

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

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

(Form AR 140) 8.2020

Subject Code	HTI4990
Subject Title	AIDA in Clinical Diagnosis and Radiotherapy
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	Artificial intelligence and data analytics (AIDA) have been investigated extensively in various fields. This subject aims to teach the students the applications of AIDA in clinical diagnosis and radiotherapy. Emphasis is put in the most prevalent and advanced applications in various aspects in clinical diagnosis and radiotherapy.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. demonstrate understanding of basic principles of clinical diagnosis and radiotherapy</li> <li>b. explain the roles of AIDA in clinical diagnosis and radiotherapy</li> <li>c. demonstrate understanding of the applications of AIDA in clinical diagnosis and radiotherapy</li> <li>d. discuss the strengths and weaknesses of various AIDA methods in their applications in clinical diagnosis and radiotherapy</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>AIDA in clinical diagnosis (18)</li> <li>Basic principles and processes of clinical diagnosis</li> <li>Different algorithms and models</li> <li>Applications in clinical diagnosis</li> <li>Current trend in clinical diagnosis applications</li> <li>AIDA in radiotherapy (18)</li> <li>Basic principles and processes of radiotherapy processes</li> <li>Different algorithms and models</li> <li>Applications in radiotherapy</li> <li>Current trend in radiotherapy</li> <li>Current trend in radiotherapy applications</li> <li>Advanced topics (3)</li> <li>The state-of-art AIDA methods and potential applications in clinical diagnosis and radiotherapy</li> </ul>
Teaching/Learning Methodology	This subject provides broad knowledge on the basic principles and applications of AIDA in clinical diagnosis and radiotherapy. Lectures aim to cover the theoretical concepts of various AIDA methods

	and their applications in cl sessions will be used to rei methods and enhance the a environments. A practical understanding the basic AI discuss the strengths and w	inical diagnos nforce the the pplication of t session on AI principles and yeaknesses of t	is and rac oretical lo he know will facil d process the variou	liotherap earning i ledge in itate the . The stu us AIDA	y. Tutori n various clinical students idents wi methods	al s AIDA in ll s.		
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks 100% continuous	% weighting	Intende outcom a	d subject es to be b	subject learning to be assessed b c d			
Outcomes	1. Written assignment	20%	V	$\checkmark$	1	$\checkmark$		
	2. Group presentation	20%	V	V	1	$\checkmark$		
	3. Written test	60%	V	V	$\checkmark$	V		
	Total	100 %						
	Written assignment: stude weaknesses of specific a radiotherapy. This assignt concepts and their integr knowledge Group presentation: studen of AIDA in clinical diagno assess the students' unders and communication skills Written test: The written t	f AIDA students alytical to prese erapy in sic conce tudents' in arious	in clinical diagnosis or s' understanding of basic abilities of the relevant ent one specific application a group. This presentation repts and their presentation integration and application					
	applications in clinical diagnosis and radiotherapy.							
Student Study Effort Expected	Class contact:				26 Hrs.			
	Practical	Practical			4 Hrs.			
	<ul> <li>Tutorial</li> </ul>				9 Hrs.			
	Other student study effort:							
	<ul> <li>Self Study</li> </ul>				30 Hrs.			
	<ul> <li>Practical Work &amp; Report</li> </ul>				40 Hrs.			
	■ Total student study effort 109 H			109 Hrs.				

Reading List and References	Ranschaert E. Artificial Intelligence in Medical Imaging. Springer 2019
	Fujita H. Trends in Artificial Intelligence Theory and Applications. Artificial Intelligence Practices. Springer 2020
	Masmoudi M. Artificial Intelligence and Data Mining in Healthcare. Springer 2021
	Chang D. Basic Radiotherapy Physics and Biology. Springer 2021
	Bushberg J. The Essential Physics of Medical Imaging 4 th Ed. LWW 2020
	Russell S. Artificial Intelligence: A Modern Approach 4th Ed. Pearson 2020

Subject Code	HTM3228
Subject Title	Smart Service Design in Tourism and Hospitality
Credit Value	3
Level	3
Pre-requisite / Co-requisite/ Exclusion	HTM2305 – Delivering Service Quality
Objectives	This subject is designed to introduce students to the principles of experience design and service management, concepts of design thinking and design science, functionalities of service diagnosis tools and smart technologies, as well as other subject-related knowledge. Upon completion of this subject, students will be able to thoroughly assess and identify areas for further improvement in the existing tourism or/and hospitality businesses' service systems. Students will also be able to provide recommendations for optimizing the service design and service experience.
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of this subject, students will be able to:</li> <li>A. Competent Professional <ul> <li>Understand the principles of experience design and service management</li> <li>Understand and apply concepts of design thinking and design science to develop new service ideas / optimize existing service provision</li> <li>Understand the functionalities of service diagnosis tools and smart technologies, and utilize those tools to improve service provision</li> </ul> </li> <li>B. Critical Thinkers <ul> <li>Critically evaluate the soundness of existing tourism or/and hospitality businesses' service systems</li> <li>Identify and define problems in the existing businesses' service systems in general and specific service encounters in particular</li> </ul> </li> <li>C. Innovative Problem Solvers <ul> <li>Identify adequate technologies that can advance the quality of service design and service experience offered to consumers</li> </ul> </li> </ul>
	D. Effective Communicators
	• Effectively communicate the evaluation results and problems found in existing tourism or/and hospitality businesses' service systems

	• Effectively communicate the solutions to resolve existing problems and introduce adequate technologies to clients / interested parties						
	E. Lifelong learner (not applicable)						
	F. Ethical Leader (not applicable)						
	G. Socially Responsible Global Citizen						
	• Recognize the personal and corporate social responsibilities in designing and optimizing service systems for global citizens						
Subject Synopsis/ Indicative Syllabus (Note 2)	<ul> <li>Key topics to be addressed in this subject include (but not limited to):</li> <li>Principles of experience design</li> <li>Service management</li> <li>Design thinking and design science</li> <li>Smartness and smart technologies</li> <li>Service diagnosis tools</li> </ul>						
	<ul> <li>Secondary data colle</li> </ul>	ction and anal	lysis me	ethods			
Teaching/Learning Methodology (Note 3)	<ul> <li>Interactive lectures: Key concepts, principles, theories and other background knowledge relating to the subject will be explained and discussed with students in the interactive lectures.</li> <li>Tutorials: Useful tools and skills will be introduced to students in the tutorial sessions. Case studies, practical trainings, hands-on practices will also be provided to students in the tutorial sessions.</li> <li>Group project: Students will work in teams and comprehensively evaluate the service system of a selected tourism or/and hospitality business. Apart from evaluating and outlining problems via using the knowledge learnt from lessons, students will be asked to provide solutions and implementation plans for the management of their selected businesses' consideration.</li> </ul>						
Assessment Methods in Alignment with	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
Outcomes			А	В	С	D	G
(Note 4)	1. Class attendance and participation	10%	$\checkmark$	$\checkmark$	$\checkmark$		
	2. Group project	30%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
	3. Mid-term test	30%	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$
	4. Final exam	30%	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$
	Total	100 %					
	L						

Student Study	Class contact:				
Effort Expected	<ul> <li>Lectures (2 hours x 13 weeks)</li> </ul>	26 Hrs.			
	<ul> <li>Tutorials (1 hour x 13 weeks)</li> </ul>	13 Hrs.			
	Other student study effort:				
	<ul> <li>Self-study</li> </ul>	52 Hrs.			
	Group project	30 Hrs.			
	Total student study effort	121 Hrs.			
Reading List and References	<ul> <li>Fesenmaier, D. R., &amp; Xiang, Z. (2017). Design Foundations of Destination Management. Spring</li> <li>Describer S., &amp; Bologe, E. (2010). Smort convict</li> </ul>	Science in Tourism: ger, Cham.			
	• Barne, S., & Polese, F. (2010). Smart service service systems: Applying systems theory to ser <i>Science</i> , 2(1-2), 21-40.	rvice science. Service			
	• Beverungen, D., Müller, O., Matzner, M., M Brocke, J. (2019). Conceptualizing smart servic <i>Markets</i> , 29(1), 7-18.	endling, J., & Vom e systems. <i>Electronic</i>			
	• Buhalis, D., & Leung, R. (2018). Smart hospitality—Interconnective and interoperability towards an ecosystem. <i>International Journal</i> <i>Hospitality Management</i> , 71, 41-50.				
	<ul> <li>Chung, N., Lee, H., Ham, J., &amp; Koo, C. (2021). Smart Tourism Citic Competitiveness Index: A Conceptual Model. In <i>Information of</i> <i>Communication Technologies in Tourism 2021</i> (pp. 433-43) Springer, Cham.</li> </ul>				
	• Gretzel, U., Werthner, H., Koo, C., & Lamsfus, C foundations for understanding smart tourism ec <i>in Human Behavior, 50</i> , 558-563.	C. (2015). Conceptual cosystems. <i>Computers</i>			
	<ul> <li>Henkens, B., Verleye, K., &amp; Larivière, B. (202 better?! Customer well-being, engagement, and service systems. <i>International Journal of Res</i> 38(2), 425-447.</li> </ul>	arivière, B. (2021). The smarter, the engagement, and perceptions in smart Journal of Research in Marketing,			
	• Kabadayi, S., Ali, F., Choi, H., Joosten, H., & service experience in hospitality and to conceptualization and future research agenda. <i>Management</i> , 30(3), 326-348.	<ul> <li>Ali, F., Choi, H., Joosten, H., &amp; Lu, C. (2019). Smart perience in hospitality and tourism services: A zation and future research agenda. <i>Journal of Service it</i>, 30(3), 326-348.</li> <li>C., Huang, C., &amp; Duan, L. (2017). The concept of smart the context of tourism information services. <i>Tourism it</i>, 58, 293-300.</li> </ul>			
	• Li, Y., Hu, C., Huang, C., & Duan, L. (2017). tourism in the context of tourism information <i>Management</i> , 58, 293-300.				
	• Neuhofer, B., Buhalis, D., & Ladkin, A. (2015). Smart technologies a case study in the hospitalit <i>Electronic Markets</i> , 25(3), 243-254.				
	• Troisi, O., Grimaldi, M., & Monda, A. (2019). M ecosystems through technology: how ICTs ena <i>Tourism Analysis</i> , 24(3), 377-393.	anaging smart service ble value cocreation.			
	• Yang, H., Song, H., Cheung, C., & Guan, J. (2021). How to enhance	;			
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	hotel guests' acceptance and experience of smart hotel technology: An				
	examination of visiting intentions. International Journal of	c			
	Hospitality Management, 97, 103000.				

Subject Code	HTM4350						
Subject Title	Big Data Analytics in Hospitality, Tourism and Events						
Credit Value	3						
Level	4						
Pre-requisite / Co-requisite/ Exclusion	HTM3205 – Analysing and Interpreting Research (or other equivalent subjects)						
Objectives	This subject is designed to provide students with the fundamental concepts ar practical applications of big data analytics in tourism and hospitality industr This course will emphasize how to understand, analyze and articulate da analytics as well as produce original insights from big data application Students will perform a variety of analytical practices using a big da programming to have hands-on experiences. Upon completion of the subject students will be able to obtain comprehensive understandings of big data analytics for facilitating better business decision-making process.						
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>A. Competent professional: <ul> <li>possess and be able to apply the skills, knowledge and abilities relevant to managerial concepts in big data analytics</li> <li>discuss the basic concepts and principles of big data analytics</li> <li>possess and be able to apply the skills, knowledge and abilities relevant to managerial concepts in big data analytics</li> <li>possess and be able to apply the skills, knowledge and abilities relevant to managerial concepts in big data analytics</li> <li>discuss the basic concepts and principles of big data analytics</li> <li>discuss the basic concepts and principles of big data analytics</li> <li>discuss the basic concepts and principles of big data analytics</li> </ul> </li> <li>B. Critical Thinkers <ul> <li>execute efficient big data analytics to solve hospitality and tourism business problems</li> <li>follow and acquire the procedures in implementing big data analytics</li> <li>critically evaluate and review big data analytics that create values</li> <li>understand and compare a variety of big data analytics</li> </ul> </li> <li>C. Innovative Problem Solvers <ul> <li>apply business analytics to identify business insights and support better business decision-making</li> </ul> </li> <li>D. Effective Communicators (not applicable)</li> </ul>						
	E. Lifelong Learners (not applicable)						

	<ul> <li>F. Ethical Leaders <ul> <li>understand global and ethical standards in general data protection regulation</li> </ul> </li> <li>G. Socially Responsible Global Citizen (not applicable)</li> </ul>									
Subject Synopsis/ Indicative Syllabus	<ol> <li>Business analytics and big data in hospitality and tourism</li> <li>Smart city and smart tourism</li> <li>Data issues / management</li> <li>Statistical inference</li> <li>Descriptive analytics</li> <li>Data visualization</li> <li>Predictive Analytics 1: Linear / Multiple regression</li> <li>Predictive Analytics 2: Logistic regression</li> <li>Classification / clustering methods</li> <li>Geospatial analytics</li> <li>Spatial data visualization</li> <li>Ethical issues related to big data</li> </ol>									
Teaching/Learning Methodology	This subject will use various teaching and learning methods including lectures, case studies and class discussion. Lectures and case studies will enable students to understand fundamental concepts of big data analytics in hospitality and tourism fields. Class discussion gives students opportunities to assess and evaluate contemporary big data analytics in hospitality and tourism. Furthermore, this subject will offer students learning environment involving hands-on experiences that uses a tool of big data analytics, such as Python.									
Assessment Methods in Alignment with Intended Learning Outcomes (Note 4)	Specific assessment methods/tasks% weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)ABCF									
	1. Attendance and class participation	10%	~	~	~	~				
	2. Mid-term exam	20%	$\checkmark$	$\checkmark$	$\checkmark$					
	3. Individual assignments	40%	~	~	~					
	4. Final exam	30%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$				
	Total 100 %									
	Explanation of the approp intended learning outcom	oriateness of t es:	the asse	essmen	t metho	ods in a	ssessir	ig the		

	To pass this subject, students are required to obtain Grade D or above in the aggregated assessment components.							
	Explanation of the appropriateness of the assessmen intended learning outcomes:	t methods in assessing the						
	• Attendance and class participation assess students' levels of involvement and engagement in class and proactive attitude toward Q&A.							
	• Mid-term exam tests students' cognitive understandings of theories/concepts related to big data analytics and application of analytical tools/methods (i.e., Python).							
	• Individual assignments evaluate students' comprehension of class contents and analytical ability. The assignments will ask students to develop statistical/analytical methods applying corresponding knowledge covered during the class.							
	Final exam assesses students' comprehensive understandings of big data analytics and application of analytical skills to solve business problems in hospitality and tourism fields.							
Student Study	Class contact:							
Effort Expected	<ul> <li>Lecturer</li> </ul>	39 Hrs.						
	Other student study effort:							
	Preparation for lectures	31 Hrs.						
	<ul> <li>Preparation of mid-term and final exams / individual assignment</li> </ul>	60 Hrs.						
	Total student study effort	130Hrs.						
Reading List and References	McKinney, W. (2012). <i>Python for data analysis: Da</i> <i>NumPy, and IPython</i> . O'Reilly Media, Inc.	tta wrangling with Pandas,						
	Sharda, R., Delen, D., & Turban, E. (2015). Business intelligence and analytics: Systems for decision support (Tenth ed.). Boston: Pearson.							
	Sigala, M., Rahimi, R., & Thelwall, M. (Eds.). (2019). Big Data and							
	Innovation in Tourism, Travel, and Hospitality: Managerial Approaches, Techniques, and Applications. Springer.							
	Journals:							
	Annals of Tourism Research							
	I ourism Management Journal of Travel Research							
	International Journal of Hospitality Management							

International Journal of Contemporary Hospitality Management Information Technology and Tourism

### **Subject Description Form**

Subject Code	HTM4362							
Subject Title	Artificial Intelligence in Tourism and Hospitality							
Credit Value	3							
Level	4							
Pre-requisite / Co-requisite/ Exclusion	Nil							
Objectives	The objective of this subject is to learn the fundamental concepts and practical applications of artificial intelligence (AI) in the tourism and hospitality industry, understand the critical components of AI technologies and examine the key relevant issues. At the end of the subject, students will be able to build new insights of AI technologies in tourism and hospitality industry, identify and solve the challenges during their implementations, and anticipate future trends and prospects.							
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>A. Competent Professionals <ul> <li>Discuss the basic concepts, and describe critical components of AI technologies.</li> </ul> </li> <li>B. Critical Thinkers <ul> <li>Examine, apply and evaluate the AI technologies and concepts within the context of management and operations of tourism and hospitality organizations.</li> <li>Critically assess the advantages and disadvantages of applying AI technologies in a tourism and hospitality context.</li> </ul> </li> <li>C. Innovative Problem Solvers <ul> <li>Identify, define, and solve problems relevant to AI in a tourism and hospitality management context.</li> </ul> </li> <li>D. Effective Communicators <ul> <li>Working as a team to research, plan, organize, and present a project on AI technology for a service operation.</li> </ul> </li> </ul>							
	E. Lifelong Learners (not applicable)							

	<ul> <li>F. Ethical Leader</li> <li>Understand and apply ethical skills to make sound decisions in both principle and practice</li> </ul>										
Subject Synonsis/	G. Socially Responsible Global Citizen (not applicable)										
Indicative Syllabus	1. Introduction to AI										
(Note 2)	2.	Basic terms and know	wledge of A	1							
	3.	Key AI technologies	and its appl	ications in	tourism	and hosp	itality in	dustry			
	4.	Intelligent agent and	problem sol	ving in tou	urism and	l hospital	lity indus	try			
	5.	Machine learning and	d its applicat	tions in tou	urism and	l hospital	lity indus	try			
	6.	AI-Driven Hospitalit	y and Touris	sm Busine	ss Strateg	gy					
	7.	AI in tourism and ho	spitality mar	nagement -	– The fut	ure					
	8.	AI ethical issues and	concern								
Teaching/Learning Methodology	1. <b>Interactive lectures</b> will be given with class discussions and illustrations of artificial intelligence concepts and methods.										
(1010 5)	2. <b>Tutorials</b> will be held to provoke active class participation in discussion. Problems will be raised for group discussions in the tutorials.										
	3. <b>Projects</b> will be used to invoke students in investigative activities that require them to employ knowledge of, and skills from, more than one discipline. For group project, team members will have to make a presentation on their chosen topic. A question-and-answer session will be held after the presentation in order to authenticate the students' understanding and critical thinking ability.										
	4. <b>Guest speaker</b> will be invited to give lectures/seminars on specific issues related to AI technologies in order to enhance students' understanding of the theories learnt and their applications.										
	5. <b>Case studies</b> will be used to give students the opportunities to place themselves in the position of the decision maker and apply their analytical and critical thinking skills to explore scenarios and solutions.										
Assessment Methods in											
Alignment with Intended Learning Outcomes	Specific assessment methods/tasks% weightingIntended subject learning outcomes to be assessed (Please tick as appropriate)										
(Note 4)				А	В	С	D	F			
	i. Assignments and quizzes25% $$ $$										
	ii p	. Group project and resentation	30%		$\checkmark$	$\checkmark$	$\checkmark$				
	iii. Class participation     10% $$ $$ $$										

	iv. Final exam	35%	$\checkmark$	$\checkmark$	$\checkmark$								
	Total	100%		I	I								
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Assignments and quizzes intends to examine the extent students can critically												
	assess and apply the AI technologies in tourism and hospitality management.												
	<b>Group Project and presentation</b> will enable students to work in teams and apply AI technologies in a real world setting. This component is essential as students will be able to illustrate the application of these technologies, and assess the influence of these technologies for tourism and hospitality management.												
	<b>Class participation</b> intends to examine whether students can use AI technologies and knowledge to explain and clarify ideas in addition to asking questions throughout the semester.												
	<b>Final exam</b> intends to measure to what extent student can understand, apply and critically assess AI technologies and knowledge they have learnt in the course of a semester.												
Student Study	Class contact:												
Ellort Required	Lecture						26 Hrs.						
	Tutorial						13 Hrs.						
	Other student study effor	rt:											
	<ul> <li>Reading assigned reading</li> </ul>	adings					25 Hrs.						
	Preparation for the tu	itorials and					14 Hrs.						
	Preparation for the example.	xaminations					25 Hrs.						
	<ul> <li>Preparation for the g</li> </ul>	roup project					20 Hrs.						
Deading Lint and	Total student study effor	t					123 Hrs.						
Reading List and References	• Aluri, A., Price, B. S cocreate value throug program. <i>Journal of</i>	., & McIntyr gh dynamic o <i>Hospitality o</i>	re, N. H. (2 customer e & <i>Tourism</i>	2019). Us ingageme <i>Researc</i>	sing mac ent in a b <i>h</i> , <i>43</i> (1),	hine lear rand loya 78-100.	ning to alty						
	Barro, S., & Davenpoinnovation. <i>MIT Sloc</i>	ort, T. H. (20 an Managem	)19). Peop ent Reviev	le and ma v, <i>60</i> (4), 2	achines: 22-28.	Partners	in						
	• Bird, S., Klein, E., & Loper, E. (2009). Natural Language Processing with Python. <i>O'Reilly Media</i> .												
	• Bishop, C. M. (2006). Pattern recognition and machine learning. <i>Springer</i> .												
	• Brynjolfsson, E., & Mcafee, A. N. D. R. E. W. (2017). The business of artificial intelligence. <i>Harvard Business Review</i> , 1-20.												
	Goodfellow, I., Beng Press.	gio, Y., & Co	ourville, A	. (2016).	Deep Le	arning. 7	The MIT						
	• Hagendorff, T. (2020	)). The ethics	s of AI eth	ics: An e	valuation	n of							

guidelines. Minds and Machines, 1-22.
• He, K., Zhang, X., Ren, S., & Sun, J. (2016). Deep residual learning for image recognition. In <i>Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition</i> (pp. 770-778).
• Ivanov, S., Gretzel, U., Berezina, K., Sigala, M., & Webster, C. (2019). Progress on robotics in hospitality and tourism: a review of the literature. <i>Journal of Hospitality and Tourism Technology</i> , <i>10</i> (4), 489-521.
• Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. <i>Nature Machine Intelligence</i> , 1(9), 389-399.
• Law, R., Li, G., Fong, D. K. C., & Han, X. (2019). Tourism demand forecasting: A deep learning approach. <i>Annals of Tourism Research</i> , <i>75</i> , 410-423.
• Martinez-Torres, M. R., & Toral, S. L. (2019). A machine learning approach for the identification of the deceptive reviews in the hospitality sector using unique attributes and sentiment orientation. <i>Tourism Management</i> , <i>75</i> , 393-403.
• Rességuier, A., & Rodrigues, R. (2020). AI ethics should not remain toothless! A call to bring back the teeth of ethics. <i>Big Data &amp; Society</i> , 7(2), 2053951720942541.
• Trappl, R. (1986). Impacts of Artificial Intelligence: An Overview. Impacts of Artificial Intelligence: Scientific, Technological, Military, Economic, Societal, and Political. DBLP.
• Tung, V. W. S., & Au, N. (2018). Exploring customer experiences with robotics in hospitality. <i>International Journal of Contemporary Hospitality Management</i> , <i>30</i> (7), 2680-2697.
• Tung, V. W. S., & Law, R. (2017). The potential for tourism and hospitality experience research in human-robot interactions. <i>International Journal of Contemporary Hospitality Management</i> , <i>29</i> (10), 2498-2513.

Intended learning outcomes should state what students should be able to do or attain upon subject completion. Subject outcomes are expected to contribute to the attainment of the overall program outcomes.

