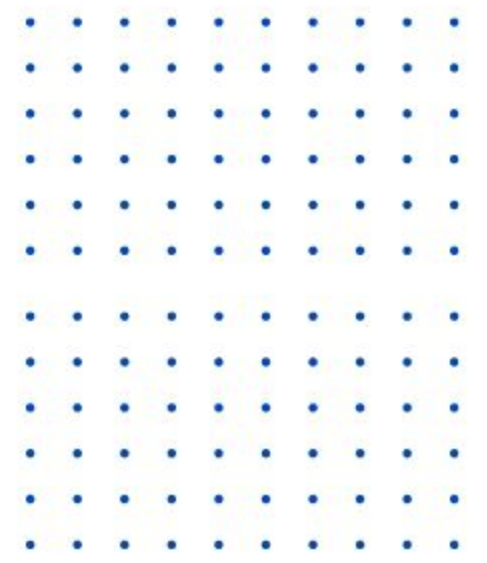UNIVERSITI MALAYA

POSTGRADUATE
PROGRAMME
HANDBOOK
SESSION 2023/2024

Faculty of Computer Science &
Information Technology

Universiti Malaya

Faculty of Computer Science and Information Technology

POSTGRADUATE PROGRAMME HANDBOOK

2023/2024

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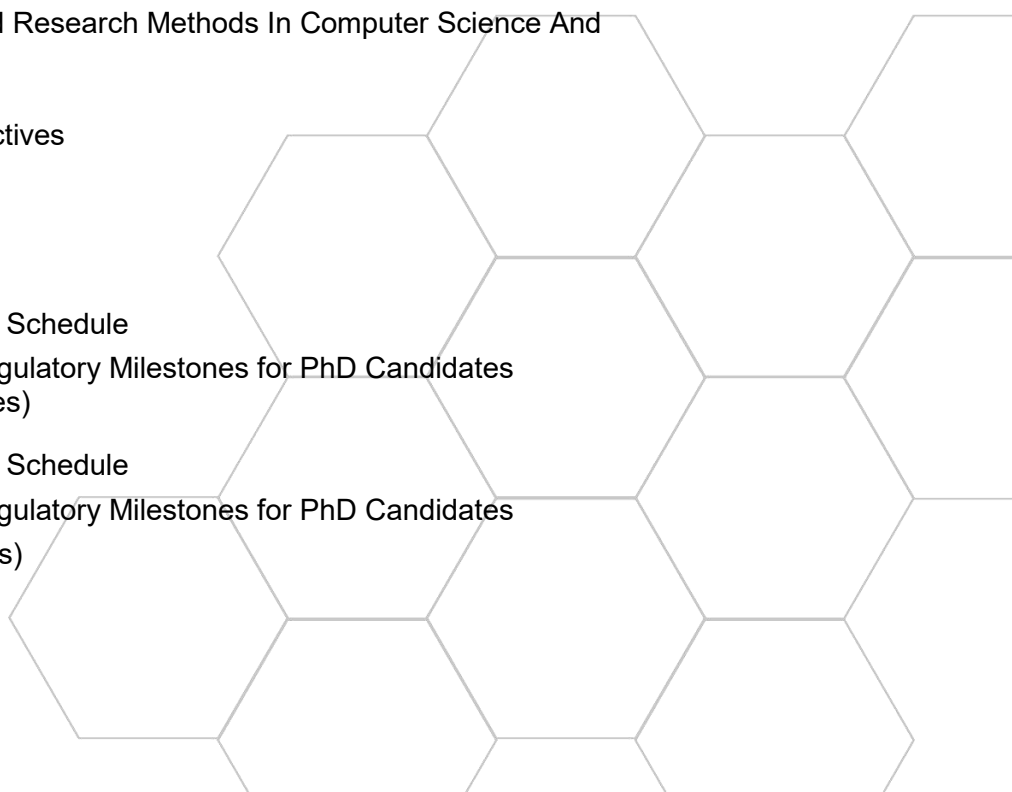
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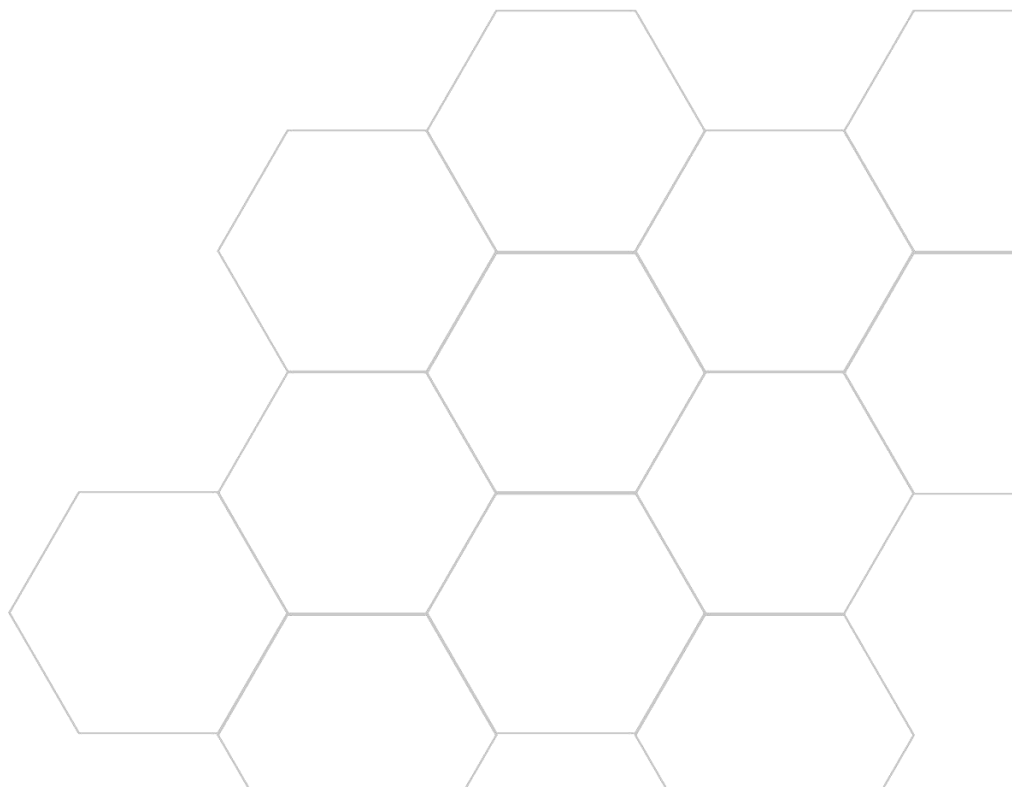
VISION, MISSION, AND OBJECTIVES OF THE FACULTY

Vision

A globally-influential faculty, enriching lives & shaping the future through computing technology.

Mission

To enrich lives and shape the future for the nation and humanity through education, research and technopreneurship.

Objectives

- To sustain an outstanding faculty dedicated to excellence in undergraduate and postgraduate teaching, learning and research

- To contribute towards the development of the nation through the production of quality research and publications

- To provide innovative academic programs that can respond to the changing needs of the society

- To produce quality graduates who are equipped with advanced knowledge and skills of computer science and information technology

HISTORY OF THE FACULTY

The provision of computer facilities and services at the Universiti Malaya (UM) began in mid-1967, soon after the Computer Centre was officially formed in 1965. This also made the university one of the pioneers in computer usage in Malaysia. In December 1969, the Computer Centre took on an additional role of teaching and research of computer science and information technology. The Computer Centre Board was formed, comprising the Vice Chancellor (as Chairman), the Director of Computer Centre (as Secretary), and a representative from each Faculty, Institute, Centre of the University, and from the University Senate.
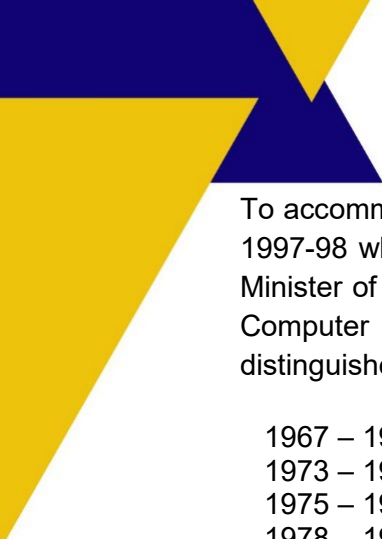
In 1974, the Diploma in Computer Science postgraduate programme was introduced. From its inception in the 1974/75 session to the 1999/2001 session, a total of 304 students had been awarded the Diploma.

The Master of Computer Science (M. Comp. Sc.) and the Doctor of Philosophy (Ph.D.) were two higher degree research programmes approved by the Senate and had been administered by the Computer Centre since 1985. In addition, the Computer Centre offered a 4-year Bachelor of Computer Science programme. The first undergraduate enrollment for 1990/91 session was 50 students.

In April 1993, the University Senate agreed to the formation of the Computer Centre Study Board. The Board proposed the establishment of a faculty to be called the Faculty of Computer Science and Information Technology (FCSIT). The existing Computer Centre was to be annulled and replaced by a Computer Services Division which was placed under the Chancellery.

On September 22 1994, the Universiti Malaya Council agreed to the formation of the Faculty of Computer Science and Information Technology (FCSIT), and the Computer Services Division. A sum of RM 4.2 million was obtained from the Ministry of Education under the 6th Malaysia Plan to put up a new building for the faculty, with the necessary infrastructure for teaching, learning and research. The building was officially declared open by the then Minister of Education, Datuk Seri Najib Tun Abdul Razak on 26 September 1996.

The Bachelor of Information Technology programme started in the 1996/97 academic session, with an initial intake of 50 students. In 1997, the Faculty established four departments, Artificial Intelligence, Software Engineering, Information and Library Science, and, Computer Systems and Technology.

To accommodate an increased student population, an additional building was built in 1997-98 which was officially opened by Dato' Dr. Fong Chan Onn, the then Deputy Minister of Education on 21 September 1998. Since its establishment, the Faculty of Computer Science and Information Technology has been led by a number of distinguished persons. The following have served as Directors/Deans:

1967 – 1973	Mr. Ong Yin Fook
1973 – 1975	Professor Paul Peach
1975 – 1978	Dr. R.K. Pillay
1978 – 1982	Dr. Tan Bock Thiam
1982 – 1990	Associate Professor Ir. Dr. Mashkuri Yaacob
1990 – 1992	Professor Lee Poh Aun
1992 – 2000	Professor Ir. Dr. Mashkuri Yaacob
2000 – 2002	Associate Professor Dr. Siti Salwah Salim
2002 – 2004	Associate Professor Dr. Zainab Awang Ngah
2004 – 2005	Professor Ir. Dr. N. Selvanathan
2005 – 2006	Associate Professor Dr. Siti Salwah Salim
2006 – 2007	Professor Dato' Dr. Ir. Mashkuri Hj. Yaacob
2007 – 2009	Professor Dr. Mohd. Sapiyan Baba
2009 – 2010	Professor Dr. David Ngo Chek Ling
2010 – 2011	Professor Dr. Wan Ahmad Tajuddin Wan Abdullah
2011 – 2014	Professor Dr. Siti Salwah Salim
2014 – 2017	Professor Dr. Abdullah Gani
2017 – 2019	Professor Dr. Abrizah Abdullah
2019 – 2021	Professor Datin Dr. Sameem Abdul Kareem
2022 – Present	Professor Dr. Loo Chu Kiong

DEAN'S OFFICE

: **Professor Dr. Loo Chu Kiong**
BEng (Hons) (Malaya), PhD (USM)

Dean

: **Associate Prof. Dr. Ang Tan Fong**
B.IT (Malaya), MCompSc (Malaya), PhD (Malaya)

Deputy Dean (Postgraduate)

: **Associate Prof. Dr. Norisma Idris**
B.CS. (Hons) (Malaya), M.Sc. (Malaya), PhD (Malaya)

Deputy Dean
(Undergraduate)

: **Prof. Ts. Dr. Ainuddin Wahid Abdul Wahab**
BComSc (Malaya), MCompSc (Malaya), PhD (UK)

Deputy Dean
(Research & Development)

Deputy Dean
(Student Affairs)

: **Associate Prof. Dr. Suraya Hamid**
PhD (Australia), M.IT (UKM), B.IT (UKM)

Deputy Dean
(Value Creation
& Enterprise)

: **Associate Prof. Dr. Azah Anir Norman**
PhD (Malaya), M.Sc (Royal Holloway University of London)

HONORARY PROFESSOR

: **Honorary Professor Dr. Abdullah Gani**
PhD, University of Sheffield, UK, MSc (Information Management, Hull University, UK, B.Phil, Hull University, UK

: **Honorary Professor Datin Dr. Sameem Abdul Kareem**
PhD, UM (2002), MCS, Univ. of Wales, UK (1992), BSc, UM (1986)

HEAD OF DEPARTMENT

| | : | **Dr. Ong Sim Ying**
BComSc (SE) (Malaya),PhD (UTM) |

Software Engineering

: **Dr. Erma Rahayu Mohd Faizal Abdullah**

BComSc (Malaya), Master OITA University (Kejuruteraan Elektrik), PhD (UTM)

Artificial Intelligence

: **Associate Prof. Ts. Dr. Ismail Ahmedy**
Dip.Comp.Sc (UTM), BSc (Hons) (Computer) (UTM), MSc (Computer Science) (University of Queensland), PhD (Sc.Comp) (UTM)

Computer System
and Technology
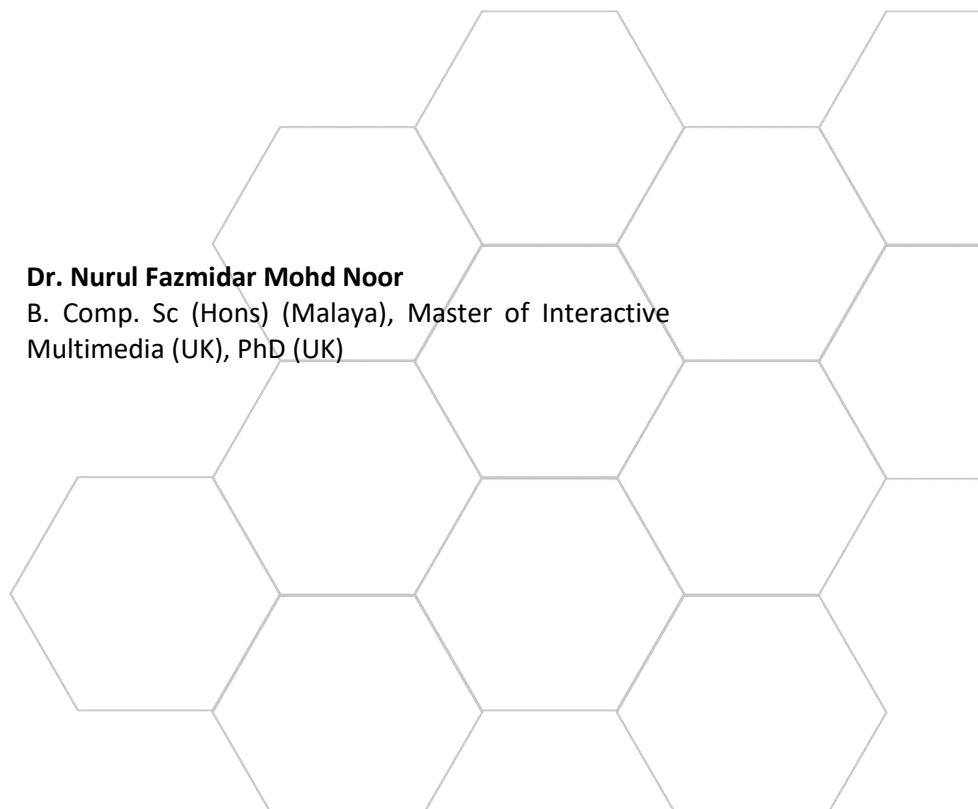
: **Associate Prof. Dr. Norjihan Abdul Ghani**
BIT (Hons) (UUM), MIT.IS (UKM), PhD (UTM)

Information Systems

Head of Unit

: **Dr. Nurul Fazmidar Mohd Noor**
B. Comp. Sc (Hons) (Malaya), Master of Interactive Multimedia (UK), PhD (UK)

Multimedia
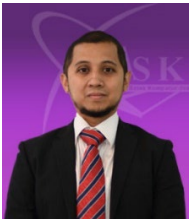
DEPARTMENT OF ARTIFICIAL INTELLIGENCE

Head of Department:
Dr. Erma Rahayu Mohd Faizal Abdullah

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
1.	Dr. Erma Rahayu Mohd Faizal Abdullah (DS51)	PhD (2013) Doctoral Degree, Universiti Teknologi MARA (Kejuruteraan Elektrik) Master, (2007) OITA University (Kejuruteraan Elektrik) Bachelor (2003) Bachelor of Computer Science (Hons)(Multimedia), Universiti Malaya	• Computer Vision and Image Processing • Neural Networks, Genetic Algorithms and Fuzzy Logic (Backpropagation algorithm) • Pattern Recognition
2.	Prof. Ir. Dr. Chan Chee Seng (VK7)	PhD (2008) PhD, University of Portsmouth, U.K. Master (2005) MSc in Communication Systems Engineering, University of Portsmouth, U.K. Bachelor (2003) BEng (Hons) in Electronics Engineering, Multimedia University.	• Fuzzy Sets & Systems and Computer Vision (Image/Video Content Analysis and Human-Robot Interaction)
3.	Prof. Dr. Loo Chu Kiong (VK7)	PhD (2004) PhD, Universiti Sains Malaysia Bachelor (1996) Bachelor of Engineering (Hons), Universiti Malaya.	• Soft Computing, Affective Computing, Human-Robot Interaction (HIR), Deep Learning.

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
4.	Assoc. Prof. Dr. Aznul Qalid Md Sabri (DS54)	PhD (2013) Doctoral Degree (PhD), Ecole Des Mines, Douai, Perancis (Kepintaran Buatan) Master (2009) Masters in Vision and Robotics, Heriot-Watt University Master Degree, (2009) Universite De Bourgogne (Robotik) Bachelor (2006) Bachelor of Computer Science, Universiti Malaya.	• Computer Vision (Human Action Classification, Feature Extraction, Object Detection/ Recognition, Biometrics, Machine Learning, Data Analytics)
5.	Assoc. Prof. Dr. Norisma Idris (DS54)	PhD (2011) PhD (Natural Language Processing), Universiti Malaya. Master (2001) Master of Computer Science, Universiti Malaya. Bachelor (1999) Bachelor of Computer Science (Hons), Universiti Malaya.	• Artificial Intelligence in Education (Automated summarization assessment, Summary sentence decomposition, Adaptive learning, essay grading system) • Natural Language Processing (Text Normalization, Malay text processing, Stemming algorithm, Sentiment Analysis))
6.	Dr. Rohana Mahmud (DS52)	PhD (2008) PhD, University of Manchester,UK Master (1995) Master of Science Artificial, Universiti Sains Malaysia Bachelor (1990) Bachelor of Science, University of Waikato, New Zealand.	• Natural Language Processing (Corpus Development, Discourse Analysis) • Expert System (Multi Agent Consultation Systems, Expert Tutoring System) • Machine learning and Genetic Algorithm (Text Analytic, Text to Picture System)

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
7.	Dr. Saw Shier Nee (DS51)	PhD PhD, National University of Singapore Bachelor BBMedEng, Universiti Malaya	• Biomechanical Engineering (Biomechanics) • Artificial Intelligent Diagnostic Technique (AI in Healthcare)
8.	Dr. Siti Soraya Abdul Rahman (DS52)	PhD (2012) PhD Cognitive Science, University of Sussex, UK Master (2003) Master of Computer Science, Universiti Malaya Bachelor (1998) Bachelor of Science (Hons) Information Technology, University of Glamorgan, UK	• Expert System • Cognitive Science (Cognition and programming, physics problem-solving, Cognitive Load Theory) • Artificial Intelligence in Education (AIED) (Adaptive e-learning, student modelling using Fuzzy Cognitive Map)
9.	Dr. Muhammad Shahreeza Safiruz Kassim (DS51)	PhD in Computer Science, University of Southampton MSc in Artificial Intelligence (Distinction), University of Southampton, UK Bachelor of Engineering, Nagaoka University of Technology, Japan	• Bayesian probability modelling • Machine Learning • Parameter estimation
10.	Dr. Woo Chaw Seng (DS52)	PhD (2007) PhD, Queensland University of Technology, Australia Master (1999) Master of Computer Science, Universiti Malaya. Bachelor (1996) Bachelor of Computer Science, Universiti Malaya.	• Artificial Neural Network • Biomedical Image Segmentation • Wavelet Transform Applications • Data Hiding and Steganography (Multimedia Watermarking) • Mobile Computing (mobile security) • Soft Computing (Swarm Behavior, Software Agent)

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
			• Security Services Sn: Digital Forensic, Steganography, Network Security, Public Key Infrastructure and Biometrics (Digital Watermarking) • National Security Sn: Including Health Aspects Such as Medicine and Medical Supply, Disaster Preparedness and Imported Diseases (Tele-Medicine) • Biometrics Security System (mobile biometric systems)
11.	Dr. Unaizah Hanum Obaidellah (DS51)	PhD (2012) Cognitive Science, University of Sussex, UK Master (2007) Master of Computer Science (Artificial Intelligence), Universiti Malaya. Bachelor (2004) Bachelor of Computer Science (Artificial Intelligence), Universiti Malaya.	• Cognitive Science (Diagrams, Semantic and spatial representation, Memory, Learning) • Biomedical simulation & modelling
12.	Dr. Zati Hakim Azizul Hasan (DS51)	PhD (2014) PhD in Artificial Intelligence and Robotics, Auckland University of Technology, New Zealand Master (2007) Master of Computer Science (Artificial Intelligence), Universiti Malaya. Bachelor (2004) Bachelor of Computer Science (Artificial Intelligence), Universiti Malaya.	• Robotics (mobile robots, localization and mapping) • Cognitive Mapping (spatial cognition in humans and animals) • Biomedical simulation & modelling • Biometrics (Speech processing, spectral analysis)
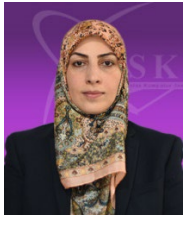
NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
13.	Dr. Lim Chee Kau (DS51)	PhD (2015) PhD (Comp Science), Universiti Malaya Master (2002) Master of Computer, Universiti Malaya Bachelor (1996) Bachelor of Science (Hons), Universiti Sains Malaysia	• Fuzzy Relational Theory • Fuzzy Logic
14.	Dr. Nurul Japar (DS51)	PhD (2021) PhD (Computer Vision), Universiti Malaya Bachelor (2018) Bachelor of Computer Science (Artificial Intelligence), Universiti Malaya.	• Image Processing • Computer Vision • Machine Learning
15	Dr. Liew Wei Shiung (DS51)	PhD (2022) (Computer Science), Universiti Malaya Master of Biomedical Engineering (2015), Universiti Malaya Bachelor of Electronics Engineering (2010), Multimedia University	• Affective computing, artificial intelligence, evolutionary computing, neural networks.