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

### **Subject Description Form**

Subject Code	HTM4364					
Subject Title	Social Media and Digital Marketing Analytics					
Credit Value	3					
Level	4					
Pre-requisite / Co-requisite/ Exclusion	HTM 2324 Marketing in Hospitality, Tourism and Events in the Digital Age (or other equivalent subjects)					
Objectives	This course provides students with professional knowledge in social media and digital marketing analytics about how to measure social media and digital marketing performance in the tourism, hospitality and events industries. It helps students to develop an understanding of social media and digital marketing analytics; the process through marketing analytics to craft experiences that profoundly reflect each customer's needs, expectations, and behaviors; measure real social media ROI: sales, leads, and customer satisfaction; and track the performance of all paid, earned, and owned social media channels. In addition, it helps the students understand how to integrate paid and earned social media data to drive more value for tourism, hospitality and events organizations through new marketing and social media investments.					
Intended Learning	Upon completion of the subject, students will be able to:					
Outcomes	A. Competent professional:					
	Students should be able to integrate and to apply social media and digital marketing analytics knowledge and skills that are fundamental to functioning effectively as an digital marketing analytics professional (professional competence); understand the global trends and opportunities related to social media and digital marketing analytics (global outlook); and demonstrate entrepreneurial spirit and skills in their social media and digital marketing analytics related work, including the discovery and use of opportunities, and experimentation with novel ideas (entrepreneurship).					
	B. Critical thinker:					
	Students should be able to examine and critique the validity of social media and digital marketing information, arguments, and different viewpoints, and to reach sound judgments on the basis of credible					

	evidence and logical reasoning in social media and digital marketing analytics contexts.							
	C. Innovative problem solver:							
	Students should be able to identify and define social media and digital marketing analytics problems in both professional and day-to-day contexts, and produce innovative solutions to solve marketing problems.							
	<ul> <li>evidence and logical reasoning in social media and digital marketing analytics contexts.</li> <li>C. Innovative problem solver:</li> <li>Students should be able to identify and define social media and digital marketing analytics problems in both professional and day-to-day contexts, and produce innovative solutions to solve marketing problems.</li> <li>D. Effective communicator:</li> <li>Students should be able to comprehend and communicate effectively in English orally and in writing, in social media and digital marketing analytics contexts.</li> <li>E. Lifelong learner:</li> <li>Students should be able to recognise the social media and digital marketing analytics contexts.</li> <li>F. Lifelong learner:</li> <li>Students should be able to recognise the social media and digital marketing analytics need for continual learning and self-improvement, and be able to plan, manage and evaluate their own learning in pursuit of self-determined goals in social media and digital marketing contexts.</li> <li>F. Ethical leader:</li> <li>Students should have an understanding of leadership and be prepared to serve as a digital marketing leader and a team player (leadership and teamwork); be capable of building and maintaining relationship and resolving conflicts in group work situations (interpersonal competence); and demonstrate ethical reasoning in social media and digital marketing contexts (ethical reasoning).</li> <li>G. Socially responsible global citizen:</li> <li>Students should have the capacity for understanding different cultures and social development needs in in social media and digital marketing contexts (interest in culture and social development); and accept their responsibilities as digital marketing professionals to society, their own nation and the world (social media, digital and content marketing analytics tools in hospitality, tourism and events industries</li> <li>Understanding social media listening and digital marketing analytics tools i</li></ul>							
	Students should be able to comprehend and communicate effectively in English orally and in writing, in social media and digital marketing analytics contexts.							
	E. Lifelong learner:							
	Students should be able to recognise the social media and digital marketing analytics need for continual learning and self-improvement, and be able to plan, manage and evaluate their own learning in pursuit of self- determined goals in social media and digital marketing contexts.							
	F. Ethical leader:							
	<ul> <li>Students should have an understanding of leadership and be prepared to serve as a digital marketing leader and a team player (leadership and teamwork); be capable of building and maintaining relationship and resolving conflicts in group work situations (interpersonal competence); and demonstrate ethical reasoning in social media and digital marketing contexts (ethical reasoning).</li> <li>G. Socially responsible global citizen:</li> </ul>							
	G. Socially responsible global citizen:							
	Students should have the capacity for understanding different cultures and social development needs in in social media and digital marketing contexts (interest in culture and social development); and accept their responsibilities as digital marketing professionals to society, their own nation and the world (social, national, and global responsibility).							
Subject Synopsis/	1. Overview of social media, digital and content marketing analytics							
Indicative Syllabus (Note 2)	<ol> <li>Understanding the synergetic digital ecosystem in hospitality, tourism and events industries</li> </ol>							
	3. Understanding social media listening and digital marketing analytics tools in hospitality, tourism and events industries							
	4. Understanding digital brand analysis and audience analysis							
	5. Digital ecosystem analysis and maps							
	6. Tracking return on investment approaches							
	7. Understanding digital influence and developing influence approach							
	8. Understanding the social media landscape analysis							
	9. The role of digital analytics on launching a new product							
	10. Forecasting the digital marketing analysis of the future							

	11. Using digital analytics to anticipate a crisis										
Teaching/Learning Methodology	<b>I. Lectures</b> with discussions in class and illustration of real tourism, event and hospitality cases will be used.										
(Note 3)	<b>II. Tutorials</b> will be conducted with hands-on examples, interactive activities and group discussions to support and reinforce the topics covered in lectures.										
	<b>III. Group Project</b> will involve asking students to form small teams for working on a case study that relates to social media and digital marketing analytics in the hospitality, tourism and events industries. The project requires students to evaluate the impact of the social media and digital marketing based on the case and provide recommendations accordingly.										
	<b>IV. Guest speakers</b> or speakers from the Hotel ICON and tourism and events organizations will be invited to give lectures/seminars on contemporary practices of social media and digital marketing analytics in hospitality, tourism and events organizations.										
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	% Intended subject learning outcomes to be assessed (Please tick as appropriate)								
(Note 4)			A	В	С	D	Е	F	G		
	i.Tutorial exercise and discussions	10%	1	V	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		
	ii.Individual written assignment	15%	$\checkmark$	$\checkmark$	$\checkmark$				$\checkmark$		
	iii. Group project	35%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$		
	iv. Final examination	40%	$\checkmark$	$\checkmark$	$\checkmark$						
	Total	100 %									
	Explanation of the app the intended learning of <b>Tutorial exercises a</b> examples, exercises discussed in lecture to and ability to apply th <b>Individual written as</b> be asked to conduct Students will be requir result.	oropriateness outcomes: and discuss and discuss o demonstrat e concepts in signment: T an analysis ired to make	s of th ions: ions of te thei n solvi This is of a of e recor	e asse Stude on pr r unde ing the a writ case s mmene	ssmer oblem erstand e digit tten pa tudy	nt meth vill w is rela ding c al man aper w with s is base	hods i ork of ated t of the rketin, hich s simula ed on	n asse on har o the conce g prol studen ated d the an	essing nds-on topic eptions olem. nts will ataset. nalysis		

	<b>Group Project</b> : Group Project comprising of a group digital marketing analytic report and a group presentation. It involves an in-depth analysis of social media and digital marketing strategy of a hospitality, tourism and events organization. Both written and presentation skills will be assessed. <b>Examination</b> : Examination will be used to assess the students'								
	understanding of the knowledge and application ability in answering applied social media and digital marketing analytics related problems in the hospitality and tourism industry.								
Student Study Effort Expected	Class contact:								
Lifert Expected	Lecture	26 Hrs.							
	Tutorial	13 Hrs.							
	Other student study effort:								
	<ul> <li>Reading textbook and assigned reading</li> </ul>								
	<ul> <li>Preparation for continue assessments</li> </ul>	65 Hrs.							
	<ul> <li>Studying for examination</li> </ul>	15 Hrs.							
	Total student study effort	134 Hrs.							
Reading List and References	Required Readings:         Hemann, C., & Burbary, K. (2018). Digital marketing analytics: resense of consumer data in a digital world (Second edition). PEducation, Inc.								
	Suggested Readings:								
	McGuire, K. A. (2017). The analytic hospitality exdata analytics in hotels and casinos (1st edition.). W	<i>xecutive : implementing</i> Viley.							
	Park, Deukhee, Kim, Woo Gon, & Choi, Soojin. (2019). Application of social media analytics in tourism crisis communication. <i>Current Issues in Tourism</i> , 22(15), 1810–1824.								
	Rana, Nripendra P, Slade, Emma L, Sahu, Ganesh P, Kizgin, Hatice, Singh, Nitish, Dey, Bidit, Gutierrez, Anabel, & Dwivedi, Yogesh K. (2019). <i>Digital and Social Media Marketing</i> . Springer International Publishing AG.								
	Singh, Amandeep. (2021). Big Data Analytics for Efficiency, and Decision Making in Digital Marketin	or Improved Accuracy, ng. IGI Global.							
	Sponder, M., & Khan, G. F. (2018). Digital ar Routledge.	alytics for marketing.							

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

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

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

# **Subject Description Form**

Subject Code	HTM4365
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	<b>Pre-requisite:</b> HTM3205 – Analyzing and Interpreting Research <b>Exclusion</b> : Any other equivalent capstone project
Objectives	The objectives of this subject are to:
	<ul> <li>provide students with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to the hospitality and tourism industry.</li> <li>develop the capabilities of students in analyzing and solving complex and possibly real-life problems using hotel and tourism management (HTM) and AIDA knowledge.</li> <li>train students with the skills necessary for the systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) conduct literature surveys to locate materials and sources relevant to the selected problem area in hospitality and tourism;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using HTM and AIDA knowledge and skills;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> </li> <li><u>Attributes for all-roundedness</u> <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(j) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> <li>Presentation and Demonstration</li> </ol>

Teaching/Learning	Students are expected to identify a project topic with a supervisor in School of Hotel and Tourism Management (SHTM) and a co-supervisor with expertise in artificial intelligence and data analytics. Students need to demonstrate their knowledge in both HTM and AIDA in the project relevant to the hospitality or tourism industry, receiving advice from both supervisors. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.												
Methodology	semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.												
<b>Assessment Methods</b>		I											
in Alignment with Intended Learning	Specific assessment	% weighting		Intend	ded su	ıbject (Plea	learn	ing oı k as a	itcom pprop	es to riate)	be as	sessec	1
Outcomes	methods/tasks		а	b	c	d	e	f	g	h	i	j	k
	Continuous Assessment	100	1	1	1	1	~	1	1	1	1	1	1
	Total	100			l					l			<u> </u>
Student Study Effort	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</li> <li>The Integrated Capstone Project will be assessed by the supervisor and/or co-supervisor and other assessors. Attributes to be assessed include, but are not limited to, Problem Identification, Problem Solving, Communication and Presentation, Project Management, and Self-Discipline.</li> <li>Integrated Capstone Projects should be problem-oriented and there are no restrictions on the nature of the problem except that it should be relevant to HTM and AIDA. 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 and/or co-supervisor before the student can proceed with the Integrated Capstone Project. An oral presentation/demonstration is essential at the end of the project. A mid-term presentation and demonstration may also be required for progress assessment.</li> </ul>									rvisor oblem ement, ons on oroject ut not osal, a oroved grated roject.			
Expected	Class contact:												
	• Lecture											0	Hrs.
	Other student st	udy effort:											
	<ul> <li>Searching as supervisor / system deve presentation</li> </ul>	nd reading m co-supervise lopment, tes , etc.	nateria or / ot ting,	als, m thers, docur	eeting desig nenta	g with n and tion,	1					210	Hrs.
	Total student study effort								210	Hrs			

Reading List and	Reference Books:					
References	<ol> <li>Kumar, Ranjit (2011). Research Methodology: A Step-by-step Guide for Beginners (3rd ed.). SAGE Publications.</li> </ol>					
	<ol> <li>Burns, Robert B. (2000). Introduction to Research Methods (4th ed.). SAGE Publications.</li> </ol>					
	3. Finn, M., Elliott-White, M., & Walton, M. (2000). <i>Tourism and Leisure</i> <i>Research Methods – Data Collection, Analysis and Interpretation</i> . Pearson Education, UK.					
	<ol> <li>Roberts, Carol M. (2007). The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation (3rd ed.). Corwin Press.</li> </ol>					
	5. Mauch, James E. and Park, Namgi (2003). <i>Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty</i> (5 th ed.). Marcel Dekker.					
	6. Rudestam, Kjell Erik and Newton, Rae R. (2001). <i>Surviving Your Dissertation:</i> A Comprehensive Guide to Content and Process (2 nd ed.). Sage Publications.					
	7. Garson, G. David (2002). <i>Guide to Writing Empirical Papers, Theses and Dissertations</i> . Marcel Dekker.					
	8. Reinhart, Susan M. (2013). <i>Giving Academic Presentations</i> (2 nd ed.). University of Michigan Press.					
	<ol> <li>Oshima, Alice and Hogue, Ann (2006). Writing Academic English (4th ed.). Pearson Longman.</li> </ol>					
	10. American Psychological Association (2010). <i>Publication Manual of the American Psychological Association</i> (6 th ed.). American Psychological Association.					
	<ol> <li>Szuchman, Lenore T. (2011). Writing with Style: APA Style Made Easy (5th ed.). Wadsworth/Cengage Learning.</li> </ol>					
	12. Statistics, simulation, programming, and relevant books.					
	13. ACM and IEEE magazines, Transactions and Journals.					
	14. Other International Journals.					
	15. Relevant conference proceedings and magazines (including ACM and IEEE conferences).					
	16. Technical reports from universities and major companies.					

Updated on 18 March 2022

# [Draft] Subject Description Form

Subject Code	ISE3011
Subject Title	Applied Quality and Reliability with AIDA
Credit Value	3
Level	3
Pre-requisite/Co- requisite/Exclusion	
Objectives	The subject will provide students with
	1. the understanding of quality and reliability systems;
	2. the ability to develop quality and reliability systems by applying AIDA;
	3. the ability to conduct quality and reliability control by applying AIDA.
Intended Learning	Upon completion of the course, students will be able to
Outcomes	a. integrate AIDA in quality and reliability systems;
	b. use appropriate AI tools for better process quality and reliability control;
	c. make decision by using quality and reliability principle and techniques.
Subject Synopsis/	1. Introduction to Quality and Reliability
Indicative Synabus	Basic concepts of quality and quality planning; Reliability fundamental; Quantification of reliability; Failure rate prediction and reliability estimation; Basic concepts of process variation and process capability study; Control charts and statistical tolerancing.
	2. <u>Quality Control by applying AIDA</u>
	AIDA techniques for Monitoring (e.g., sensors, image recognition); Proactive Monitoring; Anomalies Prediction. Using AIDA for acceptance sampling plans; Case Studies for using AIDA for quality control.
	3. <u>System Reliability by applying AIDA</u>
	Reliability block diagrams. Estimation of reliability functions by applying AIDA; Case Studies for using AI for Quality Control.

Teaching/Learning Methodology	The teaching pedagogy of this subject is a combination of classroom teaching and experiential learning. It consists of a series of lectures and well-organized laboratory activities. Emphasis is put on the acquisition of required skills and knowledge in artificial intelligence for quality and reliability. The lectures provide the basics and theories while the laboratory activities cover the skills following an interest-based approach.							
Assessment Methods								
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes g be assessed					es to
			а	b	c			
	Quizzes and Midterm Test	40%	~	~				
	Laboratory Exercises	20%	✓	~	~			
	Final Examination	40%	~	~	~			
	Total	100 %			1		1	
	concepts of applying laboratory exercises are At the end of the cour knowledge on using A monitoring and predictir	AIDA in qu used to asse rse, an exam AIDA for qu ng anomalies.	quality control and system reliability. The ssess their ability on using AIDA technology. mination is given to students to assess their quality control, system reliability, proactive es.					
Student Study	Class contact							
Enori Expected	• Lecture 2 hours/week for 13 weeks							26 Hrs.
	Tutorial/Case Stud	s	13 Hrs.					
	Other student study effor	rts						
	<ul> <li>Self Study/Assignr</li> </ul>	nent						58 Hrs.
	Case Study							13 Hrs.
	Total student study effor	t					]	110 Hrs.
Reading List and References	1. Sheila Anand, and New York, NY: Cl	L. Priya, A G RC Press, 202	<i>fuide fo</i> 20.	or Mach	ine Vis	sion in	Quality	[,] Control,
	2. Diego Galar Pass Systems in Condit Press, 2015.	cual, Artification Monitor	ial Int ing and	elligen d Diag	ce Too nosis,	ols: D Boca I	ecision Raton, 1	<i>Support</i> FL: CRC
	3. Pravinbhai Bhatt,	Babji Srin	ivasan,	Nirav	Prav	inbhai	Bhatt,	Process

	Control Fundamentals: Analysis, Design, Assessment and Diagnosis, Boca Raton: CRC Press, 2020.
4.	José A. Orosa García, <i>Quality Control: Developments, Methods and Applications</i> , New York: Nova Publishers, 2012.
5.	Ruth P. Saunders, <i>Implementation Monitoring and Process Evaluation</i> , Thousand Oaks, CA: SAGE, 2016.
6.	

# [Draft] Subject Description Form

Subject Code	ISE3017
Subject Title	Applied AIDA in Operations Research and Management
Credit Value	3
Level	3
Pre-requisite/Co- requisite/Exclusion	
Objectives	The subject will provide students with
	1. the understanding of the basics of operations research and management;
	2. the ability to model/formulate real life operations research and management problems with the enrichment of AIDA technologies;
	3. the ability to solve operations research and management problems.
Intended Learning	Upon completion of the course, students will be able to
Outcomes	a. apply AIDA techniques to enrich the modelling of operations management;
	b. apply the results of AIDA to produce operations research and management solutions;
	c. solve operations research and operations management problems.
Subject Synopsis/	1 Introduction to modelling with AIDA
Indicative Syllabus	Data driven modelling approach; AIDA techniques for data driven modelling (e.g., machine learning, big data).
	2. <u>Operations Research Modelling by using AIDA</u>
	Basic operations research concept; Optimization algorithms (e.g., linear programming, integer programming, dynamic programming); Mathematical modelling with AIDA; Case Studies for using AIDA for operations research.
	3. <u>Operations Management Modelling by using AIDA</u>
	Basic concept of demand management, and managing capacity; Case Studies for using AIDA for operations management.

Teaching/Learning Methodology	The teaching pedagogy of this subject is a combination of classroom teaching and experiential learning. It consists of a series of lectures and well-organized laboratory activities. Emphasis is put on the acquisition of required skills and knowledge in artificial intelligence for enriching modelling of operations research and operations management. The lectures provide the basics and theories while the laboratory activities cover the skills following an interest-based approach.											
Assessment Methods												
In Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intene be as	ded sub sessed	ject lea	arning o	outcome	es to				
			а	b	с							
	Quizzes and Midterm Test	40%	~	~								
	Laboratory Exercises	20%	✓	~	✓							
	Final Examination	40%	~	~	~							
	Total	100 %										
	concepts of applying A operations management on using AIDA technolo students to assess their operations research and problems.	IDA to enric The laborate ogy. At the e knowledge d operations	rich the modelling of operations research and ratory exercises are used to assess their ability e end of the course, an examination is given to ge on using AIDA to enrich the modelling of ns management, and to solve the modelled									
Student Study	Class contact											
Enori Expected	<ul> <li>Lecture</li> </ul>	ts	26 Hrs.									
	Tutorial/Case Stud	ts	13 Hrs.									
	Other student study effo											
	<ul> <li>Self Study/Assign</li> </ul>	ment						58 Hrs.				
	Case Study							13 Hrs.				
	Total student study effor	rt					]	110 Hrs.				
Reading List and References	1. Eberhard Hechle Thummalapalli, D DevOps, Governa Computing, Apress	er, Martin eploying AI i unce, Change s, 2020.	Oberh n the E e Mand	ofer, Interpri Igemen	Thoma se: IT t, Bloc	s Scł Approc ekchain	naeck, aches fo , and	Srinivas or Design Quantum				
	2. David Forsyth, Ap 2019.	oplied Machi	ne Lea	rning,	Cham:	. David Forsyth, Applied Machine Learning, Cham: Switzerland, Springer, 2019.						

3.	Gopinath Rebala, Ajay Ravi, Sanjay Churiwala, <i>An Introduction to Machine Learning</i> , Cham: Springer, 2019.
4.	Henrik Brink, Joseph W. Richards, Mark Fetherolf, <i>Real-world machine learning</i> , Shelter Island, NY: Manning Publications Co., 2017.
5.	Frederick S. Hillier, and Gerald J. Lieberman, <i>Introduction to Operations Research</i> , New York, NY: McGraw-Hill, 2015, Tenth edition.
6.	William J. Stevenson, Operations Management, New York, NY: McGraw- Hill, 2021, Fourteenth edition.

# **Subject Description Form**

Subject Code	ISE3018
Subject Title	Logistics Automation
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject provides students with
	1. the understanding of artificial intelligence and automation concept;
	2. the understanding of artificial intelligence and automation applications in facilitating logistics operations; and
	3. the ability to identify potential applications of artificial intelligence and automation in logistics operations in practice.
Intended Learning Outcomes	Upon completion of the subject, students will be able to:
(Note 1)	a. evaluate and improve the performance of terminal operations based on logistics engineering approach;
	b. analyze and design a solution to enhance warehouse operation efficiency and accuracy by using robots and automation technology; and
	c. analyze and develop a solution to support last-mile delivery operations by using drones and unmanned guided vehicles.
Subject Synopsis/	1. <u>Artificial Intelligence and Automation</u>
(Note 2)	Introduction to artificial intelligence and automation.
(Note 2)	2. <u>Container Terminal Automation</u>
	Introduction to container terminal industries and container terminal operations. Applications of automation technologies, (e.g., automated cranes, automated vehicles, information systems) in yard, quay, and gate operations.
	3. <u>Warehouse Automation</u>
	Warehouse and distribution center operations. Applications of autonomous robots, e.g., order picking robots and

	autonomous mobile robots, to enhance order picking, and goods storage and retrieval operations.							
	4. Last-mile Automation							
	Last-mile delivery operations. Applications of drones and unmanned guided vehicles in last-mile delivery.							
<b>Teaching/Learning</b> <b>Methodology</b> (Note 3)	The teaching pedagogy of this subject is a combination of classroom teaching and experiential learning. It consists of a series of lectures and well-organized laboratory activities. Emphasizing is put on the acquisition of required skills and knowledge in artificial intelligence and automation applied in logistics industries. The lectures provide the basics and theories while the laboratory activities cover the skills following an interest-based approach							
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed					
Outcomes			a	b	с			
(Note 4)	Quizzes and Midterm Test	40%	~	~	~			
	Laboratory Exercises	20%		✓				
	Final Examination	40%	~	~	~			
	Total	100%						
	Quizzes and midter understanding on the c logistics operations. Th on using logistics autor an examination is gi outcomes.	rm test are concepts of app ne laboratories mation technolo iven to studen	are used to assess students' applying logistics automations in ries are used to assess their ability mology. At the end of the subject, udents to assess their learning					
Student Study Effort	Class contact:							
Expected	Lecture	3 hours/week	k for 7 we	eks	21 Hrs.			
	Tutorial/Laborator	ry 3 hours/wee	k for 6 we	eks	18 Hrs.			
	Other student study effor	rt:						
	Laboratory Reports							
	Preparation for Te	ests and Examin	nation		39 Hrs.			
	Total student study effor	t			117 Hrs.			
Reading List and References	<ol> <li>Jerry Kaplan 201 Oxford University</li> <li>Eric Su 2016, Op Terminals, Abingo</li> </ol>	6, Artificial In 7 Press. 9 Press. Perational Risk 10n, Oxon, Nev	telligence Manager w York, N	, New Y ment in C IY: Routl	ork, NY: <i>Container</i> edge.			

3.	Ning Zhao, Yuan Liu, Weijian Mi 2020, Digital Management
	of Container Terminal Operations, Singapore: Springer.
4.	Gwynne Richards 2018, Warehouse Management: A
	Complete Guide to Improving Efficiency and Minimizing
	Costs in the Modern Warehouse, London, United Kingdom:
	Kogan Page Limited.
5.	Christian Wurst, Luca Graf 2021, Disrupting Logistics:
	Startups, Technologies, and Investor Building Future Supply
	Chains, Springer International Publishing.
6.	Albert Causo 2020, Advances on Robotic Item Picking:
	Applications in Warehousing & e-commerce Fulfillment.
	Springer.

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

### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

(Form AR 140) 8.2020

# **Subject Description Form**

Subject Code	ISE4001					
Subject Title	Integrated Capstone Project					
Credit Value	6					
Level	4					
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ISE3018 Logistics Automation Exclusion: ISE4008 Individual Project and ISE445 Capstone Project					
Objectives	While the specific objectives of integrated capstone projects may vary from one project to another, students are expected to develop the following generic skills through the learning experience of working on an individual project under the guidance of a supervisor:					
	1. Skills to obtain information needed to formulate a problem in logistics, and to devise and implement strategies that will produce a solution.					
	2. Skills to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to logistics.					
	3. Skills to apply knowledge, procedures (principles, techniques and methods), and to understand their limitations in problem identification, data analysis and formulation of logical observations and or solutions.					
	4. Capabilities of analyzing and solving complex and possibly real-life problems using AIDA.					
	5. Skills to work effectively as an individual using one's own initiative and within constraints.					
	6. Skills to prepare, present, and defend a project report effectively.					

Intended Learning Outcomes	Upon completion of the subject, students will be able to:					
(Note 1)	a. understand the background, as well as define the objectives (time, cost and technical requirements) and deliverables of a project that address a significant issue relevant to the field of logistics;					
	. formulate strategies and methodologies to achieve the project objectives within the constraints of a given situation, and understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills;					
	c. select, apply, integrate and, ideally, extend available knowledge, procedures and tools to collect data in performing the needed investigational or design work, and to draw conclusions that address the project objectives;					
	d. communicate effectively with stakeholders of the project outputs and work independently to produce, within applicable constraints, optimal solutions that address the project objectives;					
	e. evaluate the final outcome in an objective manner, and prepare, present, and defend a clear, coherent and succinct report.					
Subject Synopsis/ Indicative Syllabus (Note 2)	Each student is required carry out an individual project in an area relevant to the discipline of logistics engineering. Details of the work will depend on the subject of the project that the student works on.					
Teaching/Learning Methodology	Throughout the duration of the project, the supervisor provides guidance and monitors the progress of the project.					
(Note 3)	The progression of the project typically follows the following indicative stages:					
	<ul> <li>Project Definition – in this stage, the student will work in consultation with the project supervisor to draw up a project plan addressing issues such as: <ul> <li>Background of the project</li> <li>Aims and objectives</li> <li>Deliverables</li> <li>Project scope and applicable constraints</li> <li>Coverage of literature review</li> <li>Methodologies to be considered</li> <li>Project schedule</li> </ul> </li> </ul>					
	<b>Project Execution</b> – This is the major part of the project. After the project requirements are defined, the student will work independently under the guidance of the project supervisor towards the achievement of the project objectives and produce the project deliverables in a given situation. On his or her own initiative, the student will meet the project supervisor regularly					

	<ul> <li>to review progress and discuss issues of the project. In this stage, the student should demonstrate:</li> <li>Adherence to the schedule</li> <li>Initiatives to acquire and synthesize knowledge, collect the needed data, and solve problems</li> <li>Tenacity, resourcefulness, critical thinking and creativity in achieving project objectives</li> <li>Systematic documentation of data, design and results throughout the process</li> </ul>						
	The student is required to maintain a project workbook that records the meetings held and summarizes the work performed in this stage.						
	<ul> <li>Project Report – On completion of the project, the student will disseminate the results to examiners to review. The major deliverables of this stage are: <ul> <li>A written project report (softcopy and hardcopy)</li> <li>An oral presentation</li> <li>Taking questions and comments in a question-and-answer session</li> </ul> </li> <li>The proposed project defined by the student and/or the supervisor should be in an area relevant to the field of logistics. The project will be used as a vehicle for the student to integrate his/her knowledge gained in the programme. In order to achieve the subject learning outcomes, it is not appropriate to have projects mainly focused on literature review or pure computer programming. Depends on the nature of the project, the work covers by the students may include the background and scope of the project; literature review, field works; experiments; data collection; case attalian mathematical and an and and an and and and and and a</li></ul>						
Assessment Methods in Alignment with	Specific assessment methods/tasks%Intended subject learning outcomes to be assessed						rning d
Outcomes	a b c d					d	e
(Note 4)	<ul> <li>Progress</li> </ul>	15%	~	~	~	~	
	<ul> <li>Workbook</li> </ul>	10%	~	~	~	✓	
	• Final Report 50% $\checkmark$ $\checkmark$ $\checkmark$ $\checkmark$						✓
	■ Oral Presentation       25%       ✓       ✓       ✓       ✓       ✓         Total       100%						
	The workbook is designed to assist the project student to organise and document, in summary form, his or her project work in a systematic manner. This workbook, to be submitted at the end o Semester 1, will be commented by the Project Supervisor and ther assessed by a co-examiner of the project. The final report should be a clear, coherent and succinct document that disseminate the background, problem statement, objectives and expected deliverables, literature review, methodologies, project execution						ganise k in a end of d then should the the pected cution,

	analysis and, where appropriate, design, as well as discussion and conclusions. Thus, the written report and the oral presentation are assessed by the project supervisor and a co-examiner to determine the achievement of all the learning outcomes of the project work. The project supervisor, who communicates regularly with the student, will assess the student's progress during project execution.					
Student Study Effort	Class contact:					
Expected	<ul> <li>Briefing on Final Year Project</li> </ul>	2 Hrs.				
	Information Literacy Seminar	2 Hrs.				
	Other student study effort:					
	<ul> <li>Meetings with Supervisor and/or project stakeholders 2 Hrs. × 13</li> </ul>	26 Hrs.				
	<ul> <li>Literature review/field work/experiments</li> </ul>	120 Hrs.				
	Analysis/report writing 90 Hrs.					
	Total student study effort	240 Hrs.				
Reading List and References	1. Blaxter, L., et al. 2001, <i>How to Research</i> , 2 nd edn, Open University Press					
	2. Bryman, A. 1989, <i>Research Methods and Organization</i> <i>Studies</i> , Unwin Hyman					
	3. Campbell, W.G., et al. 1990, <i>Forms and Style: Thesis, Reports, Term Papers</i> , 8 th edn, Boston, Houghton Mifflin					
	4. Murray, Rowena 2002, <i>How to Write a Thesis</i> , Open University Press					

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

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

(Form AR 140) 8.2020

# **Subject Description Form**

Subject Code	LGT/MM3425				
Subject Title	Business Analytics				
Credit Value	3				
Level	3				
Pre-requisite/ Co-requisite/ Exclusion	<b>Exclusion</b> : Introduction to Business Analytics (LGT/MM2425) and Business Analytics (LGT3425)				
Objectives	This subject aims to expose students to the cutting-edge practices and technologies (including artificial intelligence and cloud computing) which are used for transforming business data and big data into useful information. It focuses on the cultivation of a sense of viewing business problems from a data perspective and critical thinking in business analytics. Through equipping students with a solid understanding of the principles, methods and technologies for business analytics, students can apply business intelligence tools to effectively address various issues faced by organizations. Hands-on practices for relevant computer application software and computer programming (Python) will be emphasized in the whole subject				
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Understand the current concepts and applications of business analytics in both local and global business environments (BBA Outcome 6b)</li> <li>b. Analyze business situations and tackle business problems using various types of business analytics tools (BBA Outcome 6b).</li> <li>c. Understand how current technologies such as artificial intelligence and cloud computing contribute to the success of data analytics implemented in companies (BBA Outcome 5c)</li> <li>d. Think critically and creatively on applying business analytics in different business contexts and daily contexts (BBA Outcome 6b)</li> <li>e. Identify and evaluate business opportunities using business analytics (BBA Outcome 5c)</li> <li>f. Identify the critical managerial and ethical issues in using business analytics (BBA Outcome 6b)</li> </ul>				
Subject Synopsis/ Indicative Syllabus	The subject presents an overview of strategic and managerial issues on business analytics in modern enterprises. Upon completion of the subject, students will be able to grasp fundamental issues of business analytics: <b>Business Analytics Overview</b>				

	Introduction to business analytics, data-analytic thinking, data science						
	solution for business problems						
	Der die diese Mandellieren						
	Predictive Modelling						
	introduction to predictive modernig. Torecasting analytics.						
	Prescriptive Analytics						
	Introduction to optimization and simulation.						
	Decision Analytics						
	What is a good model? Visualizing model performance, introduction to						
	data. mining and text analytics.						
	Students will learn the relationships among artificial intalligence, aloud						
	computing and big data, and understand how they can be integrated and						
	applied in business analytics.						
	The course will use a variety of methods as its nedagoory to help students						
Teaching/Learning	achieve the above learning outcomes.						
Methodology	1. Concern approximation of an apportunity for students to ask questions						
	to address any unfinished thoughts from the previous class;						
	2. Overview of the current class agenda and its relationships to past discussion:						
	3. Extended period of students- or instructor-led discussion of the key issues in the assigned case or readings. Collaborative learning strategies (learning						
	via discussion in a small group) may be employed during part of this time;						
	4. Lab sessions during tutorials to provide students hands-on experiences of using business analytics tools.						
	8						

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
(Note 4)			a	b	c	d	e	f	1	
	Continuous Assessment50%				-					
	1. Participation	5%	~	~	~	~	~	✓		
	2. Individual Assignment(s)	15%	~	~	~	~				
	3. Group Assignment(s)	30%	~	~	~	~	~	~		
	Examination	50%	~	✓ ✓ ✓		~	~	✓		
	Total	100%								
	<ul> <li>To reflect the significant technology content in this subject, 10% (or the overall weighting of this subject is based on individual as concerning technology-related knowledge.</li> <li>To pass this subject, students are required to obtain Grade D or abor overall subject grade.</li> <li>Explanation of the appropriateness of the assessment methods in a the intended learning outcomes: the various methods are designed to that all students taking this subject to have a balanced learning experied.</li> <li>Feedback is given to students immediately following the presentation students are invited to join this discussion.</li> </ul>						(or m asse above in ass red to eriend tions	ore) of ssment e in the sessing ensure ce. and all		
Student Study Effort Expected	Class contact:									
	Lectures				26 Hrs.					
	Tutorials					13 Hrs.				
	Other student study effort:									
	Preparation for lectures				28 Hrs.					
	<ul> <li>Preparation of assign and presentation / ex</li> </ul>	mment / group assignment xamination			56	Hrs.				
	Total student study effort			123Hrs.						

Reading List and	<b>Recommended Textbooks and References</b>			
Kelerences	<b>Recommended Textbooks</b> Camm, J.D., Cochran, J.J., Fry, M.J., Ohlmann, J.W., Anderson, D.R., Sweeney, D.J. and Williams, T.A. (2019). <i>Business Analytics (3rd edition)</i> . Cengage Learning.			
	<b>Reference Books</b> Akerkar, R. (2019). <i>Artifical Intelligence for Business</i> . Springer.			
	Albright, S. C. and Wayne L. Winston (2014), <i>Business Analytics: Data Analysis &amp; Decision Making, 5th Edition</i> , Cengage Learning.			
	Morrison, R. (2015). <i>Data-driven Organization Design: Sustaining the Competitive Edge through Organizational Analytics</i> , EBSCOhost ebook collection.			
	Provost, F., & Fawcett, Tom. (2013). <i>Data Science for Business (1st ed.)</i> . Sebastopol, Calif: O'Reilly.			
	Ragsdale, C. (2015). Spreadsheet Modeling & Decision Analysis: A Practical Introduction to Business Analytics (7e, Seventh ed.). Stamford, CT: Cengage Learning.			
	<i>Other References</i> Rentschler, Christina Verena. (2017). <i>Data at the edge but what does it mean?</i> <i>MS&amp;E 238 Blog: Leading Trends in Information Technology</i> . Stanford University.			
	Fu, K. & Xu, W. (2018). Risks of trusting the physics of sensors: protecting the Internet of Things with embedded security. <i>Communications of the ACM</i> , $61(2)$ , $20-23$ .			

# **Subject Description Form**

Subject Code	LGT3108				
Subject Title	Introduction to Enterprise Resource Planning System				
Credit Value	3				
Level	3				
Normal Duration	1-semester				
Pre-requisite / Co-requisite/ Exclusion	Nil				
Objectives	This course is to introduce the most important issues, technologies, usages, and concepts associated with ERP systems and their applications in business firms, where a commercial ERP system, such as SAP, will be used as a learning platform for students.				
	The objective is to enable students to:				
	1. understand the basic concepts and up-to-date technologies (such as cloud computing and business intelligence) of ERP systems;				
	2. be familiar with the basic usage of ERP systems, such as SAP, for various business processes;				
	3. be able to analyze important issues in implementing an ERP system in a firm;				
	4. develop ability and confidence in exploiting benefits from ERP systems and/or other information technology for business .				
Subject Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. To demonstrate a clear and relevant understanding of the definitions, importance, potential business values, and relevant technologies of ERP systems;</li> <li>b. To demonstrate the ability in learning the applications of ERP and using the up-to-date ERP systems (such as SAP) for business</li> <li>c. To demonstrate a clear understanding of the life-cycle model of the process that a firm goes through with ERP systems</li> </ul>				

Subject Synopsis/		Γ									
Indicative Syllabus	Topics	Sub-topics	Remarks								
		Introduction to the course Introduction to ERP and ERP Life Cycle	Lectures and Case Study								
	Introduction to ERP	ERP Technology, Market Awareness, and Future Trends									
		Cloud-based ERP									
		Business Functions and Business Process									
		Business Process Modeling									
		Data Management in ERP	Lectures and								
		Sales and marketing management with ERP	Lab Tutorials, with a commercial								
	Management with ERP systems	Procurement management with ERP	such as SAP, as a learning								
		Production Management with ERP	students' practice and								
		Accounting, finance, and human resource management with ERP	for the lecturer's demonstration								
	Monoping the	ERP Initiatives & Selection	Lectures, Case								
	Life Cycle of	ERP Design and Implementation	Group Project								
	an EKP Project	After ERP going live									
	Selected advanced topics on ERP	Applications of Business Analytics and Intelligence with ERP	Lectures, Case Study, Demonstration, and Site visit/Invited speaker								
Teaching/Learning Methodology	<ul> <li>During lectures, basic concepts of ERP and ERP systems will be introduced, and case studies will be discussed.</li> </ul>										
	<ul> <li>During tutorials, students will be guided to practice applications and usages of ERP systems in a computer lab.</li> </ul>										
Assessment Methods in	nent Is in										
-------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------	---------------------------------------------	--------------------------------------------	-------------------------------------------	----------------------------------------------------------------------------------------------------------------------------	-----------------	-----------	--	--	--
Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	be assessed (Please tick as appropriate)					nes to			
		c									
	Coursework	50 %	~	~							
	Examination	50 %	~		~						
	Total	100 %					·				
	Explanation of the appro- intended learning outcon	opriateness ones:	f the a	ssessm	ent methods in assessing the						
	The coursework includes assignments and case stu 2 respectively. The final ERP and a case study a outcomes 1 and 3.	s a series of t dies. They ar exam is base bout the ER	utorial e used d on qu P life o	exercis to asse testions cycle, v	es of u ess the s s releva which	s of using ERP systems, and the subject outcomes 1 and relevant to basic concepts of hich are relevant to subject					
Student Study	Class contact:										
Enori Expected	Lectures						26 Hrs.				
	Tutorials					13 Hrs.					
	Other student study effort:         • Assignment and Self-Study										
								45 Hrs.			
	<ul> <li>Additional Exercise</li> </ul>	es on ERP aft	er class	5		42 Hrs.					
	Total student study effor	t					1	26 Hrs.			
Reading List and	Recommended Textboo	<u>ok</u>									
Kelerences	Monk, Ellen and Wagi <i>Planning</i> , 4 th Edition, Co	ner, Bret J. ourse Techno	(2014) logy Co	<i>Conc</i> engage	<i>epts in</i> Learni	<i>Ente</i>	rprise	Resource			
	<u>Useful Reference Textb</u>	ooks									
	Bradford, Marianne. (20 Advanced Business Syst	015) Modern ems, Third E	ERP: dition,	Select, Lulu	, Imple	ement	& Use	: Today's			
	O'Leary, Daniel E. (200 cycle, Electronic Comme	0) Enterprise erce, and Ris	Resou k, Cam	rce Pla bridge	nning S Univer	System sity Pr	ns: Syst æss	ems, Life			

# The Hong Kong Polytechnic University

Subject Code	LGT3109						
Subject Title	Introduction to Coding for Business with Python						
Credit Value	3						
Level	3						
Normal Duration	1-semester						
Pre-requisite / Co-requisite/ Exclusion	Nil						
Objectives	<ul> <li>Python is a popular coding (programming) language. It is easy to learn, and has been widely used by business professionals to facilitate their daily operational tasks and analytical jobs. This course introduces the fundamentals of Pytho language and its applications for task automation for business operations, and dat management for business analytics. Students with or without programmin experience are all welcome.</li> <li>The objective of this course is to enable students to:</li> <li>grasp the fundamentals of Python language and the basics of coding;</li> <li>be familiar with the basic usage of Python language in business applications</li> <li>be able to apply basic knowledge and skills of Python programming for basis business applications;</li> </ul>						
	for business.						
Subject Learning Outcomes	Upon completion of the subject, students will be able to: a. read and analyse basic Python programs; b. develop test and debug basic Python programs;						
	<ul> <li>develop, lest and debug basic Python programs;</li> <li>understand business applications of Python programs;</li> </ul>						
	<ul> <li>d. apply Python programming for basic business applications in task automation data management.</li> </ul>						

Subject Synopsis/			1		
Indicative Syllabus	Topics	Sub-topics	Remarks		
		Getting Started: What's the use of Python? How to type and execute Python programs?	Lectures and Lab Tutorials		
	Python	Variables, Simple Data Types, and Basic Flow Control			
	Fundamentals	Functions			
		Strings, Lists, and Dictionaries			
		Testing and Debugging Python Programs			
		Object-Oriented Programming			
	Business Applications of Python (1):	Organizing, Reading, and Writing Working Files	Lectures, Case Study, and Lab Tutorials		
	Task Automation in Business Operations	Working with CSV Files and Excel Spread Sheets			
	Business	Data Cleaning	Lectures, Case		
	Python (2):	Data Analysis	Tutorial		
Management for Business Analytics		Data Visualization			
Teaching/Learning Methodology	<ul> <li>During lectur application wi</li> </ul>	es, basic knowledge of python languaged languaged by the introduced and discussed.	ge and its business		
	<ul> <li>During tutoria development of</li> </ul>	ils, students will be guided to practice t of Python programs for business applicatio	he basic usages and ns in a computer lab.		

Assessment									
Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
			а	b	с	d			
	Coursework	50 %	~	~	✓	✓			
	Examination	50 %	~	~	~	~			
	Total	100 %		1			1	L	
	Explanation of the approintended learning outcon	opriateness o nes:	of the assessment methods in assessing the					ssing the	
	The coursework includes a series of written assignments to assess the sub- outcomes (a) and (c), as well as a series of tutorial exercises for practicing development of Python programs to assess the subject outcomes (b) and (d). The final exam is based on questions relevant to basic concepts, knowledge, and sk about Python language and its business applications, to access subject outcom (a) – (d). To reflect the significant technology content in this subject, <i>10% (or more)</i> of the overall weighting of this subject is based on individual assessment concerning technology-related knowledge.						e subject ticing the d (d). The and skills outcomes		
Student Study	Class contact:								
Effort Expected	<ul> <li>Lectures</li> </ul>		26 Hrs.						
	<ul> <li>Tutorials</li> </ul>		13 Hrs.						
	Other student study effort:         • Assignment and Self-Study         • Additional Exercises on Python Programming After Tutorials								
								40 Hrs.	
								47 Hrs.	
	Total student study effor	t					1	26 Hrs.	
Reading List and	<b>Reference Textbook</b>				•				
References	Charles Russell Severand (2016) <i>Python for Eve</i> Independent Publishing I	ce, Sue Blum erybody: Exp Platform.	enber, ploring	Elliott Data	Hauser in Py	, and A Athon	Aimee A 3. Cre	Andrion . eateSpace	
	Clinton W. Brownley. (2 <i>Programmer to Hacker</i> ,	016) <i>Founda</i> O'Reilly Meo	<i>tions fo</i> lia.	or Anal	ytics w	ith Pyt	hon: Fi	rom Non-	
	Al Sweigart. (2019) Auto Practical Programming	veigart. (2019) Automate the Boring Stuff with Python, 2nd Edition: tical Programming for Total Beginners. No Starch Press.					1:		

Subject Code	LSGI3220
Subject Title	Building Information Modelling & 3D GIS
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	<ul> <li>The aims of this subject are:</li> <li>1. To understand the industry needs and trend of BIM development;</li> <li>2. To teach functions of BIM software;</li> <li>3. To describe the theories and concepts of BIM;</li> <li>4. To introduce the technologies of Building Information Modelling (BIM) and 3D Geographic Information Systems (GIS) and their integration;</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Grasp knowledge on BIM concepts, technologies and standards (L2);</li> <li>b. Utilize BIM and GIS software to build 3D models (L2);</li> <li>c. Operate BIM software for project process management, including engineering and construction components (L3);</li> <li>d. Demonstrate knowledge on 3D data interoperability between BIM, City GML and GIS (L3);</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>Basic concepts of BIM: standard, stages (design, tendering, construction, and maintenance), level of detail, multi-dimension, and the development and emergence;</li> <li>Benefits of Building Information Modelling (BIM) technologies: 3D model project setup, creation, editing and modifying of building components in details, 3D visualization and analysis, clash detection;</li> <li>Integration 3D GIS with BIM: models and data (GIS data, Lidar data, IFC, CityGML), and other exchange standard and platform);</li> <li>Practical skills on BIM: Autodesk Revit with representative cases.</li> </ol>
Teaching/Learning Methodology	Teaching and learning materials will be provided on-line for students to download easily. Contact hours will be used for formal lectures, in-class discussions and presentations, and practical work.