DEPARTMENT OF SOFTWARE ENGINEERING

Head of Department:
Dr. Ong Sim Ying

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
1.	Dr. Ong Sim Ying (DS51)	PhD (2015), Universiti Malaya Bachelor (2007) Bachelor of Computer Science (Software Engineering), Universiti Malaya	• Image, Signal and Video Coding and Processing • Information Security (Data Hiding and Encryption) • Linear Programming
2.	Assoc. Prof. Dr. Mumtaz Begum Peer Mustafa (DS54)	PhD (2012) Universiti Malaya. Master (2006) Master of Science, Universiti Malaya. Bachelor (2002) Bachelor of Science (Computer Science), Universiti Putra Malaysia. Diploma (1998) Pusat Teknologi dan Pengurusan Lanjutan (PTPL), Malaysia	• Component Based Software Development (Component Based Software Engineering, Software Reuse, Reusable Component) • Software Testing • Speech Recognition • Speech Synthesis • Pattern Recognition • Software Agents • Human Computer Interaction
3.	Assoc. Prof. Dr. Rodina Ahmad (DS54)	PhD (2006) Universiti Kebangsaan Malaysia Master (1991) Master of Computer Science Renselaer Polytechnique Institute (RPI), USA Bachelor (1988) Bachelor of Computer Science and Mathematics University of Hartford, CT, USA	• Software Requirements Engineering, Software Process Improvement, • Empirical Software Engineering • Computer Assisted Learning and E-learning Quality

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
4.	Assoc. Prof. Dr. Chiew Thiam Kian (DS54)	PhD (2009) University of Glasgow, Scotland Master (2000) Master of Computer Science, Universiti Malaya. Bachelor (1998) Bachelor of Computer Science, Universiti Malaya.	• Web Performance Analysis and Management (Web Performance) • Usability of Web-Based Systems (Web Usability) • Software Architecture (Interoperability) • Personalised and Community-Based Healthcare (ICT, Healthcare, Interdisciplinary)
5.	Assoc. Prof. Dr. Siti Hafizah Ab. Hamid (DS54)	PhD (2013) Universiti Malaya. Master (2002) Master of Science (Computer System Design), Manchester University Institute of Science and Technology. Bachelor (2000) Bachelor of Science (Hons) (Computer Science), Universiti Teknologi Malaysia, Skudai.	• Software Verification, Validation & Testing (Test Cases, Formal Specification) • Logics and Meanings of Programs (Formal Methods) • Mathematical Logic and Formal Language (Object-Oriented Languages (OOL)) • Edutainment (Mobile Games, E-Learning, Object-Oriented Programming) • Project Management (PRINCE2)
6.	Dr. Adeleh Asemi Zavareh (DS51)	PhD of Computer Science (Artificial Intelligence), Universiti Malaya (2014) Master of Computer Science, University of Pune, India (2008) Bachelor of Computer Science, University of Ashrafi Isfahani, Isfahan, Iran (2006)	• Human Computer Interaction • Evaluation of Software and Systems • Neuro Fuzzy Inference Systems • Multi Criteria Decision Analysis • Software Design • Data Analysis • Big Data • Decision Support Systems • Knowledge Based Systems • E-Commerce

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
7.	Dr. Nazean Jomhari (DS52)	PhD (2010) Manchester University, United Kingdom Master (2001) Master of Science, University of Essex, Colchester, UK Bachelor (2000) Bachelor of Science (Hons) (Information Science), Universiti Kebangsaan Malaysia.	• Interface Design (Older Adult, Child, Autistic and Computer)
8.	Dr. Raja Jamilah Raja Yusof (DS52)	PhD (2012) Universiti Malaya. Master (2000) Master of Computer Sciense, Universiti Malaya. Bachelor (1997) Bachelor of Engineering, Imperial College of Science,Technology and Medicine.	• Human Computer Interaction (Interface Design, Information Visualization, Hierarchical Task Analysis Model) • E-Culture (Muslim Information System, Techno-Daie, Islam, Science and Technology) • Cognitive Psychology (Reading Comprehension) • Information Processing (Arabic Stemming) • Information, Computer and Communication Technology (ICT), Software Engineering
9.	Dr. Su Moon Ting (DS52)	PhD (2015) University of Auckland, New Zealand Master (1999) Master of Science (Computer Science), Universiti Putra Malaysia. Bachelor (1996) Bachelor of Computer Science (Hons), Universiti Putra Malaysia.	• Service-Oriented Architecture) • Education (E-Learning) • Computer Aided Software Architecture (Software Architecture Documentation, Architectural Knowledge) • Web Services (Software Engineering (Case) Tools (Syntax-Directed Programming Editor) • Virtual Reality (Vrml, Vr for Internet) • Web services composition • End-user development/ programming

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
10.	Dr. Chiam Yin Kia (DS51)	PhD (2011) Doctor of Philosophy in Computer Science & Engineering, The University of New South Wales, Australia Master (2005) Master of Science in Information Technology, Malaysia University of Science and Technology, Malaysia. Bachelor (2003) Bachelor of Computer Science (Software Engineering), Universiti Malaya.	• Software Process Modelling • Software Quality • Requirements Engineering • Software Testing • Risk Management.
11.	Dr. Asmiza Abdul Sani (DS51)	PhD (2013) University of York, UK Master (2007) University of York, UK Bachelor (2006) Bachelor of Computer Science (Hons) (Software Engineering), Universiti Malaya.	• Formal methods, model-driven engineering, advance software engineering
12.	Dr. Hazrina Binti Sofian (DS51)	PhD (2018), Doctor of Philosophy University Putra Malaysia Master (2010) Masters of Software Engineering, Universiti Malaya Bachelor (2006) Bachelor of Computer Science (Hons), Universiti Malaya	• Software Requirements Engineering • Intelligent Computing Adaptive, self-adaptive and incremental learning • Semantic Web • Linked Data

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
13.	Dr. Hema Subramaniam (DS51)	PhD (2016) PhD (Software Engineering), Universiti Putra Malaysia (UPM) Master (2010) Master of Computer Science (Software Engineering), Universiti Industri Selangor (UNISEL) Bachelor (2007) BSc (Information Technology), Universiti Industri Selangor (UNISEL)	• Software Maintainability (Aspect Oriented Software Engineering) • Counseling System (Counseling Application) • Project Management (Tools Based Project Management) • Software Tools (Web Development)

DEPARTMENT OF INFORMATION SYSTEMS

Head of Department:
Assoc. Prof. Dr. Norjihan Abdul Ghani

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
1.	Assoc. Prof. Dr. Norjihan Abdul Ghani (DS52)	PhD (2013) Universiti Teknologi Malaysia. Bachelor (2000) Master (2002) Master of Information Technology (Infomation Science), Universiti Kebangsaan Malaysia. Bachelor Bachelor of Information Technology, Universiti Utara Malaysia.	• Database (Database Security & Privacy) • Digital Image Processing System (Image Retrieval) • Data Security (Information Security and Privacy)
2.	Prof. Dr. Teh Ying Wah (VK7)	PhD (2004) Universiti Malaya Master (1995) Master of Computer Science, Oklahoma City University, USA Bachelor (1994) Bachelor of Computer Science, Oklahoma City University, USA	• Data Mining • Database
3.	Assoc. Prof. Ts. Dr. Sri Devi Ravana (DS54)	PhD (2012) University of Melbourne, Australia. Master (2001) Master of Software Engineering, Universiti Malaya. Bachelor (2000) Bachelor of Information Technology (Hons.) (Information Science), Universiti Kebangsaan Malaysia.	• Search Engine (IR Evaluation (e.g. evaluation metrics, aggregation methods, experiments) • Web Application and Services
4.	Assoc. Prof. Dr. Maizatul Akmar Ismail (DS54)	PhD (2011) Universiti Malaya. Master (2002) Master of Science, Universiti Putra Malaysia. Bachelor (1999)	• Management Information System, Semantic Web in Education, Knowledge Management, E-Commerce.

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
		Bachelor of Information Technology, Universiti Malaya.	
5.	Assoc. Prof. Dr. Suraya Hamid (DS54)	PhD (2013) Computing and Information Systems, The University of Melbourne, Australia Master (2002) Master of Information Technology, Universiti Kebangsaan Malaysia. Bachelor (1998) Bachelor of Information Technology (Hons. in Industrial Computing), Universiti Kebangsaan Malaysia.	• Information Services (e-Government, e-Learning, e-commerce, cybersecurity awareness and IS for Sustainability • ICT and Emergent Information Technology (Information Seeking, Online Behaviour and Its Impact, Activity Theory, Qualitative Research and Social Media)
6.	Assoc. Prof. Dr. Nor Liyana Mohd Shuib (DS54)	PhD (2013) University Malaya Master (2008) Master of Information Technology, Universiti Kebangsaan Malaysia (UKM) Bachelor (2005) Bachelor of Science (Computer)(Hons), Universiti Teknologi Malaysia, Skudai	• Management Information System (Decision Support System, Expert System) • Information Management (Database, Data Mining, Information Retrieval, Recommender System, Social Media) • Mobile Computing • Educational Technology and Media (E-learning, Learning Style, Personalization, Information Seeking, Social Media) •
7.	Assoc. Prof. Ts. Dr. Vimala Balakrishnan (DS54)	PhD (2008) Universiti Multimedia Malaysia Master (2002) Master of Science (Computer Science), Universiti Sains Malaysia Bachelor (1998) Bachelor of Computer Science (Hons), Universiti Sains Malaysia	• Data and Knowledge Engineering (Data Mining, Opinion Mining), • Information Retrieval • Social Media • Recommender Systems

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
8.	Assoc. Prof. Dr. Kasturi Dewi Varathan (DS51)	PhD (2012) Universiti Kebangsaan Malaysia. Master (2005) Master of Computer Science, Universiti Malaya. Bachelor (2002) Bachelor of Information Technology (Hons), Universiti Tenaga Nasional.	- Big Data - Information Retrieval - Data Storage and Representations
9.	Assoc. Prof. Dr. Azah Anir Norman (DS52)	PhD (2014) Universiti Malaya. Master (2004) Master of Information Security, Royal Holloway University of London, UK Bachelor (2000) Bachelor of Information Technology, Universiti Kebangsaan Malaysia.	Management Information System (Electronic Commerce Security, Information Security Management, Information Systems)
10.	Dr. Hoo Wai Lam (DS51)	PhD (2015), Universiti Malaya (UM) Bachelor (2010) Bachelor of Computer Science (Hons) (2010), Universiti Malaya (UM)	- Data Analytics - Machine Learning - Computer Vision - Artificial Intelligence
11.	Dr. Riyaz Ahamed Ariyaluran Habeeb Mohamed (DS51)	PhD (2019) Master of Software Engineering (2013) B.Eng, (Computer Science and Engineering) (2008)	- Machine Learning - Data Science - Generative AI - Cloud Computing
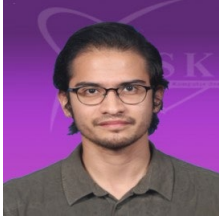
DEPARTMENT OF COMPUTER SYSTEM AND TECHNOLOGY

Head of Department:
Assoc. Prof. Ts. Dr. Ismail Ahmedy

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
1.	Assoc. Prof. Ts. Dr. Ismail Ahmedy (DS54)	Bachelor (2006) Bachelor of Science(Hons)(Computer) (2006), Universiti Teknologi Malaysia Master (2009) Master of Science (Computer Science) (2009), University of Queensland PhD (2015) Universiti Teknologi Malaysia	• Internet of Things • Wireless Sensor Networks • Wireless Technologies • Embedded Systems
2.	Prof. Ts. Dr. Miss Laiha Mat Kiah (VK7)	PhD (2007) University of London Master (1999) Master of Science, University of London Bachelor (1997) Bachelor of Computer Science, Universiti Malaya	• Security Protocols (Group Communication, Key Management, Wireless Mobile Environments) • Communication Protocols (Wireless Security, Ad-Hoc Network Security, Mobile Communication Security) • Information Security (Applied Cryptography, Applied Steganography)
3.	Prof. Ts. Dr. Rafidah Md Noor (VK7)	PhD (2010), Lancaster University, UK Master (2000) Master of Science, Universiti Teknologi Malaysia Bachelor (1998) Bachelor of Information Technology, Universiti Utara Malaysia	• Mobile Network Technologies (Network Mobility, Quality of Service, Quality of Experience, Vehicular Ad Hoc Networks) •