Assessment Methods	Specific assessment	% Intended subject learning outcomes								
in Alignment with	methods/tasks	weighting	be assessed (Please tick as							
Intended Learning	memous, asks		appro	priate)						
Outcomes			а	b	c	d				
	1. Individual essay	20								
	2. Test	30								
	3. Project	50								
	Total	100								
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes: Practical work / project will be used to assess students' ability to process and manage BIM data in a spatial context. The essay will assess students' independent understanding of basic concepts and students' ability of independent thinking, English writing skills.									
Student Study Effort	Class contact:									
Expected	Lecture						26 Hrs.			
Practical					26 Hrs					
	Other student study effort:Project preparation work25 Hrs.									
	Self study				28	8 Hrs.				
	Total student study effor	t			10	05 Hrs.				
Reading List and References										

Subject Code	LSGI3801					
Subject Title	GeoAI [GeoAI is the revised subject name in which previous submission named as Geospatial Intelligence and Geo-visualization]					
Credit Value	3					
Level	3					
Pre-requisite/ Co-requisite/ Exclusion	Nil					
Objectives	<ol> <li>The objectives of this subject are:</li> <li>To frame any geospatial problem using a machine learning approach,</li> <li>To enable students become proficient in the use of conventional and modern geovisualization techniques,</li> <li>To enable students properly apply geovisualization principles and methods to practical problems</li> <li>To enable students to know how to create and extract relevant and useful features of a given geospatial problem,</li> <li>To introduce common machine learning approaches to perform classification and estimation, and</li> <li>To enable students properly apply qualitative indices to assess the results and the model.</li> </ol>					
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>1. Define various types of visual representations (L1)</li> <li>2. Explain the techniques for thematic mapping and visualization (L2)</li> <li>3. Extract or create useful features from a geospatial dataset (L3),</li> <li>4. Improve the geospatial data quality by data pre-processing (L3),</li> <li>5. Construct a machine learning workflow to extract information of a geospatial problem (L4),</li> <li>6. Assess the results using different qualitative indicator (L3), and</li> <li>7. Handle different geospatial data collected from different platforms and understand the pros and cons of each covered approach (L4).</li> </ul>					
Subject Synopsis/ Indicative Syllabus	<ul> <li>A. Problem Definition         Framing and understanding a geospatial problem (e.g., number of classes), desirable accuracy/outcomes, choice of geospatial data, data resolution, etc.     </li> <li>B. Principles and theories for symbol and map design.         Visual variables, colour scheme, visual information processing,     </li> </ul>					

		perceptional theories, map perception, map evaluation.
	C.	<b>Scale and generalization:</b> Theories and principles of map generalization in digital environment, algorithms for various operations in both vector and raster modes, automated systems.
	D.	<b>Geo-Visualization:</b> Variables for visualization (dynamic variable, screen variables, exploration acts, web-specific variables), cartograms, pictorial maps, dynamic maps, rendering and animations, virtual reality, augmented reality
	Е.	<b>Data Preparation and Pre-processing</b> Outlier removal, data cleaning, data/coordinate transformation, etc.
	F.	<b>Feature Selection and Extraction</b> Preparation of features based on location, time, attributes and/or semantic information, dimension reduction, principal component analysis, etc.
	G.	Machine Learning/Classification Model Supervised and unsupervised learning, parametric and non- parametric models, clustering and segmentation, etc.
	H.	<b>Model Validation and Accuracy Assessment</b> Confusion matrix, accuracy, F-measures, quantity disagreement and allocation disagreement, receiver operating characteristic (RoC) curve, etc.
	I.	Case Studies and Applications LiDAR point clouds, spatial-temporal dataset, urban big data, etc.
Teaching/Learning Methodology	•	Lectures will be used to introduce the subject materials. Lab sessions will be broken down into different stages of machine learning process using Python. A final group project will be introduced to enhance the team spirit, communication skills, problem solving skill, and presentation skill.

Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
Outcomes	1 2					4	5	6	7	
	1. Lab assignments	30%								
	2. Mid-term test	30%								
	3. Project (Report and presentation)	40%	V	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
	Total	100%								
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:									
	Continuous assessment consists of two components: lab assignments and a group project. Four lab assignments will be given to the students covering different stages of the machine learning process. The group project (upon discussion with the subject lecturer) will let students work on a specific geospatial problem (e.g. point cloud classification, urban big data analysis, information extraction from spatial-temporal images, etc.) with a submission of a group report and a final presentation.									
Student Study Effort	Class contact:									
Expected	Lecture							26 Hrs.		
	Practical							26 Hrs.		
	Other student study effo	ort:								
	<ul> <li>Reading of textboo</li> </ul>	k and journa	l pape	ers				23	Hrs.	
	<ul> <li>Project completion</li> </ul>	and writing						40	Hrs.	
	Total student study effo	rt						115	Hrs.	
Reading List and References	<ol> <li>Yamagata, Y., &amp; Se data: Methods and u</li> <li>Shan, J., &amp; Toth, C. and scanning: principal</li> </ol>	ya, H. (Eds.) Irban applica K. (Eds.). (2 iples and pro	). (20] utions 2018). cessii	9). S Aca Topo ng. C	patial demic ograpl RC Pi	l analy c Pres hic la ress. (	ysis u s. 302 ser ra 637 p	sing <del>l</del> 2 pp. nging p.	big 5	

3.	Pedregosa, F., et al., (2011). Scikit-learn: Machine learning in Python. <i>Journal of Machine Learning Research</i> , 12, 2825-2830.
4.	VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. O'Reilly Media, Inc. 743 pp.
5.	Dent, B. 1999. <i>Cartography: Thematic Map Design</i> . 5 th edition, Wm C. Brown Publishers. 417pp.
6.	Robinson, A. et al., (1995). <i>Elements of Cartography</i> . 6 th edition, John Wiley & Sons Inc. 674pp.
7.	Slocum, T., McMaster, R., Kessler, F. and Howard, H., 2004. <i>Thematic Cartography and Geographic Visualization</i> , Second Edition, Jul 2004, Pearson Education, 528 pages.
8.	MacEachren, A. and D. Taylor (eds.) (1994). Visualization in Modern Cartography. Pergamon. 345pp.
9.	Kraak, MJ., and Brown, A. (eds.), Web Cartography. Taylor and Francis, 213pp.
10.	Keates, J., (1989). <i>Cartographic Design and Production</i> . 2 nd edition, Longman. 261pp.

Subject Code	LSGI3802				
Subject Title	Spatial Data Science [Spatial Data Science is the revised subject name in which previous submission named as Spatial Data and Geo-Information Science]				
Credit Value	3				
Level	3				
Pre-requisite/ Co-requisite/ Exclusion	Nil				
Objectives	This subject aims at presenting the fundamental concepts and principles of geographic information Sciences (GISc), including spatial data, spatial modelling and analysis in GISc. It also provides an appreciation of the operation of Geographic Information Systems (GIS) to carry out what have been learnt theoretically. Students' English communication and critical thinking will also be addressed through written assessments. Student will also understand the concepts and sciences about the Open Data in Hong Kong and worldwide.				
Intended Learning Outcomes	<ul> <li>At the end of this subject students who gain a pass will be able to:</li> <li>1. Grasp a general understanding of GISc concepts / theories</li> <li>2. Grasp a understanding of the concepts and theories about the Open Data</li> <li>3. Master the operation of at least one GIS software</li> <li>4. Able to construct a small spatial database with relevant attribute data, perform a simple analysis of spatial pattern and present results are phinally.</li> </ul>				
Subject Synopsis/ Indicative Syllabus	<ul> <li>A. Overview Evolution of GIS, its development and relationships with other disciplines; an overview of the basic functions of GIS and how GIS is different from CAD and database systems.</li> <li>B. Fundamental Principles of GISc Recognition, abstraction and modelling the real world; uncertainty of spatial data quality; scale and generalization; georeference; spatial analysis.</li> <li>C. Hardware and Software Components The user interface, the database, the software, the storage devices, the digitizer, the scanner and the display devices.</li> </ul>				

	D.	<b>Space model and Spatial Features</b> Space and its tessellations; nature of spatial features, their entities and relationships; interpreting different classes of features from maps.
	E.	<b>Management of attributes in database</b> Difference between spatial and non-spatial attributes; procedures of tagging attributes to features and linking up attributes from different databases; use of primary identifier.
	F.	<b>Concepts and theories of Open Data</b> in Hong Kong and worldwide, how to retrieve and process the Open Data spatially and apply in real-life applications
	G.	<b>Spatial Data Structures</b> The structures of simple data types such as point, line, text and image; vector and raster representation of spatial features – comparison and conversion; symbolisation of spatial features; graphic editing.
	H.	<b>Topological Data Structures</b> The need for topology; elementary graph theory; simple topological data structures; essence of topology building.
	I.	<b>Spatial Query and Analysis</b> Use of retrieval functions to find spatial features and to obtain their attribute values; distance and area measurement; operation and basic algorithms for simple topological analysis, buffer zone generation and overlay analysis.
	J.	<b>Data Modelling and Representation for Buildings (BIM)</b> Modelling of building and building components; solid model vs surface model; attribution of building components.
	K.	<b>Applications of GIS</b> Urban planning, transport, environmental study, land management, Hong Kong digital map data, e.g. the Computerized Land Information System (CLIS) and its BMS, GIRS, CIS.
Teaching/Learning Methodology	Teac The read refer conc spec asses weal	hing and learning will largely be conducted through weekly lectures. subject materials, work examples, useful web sites and required ings will be uploaded to the on-line platform for students' easy rence. The contact hours will be used for lecturing the theory and repts, individual and group discussions. In addition, a timetable for ific topics will be scheduled and a quiz will be used as formative assent in order to help students to further identify their strengths and censses.
	Stud prac prod a bas	ents' knowledge and practical skills will be developed in the assigned tical sessions. A written report along with series of data has to be uced. Upon completing these exercises, students will be able to grasp sic but solid understanding of GIS concepts for further advanced GIS

	subjects in their later stages of studies.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					ase
outcomes			1	2	3	4		
	1. In-class practicals	40	~	~	~	✓		
	2. Quiz	10	~	~				
	3. Examination	50	~	~				
	Total	100%					•	
	Students' knowledge an practical exercises assi examination aims at tes	nd skills will igned each y ting the basic	ill be continuously assessed with the week, a quiz and end of semester sic concepts.				h the nester	
	Students need to pass l in order to pass the wh	both continu tole subject.	ious a	ssessn	nent a	nd exa	amina	tion
Student Study Effort	Class contact:							
Expected	Lecture		26 Hrs.					
	Practical						26	Hrs.
	Other student study effor	rt:						
	• Self-study, reading	and revision					53	Hrs.
	Total student study effor	t					105	Hrs.
Reading List and References	1. Aranoff, S. (1990) Geographic Information Systems: A Management Perspective; WDL Publications.						s: A	
	2. Chang, K.T. (20 Systems, McGraw	002) <i>Introdi</i> v-Hill Higher	<i>iction</i> r Educ	<i>to G</i> ation.	eogra	phic I	Inform	ation
	3. Chen, Y.Q. & <i>Acquisition,</i> Sprin	Lee, Y.C. nger Wien N	(eds) ew Yo	(2001 ork.	) <i>Ge</i>	ograp	hical	Data
	4. Clarke, K.C. (1 Englewood Cliffs	990) <i>Analyt</i> s, N.J.: Prent	<i>ical a</i> ice-Ha	und C 111.	ompu	ter Ca	artogr	aphy,
	5. Laurini, R. & T Information Syste	hompson, D ems, London	). (199 : Acad	92) <i>Fi</i> emic 1	<i>indam</i> Press.	entals	of S _l	oatial
	6. Peuquet, M. (1	990) Introd	luctor	v Rea	dings	in (	Geogra	aphic

	Information Systems, Taylor & Francis.
7.	Rhind, D. W. (1991) <i>Geographical Information System: Principles and Applications</i> , Harlow, Essex, England: Longman Scientific and Technical; New York: Wiley.
8.	Robinson, A.H. & Sale, R. (1995) <i>Elements of Cartography</i> , 6th ed., New York: John Wiley & Sons, Inc.
9.	Paul Longley, M. Goodchild, D. Rhind, and D. Maguire (1999) Geographical Information System: Principles and Technical Issues, New York: John Wiley & Sons, Inc.

LSGI3803
Spatial Data Analysis and Mining
3
3
AMA1751 Linear Algebra & COMP1011 Programming Fundamentals
<ol> <li>To develop students' understanding on what geospatial data analysis and mining are.</li> <li>To enable students to learn the methods of spatial data analysis and mining including classification, clustering analysis, pattern analysis, network analysis.</li> <li>To enable students to properly apply spatial data analysis and mining techniques to practical problems.</li> </ol>
<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Explain the purpose of spatial data analysis and mining (L3)</li> <li>b. Describe a range of data analysis and mining methods and their use in analyzing spatial data (L2)</li> <li>c. Identify and select the appropriate methods for various real-world problems (L3)</li> <li>d. Test models through validation and able to criticize their reliability (L4)</li> </ul>
<ul> <li>Subject Synopsis</li> <li>Introduction of spatial data</li> <li>Spatial data acquisition and preprocessing Data cleaning, calibration, and integration</li> <li>Exploratory Spatial data analysis and visualization</li> <li>Descriptive and regression analysis Descriptive statistics for spatial data Geographically weighted regression</li> <li>Point data pattern analysis Quadrat estimation K functions</li> <li>Network analysis Accessibility measurement Shortest path algorithm</li> <li>Area data pattern analyses Global spatial dependence Local spatial dependence</li> <li>Spatial interpolation and surface analysis Distance based interpolation Geostatistics methods</li> <li>Spatial data mining Classification Clustering Change detection</li> </ul>

Teaching/Learning Methodology (Note 3)	<ol> <li>Lectures to explain theories and methodology;</li> <li>Lab sessions and a small individual project to reinforce the theories and methodology introduced during the lectures, so as to enable students to gain deeper understanding of the principles and techniques, to acquire practical problem-solving skills, to become critical in thinking; and</li> <li>A group project is designed to enhance the critical thinking, team spirit, problem solving skill, leadership and presentation skill.</li> </ol>							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
(Note 4)			а	b	c	d		
	1. Assignment	30%	~	~	~			
	2. Class project	30%		~	~	~		
	3. Written test	40%	~	~	~	~		
	Total	100 %						
	intended learning outcomes: It consists of 100% continuous assessment through assignment (309 project (30%), and written test (40%). Assignment includes lab and Through these activities, students will be assessed about the fun- knowledge in spatial data mining and the practical capabilities of per- spatial data mining using actual data sets. Class project included presentation and report. Problem based learning is carried out during the work, and is reinforced by Q and A. Presentation contributes to the development of students. Written test is designed to monitor student learning knowledge level. Students are expected to achieve a minimum standard is to obtain a passing grade in line with criterion referenced assessment a					30%), class nd tutorial. undamental performing ude student the project the project e all-round learning at rd to be able to approach.		
Student Study Effort Expected	Class contact:							
	Lectures					26 Hrs.		
	Tutorials						13 Hrs.	
	Other student study effort:							
	Assignments/Self S	tudy					31 Hrs.	
	Preparation and class	ss project				30 Hrs.		
	Total student study effor	t					120 Hrs.	

Reading List and References	1.	Statistical methods for spatial data analysis / Schabenberger & Gotway (2005)
	2.	Statistical analysis of spatial and spatio-temporal point patterns / Diggle (2013)
	3.	Applied spatial data analysis with R / Bivand, Pebesma, & Gómez-Rubio (2013)
	4.	Applied spatial analysis of public health data / Lance & Carol (2003)
	5.	Spatial statistics: geospatial information modeling and thematic mapping / Mohammed A. Kalkhan (2011)
	6.	Spatial data mining: theory and application / Li, Wang, & Li (2015)

Subject Code	LSGI3804
Subject Title	Urban Big Data Analytics
Credit Value	3
Level	3
Pre-requisite	Nil
Objectives	This course aims to provide in-depth knowledge and hands-on techniques on urban big data analytics. This course will introduce the concept of urban big data, and the methods for acquiring, processing, and analyzing these data sets. It will also introduce applications for urban planning, environmental analysis, transportation and mobility, housing, urban sustainability and resilience, business intelligence, and urban socio-economics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to:
	a. Understand the definition and principles of urban big data (1)
	techniques for big data mining and their applications to large-scale data
	warehouses and big data analytics (2)
	c. Understand solutions and issues in big data mining and analytics (3)
Subject Synopsis/ Indicative Syllabus	<ul> <li>A. Introduction of urban big data</li> <li>B. Big data acquisition</li> <li>C. Big data processing and management <ul> <li>o Aggregation</li> <li>o Systematic, stochastic, and gross error cleaning</li> <li>o Database technologies and spatiotemporal indexing</li> </ul> </li> <li>D. Method and techniques in big data analysis and mining <ul> <li>o Urban big data mining and knowledge discovery</li> <li>o Distributed and parallel computing</li> <li>o Deep learning and artificial intelligence</li> <li>o Visualization of urban big data</li> <li>E. Urban big data applications</li> <li>o Transportation</li> <li>o Traffic monitoring</li> <li>o Urban planning</li> </ul> </li> </ul>

	o Urban logistics								
	o Urban infrastructure								
	o Business intelligence								
	o Internet of things								
Teaching/Learning	1. Lectures to explain th	neories and m	nethod	ology;					
Methodology	2. Assignments to reinfo	orce the theor	ries an	d metł	nodolo	gy int	roduce	ed	
	during the lectures, so a of the principles and tec	s to enable st hniques, to b	udents ecome	s to gate critic	in deej al in tl	per ur ninkir	idersta ig; and	nding l	
	3. A group project is des spirit, problem solving s	signed to enh skill, leadersh	ance t nip and	he crit 1 prese	ical th ntatio	inking n skill	g, tean I.	ı	
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				ase		
Outcomes			1	2	3				
	1. Lab assignments	30%	$\checkmark$	$\checkmark$	$\checkmark$				
	2. Project (Report and presentation)	70%	$\checkmark$	$\checkmark$	$\checkmark$				
	Total	100%							
Student Study Effort	Class contact:								
Expected	<ul> <li>Lectures</li> </ul>						26 Hrs.		
	<ul> <li>Lab Sessions</li> </ul>						26	Hrs.	
	Other student study effo	ort:							
	<ul> <li>Project</li> </ul>						60	Hrs.	
	Total student study effo	rt					112	Hrs.	
Reading List and	Zheng Yu. Urban Comp	outing. MIT I	Press, 2	2019.					
References	Wang, S. and Goodchild	d, M. F. Cybe	erGIS	for Ge	ospati	al Inn	ovatio	n and	
	Discovery. Springer, Do	ordrecht, Net	herlan	ds, 20	18.				
	Townsend, Anthony M. quest for a new utopia.	Smart cities: WW Norton	: Big d & Cor	lata, ci npany,	vic ha 2013	ckers,	and th	ne	
	O'sullivan, David, and I John Wiley & Sons, 201	David Unwin 14.	. Geog	graphic	infor	matio	n analy	ysis.	
	O'sullivan, Arthur. Urban economics. McGraw-Hill/Irwin, 2007.								

Subject Code	LSGI3805
Subject Title	Urban Sensing for Smart City
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	<ul> <li>To give students a background to the current state of development of the remote sensing discipline including basic principles of imaging, image processing and data types and sources</li> <li>To develop students' skills in image processing</li> <li>To give students a basis to apply the skills and techniques already learned to practical problems of the urban environment To encourage students to examine ways of applying their knowledge and skills to actual urban problems and situations</li> </ul>
Intended Learning Outcomes	<ol> <li>Upon completion of the subject, students will be able to:</li> <li>Be familiar with the 'state of the art' in earth resource monitoring from remote sensing platforms (L1)</li> <li>Have the ability of knowledge on solving the urban problems and issues related to smart sensing (L2)</li> <li>Understand the current 'state of the art' in the application of smart sensing of urban environment in Hong Kong (L3)</li> <li>Solve problems arising from real-life examples (L4)</li> </ol>
Subject Synopsis/ Indicative Syllabus	<ul> <li>A. Introduction to remote sensing and physical principles of imaging</li> <li>B. Smart sensors and platforms: aircraft, satellites and scanning systems</li> <li>C. Internet of Things: Concepts, theories, applications, and recommendations</li> <li>D. Applications of remote sensing in the urban environment and in the natural environment</li> </ul>
Teaching/Learning Methodology	Teaching and learning materials will be delivered on-line for students to download easily. Contact hours will be used for formal lectures, hybrid problem-solving and practical work. Group projects will form a part of the practical work and these will require students to use initiative and explore a wide range of solutions.

Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assesse tick as appropriate)					ase
Outcomes			1	2	3	4		
	1.Written Examination	50	$\checkmark$	$\checkmark$	$\checkmark$			
	2. Practical assignments	40			$\checkmark$	$\checkmark$		
	3. Multiple Choice (phase) test	10	$\checkmark$	$\checkmark$				
	Total	100 %						
	Explanation of the a assessing the intended	ppropriatene learning out	ss of comes	the a	ssessm	nent n	nethod	ls in
	Continuous assessmen practical work. The ph of physical concepts independently. Practic students' understandin gained during the con- independent skills of a ability to apply proceed areas in Hong Kong.	nt consists o ase test will a and the st cal work wil ng of the im urse. A writt expression, k lures and con	f two assess ate of l be u age p: en exa nowle cepts t	comp studen f the used to rocess aminat dge of to a de	onents ts' bas art of o reinf ing pr ion w the di fined p	, phas sic und f the orce, actice ill tes sciplin proble	se test lerstar discip and a and s t stud ne, an m of u	and ading bline, ssess skills ents' d the urban
Student Study Effort Expected	Class contact:							
Zapeeteu	Lecture						26 Hrs.	
	Practical						26	Hrs.
	Other student study effe	ort:						
	<ul> <li>Reading of textboo</li> </ul>	ok and journa	l pape	rs			23	Hrs.
	<ul> <li>Assignment compl</li> </ul>	letion and wr	iting				40	Hrs.
	Total student study effo	ort					115	Hrs.
Reading List and References	1. Lillesand, T. and H Image Interpretation	Keifer 2008, I on, 6 th ed.Wil	Remot ley.	e Sens	ing an	d		
	<ol> <li>Mather, P. 1999, Computer processing of remotely sen images, 2nd Edition, Wiley.</li> </ol>					y sens	ed	
	<ol> <li>Longley, P., M. Goodchild, D. Maguire and D. Rhind, 1999, Geographic Information Systems (2nd Edition), John Wiley &amp; Sons, INC., USA</li> </ol>					2		

4. Skidmore, A. 2002. Environmental modelling with GIS and
Remote Sensing. Taylor and Francis
Recommended:
<ol> <li>Campbell, J.B. (1996). Introduction to remote sensing. Guilford Press, New York. 1996.</li> </ol>
<ol> <li>Robinson A. H. et al., (1996) Elements of Cartography. 6th Edition, Wiley &amp; Sons, New York.</li> </ol>
Supplementary:
7. The International Journal of Remote Sensing, The Remote Sensing Society, UK.
8. ISPRS Journal of Photogrammetry and Remote Sensing. Elsevier, Amsterdam.
9. Photogrammetric Engineering and Remote Sensing. American Society of Photogrammetry, USA.

## The Hong Kong Polytechnic University

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	LSGI4503
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: COMP1011 Programming Fundamentals, LSGI3803 Spatial Data Analytics and Mining Exclusion: Any other equivalent capstone project
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>Promote students' knowledge of artificial intelligence and data analytics (AIDA) to prepare for the increasing presence of AI and Big Data in land surveying and geo-informatics;</li> <li>Provide a student with the opportunity to apply and integrate AIDA into land surveying and geo-informatics;</li> <li>Develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA;</li> <li>Train students with skills on integrate AIDA and land surveying and geo-informatics to achieve a higher order learning process and to apply this to solve professional problems.</li> </ul>
Intended Learning Outcomes (Note 1)	Upon completion of the subject, students will be able to: Professional/academic knowledge and skills (a) get familiar with the latest approaches of AIDA in land surveying and geo-informatics, including machine learning (ML) and deep learning (DL); (b) conduct literature surveys to locate and collect materials and sources relevant to the selected problem area in a land surveying and geo-informatics; (c) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills, including data pre-processing and visualization; (d) define and specify the problem precisely (e.g., model selection or creation); (e) assimilate and apply the learned knowledge to generate good solutions to the problem (e.g., model optimization);

	<ul> <li>(f) think critically about the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(g) evaluate the final outcome in an objective manner;</li> <li><u>Attributes for all-roundedness</u></li> <li>(h) improve presentation and communication skills via oral presentation;</li> <li>(i) enhance technical report writing skills with proper organization of materials;</li> <li>(j) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(k) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(l) work collaboratively with related parties (e.g., vendors, sponsor company, technical support staff, team-partners, research students, etc.).</li> </ul>
Subject Synopsis/ Indicative Syllabus (Note 2)	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor Students are expected to identify a project topic with a supervisor in their chosen discipline, and a co-supervisor with artificial intelligence and data analytics expertise. Students need to demonstrate their knowledge in both their chosen discipline and AIDA in the project, receiving advice from both supervisors. For a specific topic, an in-depth study in the targeted domain is required.</li> <li>Project Meeting and Planning The project should represent the requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learned from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain. Regular meetings with supervisors are proceed to make a plan for their topics.</li> </ol>
	<ul> <li>3. Proposal Writing A project proposal will be submitted in the first semester. This proposal will contain a comprehensive literature review, an outline of the problem, objectives, project design, proposed methodology (AIDA), and solution evaluation. The preliminary results are also provided as well as the next plan with a timetable for project completion. </li> <li>4. Regular Progress Checking and Reporting Regular progress will be reported to supervisors, and supervisors will provide timely comments and suggestions to students in project execution, including guidance in data pre-processing, model selection, and result evaluation.</li></ul>
	<b>5. Project Documentation</b> The materials including data sets, coding, output data, and technical documentation, should be documented and archived, and students must submit a bound copy of their dissertation along with relevant documents.