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
4.	Prof. Ts. Dr. Nor Badrul Anuar Juma'at (VK7)	PhD (2012), University of Plymouth, UK Master (2003) Master of Computer Science, Universiti Malaya Bachelor (2001) Bachelor of Computer Science (Hons), Universiti Malaya	• Intrusion Detection System (Intrusion Detection Systems, Intrusion Response Systems, Security Event and Incident Management, Digital Forensic, Network Security) • High Speed Network (Switching, Routing, Ipv6, Multicast) • Management Information System (E-Thesis, Library Systems, Online Systems) •
5.	Assoc. Prof. Dr. Rosli Salleh (DS54)	PhD (2001), University of Salford Master (1997) Master of Science, University of Salford Bachelor (1994) Bachelor of Computer Science (Hons), Universiti Malaya	• Wireless Communication and Technologies Sn: Including Communication Equipment (Mobile Ipv6, Handoff)
6.	Assoc. Prof. Dr. Ling Teck Chaw (DS54)	PhD (2005) Universiti Malaya Master (1996) Master of Computer Science, Universiti Malaya Bachelor (1992) Bachelor of Science (Hons), Universiti Malaya	• Software Defined Networking • Cloud Computing, Core Network Technology • High Performance Computing (Grid Scheduling, Qos) • Parallel Architecture and Processing (Cloud Computing, Distributed Systems)
7.	Assoc. Prof. Dr. Ang Tan Fong (DS54)	PhD (2011) PhD, Universiti Malaya Master (2001) Master of Computer Science, Universiti Malaya Bachelor (2000) Bachelor of Information Technology (Hons), Universiti Malaya	• Cloud Computing • Software Defined Networking • Internet of Things • Game-based Learning

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
8.	Assoc. Prof. Dr. Mohd Yamani Idna Idris (DS54)	PhD (2013) Universiti Malaya Master (2002) Master of Computer Science, Universiti Malaya Bachelor (2000) Bachelor of Engineering (Hons), Universiti Malaya	• Image and Signal Processing • Embedded Systems (FPGA, SOC) • Sensor Networks
9.	Assoc. Prof. Dr. Por Lip Yee @ Por Khoon Sun (DS54)	PhD (2012) PhD, Universiti Malaya Master (2003) Master of Computer Science, Universiti Malaya. Bachelor (2001) Bachelor of Computer Science (Hons), Universiti Malaya.	• Security Services Sn: Digital Forensic, Steganography, Network Security, Public Key Infrastructure and Biometrics (Information Hiding, Steganography)
10.	Assoc. Prof. Dr. Tey Kok Soon (DS54)	PhD (2014), Universiti Malaya (Power Electronics and Drivers) Bachelor (2011) Bachelor of Engineering (Electrical Engineering), Universiti Malaya	• Embedded System, • System on Chip, • Control and Implementation • Photovoltaic System
11.	Assoc. Prof. Dr. Liew Chee Sun (DS54)	PhD PhD, University of Edinburgh, UK Master Master of Computer Science, Universiti Sains Malaysia Bachelor Bachelor of Computer Science (Hons), Universiti Sains Malaysia	• Distributed Computing (Grid, P2p, Scientific Workflow)

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
12.	Dr. Muhammad Faiz Mohd Zaki (DS51)	BCompSc (Networking) (Malaya) – 2015 MSc (Web Science and Big Data Analytics) (London) – 2017 PhD (Network Traffic Classification) (Malaya) - 2022	• Network Analytics and Management (Network Traffic Classification, Granular Network Traffic Classification) • Network Security (Network Traffic Profiling, Network Traffic Filtering) • Data Analytics
13.	Dr. Roziana Ramli (DS51)	PhD Universiti Malaya Master M Eng Sc, Universiti Malaya Bachelor Bachelor of Engineering, Universiti Malaya	• Digital Signal Processing • Image Processing And Computer Visio
14.	Dr. Saaidal Razzalli Azzuhri (DS51)	PhD of Computer Networks (2014), University of Queensland Master (2008) Master of Science (IT) Malaysia University of Science & Technology Bachelor (2004) Bachelor of Engineering (Telecommunication) Universiti Malaya	• Computer & Wireless Networks • Fiber Optical Communication • Unmanned Aerial Vehicle (UAV)
15.	Mrs. Fazidah Othman (DS45)	Master (2004) Master of Science (Computer Science), Universiti Teknologi Malaysia Bachelor (1999) Bachelor of Computer Science (Hons), Universiti Teknologi Malaysia	• Security Services Sn: Steganography, Network Security, Public Key • Infrastructure.

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
16.	Mr. Noorzaily Mohamed Nor (DS45)	Master (1999), Master of Computer Science Universiti Malaya Bachelor (1995) Bachelor of Science (Hons), Universiti Malaya	• Detection and Estimation • Arithmetic and Logic Structures • Embedded System
17.	Mr. Emran Mohd Tamil (DS45)	Master Master of Science, Universiti Teknologi MARA Bachelor Bachelor of Engineering, Universiti Teknologi Malaysia	• System-On-Chip (Soc) (System-On-Chip, Circuit Design, Embedded System, Scada) • Signal Analysis and Processing (Biosignal Processing, Feature • Extraction, Pattern Classification, Artificial Intelligence)

MULTIMEDIA UNIT

Head of Unit:
Dr. Nurul Fazmidar Mohd Noor

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
1.	Dr. Nurul Fazmidar Mohd Noor (DS52)	PhD (2011), Lancaster University, UK Master (2000) Master of Interactive Multimedia, Liverpool John Moores University, UK Bachelor (1999) Bachelor of Computer Science (Hons), Universiti Malaya	• 3d Information Visualization • Virtual Reality • Serious Game • Affective Computing
2.	Assoc. Prof. Dr. Mohamad Nizam Bin Ayub (DS54)	PhD (2016) PhD, University of the West of Scotland Master (2001) Master of Science, Herriot-watt University Bachelor (2000) Bachelor of Computer Science (Hons), Universiti Malaya.	• Interactive Multimedia • Serious Game
3.	Assoc. Prof. Ts. Dr. Ainuddin Wahid Abdul Wahab (DS54)	PhD (2011) PhD, Surrey University, UK (Multimedia Network) Master (2006) Master of Computer Science, Universiti Malaya Bachelor (2002) Bachelor of Computer Science, Universiti Malaya	• Digital Forensic • Information Security
4.	Assoc. Prof. Dr. Nor Aniza Abdullah (DS54)	PhD (2006) PhD, University of Southampton Master (1999) Master of Science, University of London Bachelor (1997)	• Adaptive Multimedia • Image Processing • E-Learning

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
		Bachelor of Computer Science (Hons) Universiti Malaya	
5	Assoc. Prof. Dr. Shivakumara Palaiahnakote (DS54)	PhD (2006) PhD, Mysore University, India Master (2002) Master of Science Technology (by Research) Master (1999) Master of Science (M.Sc) in Computer Science Bachelor (1995) Bachelor of Science (B.Sc) in Computer Science	• Video and Image Processing • Pattern Recognition • Document Image Analysis • Video Text Analysis
6.	Assoc. Prof. Dr. Amirrudin Kamsin (DS52)	PhD (2014) PhD, University College London, UK Master (2002) Master of Science, NCCA, Bournemouth University, UK Bachelor (2001) Bachelor of Computer Science (Hons), Universiti Malaya.	• Computer Animation • Human Computer Interaction
7.	Dr. Suzan Jabbar Obaiys (DS51)	PhD PhD, Universiti Putra Malaysia Master MSc, Science, Universiti Putra Malaysia Bachelor BSc, Mathematics, Baghdad University, Iraq	• Numerical Analysis
8.	Mrs. Hannyzzura Pal @ Affal (DS45)	Master (1998) Master of Science University of Westminster Bachelor (1997) Bachelor of Computer Science (Hons), Universiti Malaya	• Image Processing • Pattern Recognition • Multimedia Technology • E-Learning • Interactive Multimedia

NO.	NAME	ACADEMIC QUALIFICATION	AREA OF SPECIALIZATION
9.	Mrs. Nornazlita Hussin (DS45)	Master (2000) Master of Science, University of Bath, UK Bachelor (1999) Bachelor of Computer Science (Hons), Universiti Malaya	• Augmented Reality • Virtual Reality • Edutainment
10.	Mrs. Mas Idayu Md Sabri (DS45)	Master (2003) Master of Science, University of Bath, UK Bachelor (2001) Bachelor of Computer Science (Hons), Universiti Malaya	• Edutainment • Audio Synthesis • Serious games • Gamification

Administration and Support Staff

: Administrative Manager (N52)
Rafiza Hashim

: Assistant Registrar (N41)
Nur Hafiezah Mohd Nor Peah

: Assistant Registrar (N41)
Nurul Farhana Mohd Nasir

: Assistant Registrar (N41)
Nur Nadia Arshad

: Assistant Registrar (N41)
Siti Nur Aisyah Zulzaidi

: Office Secretary (N30)
Zunaida Alwadood

: Accountant Assistant (Finance) (W29)
Norazleen Ramli

: Administrative Assistant Officer (N29)
Suhana Mohd Ghanirazleen Ramli

: Administrative Assistant Officer (N29)
Siti Nor Anilawatie Muhammad

: Senior Administrative Assistant
(Clerical/Operational) (N22)
Mohd Afiffudin Mohd Ali

: Senior Administrative Assistant
(Clerical/Operational) (N22)
Norkusharina Nasir
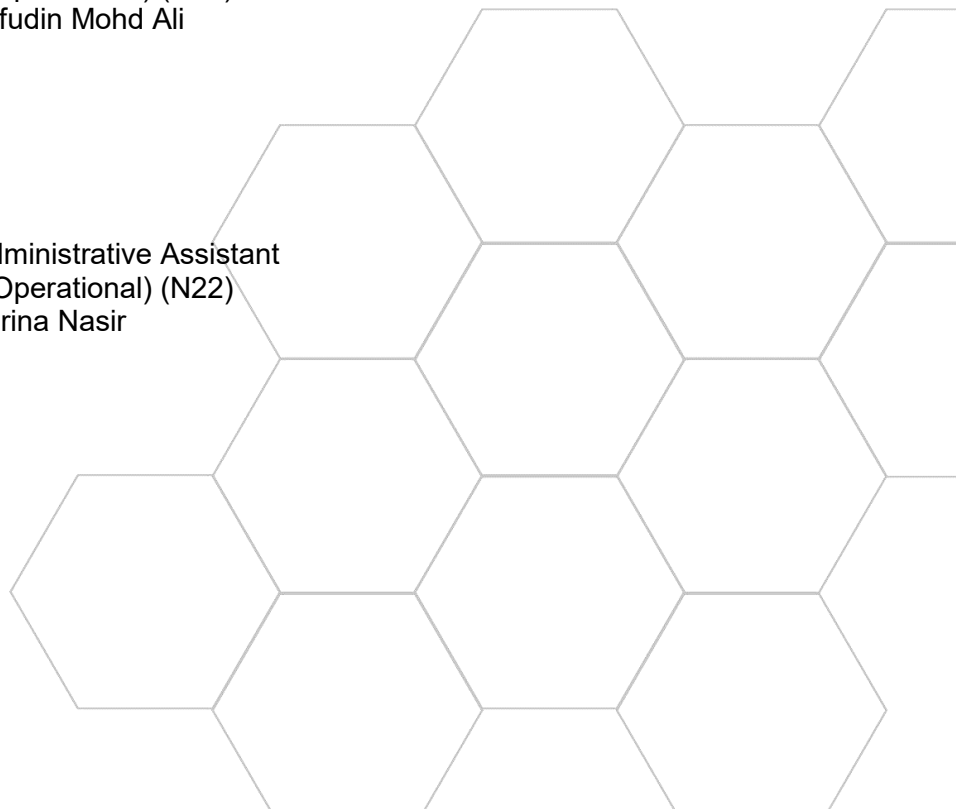
: Senior Administrative Assistant
(Clerical/Operational) (N22)
Shahrul Hasnah Ahmad

: Senior Administrative Assistant
(Clerical/Operational) (N22)
Norhayati Mohd Supi

: Senior Administrative Assistant
(Clerical/Operational) (N22)
Rohani Mohamed Arifin