	<b>6. Presentation and Demonstration</b> In the second semester, students will present a summary of their dissertation topic and defend the results and conclusions during a Q & A session.													
<b>Teaching/Learni ng Methodology</b> (Note 3)	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work, and other project management tasks.													
Assessment Methods in Alignment with	Specific assessment	% weightin	Intended subject learning outcomes to be assessed (Please tick as appropriate)											
Intended Learning	methods/tas ks	g	a	b	с	d	e	f	g	h	i	j	k	1
Outcomes (Note 4)	Continuous Assessment	100	~	~	~	~	~	~	~	~	~	~	~	~
	Total	100 %												
	Explanation of intended learnin The Integrated supervisor and limited to, Pro Presentation, Pri Integrated Cap restrictions on t student's chos academic, or a to have some o mid-term check approved by the the Integrated C essential at the may also be rec	the appropring outcome of Capstone other asservation other asservation of the nature of en discipling hybrid in wriginal contra- tropoint programe supervisor Capstone Pring end of the print puired for print	iater s: Pro- sssor tifica agen ects f the rest tr/bu ress r/co- rojec proje	ness ject s. A ation nent, shou prob nd n the tions repo supe ct. A r cor	of th will ttrib , Pr and ld b blem AID stuc S. Ea ervis n or a mio ntinu	le as oble Self e pri exc A. lent ch s al pri d-ter ious	acc to m S F-Dis coble ept t The final eford reser m pr asse	men cesse be a Solviscipl em-co hat i pro- pro- ncou ent h l repe e the ntation resentation	t me ed b assess ing, ine. orien t sho oject ort. orage as to ort. stuc on a ntatio	thod y th seed Con ted ted tould bub o sub The dent nd d on a	s in ne su incl nmu and be ra uld prop can lemo nd d	asse uper ude, nica ther eleva be j t con a pro- cosal procosal	ssing visor but tion e art pract pract pract nstra opos l mu seed atior nstra	g the c/co- not and e no o the ical, ined al, a st be with a are ation
Student Study Effort Expected	Class contact:											0.33		[ <b>r</b> c
	Other student s	tudy efforts	:										01	
	<ul> <li>Searching supervisor developme</li> </ul>	and reading /co-supervi ent, testing,	g ma sor/o doc	teria othei ume	ls, n s, de ntati	neeti esigr on, p	ng v n and prese	vith 1 sys entat	stem	etc.		2	10 H	lrs.
	Total student st	udy effort										2	10 H	lrs.

Reading List	1. Kumar, Ranjit, Research Methodology: A Step-by-step Guide for Beginners 3rd Edition SAGE Publications 2011
and References	2. Burns, Robert B., <i>Introduction to Research Methods</i> , 4th Edition, SAGE
	Publications, 2000.
	3. Roberts, Carol M., The Dissertation Journey: A Practical and
	Comprehensive Guide to Planning, Writing, and Defending Your
	<i>Dissertation</i> , 3rd Edition, Corwin Press, 2007.
	4. Mauch, James E. and Park, Namgi, <i>Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty</i> , 5th Edition, Marcel Dekker 2003
	5 Rudestam Kiell Erik and Newton Rae R Surviving Your Dissertation
	A Comprehensive Guide to Content and Process, 2nd Edition, Sage Publications, 2001.
	6. Garson, G. David, <i>Guide to Writing Empirical Papers, Theses and Dissertations</i> , 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
	10 Szuchman Lenore T. Writing with Style: APA Style Made Easy 54
	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.
	16. Ian Goodfellow, Yoshua Bengio, and A. Courville, Deep Learning.
	MIT Press, 2016.
	17. F. Chollet, <i>Deep learning with python</i> . New York, NY: Manning Publications, 2017.
	18. Fatimazahra Barramou, El Hassan El Brirchi, Khalifa Mansouri,
	Youness Dehbi, Geospatial Intelligence. Springer, Cham, 2021
	19. Cresson R. Deep Learning for Remote Sensing Images with Open
	Source Software. CRC Press, 2022.

### Note 1: Intended Learning Outcomes

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

<u>Note 2: Subject Synopsis/Indicative Syllabus</u> The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

### Note 4: Assessment Method

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

Subject Code	ME41006
Subject Title	Perceptual Robotics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear Systems and Control
Objectives	<ol> <li>The subject aims to equip students with knowledge of:</li> <li>Artificial robot perception</li> <li>Perception-guided control</li> <li>Adaptive robot behaviour</li> <li>Perception-aided algorithms</li> </ol>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a) Able to mathematically model the different perceptual modalities used for robotic systems;</li> <li>b) Able to design perception-guided motion controls for mechanical robots</li> <li>c) Able to use perceptual feedback to implement adaptive robot behaviours</li> <li>d) Able to design perception-aided methods for learning properties about the environment</li> <li>e) Able to conduct experiments with perceptual and robotic systems</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>Artificial robot perception. Vision sensors (monocular perception and RGB-D sensors), thermal imaging (models and principles), touch (force and tactile imaging), proximity (different ranging methodologies), audio sensing.</li> <li>Perception-guided control. Sensor-motion coordination problem, derivation of sensorimotor models (analytical and computational), formulation of sensor servoing controls (vision-based, thermal-based, touch-based, proximity-based).</li> <li>Adaptive robot behaviour. Braitenberg machines, reactive motion paradigms (potential fields, subsumption architecture, etc.), hybrid paradigms, multi-agent systems, robot babbling, bug algorithms, sensor-based navigation.</li> <li>Perception-aided algorithms. Iterative closest point (ICP), simultaneous localisation and mapping (SLAM), sensor-based model learning, and image registration.</li> <li>Practical work. A robotic platform is assigned to a team of 2-3 students. Each chapter is delivered with a hands-on experimental session where students reinforce their knowledge in the subject.</li> </ul>

Teaching/Learning Methodology	1. Lectures aim at providing students with fundamental knowledge required for understanding and analysing different perceptual robotic systems, including its mathematical models, controller design, and algorithms. (Outcomes a to d)								
	2. Tutorials aim at enhancing students' analytical and problem solving skills on robotics. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to d)								
	3. The experiments/proje perceptual robots, and	ect aim to pr reinforcing th	ovide hand ne acquired	ds-on e i knowl	xperien edge. (	ice for d Outcome	levelop es a to e		
	Teaching/Learning Methodology	Inten	ded Subjec	t Learn	ing Ou ed	ng Outcomes to be ed			
	internedencegy	a	b		c	d	e		
	1. Lecture	<u> </u>	<u>√</u>		1				
	2. Tutorial	- <u></u>	V		<u>v</u>				
	3. Experiments/Project	ν	√		√	<u> </u>	V		
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended be assess	l subjec sed (Ple	t learni	ng outco < as appr	mes to opriate		
			a	b	с	d	e		
	1. Class test	10%	1	$\checkmark$	1	1	1		
	2. Coursework: includes assignments, project, experiments, lab report	40%	√	1	7	1	1		
	3. Final Examination	50%	1	$\checkmark$	1	1			
	Total	100 %			•		1		
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:								
	Overall Assessment:								
	0.50 x End of Subject Examination + 0.50 x Continuous Assessment.								
	1. The continuous assessment aims at evaluating the progress of the students' study, assisting them in self-monitoring the respective learning outcomes, and applying the knowledge learnt in practical situations.								
	2. The examination is used to assess the knowledge acquired by the students for understanding and analysing the problems critically and independently; as well as to determine the degree of achieving the subject learning outcomes.								
Student Study Effort	Class contact:								
Expected	Lectures						33 H		
	Tutorials / Laboratory						6 Hı		
	Other student study effort:								

	Course work	40 Hrs.
	<ul> <li>Self-learning</li> </ul>	36 Hrs.
	Total student study effort	115 Hrs.
Reading List and References	<ol> <li>Lecture Notes, Articles, and Handouts</li> <li>Computer Vision: A Modern Approach, David A. Forsyth latest edition.</li> <li>Introduction to AI Robotics, Robin Murphy, MIT Press Ca USA, latest edition.</li> <li>Principles of Robot Motion: Theory, Algorithms, and Imp Choset et al, MIT, latest edition.</li> <li>Vehicles: Experiments in Synthetic Psychology, Valentinc Press Ltd, latest edition.</li> <li>Robotics Modelling, Planning and Control, Bruno Sicilian</li> </ol>	and Jean Ponce, ambridge, MA, lementations, Howie o Braitenberg, MIT o at al, latest edition.

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Developed in June 2019

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Subject Code	ME42001
Subject Title	Artificial Intelligence in Products
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear Systems and Control ; or ME41004 Mechatronics and Control
Objectives	To provide students with basic knowledge on Artificial Intelligence (AI) for product design and development.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Apply knowledge of mathematics, expert systems, fuzzy systems and learning models to aid the design and development of intelligent products and systems.</li> <li>b. Understand applications of AI in different fields.</li> <li>c. Work effectively as a member to tackle a multi-disciplinary design project involving the application of AI.</li> <li>d. Appreciate the state-of-the-art applications of AI in products and present a design project via computer programming and written report.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>Expert Systems - Principles of expert systems; Knowledge representations; Inference mechanisms; Graph search algorithms; Rule-based expert systems; Application of expert systems to product design and product data management using Prolog or available software packages. (Delete some topics)</li> <li>Fuzzy Inference Systems - Fuzzy sets and crisp sets; Membership functions; Properties of fuzzy sets; Operations on fuzzy sets; Operations on fuzzy relations; Fuzzy if-then statements; Inference rules; Developing fuzzy inference systems using Matlab or available software packages.</li> <li>Learning Models - Introduction to different learning algorithms and models; Regression; Classification; Supervised learning; Unsupervised learning; Reinforcement learning; Neural Network; Deep learning; Developing learning models using Python or available software packages</li> </ul>

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Teaching/Learning Methodology	1. 2. 3.	The lectures are aim intelligence for product The tutorials/computer students. Examples of products will be involve The project is aimed a team project on prod (Outcomes a - d)	edge on nd b) able skill f AI in co applied t telligence	artificial s of the mmercial through a systems.					
		Topohing/Looming M	Outcomes						
				a	b	с	d		
		Lecture		√	1				
		Tutorial		√	√				
		Project		√	√	$\checkmark$	√		
Assessment Methods in Alignment with Intended Learning Outcomes		Specific assessment methods/tasks	Intende outcom tick as	Please					
· · · · ·					h		d		
		1 Class Test	1.00/				u		
		1. Class Test	10%	N .	V				
		2. Homework	10%	√	√				
		3. Group Project	30%	1	√	$\checkmark$	√		
		4. Examination	50%	V	$\checkmark$				
		Total	100%		I	L	I		
	Expl inter Over The cons worl study by si will exan under	lanation of the approp nded learning outcomest rall Assessment: 0.50 x End of Subject I weighting of 50% or solidate their learning th k. The group project w y which enables studen tep. Report and the pres show how the students nination is used to erstanding artificial inter	briateness of Examination continuous brough continvill be assign ts to link the sentation will are able to assess the lligence of th	the ass + 0.50 x assessm nuous eff ned to st knowled l be majo design i knowled e produc	continuction continuction fort such udents at dge they or outcom ntelligent ge acquitts.	methods ous Asses neant to as assign c early st learnt wi nes of the systems ired by	in asses sment. allow stu ments and age of the th the pro- project w for produ- the stud	idents to d project e subject oject step vork that ucts. The ents for	

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Student Study Effort Expected	Class contact:	
	Lecture	30 Hrs.
	<ul> <li>Tutorial / Computer Labs</li> </ul>	9 Hrs.
	Other student study effort:	
	<ul> <li>Reading and review</li> </ul>	20 Hrs.
	<ul> <li>Homework assignment</li> </ul>	10 Hrs.
	<ul> <li>Project Report</li> </ul>	36 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	<ol> <li>Luger, G.F., and Stubblefield, W.A., Artificial In Expert Systems, The Benjamin/Cummings Publishin</li> <li>Clocksin, W. F., Programming in Prolog, Berlin; latest edition.</li> <li>Ross, Timothy J., Fuzzy logic with engineerin Hoboken, NJ: Wiley, latest edition.</li> <li>Campesato, O., Artificial Intelligence, Machine Lear Mercury Learning &amp; Information, latest edition.</li> </ol>	telligence and the Design of ng Co., latest edition. New York: Springer-Verlag, ng applications, Chichester; ning, and Deep Learning,

Revised Jun 2020

Subject Code	ME42011
Subject Title	Fundamentals of Robotics
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME31002 Linear systems and control; or ME41004 Mechatronics and Control
Objectives	<ol> <li>To provide students with the concepts and techniques for the design, modeling, analysis of robotic systems.</li> <li>To provide students with the fundamental knowledge of machine vision for robot guidance and automation.</li> </ol>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Identify different types of robots and their applications in the industry.</li> <li>b. Construct the kinematics and dynamics equations of robotic systems.</li> <li>c. Apply trajectory planning algorithms to generate the path for robotic systems.</li> <li>d. Apply different machine vision and image processing algorithms to automate robotic systems.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>Robot Modeling - Degrees of freedom, coordinate frames and homogeneous transformations, Denavit-Hartenberg (DH) convention, forward and inverse kinematics, Jacobian matrix, singularity, motion models for mobile robots, Lagrange's equation kinetic and potential energy, trajectory planning and obstacle avoidance.</li> <li>Computer Vision - Image formation, acquisition, histogram, edge and line detections, image enhancement, filtering, object recognition, camera modeling and calibration.</li> <li>Laboratory Work</li> <li>There is at least 1 2-hour laboratory session or an equivalent project. Typical Experiments are: <ol> <li>Object manipulation through a robot manipulator.</li> <li>Path planning of mobile robots for collision avoidance</li> </ol> </li> </ul>

Methodology	understanding and analyzing different robots, including system modeling, trajectory planning and image processing (Outcomes a to d)						
	Tutorials aim at enhancing students' analytical and problem solving skills on robotics. Students will be able to solve real-world problems using the knowledge they acquired in the class. (Outcomes a to d) The project/experiments aims to have hand-on experience to automation of a robot system with vision or other functions. (Outcomes a to d)						
	Teaching/Learning Methodology			Outcom	es		
		a	b		c	d	
۴	1. Lectures	$\checkmark$	1		√	$\checkmark$	
	2. Tutorials		· √		√		
	3. Homework assignments		1		√		
	4. Project or experiments	V	1		1		
Assassment Methods							
in Alignment with	Specific assessment methods/tasks	%	Intended subject learning				
Intended Learning		weighting	a	h			
Outcomes	1 Examination	50%	 √	1	1	$\sqrt{1}$	
	2 Class Test	20%	1	1	<u> </u>	$\overline{}$	
	<ol> <li>Coursework including Project/Experimental Work</li> </ol>	30%	1	1	1		
	Total	100%		1		<u> </u>	
	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</li> <li>1. The assessment is comprised of 50% continuous assessment and 50% examination.</li> <li>2. The continuous assessment consists of three components: homework assignments, test, and experiments/projects. They are aimed at evaluating the progress of students' study, assisting them in self-monitoring of fulfilling the respective subject learning outcomes, and enhancing the integration of the knowledge learnt.</li> <li>3. The examination is used to assess the knowledge acquired by the students for understanding and analyse the problems critically and independently; as well as to determine the degree of achieving the</li> </ul>						

Student Study Effort Expected	Class contact:	
	• Lecture	33 Hrs.
	<ul> <li>Tutorial/Laboratory</li> </ul>	6 Hrs.
	Other student study effort:	
	<ul> <li>Reading and review</li> </ul>	36 Hrs.
	<ul> <li>Coursework (assignments, project)</li> </ul>	40 Hrs.
	Total student study effort	115 Hrs.
Reading List and References	<ol> <li>S. B. Niku, Introduction to robotics : analysis, contro- edition.</li> <li>M. W. Spong S. Hutchinson, and M. Vidyasagar, R Wiley, latest edition.</li> <li>C. Bishop, Pattern Recognition and Machine Learnin</li> <li>R. C. Gonzalez and R. E. Woods, Digital Image Proc- edition.</li> </ol>	ol, applications, Wiley, latest obot Modeling and Control, ng, Springer, latest edition. cessing, Prentice Hall, latest

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Revised June 2021

Subject Code	ME46002								
Subject Title	Numerical Methods for Engineers								
Credit Value	3								
Level	4								
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AMA2111 Mathematics I								
Objectives	To teach students numerical methods of solving typical engineering problems.								
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Formulate simple engineering problems with knowledge in data analysis and engineering mathematics.</li> <li>b. Solve non-linear equations, simultaneous linear algebraic equations, eigenvalue problems, using numerical methods.</li> <li>c. Perform numerical differentiation and integration and analyze the errors.</li> <li>d. Know the contemporary issues, and understand the impact of artificial intelligence in a global and societal context.</li> <li>e. Use MATLAB or other data analysis tools to compute the solutions of engineering problems using the appropriate numerical methods.</li> </ul>								
Subject Synopsis/ Indicative Syllabus	<ul> <li>Introduction to Mathematical Modelling and Computational Methods – Importance of computational modelling in engineering. Data representation and errors. Applications of commercial software packages such as MATLAB. Functions and plotting using MATLAB.</li> <li>Computer Solution of Non-linear Equations - Bracketing Methods. Bisection Method. Open Methods. Newton-Raphson Method. Secant Method. Convergence of methods. Determination of multiple roots. Engineering applications.</li> <li>Simultaneous Linear Equations - Solving simultaneous linear equations by Matrix Inversion. Cramer's Rule. Gauss Elimination. Gauss-Jordan Elimination. LU decomposition method. Engineering applications and choice of methods. Eigenvalues Problems.</li> <li>Optimization - Unconstrained optimization. Multi-dimensional optimization. Unconstrained optimization.</li> <li>Curve Fitting and Data Analysis - Interpolation using splines. Linear Least-Squares Regression. Nonlinear Regression. Introduction to Machine Learning Algorithms.</li> <li>Numerical Differentiation and Integration - Taylor's series expansion. Finite differences for the first derivative and the second derivative. High-accuracy differentiation formulas. Trapezoidal rule. Simpson's rule. High-order Newton-Cotes formulas. Applications of numerical differentiation and integration in heat transfer, solid mechanics and fluid flow problems.</li> </ul>								
Teaching/Learning Methodology	Lectures are used to deliver the fundamental knowledge in relation to numerical methods. (Outcomes a - d)								
----------------------------------------	-----------------------------------------------------------------------------------------------------------	-----------------------------------	------------------------	----------------------	-----------------------------	------------------------	-----------------------	--	--
	Tutorials will be conducted in small groups to facilitate discussions. (Outcomes a - d)								
	Computational workshops numerical problems. (Outco	provide hand omes b - e)	ds-on exj	perience	in using	software	to solve		
	Teaching/Learning Metho	dology			Outcomes	5			
			а	b	с	d	e		
	Lecture		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	Tutorial		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	Computational workshop			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
Assessment Methods									
in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Intende assesse	d subjec d (Pleas	et learning e tick as ap	outcomes	s to be e)		
Outcomes			a	b	с	d	e		
	1. Test	20%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	2. Assignment	30%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
	3. Examination	50%		$\checkmark$	$\checkmark$				
	Total								
	Explanation of the appro- intended learning outcomes Overall Assessment: 0.50 × End of Subject	priateness of : Examination	the ass $+0.50 \times$	cessment Continu	methods	in asses	ssing the		
	Tests will be conducted to a	assess student	ts' learnir	ng on nu	merical m	ethods.			
	Assignments will be used t solving engineering proble problems.	o assess stude ems and usin	ents' lear ng comp	rning on utationa	using nun 1 software	nerical m e in solv	ethods in ing such		
	Examination will be conduc	eted to assess	students	' learnin	g on nume	erical met	hods.		
Student Study	Class contact:								
Effort Expected	<ul> <li>Lecture</li> </ul>						33 Hrs.		
	<ul> <li>Tutorial</li> </ul>						4 Hrs.		
	Computational Works	hop					2 Hrs.		
	Other student study effort:								
	<ul> <li>Performing assignment</li> </ul>	t					40 Hrs.		
	<ul> <li>Applying computation</li> </ul>	al software					12 Hrs.		

	<ul> <li>Private study</li> </ul>	25 Hrs.				
	Total student study effort	116 Hrs.				
Reading List and References	<ol> <li>S.C. Chapra and R.R. Canale, Numerical Methods latest edition.</li> <li>S.S. Rao, Applied Numerical Methods for Engin Hall, latest edition.</li> <li>S.C. Chapra, Applied Numerical Methods with I Scientists, McGraw-Hill, latest edition.</li> <li>D.M. Etter, Engineering Problem Solving with edition.</li> </ol>	for Engineers, McGraw-Hill, eers and Scientists, Prentice- MATLAB for Engineers and Matlab, Prentice-Hall, latest				

Revised December 2021

Subject Code	ME49006
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite:ME31001 Dynamics and Vibrations;ME31002 Linear Systems and Control;ME32001 Manufacturing Fundamentals;ME33001 Mechanics of Materials;ME34002 Engineering Thermodynamics;ME34004 Fluid Mechanics;ENG2002 Computer Programming; andME46002 Numerical Methods for Engineers.Exclusion: ME49001 Final Year Capstone Project
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>(a) Provide students with an opportunity of integrating and applying knowledge from different disciplines of mechanical engineering (ME) with artificial intelligence and data analytics (AIDA) to conduct an engineering project that is open-ended and requires team collaboration for its completion;</li> <li>(b) Develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using ME and AIDA knowledge;</li> <li>(c) Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) Conduct literature search including patents, books, archived publications and product catalogues, and to perform the state-of-the-art and benchmark studies;</li> <li>(b) Formulate the problem precisely, and utilize knowledge and skills from ME and AIDA to generate good solutions to the open-ended real-world problems encountered in the project;</li> <li>(c) Think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation;</li> <li>(d) Design, plan and carry out scientific and engineering experiments (physical tests and/or computer numerical simulations) to prove the feasibility of their designed solutions;</li> <li>(e) Design the test apparatus, rigs, assemblies or systems as required by the project;</li> <li>(f) Apply appropriate engineering tool (analytical, experimental, and/or computational) for carrying out tasks in the development and implementation of a designed solution;</li> <li>(g) Select and employ the appropriate manufacturing methods in the production and fabrication of components and assemblies required by the project;</li> </ul> </li> <li>(h) Work in a professional manner and comply with all applicable standards and regulations in conducting the project;</li> <li>(i) Take into account of safety, legal, environmental protection considerations in an engineering project</li> </ul>

	<ul> <li>(j) Participate at to sponsors (and articulate (k) Evaluate the and environm</li> <li>(l) Improve prestechnical reputation</li> </ul>	nd lead if any) e the re potenti nent, an sentatic ort wri	in a f supe sults al im nd eva on and ting s	multi rviso and f pact o aluate d con kills	-func rs, of indin of the e the nmur with	etiona ther p gs w eir de final nicati prop	al tea peer t ith se esign outc outc on sl er or	m, an teams cienti ed so ome kills ganiz	nd con s, and fic an lution in an via or zation	mmu l even nd log n on j obje ral pr	nicat n nor gical perfo ctive resen nateri	e the a-tech argu rman man tation als.	ir pro inica ment ice, si ner; n, an	oject l aud s; afety d enł	work ience , cost nance
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-depth Stu</li> <li>Project Meet</li> <li>Proposal Wr</li> <li>Regular Prog</li> <li>Project Docu</li> <li>Project Docu</li> <li>Presentation</li> <li>Students are exp intelligence and d their knowledge i The project shot data/information o subjects. Students research ability in</li> </ol>	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> <li>Presentation and Demonstration</li> <li>Students are expected to identify a project topic with a supervisor with artificial intelligence and data analytics expertise in ME Department. Students need to demonstrate their knowledge in both ME and AIDA in the project, receiving advice from supervisor. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.</li> </ol>													
Teaching/Learning Methodology	The Integrated Ca semesters. The ter- supervisor, guided and other project	apstone aching/ d study manage	Proje learni of pr ement	ect sp ing a oject t task	ans a ctivit mate s.	acros ies ir erials	s the nclud , ind	acad le reg epend	emic ular p dent p	year proje proje	for t ct me ct dev	wo co eeting velop	onseo gs with oment	cutive th the t wor	e e k
	Teaching/Learning Methodology	g	1	1				Outco	omes	1	· ·		.	1	1
	Regular project meetings and guided study	a ✓	v √	<ul> <li>c</li> <li>✓</li> </ul>	a		<i>•</i>	1	g ✓	n ✓	1		/	K V	1
Assessment Methods															
in Alignment with Intended Learning	Specific assessment	% weigh	iting	]	nten	ded s	subje (Ple	ct lea ease 1	rning tick a	g outo s app	come propri	s to b iate)	be ass	sesse	d
Outcomes			. ,	a	b	c	d	e	f	g	h	i	j	k	1
	Continuous monitoring	159	/0									1			
	Interim report	109	%	1	1	1	1	1	1	1	1	1	1	1	1
	Final report	509	%	1	~	✓	1	1	1	1	1	1	~	1	✓
	Oral examination	259	%	1	1	1	1	1	1	1	1	1	1	1	1
	Total	100	%												
	The Integrated Ca Attributes to be Solving, Commu Integrated Capsto the nature of the p could be practica constrained to have	apstone assesse nicatio one Proj problen il, acad we some	Proje d inc n and jects s n exce lemic e orig	ect w lude, l Preshoul shoul ept th or a inal o	till be but senta d be at it hyb	e acc not tion, prob shou rid i ibutio	essec limite Proj lem-e ld be n wh ons.	l by t ed to ject l orien relev nich t	the su , Pro Mana ted an vant t the st	iperv blem geme nd th o MI tuden	isor a Ider ent, a ere and E and t is o	and c ntifica and S re no AID encou	other ation Self-I restr OA. T urage	asses , Pro Discip riction The pro- the pro- the bu	ssors. blem pline. ns on roject it not

	Explanation of the learning outcomes:	Explanation of the appropriateness of the assessment methods in assessing the intended earning outcomes:								
	Overall Assessmen	verall Assessment: $1.0 \times \text{Continuous Assessment}$								
	<ul> <li>(a) Performance of each student should be assessed individually together with the team's overall performance by the supervisor, an independent assessor, the peers and an examination panel consisting of at least three academic staff;</li> <li>(b) The continuous monitoring of a project group as a whole and that of each group member on an individual basis are conducted by the supervisor. The interim report is assessed by the independent assessor. The final report is assessed by both the supervisor and the independent assessor. As part of the assessment process, each group member is required to specify his/her own contribution in completing the project when compared to his/her team mates (peer assessment). In case of an industrial-based project, comments will be invited from the industrial supervisor but he/she will not be required to perform the formal assessment;</li> <li>(c) The supervisor monitors and assesses the overall and individual progresses through regular meetings. The interim report should be submitted to the independent assessor. Due consideration of each student's individual contribution and performance will be taken into account;</li> <li>(d) During the oral examination, every group member is required to present the project especially on his/her significant contribution to the whole project, and respond to the questions addressed to him/her by the examination panel. Marks for oral examination are awarded to individual student by taking into account the group's overall performance.</li> </ul>									
	(e) The assessment Assessor	nt system is su	mmarized as s Assessment (	shown in the f Component (%	following tal % of the tota	ble:				
	10000001	Continuous	Interim	Final	Final	Oral				
		Monitoring (15)	Report (10)	Report (25)	Report (25)	Examination (25)				
	Supervisor	1		✓						
	Independent Assessor		1		1					
	Examination Panel					1				
Student Study Effort	Class contact:									
Expected	• Guided study					26 Hrs.				
	Other student study	y effort:		-						
	Conducting pro	Conducting project 154 Hrs.								
	• Literature searce	Literature search and private study72 Hrs.								
	Total student study	r effort				252 Hrs				
Reading List and References	To be advised by	supervisor.								

Developed in November 2021

### **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	MM3462
Subject Title	Artificial Intelligence and Big Data for Business
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: Business Analytics (MM3425) or equivalent
Objectives	Modern Artificial Intelligence (AI) and Big Data have fundamentally reshaped today's business and society, especially in the areas of business decision making, business processes, and enhancement of business models. This trend has created great demand for business graduates to have necessary knowledge and skills in AI and big data for continuous business innovation. This subject aims to develop student's understanding of the concepts and applications of AI and big data for business. Students will also have hands-on experience in using big data/AI- based big data tools to solve real world business problems.
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. Understand the principles, methods, and technologies of AI and big data in business. (BBA Outcome 6a)</li> <li>b. Think reflectively and creatively on applying AI and big data</li> </ul>
	<ul> <li>technologies in business contexts. (BBA Outcome 3c &amp; 6a)</li> <li>c. Grasp hands-on knowledge and skills of big data management, visualization, and analytics for business purposes. (BBA Outcome 6b)</li> <li>d. Identify and formulate existing business problems, design business plans by using AI and big data to solve these business problems, and evaluate the effectiveness of the proposed solutions. (BBA Outcome 3c &amp; 6a)</li> </ul>
Subject Synopsis/ Indicative Syllabus (Note 2)	This subject provides students with a solid understanding of the cutting-edge technologies like AI and Big Data, specifically, it covers the below topics:
	<ul> <li>Artificial Intelligence for business</li> <li>Machine Learning</li> <li>Deep Learning</li> <li>Artificial Neural Network</li> <li>Natural Language Processing</li> <li>Robotics technologies</li> </ul>

	• AI applications in various business contexts (e.g., recommendation engine, customer interaction, decision automation, etc.)								
	Big data concepts and applications								
	Introduction of big data								
	-4Vs, data source, type, infrastructure, life cycle, etc.								
	Big data storage			·					
	-Relational and non-relational databases, like RDBMS, NoSQL, and NewSQL databases								
	Big data process	sing and tech	nologies						
	-Virtualization a	and cloud co	mputing						
	-Apache softwar	re, including	Hadoop,	Cassand	ra				
	Big data analyti	cs and visual	lization						
	-Machine learni	ng with Rapi	idminer						
	-Visualization w	with Tableau	- J-4-						
	A unlighting of A Lor	1 AI and DI	g data						
	solutions	ia dig data	што	valive D	usmess				
	The course will use a va	riety of meth	nods as its	s pedagos	y to helr	)			
Teaching/Learning	students achieve the abo	ve learning	outcomes						
Methodology	Basic principles and con	cepts of AI	and Big I	Data will	be introd	uced			
(Note 3)	through lectures. In the tutorial sessions, students will have practical								
	exposure to Tableau and Rapidminer – the big data visualization and								
	AI-based big data tools. For other sessions of tutorial classes, students								
	will form in small groups to discuss about cases related to the								
	corresponding lectures. I nrough the above teaching and learning methods, students should be able to generalize the concents to business.								
	situations via critical thinking skills, and able to integrate and synthesize								
	course concepts with ideas in other domains.								
Assessment Methods									
in Alignment with									
Intended Learning	Specific assessment	%	Intende	d sub	ject	learning			
Outcomes	methods/tasks	weighting	outcom	es to be a	issessea				
(Note A)			(Please	tick as ap	opropriate	e)			
(11016 4)			a.	b.	с.	d.			
	Continuous Assessment	50%							
	1. Participation	10%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	2. Individual assignment	15%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			
	3. Group Assignments	25%	$\checkmark$	$\checkmark$		$\checkmark$			
	Final Exam/Assignment	50%	$\checkmark$	$\checkmark$		$\checkmark$			
	Total	100 %							
	*Weighting of assessment methods/tasks in continuous assessment may be different subject to each subject lecturer								
	To pass this subject, stuc grade.	lents are requ	uired to ol	btain Gra	de D in th	ne overall			
	Explanation of the ap assessing the intended	propriatene learning out	ess of th tcomes:	e assessi	nent me	thods in			

	The group project in the continuous assessment is designed specifically to assess students' ability to think reflectively and creatively in group work on applying AI and big data related knowledge in business contexts. The key concepts and analytical skills acquired by students can be reflected in their home/tutorial works (case studies, hands-on sessions, and individual paper), and their performance in the final assessment. The final exam/assignment may include essay questions and/or case analysis.						
Student Study Effort	Class contact:						
Expected	Lecture	26 Hrs.					
	Tutorial	13 Hrs.					
	Other student study effort:						
	Preparation for discussion and hands-on exercise						
	<ul> <li>Individual assignment and group assignments</li> </ul>	46 Hrs.					
	Total student study effort	117 Hrs.					
Reading List and References	<ul> <li>Recommended Textbook and References</li> <li><u>Textbooks:</u> <ol> <li>Doug R. (2020), Artificial Intelligence for Busine edition.</li> <li>Balamurugan B., Nandhini A. R., Seifedine H (2021), Big Data: Concepts, Technology and Ar Wiley &amp; Sons, Inc.</li> </ol> </li> <li>Other Readings: <ol> <li>Relevant cases and other business readings.</li> </ol> </li> </ul>	ess, Pearson, 2 nd K., Amir H. G. <i>chitecture</i> , John					

#### Note 1: Intended Learning Outcomes

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

### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

Subject Code	SD3781
Subject Title	Interface Design
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The digital interface is a core concrete component of artifacts which enables interactive dynamic experiences. It embodies the design concepts and supports the interaction between users and a system. The design and development of it is basically user-centric. This course facilitates students to internalise principles of interface design through identification, comparison, application of principles, and practising user-centred design processes. It also extends discussions to various digitally mediated environments and stimulates student critiques of user-centred approaches when compared with other alternatives in different context and scenarios.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional skills</u> <ul> <li>a. Carry out basic interaction design process: task analysis, rapid prototyping, user testing, evaluation, and iteration.</li> <li>b. Identify application of interaction design principles and design patterns in existing interfaces.</li> <li>c. Compare different styles of interfaces in different contexts.</li> <li>d. Apply interaction design principles and carry out rapid prototyping and user testing to exercise interface design for a specific context.</li> </ul> </li> <li>Transferable skills <ul> <li>e. Communicate effectively and precisely using technical terms.</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>Students will be introduced to:</li> <li><u>Concepts and Principles</u></li> <li>Conventions and developments of the graphical user interface</li> <li>Principles of interaction design</li> <li>User-centred design processes: prototyping and user testing</li> <li>Case study: websites, video games, digital art, hand-held devices, etc.</li> <li>Trends of user interface design direction: e.g., tactile, gestural, immersive, or adaptive interfaces</li> <li><u>Techniques and Experiments</u></li> <li>Rapid prototyping techniques</li> <li>Information visualization regarding advances in artificial intelligence or data analytics.</li> </ul>

Teaching/Learning	Activity Purpose													
Methodology	Lecture I	Lecture Introduces students to domain knowledge in line with												
	learning outcomes.													
	Workshop Allows students to put principles into practice with short in-									in-				
	Case study A	Case study Assists students in identifying, relating, and distinguishing									g			
	Presentation I	course Provide	contents.	with	0.000	ortu	niti	as to	orti	oulo	ta			
	and d	listing	uish, and r	evie	w kr	nowl	ledg	e ind	depe	ende	ntly	and	l	
	Critique c	critical	ly.											
Assassment Methods														
in Alignment with	Specific	v	% veighting	Int	tend	ed si ad	ubje	ct le	arni	ng c	outco	ome	s to	be
Intended Learning	methods/tasks		eighting	usi										
Outcomes				а	b	с	d	e						
	1. Presentation and critiques	IS S	20%		✓	✓		~						
	2. Assignments	s	60%	✓		✓	✓							
	3. In-class exercises		20%	✓	~	✓	~							
	Total		1009/											L
	Total		100 /8											
	Explanation of the intended lear	ne appi ning of	ropriatenes utcomes:	s of	the	asse	ssm	ent	metł	nods	in a	asse	ssing	g
	Presentations an	nd criti	iques ensu	re st	uder	nts to	o int	erna	lize	cou	rse	cont	ents	;
	by visualizing a	ind pre	esenting ide	eas,	as w	ell a	ns ac	idres	ssing	g coi	mm	ents	ntan	ta
	by performing e	extende	ed reading	s, co	ontex	tual	rev	iews	s, as	wel	l as	2 00	men	.ts
	demonstrating p	orincip	les in mak	ing a	artif	acts.								
Student Study Effort	Class contact:													
Expected	<ul> <li>Lectures, pres</li> </ul>	sentatio	ons										24	Hrs.
	<ul> <li>Workshops and</li> </ul>	nd tuto	orials										15	Hrs.
	Other student stu	ıdy eff	ort:											
	<ul> <li>Reading, pres</li> </ul>	sentatio	on preparat	tion									20	Hrs.
	<ul> <li>Assignments</li> </ul>												46	Hrs.
	Total student st	udy ef	fort									1	05 I	Hrs.
Reading List and References	<ul> <li>Books</li> <li>Bolter, J. D. Design, Digit.</li> <li>Chow, K., Ch principles. Th</li> <li>Cooper, A. (2 Wiley</li> </ul>	& Gro <i>al Art,</i> nan V. ne SD I 2007)	omala, D. <i>and the M</i> & Ho A. ( Press. <i>About Fac</i>	(199 Syth 6 2009 ce 3:	97) of Tr 9) M • Th	Win rans Iulti e Es	dow pare med ssen	rs ar ency lia R tials	nd N . Th ules of	<i>lirro</i> e M : Re Intel	ors: IT F ethin ract	Inte Press king ion	erac s. g de, Des	tion sign sign.
	<ul> <li>Krug, S. (200</li> <li>Neil, T. (2012</li> </ul>	5) Don 2) Mob	n't Make M vile Design	le Th Pat	hink. tern	. Ne Gal	w R lery	ider	s Pro Reil	ess. ly N	1edi	a, Ir	nc.	

٠	Saffer, D. (2008) Designing Gestural Interfaces: Touchscreens and
	Interactive Devices. New Riders Press.
•	Shneiderman, B. (2009) Designing the User Interface: Strategies for
	Effective Human-Computer Interaction. Addison Wesley.

Subject Code	SD4470						
Subject Title	Integrated Capstone Project – Product Design						
Credit Value	6						
Level	4						
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: SD4466 Capstone Project I Exclusion: Any other equivalent capstone project						
Objectives	It is generally assumed that over the course of design projects, more analytical knowledge-gathering and conceptualising activities (research) tend to occur before more synthesis-oriented production and refinement activities (implementation). the student will be provided with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA). Based on this assumption, this subject offers students a context to engage in self-determined design development and production work following-up on their preceding Capstone Project 1.						
Intended Learning Outcomes	Upon completion of the subject, students will be able to: <u>Professional skills</u>						
(Note 1)	<ul> <li>a. Demonstrate the ability to carry out iterative design development process through incorporating different theories and technological innovations.</li> <li>b. Apply relevant design development, research methods and processes learned on the programme using AIDA knowledge and skills.</li> <li>c. Defend their work in a critique context to argue for the implementation of novel concepts with the consideration of making positive value change.</li> <li>d. Carry out design evaluations and refinement with sound time/project management.</li> <li>e. Produce detail descriptions and illustrations for presentation and production planning including drawings with dimensions and consideration of materials and production processes.</li> </ul>						
	<ul> <li>f. Apply critical thinking and life-long learning skills.</li> <li>g. Produce a reflective report and substantiate relevant sustainability claims or positive social value change.</li> </ul>						
Subject Synopsis/ Indicative Syllabus	<ul> <li>The subject requires students to apply a suitable selection of all knowledge-gathering and proposal formulation techniques taught on this programme and AIDA up to this point, including:</li> <li>1. Produce information graphic to illustrate methods and findings and insights for effective communication</li> </ul>						
	<ol> <li>Record the concept development process through mock-up and functional prototype making</li> </ol>						

Teaching/Learning Methodology	<ul> <li>3. Record the experimentation of materials and production processes</li> <li>4. Present the design concepts with strong evidence, creatively and explicitly</li> <li>5. Identify relevant industry and show potentiality of career development</li> <li>6. Record of all design processes and supporting materials with in-depth reflection and show life-long learning skills</li> <li>The teaching and learning methodology of subject is squarely centred on studio tutorial interaction between students and tutors as well as on tutor-critiqued milestone student presentations. Supporting lectures are offered if/as deemed necessary by tutors. Tutors are typically in charge of groups of 3 to 6 students. Tutorials occur in groups or individually as deemed appropriate by students and tutors.</li> </ul>												
	Activity	Purpose											
	Lecture Tutorial	Introduces Guides stu	theories and dents through	prine the c	ipals r levelo	elated	to the	topic					
	Seminar	individuall	y and in smal	ll grou	ips. elated	to the		evna	nding				
		students' c	ontextual kno	owled	ge.			, cxpa	munig				
	Critique	of their pee	dents to learn ers and provid	des a	frame	work f	ns and for eva	luatin	nesses				
		effectivene	ess of student	s' pro	jects f	rom v	arious	persp	ective	<u>s.</u>			
Assessment Methods in Alignment with Intended Learning	S Specific assessment % Intende methods/tasks weighting be asse				nded s ssesse	ded subject learning outcomes to sessed (Please tick as appropriate)							
Outcomes				а	b	c	d	e	f	g			
	1. Interim Presentatio	n	30 %	~	~	~	~		~				
	2. Final Pre	esentation	50 %	~	~	~	~	~	~				
	3. Final Re	port	20 %	~	~		~	~	~	$\checkmark$			
	Total		100 %										
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:InterimEvaluates students' ability to identify an issue, needs, or design opportunities; the overall quality of the design brief; considerations of intended audience/users; evidence of divergent and convergent thinking; range of							g the , or of					
		verba	al and visual	comn	nunica	tion o	f ideas	5.					
	FinalEvaluates students' ability to make informed design decisions based on project criteria as set out in the design brief; the strength of the final chosen concept; relevance of the final solution to the brief; aesthetic value; technical competence; professionalism; personal insights into the design problem: the ability to communicate their							sign nce ghts heir					

	final solution via visual and written	means.			
	Final reportEvaluates students' ability to critical design and learning process; the org of process material; the clarity of the of the written communication.	lly reflect on the anisation of a body e report; the quality			
Student Study	Class contact:				
Effort Expected	<ul> <li>Lectures, workshops and in-class exercises</li> </ul>	9 Hrs.			
	Tutorials: group and individual	54Hrs.			
	Critiques	15 Hrs.			
	Other student study effort:				
	Self-study	40 Hrs.			
	Project work	152 Hrs.			
	Total student study effort	270 Hrs.			
Reading List and References	Books           Cagan J., & Vogel, C.M. (2002). Creating breakthrough products: Innovation           from product planning to program approval. Prentice Hall.				
	Denning, Peter J. (2002). The invisible future: The seamless integration of technology into everyday life. McGraw-Hill.				
	Frisa, M. L., Lupano, M., Tonchi, S., Antonelli, P., Muschamp, H. & Pearlman C. (2002). <i>Total living</i> . Charta.				
	Miller, R. B., Heiman S. E, & Tuleja, T. (2011). <i>The new strategic selling</i> . (Rev. 3rd. ed). Kogan Page.				
	Papanek V. J. (1995). <i>The green imperative: Ecology an architecture</i> . Thames & Hudson.	d ethics in design and			
	Papanek V. J. (1972). <i>Design for the real world: Human change</i> . Pantheon Books.	ecology and social			
	Postrel V. (2003). The substance of style: How the rise of remaking commerce, culture and consciousness. Harper	of aesthetic value is Collins.			
	Wheeler, A. (2003). <i>Designing brand identity</i> . John Wil	ey & Sons.			
	<u>Magazines/journals</u> View Point Design Management Journal				

Subject Code	SD4772 (previous subject code: SD3771)			
Subject Title	Interactive Media and Marketing			
Credit Value	3			
Level	4			
Pre-requisite/ Co-requisite/ Exclusion	Nil			
Objectives	Marketing drastically changes its shape in the digital age. With the advent of the new media, marketing takes place at different facets, including websites, electronic direct mails, social networks, location-based services, and others. It takes various forms, such as viral marketing, game-based marketing, or customer relationship management. Designers in the digital age have to develop the related mindset and skillset to make more effective and persuasive delivery of messages. This subject introduces students to the basic principles of marketing, with a view to opening up possibilities for more persuasive marketing campaigns with all accessible digital media tools. This subject also introduces the marketing and design implications of data made available by various digital platforms.			
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional skills</u> <ul> <li>a. identify and compare different marketing elements on the digital platform</li> <li>b. contrive appropriate marketing strategies for the digital generation</li> <li>c. demonstrate new interactive experience and the added values generated from it</li> </ul> </li> <li><u>Transferable skills</u> <ul> <li>d. reflect critically on their learning process</li> <li>e. communicate effectively and precisely using technical terms</li> </ul> </li> </ul>			
Subject Synopsis/ Indicative Syllabus	<ul> <li>Students will be introduced to:</li> <li>Internet marketing and online advertising</li> <li>Marketing strategies for the digital age</li> <li>Web management</li> <li>Search engine optimization</li> <li>Viral elements in digital marketing</li> <li>Social media and online consumer engagement</li> <li>Online branding and reputation management</li> <li>Location-based marketing</li> <li>Game-based marketing</li> <li>Data analytics and the implications</li> </ul>			

	Case study															
Teaching/Learning	Activity	Pu	rpose													
Methodology	Lecture	То	provide stud	ents	s wi	th a	the	ore	tical	apj	pproach to the					
	Tutorial	Tutorial To guide students on the development of						t of	of projects,							
		inc	lividually and	l in												
	Workshop	To	provide stud	ents	s wi	th h	and	S-01	n ex	peri	ienc	e ai	nd te	0		
	Assignment	pu To	t principles in	nto j	orac	tice		nac	a in	ord	lar t	0.11				
	Assignment	wh	at they have	lear	ned	and	d to	pro	vide	e the	en t	with	i an			
		op	portunity to p	oerso hts	onal	ize	tho	se s	kill-	sets	s wi	th t	neir			
		IIIC	iividuai iiisig	mo.												
Assessment Methods in Alignment with Intended Learning	Specific assessment	% weighting	Intended subject learning assessed					ing o	ig outcomes to be							
Outcomes	methods/tasks			a	b	c	d	e								
	1. Assignment	t	90%	~	~	~	~	~								
	2. Participatio	n	10%		✓	✓	~	~								
	3.		%													
	4.		%													
	Total 100%															
	Explanation of t the intended lear	he a rnin	appropriatenes ag outcomes:	s of	the	asse	ssm	ent	metl	hods	s in a	asse	ssin	g		
	The assignme they learn and	ents 1 re	are designed flect	to	et t	he s	tude	ents	der	non	stra	te v	vhat	;		
Student Study Effort	Class contact:													·		
Expected	<ul> <li>Lecture</li> </ul>												19	Hrs.		
	Tutorial and	ł w	orkshop										20	Hrs.		
	Other student st	udy	effort:													
	<ul> <li>Reading, press</li> </ul>	epa	ration for pre	sen	tatio	on							22	Hrs.		
	<ul> <li>Project work</li> </ul>	k aı	nd Assignmer	nt									44	Hrs.		
	Total student s	tud	y effort									1	.05 1	Hrs.		
Reading List and References	Books Krug, S. (2006) <i>usability</i> . New F	<i>Da</i> Ride	on't make me i ers.	thin	k! :	a co	omn	ion	sens	e ap	opro	bach	to	Web		
	Ryan, D. (2012) engaging the dig	) U gita	nderstanding l generation. P	<i>digi</i> Phila	<i>tal r</i> delp	<i>nark</i> ohia,	<i>ketin</i> Pa.	eg: 1 : Ko	nark ogan	<i>ketin</i> Pag	g st ge.	rate	gies	for		

Ryan, D & Jones, C. (2011) The Best Digital Marketing Campaigns in the
World. Philadelphia, Pa.: Kogan Page.
Weinschenk, S. (2009). Neuro web design : what makes them click? New Riders
Zichermann, G. & Linder J. (2010) Game-based Marketing: Inspire Customer Loyalty Through Rewards, Challenges, and Contents. Wiley.