: Administrative Assistant (Finance) (W22)
Haida Izwani Che Mahmood

: Administrative Assistant
(Clerical/Operational) (N19)
Ibrahim Hussin

: Assistant Office Secretary (N19)
Nur Hidayah Mohd Sarbini
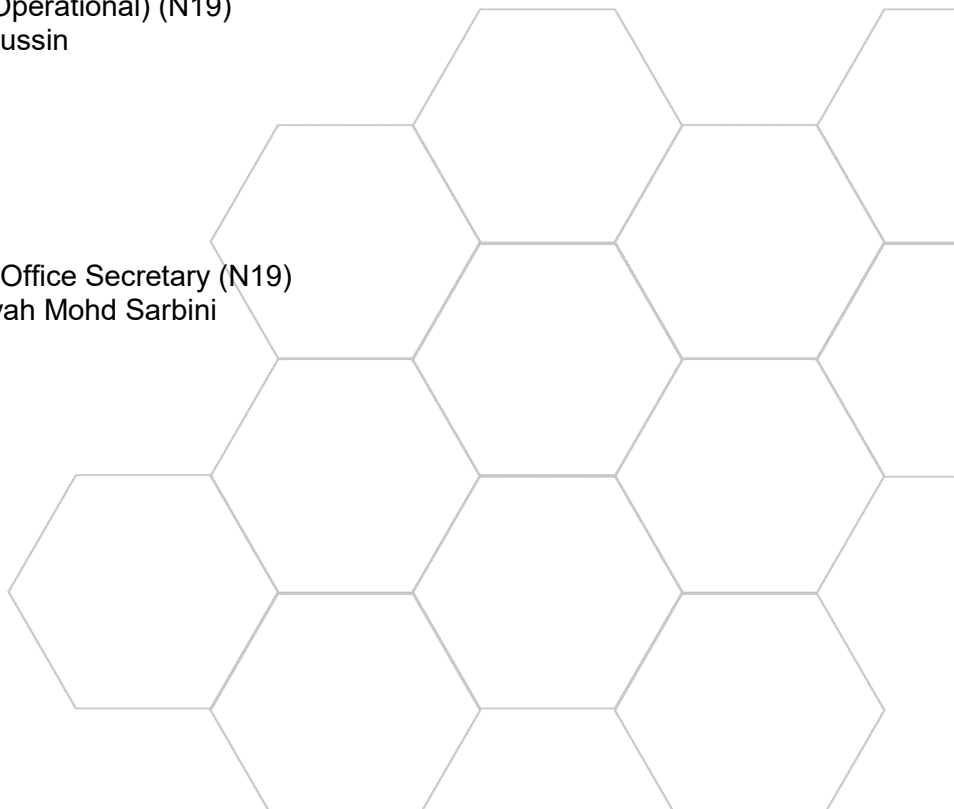
: Assistant Office Secretary (N19)
Noorhafiza Kamaruddin

: Assistant Office Secretary (N19)
Nurfatehah M. Zahir

: Senior Administrative Assistant
(Clerical/Operational) (N22)
Norazarina Bohari

: Administrative Assistant
(Clerical/Operational) (N19)
Nadhirah Mohd Aznam

: Administrative Assistant
(Clerical/Operational) (N19)
Nur Nadia Azizan

: Administrative Assistant
(Clerical/Operational) (N19)
Nurfaziela Ibrahim

: Administrative Assistant
(Clerical/Operational) (N19)
Zaleha Sumairi

: General Office Assistant (N11)
Mohd Fareek Muhiyeddin

: General Office Assistant (N11)
Nanthini Krishnan

: Driver (H11)
Mohd Haffes Rahim

Technical Staff

: Information Technology Officer (F44)
Noorsyahidah Abd Wahab

: Senior Assistant Information Technology Officer (FA32)
Azzyaty Razalli

Senior Assistant Information Technology Officer (FA32)
Haryati Masilan
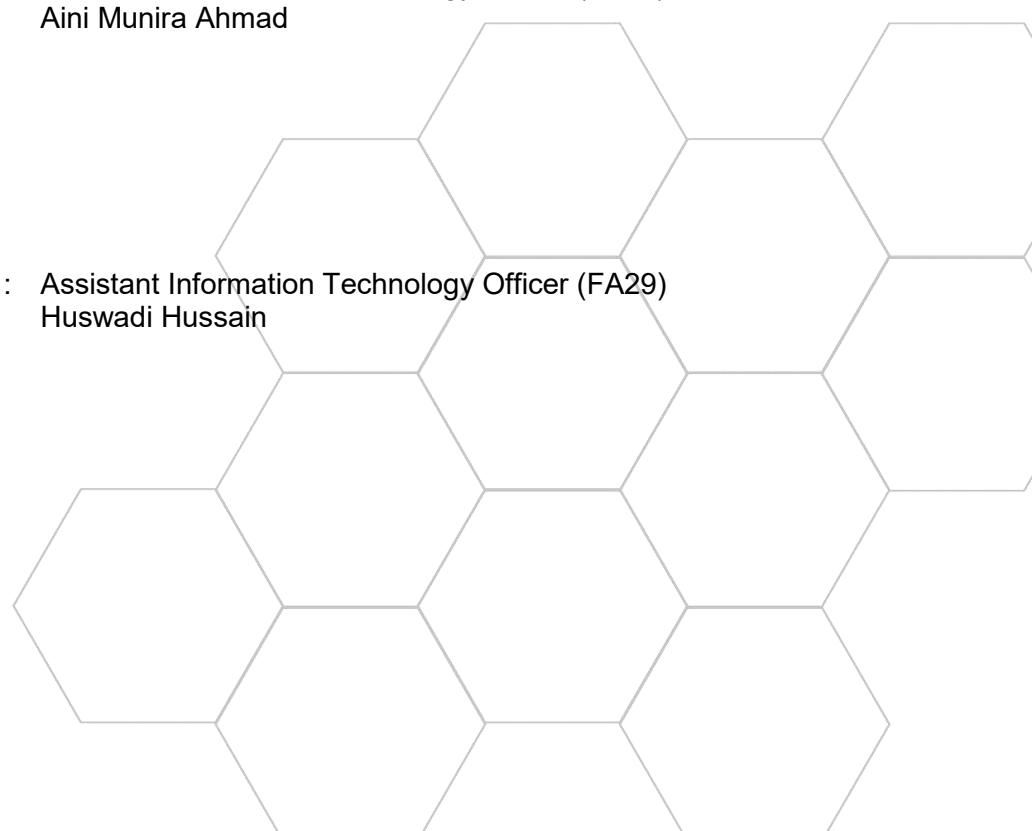
Senior Assistant Information Technology Officer (FA32)
Wan Mohd Hasanul Isyraf Wan Yusoff

: Assistant Information Technology Officer (FA29)
Aini Munira Ahmad

: Assistant Information Technology Officer (FA29)
Huswadi Hussain

: Assistant Information Technology Officer (FA29)
Jamal Amran

: Assistant Information Technology Officer (FA29)
Nurfadhilah Amir Hamzah

: Assistant Information Technology Officer (FA29)
Syazwani Nuru Mohamad

: Assistant Engineer (JA29)
Mohd Azren Misnan

: Assistant Engineer (JA29)
Zulzefle Kassim

: Assistant Engineer (JA29)
Mohd Noor Aizad Morad

: Senior Computer Technician (FT22)
  Mohd Farhan Abdul Rahman

ACADEMIC CALENDAR FOR 2023/2024 ACADEMIC SESSION
(HIGHER DEGREE LEVEL)

SEMESTER I				
Lectures	7 weeks*	09.10.2023	-	26.11.2023
Mid-Semester I Break	1 week	27.11.2023	-	03.12.2023
Lectures	7 weeks*	04.12.2023	-	21.01.2024
Revision Week	1 week*	22.01.2024	-	28.01.2024
Semester I Final Examination	2 weeks*	29.01.2024	-	11.02.2024
Semester Break	3 weeks*	12.02.2024	-	03.03.2024
	22 weeks			

SEMESTER II				
Lectures	5 weeks*	04.03.2024	-	07.04.2024
Mid-Semester II Break	1 week	08.04.2024	-	14.04.2024
Lectures	9 weeks*	15.04.2024	-	16.06.2024
Revision Week	1 week*	17.06.2024	-	23.06.2024
Semester II Final Examination	2 weeks*	24.06.2024	-	07.07.2024
	18 weeks			

SEMESTER BREAK				
Break	9 weeks*	08.07.2024	-	08.09.2024

SPECIAL SEMESTER				
Lectures	7 weeks*	08.07.2024	-	25.08.2024
Special Semester Final Examination	1 week*	26.08.2024	-	01.09.2024
Break	1 week	02.09.2024	-	08.09.2024
	9 weeks			

Note:

(1) Course Registration and Examination Schedule can be referred at *(https://umsitsguide.um.edu.my).*

(*) The Academic Calendar has taken into account public and festive holidays.

Maulidur Rasul 28 September 2023	Eidul Fitri 10 & 11 April 2024
Deepavali 12 November 2023	Labour Day 01 Mei 2024
Chritmas Day 25 Disember 2023	Wesak Day 22 Mei 2024
New Year 01 Januari 2024	His Majesty's King's Birthday 03 Jun 2024
Thaipusam 25 Januari 2024	Eidul Aidiladha 17 Jun 2024
Federal Territort Day 01 Februari 2024	Awal Muharam 07 Julai 2024
Chinese New Year 10 & 11 Februari 2024	National Day 31 Ogos 2024
Nuzul Al-Quran 28 Mac 2024	Malaysia Day 16 September 2024
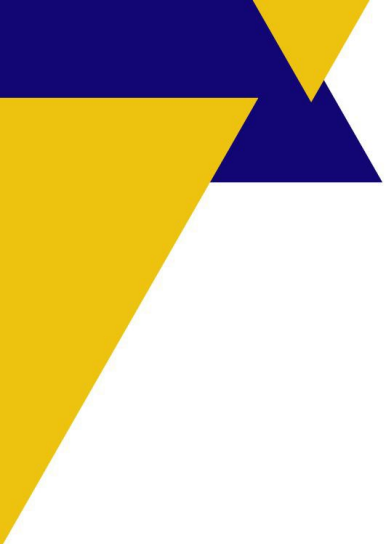
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G7=9B79˙
f5DD@9 8˙7 CADI H=B;˙Ł˙˙

MASTER OF COMPUTER SCIENCE (APPLIED COMPUTING)
PROGRAMME REQUIREMENTS

1. **Programme Type**

   The type of programme offered for the Master of Computer Science (Applied Computing) is a programme which shall consist of coursework (50%) and research leading to the submission of a dissertation in the candidate's area of study (50%).

2. **Admission Requirements**

   (a)   Qualifications for Admission

      (i)   A bachelor's degree with Honours or a equivalent in Computer Science/Information Technology/related field from a recognized university with a CGPA of 3.0 and above/equivalent,

         OR

      (ii)   A bachelor degree in Computer Science/Information Technology/related field from a recognized university with a CGPA in the range of 2.50 – 2.99/equivalent can be considered provided the fulfilment of the University requirements.

   (b)   English Language Proficiency

   International candidates are required to:

      (i)   At least IELTS Band 6 (Academic) or TOEFL score of 550 (paper based) / 213 (computer based) / 80 (Internet based) /PTE Academic/PTE Online with minimum score 57 if their first degree is from a university where English is not the medium of instruction.,

         OR
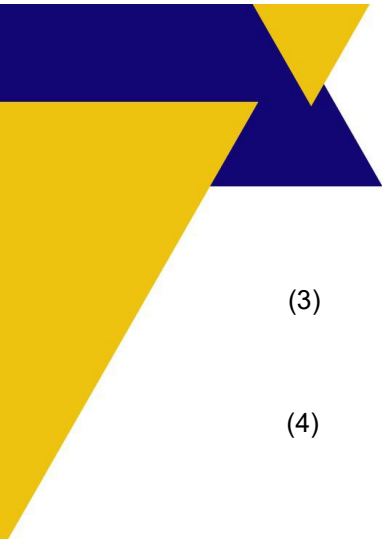
      (ii)   Pass an English Proficiency test approved by the university

3. **Duration of Study**

   The recommended study duration is between three (3) to eight (8) semesters.