Subject Code	SD4788
Subject Title	User Experience Design
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	User experience (UX) design is a design approach that explores, creates, and evaluates design solutions with the goal of enriching the experiences of users and customers. Current literature recognizes that experience emerged from users interacting with products, services, and people among other tangible and intangible touchpoints. Also, experiences involve a sense-making process between an individual's inner world, the present moment, and future orientations. Digital technology also plays a role in mediating user experiences with these touchpoints. Therefore, UX design incorporates theories, knowledge, and practices from different academic fields, such as psychology, marketing, design, and technology. This subject introduces UX design to students through case studies of existing systems and practices of the digital product development process. Students will also be inspired to incorporate emergent interactive technologies to create products and services with interactive dynamic experiences.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional skills</u> <ul> <li>a. Delineate user experience components and give examples from existing applications or digital products</li> <li>b. Perform user experience evaluation on existing applications or digital products</li> <li>c. Identify recent digital interaction development trends in society and explain their impact on everyday life</li> <li>d. Carry out digital product development process from user experience perspective</li> </ul> </li> <li>Transferable skills <ul> <li>e. Communicate design proposal effectively and precisely</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>Students will be introduced to: <u>Concepts and Principles</u> <ul> <li>Experience design literacy</li> <li>Persuasion and technology</li> </ul> </li> <li>Digital product development process in relation to user experience design: task analysis, persona, user scenario, service blueprint, etc.</li> <li>Advances in interactive technologies</li> <li>Case study: online branding, internet applications, mobile applications, etc.</li> </ul> <li><u>Techniques and Experiments</u> <ul> <li>Design methods for user experience: Persona, Scenario, Storytelling, service blueprint etc.</li> </ul> </li>

Teaching/Learning	Activity Purpose								
Methodology	Lecture	To introduce stude	ents to domain	know	ledge	in line	e with		
	Workshop	To put principles i	nto practice w	vith she	ort in-	class e	exerci	ses	
	Case study	To assist students	in identifying,	relati	ng, an	d disti	inguis	hing	
	Dresentation	course contents	ta with annort	mitia	toor	tion lot			
	and Critique	distinguish, and review knowledge independently and							
			1	1					
Assessment Methods in Alignment with	Specific assess methods/tasks	Specific assessment methods/tasks%Intended soutcomes			subject learning to be assessed				
Intended Learning Outcomes			a	b	с	d	e		
	1. Presentation	ns and critiques	30%	✓		~		~	
	2. Assignment	ts	70%	$\checkmark$	✓	✓	$\checkmark$	$\checkmark$	
	Total		100%						
	Explanation of t intended learnin	he appropriateness og outcomes:	of the assessm	ent me	ethods	in ass	sessing	g the	
	Assignments en extended readin making artifacts	sure students to elab gs, contextual reviev	oorate on cours ws, as well as	se con demor	tents ł istrati	by pering prin	formin nciple	ng s by	
Student Study Effort	Class contact:								
Expected	<ul> <li>Lectures, pre</li> </ul>	esentations						19 Hrs.	
	<ul> <li>Workshops</li> </ul>						4	20 Hrs.	
	Other student st	udy effort:							
	<ul> <li>Reading, pre</li> </ul>	sentation preparation	n				3	30 Hrs.	
	<ul> <li>Assignments</li> </ul>	,						36 Hrs.	
	Total student s	tudy effort					10	5 Hrs.	
Reading List and References	Books Calvo, R.A. & I and Human Pot	Dorian, P. (2014) <i>Po</i> ential, MIT Press.	sitive Comput	ing Te	chnol	ogy fo	r Wel	lbeing	
	Fogg, B. J. (2002) Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann						What		
	Hassenzahl, M. <i>Reasons</i> . Morga	(2010) <i>Experience 1</i> in & Claypool Publis	Design: Techn shers.	ology	for Al	l the F	Right		
	Wendel, S. (202 behavioral econ	0). <i>Designing for be</i> <i>omics</i> (2 nd ed). Seb	<i>ehavior chang</i> bastopol, CA:	<i>e: App</i> O'Reil	lying ly Me	<i>psych</i> dia.	ology	and	
	<u>Articles</u> Desmet, P. M. A to Design for Su 19.	A., & Pohlmeyer, A. Ibjective Well-Being	E. (2013). Po g. Internationa	sitive al Jour	desigr nal oj	n: An l f Desig	Introd gn, 7(3	uction 3), 5–	

Subject Code	SD4790
Subject Title	Integrated Capstone Project - Interaction Design
Credit Value	6
Level	4
Pre-requisite / Co-requisite/ Exclusion	Pre-requisite: SD4791 Capstone Project I Exclusion: Any other equivalent capstone project
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to the design discipline.</li> <li>develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA.</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> <li>In this capstone project, students will formulate design problems, generate design concepts, undertake design and creation processes, and produce material outcomes, which demonstrate their creative and insightful applications of knowledge and skills they have acquired from the programme.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional skills</u> <ul> <li>a. Formulate design problems of human needs for new experiences.</li> <li>b. Perform substantial research and analysis.</li> <li>c. Develop conceptual, technical, and cultural frameworks.</li> <li>d. Make critical judgment based on contextual review.</li> <li>e. Carry out iterative design processes.</li> <li>f. Apply principles and techniques acquired in other subjects to accomplish project goals; understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills.</li> </ul> </li> <li>Transferable skills <ul> <li>g. Critically reflect results and documents development.</li> <li>h. Communicate effectively and precisely with professional vocabularies.</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	Students will undertake a complete design and creation process to apply a suitable selection of all knowledge-gathering and proposal formulation techniques taught on this programme and AIDA to accomplish their project aims. Teachers will serve as project supervisors or advisors to guide students from project specification to project completion. Faculty members may lead

	different project teams according to their areas of expertise and research interests.									
Teaching/Learning	Activity Pu	Activity Purpose								
Methodology	Tutorial Ad	vises students	on th	eir pr	oject	devel	opme	nt.		
<i></i>	Production All workshop the	ProductionAllows students to execute their project plans and evaluateworkshoptheir concepts iteratively.							late	
	Presentation Pro	vide students	with o	oppor	tuniti	es to	articu	late,		
	and Critique dis ass	tinguish, and 1 ertively.	review	v desi	gn co	ncept	s inde	epend	ently	and
Assessment Methods										
in Alignment with	Specific	%	Inte	nded	subje	ct lear	rning	outco	mes t	to be
Intended Learning	assessment	weighting	asse	ssed						
Outcomes	methods/tasks		a	b	c	d	e	f	g	h
	1. Presentations and critiques	20%								~
	2. Continuous assessment	60%	~	~	~	~	~	~		
	3. Project report	20%							✓	
	Total	100%								
	Explanation of the a	appropriatenes	s of tl	ne ass	essm	ent m	ethod	s in a	ssessi	ng
	the intended learnin	g outcomes:	~						1 0	
	Presentations requ	ire students to	reflec	et upe	on the	cours	se con	itents,	, defir	ne
	structure their argu	iments, etc.	JIIS all	lu ma		inpan	5011, 2	155011	anu	
	Peer critiques further prompt students to compare, analyse, and make									
	judgment independently and assertively.						c			
	Continuous assess	ment evaluate	s stud	ents' j	progre	ess in	diffe	rent s	tages	of
	Project report sum	marises stude	nts' fi	nal ac	hieve	ement	s in te	erms o	of pro	ject
	background, research processes and findings, project goals, design							,		
	strategies and processes, final concepts and solution, and evaluation.									
Student Study Effort	Class contact:									
Expected	Tutorials and wo	orkshops							78	8 Hrs.
	Other student study	effort:								
	Project developm	nent							132	2 Hrs.
	Total student stud	y effort							210	) Hrs.
Reading List and References	Books Hekkert, P., & van Dijk, M. (2011). Vision in design: A guidebook for innovators. BIS.									
	Lupton, E. (2017). <i>I</i> Museum.	Design is story	rtelling	g. Co	oper l	Hewit	t, Sm	ithsor	nian D	Design
	Martin, B., & Hanir research complex p solutions (1 st ed). I	ngton, B. (2012 problems, dev Rockport.	2). Un elop i	nivers nnove	al me ative	thods ideas	of de , and	sign I desig	100 wi zn eff	ays to ective
	Vijay Kumar. (2012	2). 101 Design	Meth	ods.	Wiley	<b>.</b>				

Websites
Interactions. https://interactions.acm.org/
Communications of the ACM. https://cacm.acm.org/
Wired. https://www.wired.com/
Ted. http://www.ted.com
RSA. http://www.thersa.org/

### **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	SO4020X
Subject Title	Application of AI and Data Analytics to Manage Ocular Problems
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	NIL
Objectives	1. To equip students with knowledge of contemporary challenges in the ophthalmic field
	<ol> <li>To provide students insight of applying AIDA to tackle problems related to the eye and the visual system</li> </ol>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>a. describe epidemiology of refractive errors in the world and the public health perspective of refractive errors</li> <li>b. demonstrate the understanding on clinical management of refractive errors by different means</li> <li>c. demonstrate the understanding of contemporary challenges of ocular problems in the ophthalmic field</li> <li>d. demonstrate the ability to apply AIDA in the ophthalmic field</li> <li>e. design AIDA systems, components and processes to meet given specifications and constraints</li> </ul>
Subject Synopsis/ Indicative Syllabus	Epidemiology of refractive errors in different regions andcountries: past, present and future Public health and refractive errors: the societal, economical and personal cost of refractive errors Clinical methods to manage refractive errors: an overviewof history and current clinical practice Complications from refractive errors Contemporary ophthalmic issues affecting the world Application of AIDA in the ophthalmic field
Teaching/Learning Methodology	<ul> <li>Lecture: Didactic teaching will be used. Real examples will be covered to illustrate different ophthalmic challenges.</li> <li>Problem based learning.</li> <li>Tutorial: Student-centred tutorial so students, as a group, can share problems among themselves and try to solve them together. It also helps students to consolidate what they have learned from the lectures.</li> </ul>

Assessment Methods		-							
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Inten outco (Plea	earning sessed propria	g ite)				
			а	b	c	d	e		
	1. Coursework (tests)	50	~	~	~				
	2. Assignment	50	~	~	~	~	~		
	Total	100 %							
	Explanation of the appropriateness of the assessment methods assessing the intended learning outcomes:								
	Several written tests will b students' knowledge on the	e arranged du e challenges i	uring th n the c	ne cour ophtha	rse to e Imic fi	examin eld.	e		
	Assignment will be given to assess students the application of AIDA to tackle problems in the ophthalmic field. This can examine their problem-solving skills, critical thinking and analytical power.								
Student Study Effort	Class contact:								
Expected	Lecture						0 Hrs.		
	<ul> <li>Tutorial</li> </ul>		2	4 Hrs.					
	Problem-based learnin	ng				5 Hrs.			
	Other student study effort:								
	<ul> <li>Self-study</li> </ul>					80	80 Hrs.		
	Total student study effor	t:				119	) Hrs.		
Reading List and References	Saw S, Matsumura S, & I management of myopia a Ophthalmology & Visual	Hoang Q. (20 nd myopic p Science, 60(	019). P atholo (2), 48	reven gy. In 8-99.	tion ar vestiga	nd ative			
	Cooper J. (2019). Etiology and Management of Myopia. Advances in Ophthalmology and Optometry, 4, 39-64.								
	<ul> <li>Farooqui J, Acharya M, &amp; Kekan M. (2019). Current trends in surgical management of myopia. Community Eye Health, 32(105), S5-S6.</li> <li>Moore M, Loughman J, Butler JS, Ohlendorf A, Wahl S, et al. (2021). Application of big-data for epidemiological studies of refractive error. PLOS ONE, 16(4): e0250468.</li> </ul>								

A	Avinash V. Varadarajan, Ryan Poplin, Katy Blumer, Christof
A	Angermueller, Joe Ledsam, Reena Chopra, Pearse A. Keane, Greg
S.	S. Corrado, Lily Peng, Dale R. (2018). Webster; Deep learning for
pr	oredicting refractive error from retinal fundus images.
In	nvestigative Ophthalmology & Visual Science, 59(7), 2861-8.

#### Note 1: Intended Learning Outcomes

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

#### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

#### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

## **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	SO4039X
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	<ul> <li>Application of AI and Data Analytics to Manage Ocular Problems (SO4020X)</li> <li>Any other equivalent capstone project should be excluded.</li> </ul>
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to optometry / vision science;</li> <li>develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA;</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) conduct literature review to locate materials and sources relevant to optometry / vision science;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> </li> <li>Attributes for all-roundedness <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(j) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> <li>(k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).</li> </ul> </li> </ul>
Subject Synopsis/ Indicative Syllabus	<ol> <li>In-depth Study of a Topic Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> </ol>

	<ol> <li>5. Project Documentation</li> <li>6. Presentation and Demonstration</li> </ol>												
	Students are expected to identify a project topic with a supervisor in optometry / vision science, and a co-supervisor with artificial intelligence and data analytics expertise. Students need to demonstrate their knowledge in both optometry / vision science and AIDA in the project, receiving advice from both supervisors. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in optometry / vision science.												
Teaching/Learning Methodology	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.												
Assessment Methods		[	_										
in Alignment with	Specific	% weighting	Inte	endec	l subj (F	ject l Please	earni e tick	ng o as a	utcon pproi	nes to priate	be: b)	asses	sed
Outcomes	methods/tasks		a	b	c	d	e	f	g	h	i	j	k
	Continuous Assessment	100	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
	Total	100					•					•	
	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</li> <li>The Integrated Capstone Project will be accessed by the supervisor/co-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.</li> <li>Integrated Capstone Projects should be problem-oriented and there are no restrictions on the nature of the problem except that it should be relevant to optometry / vision science and AIDA. 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/co-supervisor before the student can proceed with the Integrated Capstone Project. An oral presentation and demonstration is essential at the and</li> </ul>												
Student Study	for proper contin	nuous assess	men	t.									
Effort Expected	Lecture											0 H	Hrs.
	Other student st	udy effort:											
	<ul> <li>Searching a supervisor development etc.</li> </ul>	<ul> <li>Searching and reading materials, meeting with supervisor / co-supervisor / others, design and system development, testing, documentation, presentation, etc.</li> </ul>											
	<ul> <li>Total stude</li> </ul>	nt study effo	ort									210	Hrs

Reading List and	Reference Books:
References	1. Kumar, Ranjit, <i>Research Methodology: A Step-by-step Guide for Beginners</i> , 3rd Edition, SAGE Publications, 2011.
	2. Burns, Robert B., <i>Introduction to Research Methods</i> , 4th Edition, SAGE Publications, 2000.
	3. Roberts, Carol M., <i>The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation</i> , 3rd Edition, Corwin Press, 2007.
	4. Mauch, James E. and Park, Namgi, <i>Guide to the Successful Thesis and Dissertation: A Handbook for Students and Faculty</i> , 5th Edition, Marcel Dekker, 2003.
	<ol> <li>Rudestam, Kjell Erik and Newton, Rae R., Surviving Your Dissertation: A Comprehensive Guide to Content and Process, 2nd Edition, Sage Publications, 2001.</li> </ol>
	6. Garson, G. David, <i>Guide to Writing Empirical Papers, Theses and Dissertations</i> , Marcel Dekker, 2002.
	7. Reinhart, Susan M., <i>Giving Academic Presentations</i> , 2nd Edition, University of Michigan Press, 2013.
	8. Oshima, Alice and Hogue, Ann, <i>Writing Academic English</i> , 4th Edition, Pearson Longman, 2006.
	9. American Psychological Association. <i>Publication Manual of the American</i> <i>Psychological Association</i> , 6th Edition, American Psychological Association, 2010.
	10. Szuchman, Lenore T., <i>Writing with Style: APA Style Made Easy</i> , 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.

#### Note 1: Intended Learning Outcomes

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

### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

Subject Code	SFT303AF
Subject Title	AI in Fashion Business
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Students will be exposed to various AI technologies being applied in the fashion industry. They will also learn the fundamental principles and mechanisms of sophisticated and commonly applied data-driven technologies, raw data analysis, and dataset structure for formulating new Artificial Intelligence (AI) applications to boost and reshape the fashion retail and marketing operations.
Intended Learning Outcomes	Upon completion of the subject, students will be able to:
	<ul> <li>(a) Understand how the AI technologies can be applied in real-life cases for enhancing fashion marketing and retailing operations and innovations;</li> <li>(b) be aware of basic data-driven technologies and methods to analyse data and create appropriate dataset for AI model training</li> <li>(c) label data for fashion related AI tasks such as image recognition, and segmentation, as well as conduct test script to be familiar with these technologies; and</li> <li>(d) initiate ideas or business models using AI technology for the cases/projects of fashion firms; and</li> <li>(e) plan, organise and deliver effective oral presentations on project work.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>(a) Basic knowledge of AI for fashion business applications</li> <li>Image classification: concept of image features, image classifications, attributes recognition based on the neural network.</li> <li>Voice recognition: types of voice recognition technical, music style recognition and retrieval.</li> <li>Video understanding: background and related knowledge about video understanding.</li> <li>Text understanding. Demonstrate the tasks belong to text understanding.</li> </ul>

	<ul> <li>(b) Application of AI Technologies in Fashion Business <ul> <li>Fashion understanding</li> <li>Fashion retail and marketing</li> </ul> </li> <li>(c) Labelling Training Data and Testing Pre-trained Model <ul> <li>Labelling fashion attributes data for attributes recognition</li> <li>Labelling fashion segmentation data for clothing parsing</li> <li>Run test scripts to be familiar with the codes</li> </ul> </li> <li>(d) Problem Formulation for Applying AI technologies in Fashion Business <ul> <li>Discussing the potential cases exist in current fashion industry</li> <li>Problem formulation for into a technical problem with a clear solution</li> <li>Searching technologies to solve the problem and verify its feasibility</li> </ul> </li> </ul>
Teaching/Learning Methodology	<ul> <li>In this subject, students will gain an understanding of various types of AI technology for fashion business; how to evaluate the task and define data for model training; how to assess the availability of the data and collect them to construct the training set; and how to formulate a fashion business process into a technical task and assess the feasibility.</li> <li>The following tools may be used: <ol> <li>Visual Studio Code for running the testing script</li> <li>Github: the largest source code host which provides access control and several collaboration features such as bug tracking, feature requests, task management, continuous integration, and wikis for every project.</li> <li>LabelBee: it is an open-source annotation library to label data for general AI tasks.</li> </ol> </li> <li>Lectures and tutorials will underpin students' understanding of the subject contents. Instrumental cases will be adopted to illustrate the usability of the principles in real-life fashion business.</li> </ul>

Assessment Methods		1							
in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Inter outc (Plea	nded s omes ase tic	ning sed priate)	)			
			a	b	c	d	e		
	1. Assignments	25%	~	~	~				
	2. Project	25%	~	~	~	~	~		
	3. Examination	50%	~	~	~				
	Total	100%							
	<ul> <li>Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:</li> <li>Assignments are given to assess students' understanding on subject matters.</li> <li>Project require the students to develop an AI-engaged application and potential technical proposal to benefit or improve the existing fashion industry. The project requires a project proposal and presentation as well.</li> <li>A final 2-hour exam will be closed book examination.</li> </ul>								
Student Study Effort	Class contact:								
Expected	• Lecture							Hrs.	
	• Tutorial						12 Hrs.		
	Other student study effort:								
	Self-study/Preparation						46 Hrs.		
	Project/Assignments						24 Hrs.		
	Total student study effort						108 Hrs.		
Reading List and References	Books:Wong, W. K. (Ed.). (2018). Artificial Intelligence on Fashion at Textiles: Proceedings of the Artificial Intelligence on Fashion at Textiles (AIFT) Conference 2018, Hong Kong, July 3–6, 2018 (Vol. 849). Springer.Wong, W. K. (Ed.). (2017). Applications of computer vision in fashion and textiles. Woodhead Publishing.						n and n and n		

Paper Articles:
Al-Rawi, M., & Beel, J. (2020). Towards an Interoperable Data Protocol Aimed at Linking the Fashion Industry with AI Companies. <i>arXiv preprint arXiv:2009.03005</i> .
Cheng, W. H., Song, S., Chen, C. Y., Hidayati, S. C., & Liu, J. (2021). Fashion meets computer vision: A survey. <i>ACM Computing Surveys (CSUR)</i> , <i>54</i> (4), 1-41.
Gong, W., & Khalid, L. (2021). Aesthetics, Personalization and Recommendation: A survey on Deep Learning in Fashion. <i>arXiv preprint arXiv:2101.08301</i> .
Kashilani, D., Damahe, L. B., & Thakur, N. V. (2018, August). An overview of image recognition and retrieval of clothing items. In 2018 International Conference on Research in Intelligent and Computing in Engineering (RICE) (pp. 1-6). IEEE.
Liu, S., Liu, L., & Yan, S. (2014). Fashion analysis: Current techniques and future directions. <i>IEEE MultiMedia</i> , 21(2), 72-79.
Mohammadi, S. O., & Kalhor, A. (2021). Smart Fashion: A Review of AI Applications in the Fashion & Apparel Industry. <i>arXiv preprint arXiv:2111.00905</i> .
Sha, T., Zhang, W., Shen, T., Li, Z., & Mei, T. (2021). Deep Person Generation: A Survey from the Perspective of Face, Pose and Cloth Synthesis. <i>arXiv preprint arXiv:2109.02081</i> .
Song, S., & Mei, T. (2018). When multimedia meets fashion. <i>IEEE MultiMedia</i> , 25(3), 102-108.
Zou, X., & Wong, W. (2021). fAshIon after fashion: A Report of AI in Fashion. <i>arXiv preprint arXiv:2105.03050</i> .