4. **Programme Structure**

   (1)   The Master of Computer Science (Applied Computing) Programme will have forty-two (42) credits through coursework and dissertation.

   (2)   Through Coursework and Dissertation Programme

      (i)   The programme shall consist of two parts:

         (a)   Part I comprises:

            (i)   **five (5)** core courses, each with three credits; and

            (ii)   **two (2)** elective courses..

(b)   Part II shall consist of twenty one (21) credits and shall involve research leading to the submission of a dissertation.

(3)   Details of courses offered shall be of those approved by the Senate from time to time on the recommendation of the Faculty and shall be made known to the candidates at the start of each session.

(4)   The list of Senate approved courses for the Master of Computer Science (Applied Computing) Programme shall be as indicated in List 1. Candidates shall be informed of the prescribed combination of courses for this programme prior to registration at the start of their study programme.

PROGRAMME GOALS AND OUTCOMES
MASTER OF COMPUTER SCIENCE (APPLIED COMPUTING)

AIM OF THE PROGRAM

Vision

To become a center of excellence known internationally through research and education in Computer Science and Information Technology.

Mission

To develop and disseminate knowledge through research, teaching and learning in Computer Science and Information Technology in accordance with the expectations and aspirations of the community and the country.

Objective
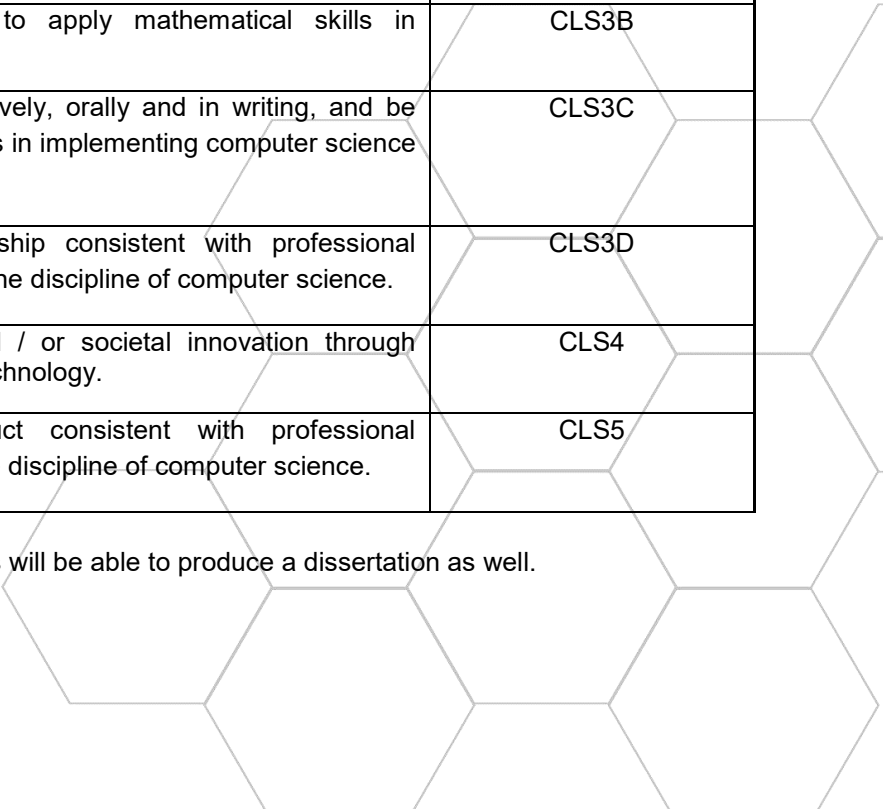
To produce competitive graduates in the field of research and equipped with high knowledge and skills in Computer Science.
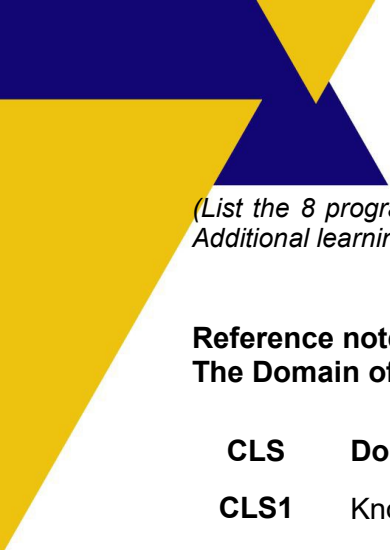
PROGRAMME LEARNING OUTCOMES

At the end of the Master of Computer Science (Applied Computing) programme, graduates will be able to:

Programme Learning Outcomes (PLO)		Cluster Learning Outcome (CLS)
PLO1	Master the latest advanced concepts and theories in computer science.	CLS1
PLO2	Use problem solving skills and computer science knowledge to solve real world problems.	CLS2
PLO3	Apply appropriate knowledge, techniques, methodological skills and technology to create ICT solutions to solve real world problems.	CLS3A
PLO4	Master the ability to apply mathematical skills in computer science.	CLS3B
PLO5	Communicate effectively, orally and in writing, and be able to work in teams in implementing computer science related projects.	CLS3C
PLO6	Demonstrate leadership consistent with professional codes and ethics in the discipline of computer science.	CLS3D
PLO7	Adopt technical and / or societal innovation through computer science technology.	CLS4
PLO8	Demonstrate conduct consistent with professional codes of ethics in the discipline of computer science.	CLS5

At the end of the program, graduates will be able to produce a dissertation as well.

(List the 8 programme learning outcomes following the MQF domain. Please refer to the Appendix. Additional learning outcomes can be given if required)

Reference notes:
The Domain of the MQF in Programme Learning Outcomes program (PLO)

CLS	Domain
CLS1	Knowledge and Understanding
CLS2	Cognitive Skills
CLS3A	Practical Skills
CLS3B	Digital and Numeracy Skills
CLS3C	Interpersonal and communication skills
CLS3D	Leadership, Autonomy, and Responsibility
CLS4	Personal and Entrepreneurial Skills
CLS5	Ethics and Professionalism

CANDIDATURE REQUIREMENTS

Master of Computer Science (Applied Computing)

No	Requirement
1.	Fulfil the minimum candidature duration of 3 semesters.
2.	Fulfil the University language requirement (Bahasa Malaysia and English) no later than the second (2nd) semester of candidature
3.	Fulfil the residential requirement of 6 months
4.	**Presentation** • Proposal presentation at the beginning of the research component registration • Present research progress in a Candidature Defence session as required by the Faculty

Graduate on Time (GOT) Schedule For Masters by Mixed Mode Candidates

Semester	Activities	Output/Milestone	Comments
1	**Register for Part I: Courses** • Attend Bahasa Melayu course* • Attend English Language course** • Complete all courses in Semester I and Semester II • Attend relevant workshops/ research seminars (Compulsory: EndNote, Turnitin, Stylewriter) • Come up with a study plan to decide on programme specific and elective courses to take as suitable foundation for research area of interest • Complete Research Methodology Course	**OUTPUT OF SEM 1:** • Completed Bahasa Melayu course • Completed English Language course • Completed a portion of required courses • Familiarized with EndNote, Turnitin, Stylewriter	
2	• Complete all courses in Semester I and Semester II • Consult coordinator/supervisor to determine broad area of interest to research on. • Choose a research topic from a list collated by programme coordinator. **Register for Part II : Dissertation** • Prepare and present proposal ➤ Research Plan (Gantt Chart) ➤ Prepare research instruments (if applicable) ➤ Plan data collection procedures (identify research site, seek permission)	**OUTPUT OF SEM 2:** • Completed all courses • Familiarized with EndNote, Turnitin, Stylewriter • Identified research topic • Research Proposal Approved by Panel • Completed draft of chapters 1, 2 & 3 (Approved by supervisor)	

3	• Collect data/conduct experiment • Analyse data • Expand Research Proposal into drafts of Chapters 1, 2, 3 • Finalize Draft of Chapter 1 (Introduction) and 3 (Methodology) • Begin Chapter 4 (Results/Analysis) and Chapter 5 (Discussion and Conclusion) • Prepare and present Candidature Defence	**OUTPUT OF SEM 3:** • Collected data. • Analysed data • Reviewed and completed all chapters • (Approved by supervisor) • Completed Candidature Defence
4	• Finalize all chapters • Submit dissertation for examination • Committee of Examiners meeting	**OUTPUT OF SEM 5:** • Submitted dissertation for examination • Outcome of Committee of Examiners meeting

Notes:
Monitoring Panel

1. Chairman & 1 member who is an expert in the field and a supervisor. A fourth member is allowed to be appointed if necessary.
2. The same panel should follow through the proposal presentation and Candidature Defence.
3. It is strongly recommended that one member is appointed as internal examiner.
4. The main responsibilities of the panel should include the following:-
   a) Advise the student to improve the research proposal.
   b) Monitor the progress of the student
   c) Improve the research plan.

*Applicable to all international candidates.
** Applicable to international candidates who are writing their dissertation in languages other than English.

COURSE PLAN FOR MASTER OF COMPUTER SCIENCE (APPLIED COMPUTING) ACADEMIC SESSION 2023/2024

INTAKE SEMESTER I 2023/2024

MASTER OF COMPUTER SCIENCE (APPLIED COMPUTING)		Credits	Semester I 2023/2024	Semester II 2023/2024	Semester I 2024/2025
Core Courses					
WOX7001	*Research Methodology	3	√		
WOA7001	Advanced Algorithms	3	√		
WOA7015	Advanced Machine Learning	3	√		
WOA7016	Cloud Computing	3		√	
WOA7017	Security Risk Analysis and Evaluation	3		√	
WOC7021	Dissertation	21		√**	√**
Elective Courses [Students are required to choose any two (2) courses from the list below]					
WOA7018	Autonomous Robotics	3	√		
WOA7019	Augmented Reality	3		√	
WOC7014	Framework-Based Software Design and Development	3		√	
WOC7020	Advanced Internet of Things	3	√		
WQD7003	Data Analytics	3	√		

* Students are required to register Research Methodology course in their first semester

** Students are only allowed to register for a Dissertation after completing six (6) credits of coursework.

Note: The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

COURSE PLAN FOR MASTER OF COMPUTER SCIENCE
(APPLIED COMPUTING)
ACADEMIC SESSION 2023/2024

INTAKE SEMESTER II 2023/2024

MASTER OF COMPUTER SCIENCE (APPLIED COMPUTING)		Credits	Semester II 2023/2024	Semester I 2024/2025	Semester II 2024/2025
Core Courses					
WOX7001	*Research Methodology	3		√	
WOA7001	Advanced Algorithms	3		√	
WOA7015	Advanced Machine Learning	3		√	
WOA7016	Cloud Computing	3	√		
WOA7017	Security Risk Analysis and Evaluation	3	√		
WOC7021	Dissertation	21		√**	√**
Elective Courses [Students are required to choose any two (2) courses from the list below]					
WOA7018	Autonomous Robotics	3		√	
WOA7019	Augmented Reality	3	√		
WOC7014	Framework-Based Software Design and Development	3	√		
WOC7020	Advanced Internet of Things	3		√	
WQD7003	Data Analytics	3		√	

* Students are required to register Research Methodology course in their first semester

*** Students are only allowed to register for a Dissertation after completing six (6) credits of coursework**

Note: The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

LIST OF COURSES AND COURSE CONTENT

CORE COURSES

Code	Courses	Credits
WOX7001*	Research Methodology*	3
WOA7001	Advanced Algorithms	3
WOA7015	Advanced Machine Learning	3
WOA7016	Cloud Computing	3
WOA7017	Security Risk Analysis and Evaluation	3
WOC7021	Dissertation**	21

ELECTIVE COURSES

(NOTE: *Students are required to choose any two (2) courses from the lists below***)**

Code	Courses	Credits
WOA7018	Autonomous Robotics	3
WOC7014	Framework-Based Software Design and Development	3
WOA7019	Augmented Reality	3
WOC7020	Advanced Internet of Things	3
WQD7003	Data Analytics	3

Note:

* Student are required to register Research Methodology course in their first semester

*** Students are only allowed to register for Dissertation after completing 6 credits of coursework.**

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

WOX7001   Research Methodology

Course Learning Outcomes

At the end of the course, students are able to:

1. Describe appropriate methodologies used in computer science and information technology research.
2. Devise a plan to be carried out within a feasible duration for answering research problems and questions identified.
3. Demonstrate attitude and character in line with professional and ethical codes in computer science and information technology research.