Subject Code	SFT304AF
Subject Title	AI in Fashion Design
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objective of this class is to prepare students to be forerunners in the digital fashion world that involves an Artificial Intelligence (AI) based assistant creation process and innovative ways to create and exhibit their design works. Students will learn the fundamentals of AI in fashion design and how to use and adopt AI technologies to help their creative process and exhibit their design works. Students will gain experience to finish the design process with the help of various AI technologies.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) be aware of the digital transformation and virtual fashion, and critically think what the future of digital fashion will be in metaverse;</li> <li>(b) demonstrate knowledge of various strategies for commonly and potentially adopted AI technologies in fashion arena;</li> <li>(c) understand how the engagement of AI technologies in fashion design process and create futuristic digital fashion collection by using an AI-based fashion design technology; and</li> <li>(d) plan, organise and deliver effective oral presentations on project work.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>(a) Future of Fashion Design Digital fashion cases and collections launched; Pros and Cons of digital fashion; what metaverse-like worlds will be or should be</li> <li>(b) AI Technologies for Creating Virtual Fashion Introduce the backbone AI technologies for fashion design.</li> <li>(c) Introduction and Hands On Workshop of AI-based Interactive Design Assistant for Fashion (AiDA) system Being familiar with technical tools to generate sketches.</li> <li>(d) Creation of Fashion Collection Using an AI-based Interactive Design Assistant for Fashion (AiDA) system to propose the mood board and create a collection.</li> </ul>

Teaching/Learning Methodology	In this subject, students will gain an understanding of the types of AI technology that can be applied in fashion design; how to create designs effectively and efficiently by adopting AI technology; how to make use of AI technology to analyze vast amounts of trend data and suggest design adjustments. The following tool may be used: AI-based Interactive Design Assistant for Fashion (AiDA) System Lecture discussion and tutorials will underpin students' understanding of the subject contents. Instrumental cases will be adopted to illustrate the usability of the principles in fashion design process. Apart from lecturing, coursework including assignments and project will also be included.						
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
			а	b	с	d	
	1. Assignments	25%	$\checkmark$	$\checkmark$	$\checkmark$		
	2. Project	25%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
	3. Examination	50% ✓ ✓ ✓				$\checkmark$	
	Total	100%			1		
	Total100%Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:Assignments are given to assess students' understanding on subject matters.The subject has a project, which requires the students to develop a set of collection based on AiDA and demonstrate their thinking about how to improve the AI design system. The project requires a project proposal and presentation as well.A final 2-hour exam will be closed book examination.						

Student Study Effort	udent Study Effort Class contact:					
Expected	• Lecture	26 Hrs.				
	• Tutorial	12 Hrs.				
	Other student study effort:					
	Self-study/Preparation	46 Hrs.				
	Project/Assignments	24 Hrs.				
	Total student study effort	108 Hrs.				
Reading List and	Books:					
Kelerences	Wong, W. K. (Ed.). (2018). Artificial Intelligence on Textiles: Proceedings of the Artificial Intelligence o Textiles (AIFT) Conference 2018, Hong Kong, July 2018 (Vol. 849). Springer.	n Fashion and n Fashion and 3–6,				
	Wong, W. K. (Ed.). (2017). <i>Applications of computer fashion and textiles</i> . Woodhead Publishing.					
	Paper Articles:					
	Dubey, A., Bhardwaj, N., Abhinav, K., Kuriakose, S & Arora, V. (2020). AI Assisted Apparel Design. <i>ar</i> <i>arXiv:2007.04950</i> .	kose, S. M., Jain, S., ign. <i>arXiv preprint</i>				
	Kato, N., Osone, H., Oomori, K., Ooi, C. W., & Och March). Gans-based clothes design: Pattern maker is to design clothing. <i>In Proceedings of the 10th Augm</i> <i>International Conference 2019 (pp. 1-7).</i>	chiai, Y. (2019, is all you need <i>nented Human</i>				
	Ravi, A., Patro, A., Garg, V., Rajagopal, A. K., Raja Banerjee, R. H. (2019). Teaching DNNs to design fa fashion. <i>arXiv preprint arXiv:1906.12159</i> .	nn, A., & ast				
	Couprie, C. e networks. omputer Vision					
	ng, Z., & Yan, l Fashion Aided by <i>ons on</i>					
	Zou, X., & Wong, W. (2021). fAshIon after fashion AI in Fashion. <i>arXiv preprint arXiv:2105.03050</i> .	: A Report of				

Subject Code	SFT330FB							
Subject Title	Fashion Digital Marketing							
Credit Value	3							
Level	3							
Pre-requisite/ Co-requisite/ Exclusion	Nil							
Objectives	This subject shall provide both theoretical and practical knowledge of digital market to fashion students. Digital marketing covers website creation, planning, optimization. Search engine optimization (SEO), social media analytics and marketing, digital customer journey design, and business data analytics. The latest development of the digital technologies for marketing will also be introduced.							
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) Develop digital marketing strategy for fashion brands</li> <li>(b) Select the right digital marketing tools for specific marketing purpose</li> <li>(c) Develop right contents for web, mobile, and social media marketing</li> <li>(d) Design engaging customer digital journey</li> <li>(e) Apply new digital technologies for fashion marketing</li> </ul>							
Subject Synopsis/ Indicative Syllabus	<ol> <li>Introduction of fashion digital marketing</li> <li>Search Engine Optimization (SEO) and Search Engine Marketing (SEM)</li> <li>Understanding digital marketplaces</li> <li>Personalized digital marketing with data analytics</li> <li>Social media listening, storytelling and branding</li> <li>Designing and executing digital marketing campaign</li> <li>Digital customer journey management</li> <li>Artificial Intelligence (AI) applications for customer insights and marketing automation</li> <li>Digital inclusion and equity design and strategy</li> <li>Emerging topics and technologies for digital marketing</li> </ol>							
Teaching/Learning	Lectures							
--------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------	------------------------	---------------------------	----------------------------	---------------------------	-------------------------	------
Methodology	<ul> <li>Introduction of digital marketing theoretical concepts, latest research findings, and fashion brands case studies</li> <li>Guest speakers from digital marketing sector</li> </ul>							
	Tutorials - Case discussion - Hands-on experience of digital technologies							
	The fundamental concepts of digital marketing, and best practices in the industry will be delivered in lectures. Tutorials will be conducted in both the classroom, the computer lab, or online so that students may both experience, design and develop, mobile applications that are suitable for fashion and luxury goods retailers.							
	There will be guest speakers on specific topics and on the trend of digital marketing in the fashion industry.							
	A flipped classroom approach will be used in some lectures to improve learning experience and student engagement. The flipped classroom supplements the tutorials that have technical contents.							
	Group project submis each team member.	sion shall re	port ii	ndivic	lual c	ontrit	oution	s of
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Inter outc (Plea	nded s omes ase tic	subjec to be ck as a	ct lear asses appro	rning ssed priate	2)
			а	b	с	d	e	
	1. Group project	50%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
	2. Exam	50%	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	
	Total	Total 100%						
	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:							

Student Study Effort	Class contact:					
Expected	• lecture	26 Hrs.				
	• tutorial	12 Hrs.				
	Other student study effort:					
	Group project	50Hrs.				
	• Reading	20Hrs.				
	Total student study effort	108Hrs.				
Reading List and	<b>Reference book</b>					
Kelerences	Gilbert, R. M. (2019). <i>Inclusive design for a digital Designing with accessibility in mind</i> . Apress.	world:				
	Unger, R., & Chandler, C. (2012). A Project Guide to UX Design: For user experience designers in the field or in the making. New Riders.					
	Reading List					
	<ul> <li>Berman, R., &amp; Katona, Z. (2013). The role of search en optimization in search marketing. <i>Marketing Science</i>, 32(4), 651.</li> <li>Campbell, C., Sands, S., Ferraro, C., Tsao, H. Y. J. Mavrommatis, A. (2020). From data to action: How marketers leverage AI. <i>Business Horizons</i>, 63(2), 227-243.</li> </ul>					
	Klein, J. F., Zhang, Y., Falk, T., Aspara, J., & Luo, X. (2020). Customer journey analyses in digital media: exploring the impact of cross-media exposure on customers' purchase decisions. <i>Journal</i> <i>of Service Management</i> , <i>31</i> (3), 489-508.					
	Liu, S., Perry, P., & Gadzinski, G. (2019). The implications of digital marketing on WeChat for luxury fashion brands in China. <i>Journal of Brand Management</i> , 26(4), 395-409.					
	Tueanrat, Y., Papagiannidis, S., & Alamanos, E. (2021). Going of a journey: A review of the customer journey literature. <i>Journal of Business Research</i> , 125, 336-353.					

# Subject Description Form

Subject Code	SFT403FI
Subject Title	Smart Textiles for Wearable Applications
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Exclusion ITC4202T Smart Textiles for Wearable Applications
Objectives	The subject provides the knowledge of the latest development, including materials, technologies and products, in smart textiles for wearable application.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) assess technologies involved in smart textile and wearable products and manufacturing processes, their advantages and disadvantages;</li> <li>(b) describe the development trends in technologies for smart textiles and wearable products and their potential in industrial applications.</li> <li>(c) cooperate efficiently in a team to achieve goals;</li> <li>(d) develop critical and creative thinking;</li> <li>(e) develop the ability to adapt new technologies and update their knowledge;</li> <li>(f) develop the ability for sourcing, selecting and integrating information.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>(I) Smart Fibres and Fibrous Assembles Electric functions of textile polymers. Electrically conductive fibres, optical fibres. Photochromic fibres. Electrochromic fabrics. Active polymer fibres.</li> <li>(II) Interactive Textile Devices Fibre-based electronic circuit and systems. Flexible fabric strain sensors. Soft tactile sensors, textile electrodes for biopotentials. Textile energy harvesters. Textile energy storages. Photonic fabric displays. Textile circuit boards.</li> <li>(III) Wearable Products and System Analysis Thermal regulating garments. Health monitoring garments. shoes. Wearable phototherapy device.</li> <li>(IV) Manufacturing Technologies Smart yarn formations. Incorporation of smart functions by weaving, knitting, embroidery, printing, coating and lamination.</li> </ul>

Teaching/Learning Methodology	Lectures will be used to introduce the principles, applications and decision implications of various technological developments to students.							
	Laboratory/studio involving case studies will be used to provide hands-on experience and supplement the lecture program.							
	Students will be encouraged to interact with the lecturer, and present their own findings based on investigation of the new developments and new products. Individual assignments, laboratory/studio work and group projects will be the major parts of continuous assessment components.							
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
			a	b	c	d	e	f
	Continuous Assessment	50%	~	~	~	~	~	~
	1. Assignment/ laboratory work	25%	~	~	~	~	~	~
	2. Group project	25%	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
	Examination	50%	$\checkmark$	$\checkmark$		$\checkmark$		
	Total	100%						
	Explanation of the appropriateness of the assessment methods is assessing the intended learning outcomes: In the continuous assessment, by individual assignments laboratory/studio work and group projects, all rounded education will be focused. In addition to professional knowledge, the importance of teamwork, critical and creative thinking, the abilit to adapt new technologies, and the demonstration of initiative is sourcing, selecting and integrating information will be stressed. For example, interaction among group members will improve the communication skills, their teamwork spirit, leadership as well a entrepreneurship potential. In order to gain systematic technica knowledge/skills, students will also be asked to do assignments.						ods in ments, cation e, the ability tive in ed. For e their well as chnical ents.	

	In the examination, students' learning performance defining concepts, explaining principles and defining application examples as well as providing of rationale for smart textile and wearable corresponding integration processes will be assessed	ce in terms of lescribing and various forms products and d.				
Student Study Effort	Class contact:					
Expected	• Lecture	26 Hrs.				
	Laboratory	12 Hrs.				
	Other student study effort:					
	• Assignments	25 Hrs.				
	Self-study					
	Total student study effort	105 Hrs.				
Reading List and References	Books					
	<u>Essentials</u>					
	Tao, X. M. (2015), Handbook of smart textiles. Springer. (e-version available)					
	Tao, X. M. (2005), Wearable electronics and photonics. Elsevier.					
	Schneegass, S., & Amft, O. (2017). Smart textiles: Fundamentals, design, and interaction (Human-computer interaction series). Springer.					
	Supplementary					
	Tao, X. M. (2001), Smart fibres, fabrics and clothin fundamentals and applications. Elsevier.	<i>g</i> –				
	Helal, A. (Sumi). (2008), Mokhtari, Mounir, Abdulrazak. <i>The Engineering Handbook of Smart Technology for Aging, disability, and Independence</i> , John Wiley & Sons, Inc., Bessam. (e-version available)					

Periodicals
Textile Research Journal Smart Materials Bulletin Smart Materials and Structures High Performance Textiles Textile Outlook International Medical Textiles

# Subject Description Form

Subject Code	SFT412FB
Subject Title	Fashion Market Intelligence
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The subject gives an overview of collecting, transforming, and organizing data to draw conclusions, make predictions, and drive informed decision making for fashion businesses.
Intended Learning Outcomes	<ul> <li>Upon completion of the subject, students will be able to:</li> <li>(a) advance the ability to develop deep knowledge of data sources required in fashion business</li> <li>(b) advance the ability to stay current on emerging technologies, data types and methods</li> <li>(c) learn how to turn data into a competitive advantage and make better management decisions for fashion organizations</li> <li>(d) upskill data management technical skills and grow into data analysts or consultants in fashion organizations</li> <li>(e) nurture professionalism, demonstrate critical/creative thinking skills, and build communication skills and teamwork spirit.</li> </ul>
Subject Synopsis/ Indicative Syllabus	<ul> <li>(I) What is Fashion Market Intelligence? <ul> <li>Business values of data for fashion business</li> <li>Information gathering and decision making</li> <li>Data warehouses</li> </ul> </li> <li>(II) Fashion data analytics with free and open-source software (e.g., KNIME) <ul> <li>KNIME in a nutshell; Moving around in KNIME: Nodes; Hello world in KNIME: CSV reader, sorter, excel writer</li> <li>Business programming in python</li> </ul> </li> <li>(III) Transforming fashion data <ul> <li>Applying data mining tools and analytics: modelling data, combining tables, joiner, aggregating values (e.g., GroupBy, pivoting)</li> </ul> </li> </ul>

	<ul> <li>(IV) What is machine learning? <ul> <li>The machine learning way:</li> <li>(i) predicting fashion market prices, (ii) segmenting fashion customers, and (iii) finding the best fashion promotion strategy</li> <li>Three types of learning algorithms: <ul> <li>(i) supervised learning, (ii) unsupervised learning, and (iii) reinforcement learning</li> <li>Evaluating fashion businesses' performance</li> </ul> </li> <li>(V) Market Intelligence for Fashion Business <ul> <li>Analysis, design, and implementation of systems for fashion market intelligence</li> <li>Market intelligence – customer segmentation</li> <li>Social media, big data, and data mining</li> <li>Strategic approach to market intelligence</li> </ul> </li> </ul></li></ul>								
Teaching/Learning Methodology	<ul> <li>Lectures will provide fundamental knowledge (i.e., the concepts, technologies, and methods) of data analytics.</li> <li>Tutorials will be used to apply the learned knowledge and principles into students' own data analytics trials.</li> <li>Group/individual projects will be given to develop students' ability to define problems; students will have an opportunity to try themselves how to transfer data into addressing the described problems and making better management decisions for fashion organizations</li> <li>In-class participation will be very important in tutorials and group</li> </ul>								
Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks Continuous Assessment	Specific assessment nethods/tasks       % weighting       Intended subject learning outcomes to be assessed (Please tick as appropriate)         a       b       c       d       e         Continuous       50%       ✓       ✓       ✓       ✓							
	1. Group project         30%         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓         ✓								
	2. Individual assignment and participation20%Image: Image: Ima								
	Examination	50%	~	✓	<ul> <li>✓</li> </ul>	<ul> <li>✓</li> </ul>			
	Total	Total 100%							

	Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:				
	The assessment methods will be designed to assess diverse aspects of students' the learning outcomes.				
Student Study Effort Expected	Class contact:				
	Lecture	26 Hrs.			
	• Tutorial	12 Hrs.			
	• Other student study effort:				
	Group project	67 Hrs.			
	• Total student study effort	105 Hrs.			
Reading List and References	Books				
	De Mauro, A. (2021). Data analytics made easy: Analyze and present data to make informed decisions without writing any code. Packt.				
	Sharda, R., Delen, D., & Turban, E. (2021). Analytics, data science, & artificial intelligence: Systems for decision support. Pearson Education Limited.				
	<b>Recommended</b>				
	Google Data Analytics Certificate: https://grow.google/certificates/data-analytics/#?mo	dal_active=none			

# The Hong Kong Polytechnic University

# **Subject Description Form**

Please read the notes at the end of the table carefully before completing the form.

Subject Code	SFT4217X
Subject Title	Integrated Capstone Project
Credit Value	6
Level	4
Pre-requisite/ Co-requisite/ Exclusion	<b>Exclusion</b> : ITC4056T Final Year Project by Thesis, ITC4215D Final Year Project by Collection and any other equivalent capstone project
Objectives	<ul> <li>The objectives of this subject are to:</li> <li>provide a student with the opportunity to apply and integrate the knowledge of artificial intelligence and data analytics (AIDA) to his/her discipline.</li> <li>develop the capabilities of a student in analyzing and solving complex and possibly real-life problems using AIDA.</li> <li>Train students with skills on systematic development and documentation of a significant piece of work.</li> </ul>
Intended Learning Outcomes (Note 1)	<ul> <li>Upon completion of the subject, students will be able to:</li> <li><u>Professional/academic knowledge and skills</u> <ul> <li>(a) conduct literature surveys to locate materials and sources relevant to the selected problem area in a specific discipline;</li> <li>(b) understand the materials obtained and connect the materials with the problem to be solved using AIDA knowledge and skills;</li> <li>(c) define and specify the problem precisely;</li> <li>(d) assimilate and apply the learnt knowledge to generate good solutions to the problem;</li> <li>(e) think critically the formulation of alternative models and solutions to the problem, in the analysis of approaches to the solution and their implementation; and</li> <li>(f) evaluate the final outcome in an objective manner;</li> </ul> </li> <li>Attributes for all-roundedness <ul> <li>(g) improve presentation and communication skills via oral presentation;</li> <li>(h) enhance technical report writing skills with proper organization of materials;</li> <li>(i) develop the ability to learn independently and to find/integrate information from different sources required in solving real-life problems;</li> <li>(j) manage the project efficiently and effectively through the supervision of supervisor(s); and</li> </ul> </li> </ul>

	(k) work collabor company, tec etc.).	<ul> <li>(k) work collaboratively with related parties (e.g. vendors, sponsor company, technical support staff, team-partners, research students, etc.).</li> </ul>											
Subject Synopsis/ Indicative Syllabus (Note 2)	<ol> <li>In-depth Study of a Topic Typically Proposed by the Supervisor</li> <li>Project Meeting and Planning</li> <li>Proposal Writing</li> <li>Regular Progress Checking and Reporting</li> <li>Project Documentation</li> <li>Presentation and Demonstration</li> </ol>												
	Students are expected to identify a project topic with a supervisor in Fashion and Textiles, and a co-supervisor with artificial intelligence and data analytics expertise. Students need to demonstrate their knowledge in both the fashion and textile discipline and AIDA in the project, receiving advice from both supervisors. The project should represent requisite effort in analysing and interpreting the data/information obtained, using the principles and techniques learnt from various related subjects. Students are also expected to demonstrate significant analytical and, preferably, research ability in the chosen application domain.												
<b>Teaching/Learning</b> <b>Methodology</b> (Note 3)	The Integrated Capstone Project spans across the academic year for two consecutive semesters. The teaching/learning activities include regular project meetings with the supervisor and the co-supervisor, guided study of project materials, independent project development work and other project management tasks.												
Assessment Methods in Alignment with Intended Learning	Specific assessment methods/tasks	% weighting	Int ass	ende	ed su ed (P	ıbjec 'leas	et lea	arnin k as	ig ou appi	itcor ropri	nes iate)	to be	e
Outcomes			a	b	c	d	e	f	g	h	i	j	k
(Note 4)	1. Continuous Assessment	100%	~	~	~	~	~	~	~	~	~	~	$\checkmark$
	Total	100%			•	•	•	•					
	Explanation of the the intended learn The Integrated C supervisor and ot limited to, Proble Presentation, Proj Integrated Capsto restrictions on the fashion and textil academic or a hyt to have some orig	e appropriate ing outcome capstone Pro her assessor em Identifica ect Managen ne Projects nature of th les discipline orid in which inal contribu	nesss s: ject s. A ation nent shou e pr e and the tion	wil Attri a, Pr , and ble d A stuc s. 1	l be bute coble 1 Sel 1 DA lent Each	sses acc s to m S f-Di roble xcep . Th is en	sme cesse be a dolvi scip em-co t tha ie pro- ncou dent	nt m ed b asses ing, line. orien at it rojec rage has	etho y th ssed Con ted shou t co d bu to su	ds in e su incl nmu and uld b uld t no	1 ass 1 perv 1 ude, nica ther be rel be r t cor it a r	vison , but tion e ar- leva: pract nstra	ng t/co- t not and e no nt to tical, ined osal,

	The proposal must be approved by the supervisor/co-sup student can proceed with the Integrated Capstone I presentation and demonstration is essential at the end of the term presentation and demonstration may also be reconciliated continuous assessment.	ervisor before the Project. An oral ne project. A mid- juired for proper
Student Study	Class contact:	
Effort Expected	Lecture	0 Hrs.
	Other student study effort:	
	<ul> <li>Searching and reading materials, meeting with supervisor/co-supervisor/others, design and system development, testing, documentation, presentation, etc</li> </ul>	210 Hrs.
	Total student study effort	210 Hrs.
Reading List and References	<ol> <li>Reference Books</li> <li>Kumar, Ranjit, Research Methodology: A Step-by-step Beginners, 3rd Edition, SAGE Publications, 2011.</li> <li>Burns, Robert B., Introduction to Research Methods, 4 Edition, SAGE Publications, 2000.</li> <li>Roberts, Carol M., The Dissertation Journey: A Pract. Comprehensive Guide to Planning, Writing, and Defe. Dissertation, 3rd Edition, Corwin Press, 2007.</li> <li>Mauch, James E. and Park, Namgi, Guide to the Succe and Dissertation: A Handbook for Students and Facul Marcel Dekker, 2003.</li> <li>Rudestam, Kjell Erik and Newton, Rae R., Surviving D Dissertation: A Comprehensive Guide to Content and Edition, Sage Publications, 2001.</li> <li>Garson, G. David, Guide to Writing Empirical Papers Dissertations, Marcel Dekker, 2002.</li> <li>Reinhart, Susan M., Giving Academic Presentations, 2 University of Michigan Press, 2013.</li> <li>Oshima, Alice and Hogue, Ann, Writing Academic En, Edition, Pearson Longman, 2006.</li> <li>American Psychological Association, 6th Edition, Am Psychological Association, 2010.</li> <li>Szuchman, Lenore T., Writing with Style: APA Style N 5th Edition, Wadsworth/Cengage Learning, 2011.</li> <li>Statistics, simulation, programming, and relevant book</li> <li>ACM and IEEE magazines, Transactions and Journals</li> <li>Other International Journals.</li> <li>Relevant conference proceedings and magazines (inclu and IEEE conferences).</li> <li>Technical reports from universities and major compan</li> </ol>	<i>c Guide for</i> 4th <i>ical and</i> <i>nding Your</i> <i>essful Thesis</i> <i>ty</i> , 5th Edition, <i>Your</i> <i>Process</i> , 2nd <i>c, Theses and</i> 2nd Edition, <i>glish</i> , 4th <i>nual of the</i> derican <i>Made Easy</i> , cs.  uding ACM ies.

## Note 1: Intended Learning Outcomes

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

### Note 2: Subject Synopsis/Indicative Syllabus

The syllabus should adequately address the intended learning outcomes. At the same time, overcrowding of the syllabus should be avoided.

### Note 3: Teaching/Learning Methodology

This section should include a brief description of the teaching and learning methods to be employed to facilitate learning, and a justification of how the methods are aligned with the intended learning outcomes of the subject.

#### Note 4: Assessment Method

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

(Form AR 140) 8.2020