Synopsis of Course Content

This course gives on overview of the dimensions of research in computer science and information technology. Major considerations and tasks in conducting research in the areas such as review of literature, identify problem statement, formulate research questions and objectives, select an appropriate approach or method to the research, plan and manage the research, tools for research, data analysis, and writing and presentation strategies, will be discussed too.

Evaluation and Weightage

Continuous Assessment   **:**   100%

Final Examination   **:**   0%

WOA7001   Advanced Algorithms

Course Learning Outcomes*

At the end of the course, students are able to:

1. Explain major algorithms and data structures.
2. Implement the algorithms and data structures to solve real world problems.
3. Develop ICT solutions with algorithms and data structures.

Synopsis of Course Content

This course introduces students to the analysis and design of computer algorithms. Students will learn advanced design techniques, important classical algorithms and data structures, and their implementation in modern programming environment.

Evaluation and Weightage
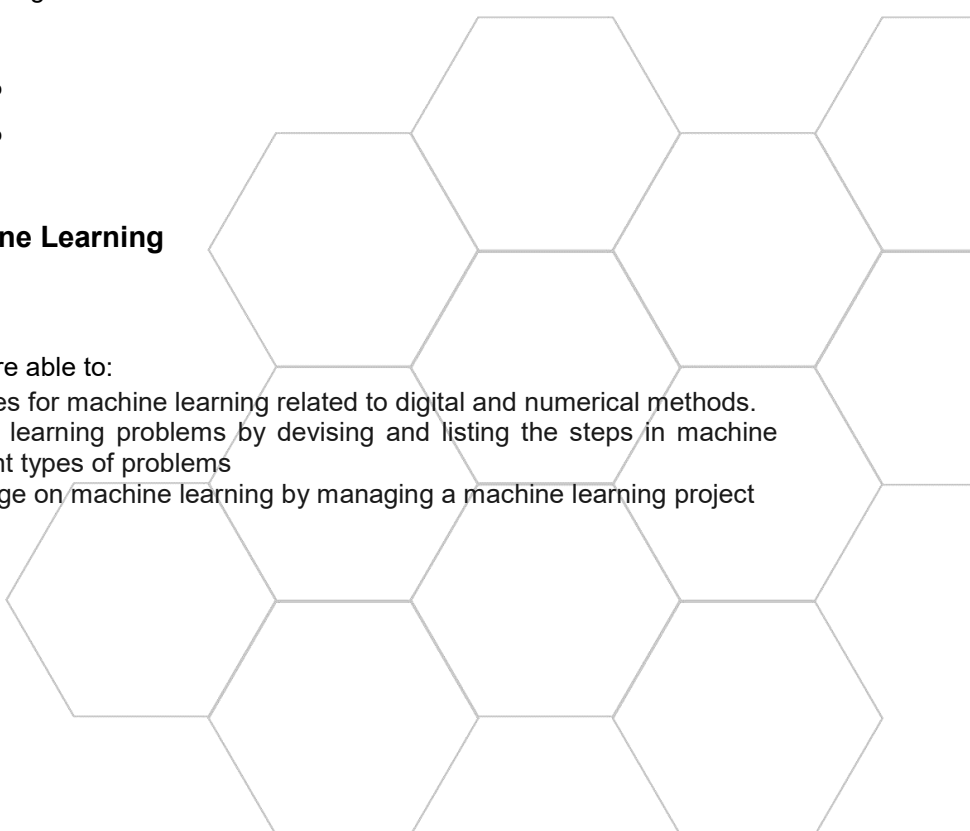
Continuous Assessment   **:**   60%

Final Examination   **:**   40%

WOA7015   Advanced Machine Learning

Course Learning Outcomes

At the end of the course, students are able to:

1. Practice concepts and techniques for machine learning related to digital and numerical methods.
2. Report the solution to machine learning problems by devising and listing the steps in machine learning applied to solve different types of problems
3. Demonstrate skills and knowledge on machine learning by managing a machine learning project

Synopsis of Course Content

This course introduces advanced concepts and techniques for machine learning. It covers topics such as linear and logistic regression, decision tree, neural network, and support vector machines as well as reinforcement learning.

Evaluation and Weightage

Continuous Assessment	:	50 %
Final Examination	:	50%

WOA7016   Cloud Computing

Course Learning Outcomes

At the end of the course, students are able to:
1. Explain the main concepts, key technologies, architecture and issues of cloud computing.
2. Apply appropriate solutions to solve and manage complex problems in cloud computing.
3. Deploy cloud application using popular cloud platforms.

Synopsis of Course Content

This course is designed to introduce students to the emerging issues related to cloud computing. This course will examine several aspects of cloud such as concepts related to cloud computing technologies, cloud models, cloud platform, virtualisation and orchestration, web services and cloud storages. This course also emphasises on practical implementations in developing and deploying cloud application.

Evaluation and Weightage

Continuous Assessment	:	50%
Final Examination	:	50%

WOA7017   Security Risk Analysis and Evaluation

Course Learning Outcomes

At the end of the course, students are able to:
1. Explain the concepts of security risk assessment.
2. Apply suitable security risk assessment methods.
3. Evaluate a particular security risk assessment method.

Synopsis of Course Content

This course introduces the concepts and techniques used in security risk analysis and evaluation. It includes a comprehensive explanation of the six basic phases of security risk assessment, i.e. project definition, project preparation, data gathering, risk analysis, risk mitigation, and risk reporting and resolution. The course also explains several risk assessment methods and describes techniques to measure the effectiveness of a particular method.

Evaluation and Weightage

Continuous Assessment	:	50%
Final Examination	:	50%

WOC7021　　　Dissertation

Course Learning Outcomes
At the end of the course, students are able to:
1. Report the literature review related to the proposed research project in the approved area.
2. Implement a detailed research project based on the proposed research.
3. Produce a dissertation of the research project

Synopsis of Course Content
The dissertation is concerned with the guidance rendered by the supervisor to the student on the proper way of conducting a software engineering, computer science or information technology research project, which could be in the form of face-to-face discussion, presentation, demonstration and communication. The dissertation also covers the identification of problem statements, understanding and formulation of the research objectives and research methodology to perform the research project

Evaluation and Weightage

Continuous Assessment　　**:**　100%

Final Examination　　　　**:**　0%

*Students have to pass candidature seminars (proposal defence and candidature defence) before submittiing dissertation for examination.Results of candidature seminars will be emailed to the students by the faculty.

*Dissertation will be examined by examiners.Final results will be decided by the committee of examiners

WOA7018　　　Autonomous Robotics

Course Learning Outcomes
At the end of the course, students are able to:
1. Discuss the fundamental principles of autonomous robot.
2. Design autonomous robots with bio-inspired Intelligence, deep neural networks and deep reinforcement learning.
3. Discuss the aspects of artificial intelligence and autonomous robotics systems from industrial 4.0 perspectives.

Synopsis of Course Content
This course will present an introduction to autonomous robots from both the academic and industrial viewpoints. For the academic part, emphasis will be given to recent advances in cognitive robotics, deep reinforcement learning, which combines deep neural networks with reinforcement learning to provide a framework for discovering suitable control actions (policies) and addressing complex tasks without explicit programming. For the industry-focused lectures, aspects of artificial intelligence and autonomous robotics systems will be considered from industrial 4.0 perspectives.

Evaluation and Weightage

Continuous Assessment　　**:**　50%

Final Examination　　　　**:**　50%

WOC7014 Framework-Based Software Design and Development

Course Learning Outcomes

At the end of the course, students are able to:

1. Identify the basic principles of framework-based software design and development.
2. Design a framework-based software system.
3. Construct a framework-based innovative software project using associated programming language

Synopsis of Course Content

This course introduces the design and development of software using framework. It includes specification, implementation and configuration of an innovative software according to a specific framework. Students will learn the framework's programming language as well as the facilities provided by the framework.

Evaluation and Weightage

Continuous Assessment	**:**	60%
Final Examination	**:**	40%

WOA7019 Augmented Reality

Course Learning Outcomes

At the end of the course, students are able to:

Describe the technologies related to Augmented Reality.

Apply the related new technologies in the design of augmented reality applications.

Develop interactive augmented reality applications for both PC based and mobile devices using a variety of input devices.

Synopsis of Course Content

This course is designed to introduce students with knowledge related to augmented reality concepts and technology. This is followed with a discussion on how knowledge about human sensory systems can facilitate in designing ergonomic augmented reality devices that match human perceptual capabilities. Students are then trained to develop an augmented application using a suitable programming language and 3D software. Towards the end of the course, there will be discussions on several examples of augmented reality applications with emphasis on the contributions of the augmented reality technology and future direction of this technology.

Evaluation and Weightage

Continuous Assessment	**:**	50%
Final Examination	**:**	50%

WOC7020 Advanced Internet of Things

Course Learning Outcomes

At the end of the course, students are able to:

1. Explain the architecture and key technologies of internet of things.
2. Identify the challenges in the implementation of internet of things.
3. Solve problems related to internet of things in wireless communications.

Synopsis of Course Content

This course is designed to introduce to students the emerging issues related to internet of things. This course will examine several aspects of internet of things such as application areas related to internet of things technologies, real-time models, local sensors, network components and application-level

components. This course also emphasises on solving problems related to wireless communications in developing and deploying internet of things.

Evaluation and Weightage

Continuous Assessment **:** 50%

Final Examination **:** 50%

WQD7003   Data Analytics

Course Learning Outcomes
At the end of the course, students are able to:
1. Explain the concepts of data analytics
2. Use suitable technique for data pre processing
3. Apply data analytics and machine learning techniques to solve real world problems.

Synopsis of Course Content
This course aims to develop students' ability to describe, explore and analyze data using suitable data analytics techniques

Evaluation and Weightage

Continuous Assessment **:** 60%

Final Examination **:** 40%
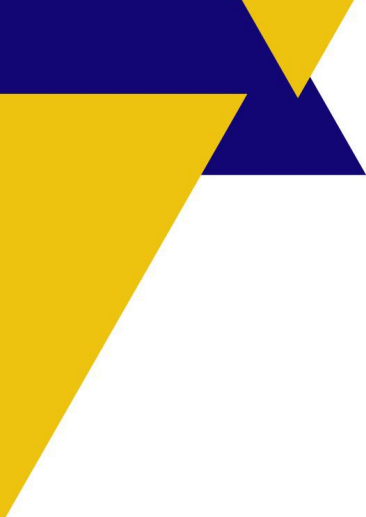
MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)

MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)
PROGRAMME REQUIREMENTS

1.   **Programme Type**

The Master of Software Engineering (Software Technology) programme which shall consist of coursework and research leading to the submission of a dissertation in the candidate's area of study whereby fifty percent (50%) or more of the total number of credits shall be for research.

2.   **Admission Requirements**

   (1)   Qualifications for Admission

      (i)   A bachelor's degree with Honours or a equivalent in Computer Science/Information Technology/related field from a recognized university with a CGPA of 3.0 and above/equivalent,

         OR

      (ii)   A bachelor degree in Computer Science/Information Technology/related field from a recognized university with a CGPA in the range of 2.50 – 2.99/equivalent can be considered provided the fulfilment of the University requirements.

   (2)   English Language Proficiency

      (a)   International candidates are required to:

         (i)   At least IELTS Band 6 (Academic) or TOEFL score of 550 (paper based) / 213 (computer based) / 80 (Internet based) /PTE Academic/PTE Online with minimum score 57 if their first degree is from a university where English is not the medium of instruction;

            OR

         (ii)   pass an English proficiency test approved by the University.

3.   **Duration of Study**

Through Coursework and Dissertation Programme

   (1)   The programme of study : three (3) to eight (8) semesters.
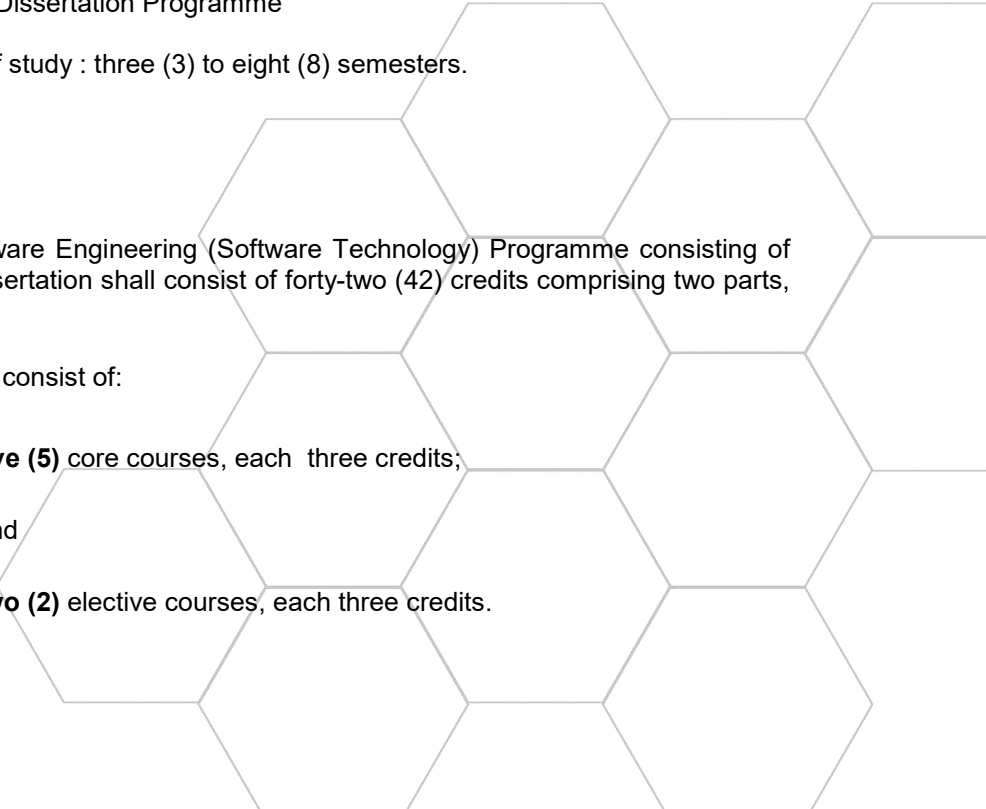
4.   **Programme Structure**
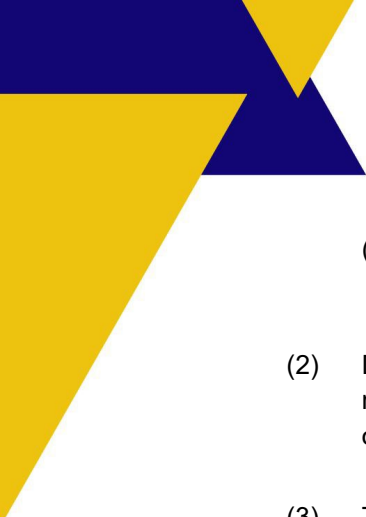
   (1)   The Master of Software Engineering (Software Technology) Programme consisting of coursework and dissertation shall consist of forty-two (42) credits comprising two parts, namely:

      (a)   Part I which consist of:

         (i)   **five (5)** core courses, each three credits;

            and

         (ii)   **two (2)** elective courses, each three credits.

(b) Part II which consist of twenty one (21) credits, shall consist of research leading to the submission of a dissertation.

(2) Details of courses offered are of those approved by the Senate from time to time on the recommendation of the Faculty and shall be made known to the candidates at the start of each session.

(3) The list of Senate approved courses for the Master of Software Engineering (Software Technology) is as indicated in List 1. Candidates shall be informed of the prescribed combination of courses for this programme prior to registration at the start of their study programme.

PROGRAMME GOALS AND OUTCOMES
MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)

PROGRAMME GOALS

To produce knowledgeable and competent graduates in software engineering theory, principles and technologies who are able to apply and develop software engineering methods, techniques and tools to fulfil the current needs of the software industry and community.

PROGRAMME EDUCATIONAL OBJECTIVE(S) (PEO)

PEO 1	*Graduates would have established themselves as practising professionals in software engineering or related areas. (Professionalism)*
PEO 2	*Graduates able to continuously pursue new knowledge to improve their competency and subsequently work in teams to contribute to the industry or academia in software engineering (Ongoing Personal Development)*
PEO 3	*Graduates would have contributed to sustainable development and the well-being of the society through professional skills and ethics in the discipline of software engineering (Societal Engagement).*

(Assessed after 3 - 5 years after students graduated)

PROGRAMME LEARNING OUTCOME(S) (PLO)

At the end of Master of Software Engineering (Software Technology) programme, graduates are able to*:*

No.	*Programme Learning Outcome(s) (PLO)*	*MQF Cluster of Learning Outcomes* *	*Taxonomy Category (K/P/A)**
PLO1	Master the advanced concepts and the latest theories in software engineering.	CLS1	K
PLO2	Apply problem solving skills and software engineering knowledge to solve real-world problems.	CLS2	K
PLO3	Analyse, design, develop and maintain software solutions by applying software engineering principles, standards, methods, techniques and tools with the aim to engineer quality software.	CLS3A	K, P
PLO4	Master the ability to apply mathematical skills in the software development life cycle.	CLS3B	K, P
PLO5	Communicate effectively, verbally and in writing, and able to work in team in carrying out software engineering projects	CLS3C	P, A
PLO6	Demonstrate leadership that is consistent with professional code of ethics in software engineering discipline.	CLS3D	P, A
PLO7	Practice technical and societal innovation through software engineering technologies.	CLS4	K, A

PLO8	Demonstrate characters that are in line with professional code of ethics in software engineering discipline.	CLS5	K, A

Matrix of mapping PLO to PEO.

PEO PLO	PEO1	PEO2	PEO3
PLO1	√		
PLO2	√		
PLO3		√	
PLO4		√	
PLO5		√	
PLO6			√
PLO7			√
PLO8			√

Total hours of student learning time for the entire program is 42 credits.

At the end of the program, graduates are able to produce a dissertation as well.

Reference notes:
Cluster of Learning Outcomes*

CLS1: Knowledge and Understanding
CLS2: Cognitive Skills
CLS3A: Practical Skills
CLS3B: Digital and Numeracy Skills
CLS3C: Interpersonal and Communication Skills
CLS3D: Leadership, Autonomy and Responsibility
CLS4: Personal and Entrepreneurial Skills
CLS5: Ethics and Professionalism

Taxonomy Category*

K   Cognitive
A   Affective
P   Psychomotor
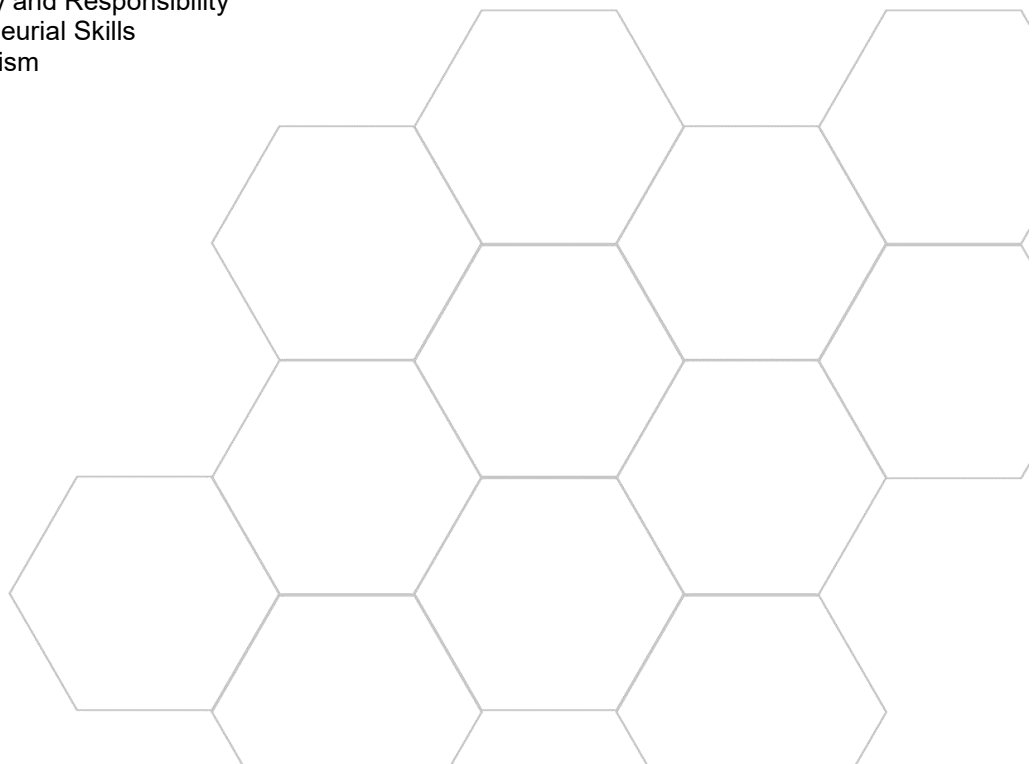
CANDIDATURE REQUIREMENTS

Master of Software Engineering (Software Technology)

No	Requirement
1.	Fulfil the minimum candidature duration of 3 semesters.
2.	Fulfil the University language requirement (Bahasa Malaysia and English) not later than the second (2nd) semester of candidature
3.	Fulfil the residential requirement of 6 months
4.	**Presentation** • Proposal presentation at the beginning of the research component registration • Present research progress in a Candidature Defence session as required by the Faculty

Graduate on Time (GOT) Schedule For Masters by Mixed Mode Candidates

Semester	Activities	Output/Milestone	Comments
1	**Register for Part I: Courses** • Attend Bahasa Melayu course* • Attend English Language course** • Complete all courses in Semester I and Semester II • Attend relevant workshops/ research seminars (Compulsory: EndNote, Turnitin, Stylewriter) • Come up with a study plan to decide on programme specific and elective courses to take as suitable foundation for research area of interest • Complete Research Methodology Course	**OUTPUT OF SEM 1:** • Completed Bahasa Melayu course • Completed English Language course • Completed a portion of required courses • Familiarized with EndNote, Turnitin, Stylewriter	

2	• Complete all courses in Semester I and Semester II
	• Consult coordinator/supervisor to determine broad area of interest to research on.
	• Choose a research topic from a list collated by programme coordinator.
	Register for Part II : Dissertation
	• Prepare and present proposal
	  ➢ Research Plan (Gantt Chart)
	  ➢ Prepare research instruments (if applicable)
	  ➢ Plan data collection procedures (identify research site, seek permission)
		OUTPUT OF SEM 2:
		• Completed all courses
		• Familiarized with EndNote, Turnitin, Stylewriter
		• Identified research topic
		• Research Proposal Approved by Panel
		• Completed draft of chapters 1, 2 & 3 (Approved by supervisor)	

3	• Collect data/conduct experiment • Analyse data • Expand Research Proposal into drafts of Chapters 1, 2, 3 • Finalize Draft of Chapter 1 (Introduction) and 3 (Methodology) • Begin Chapter 4 (Results/Analysis) and Chapter 5 (Discussion and Conclusion) • Prepare and present Candidature Defence	**OUTPUT OF SEM 3:** • Collected data. • Analysed data • Reviewed and completed all chapters (Approved by supervisor) • Completed Candidature Defence
4	• Finalize all chapters • Submit dissertation for examination • Committee of Examiners meeting	**OUTPUT OF SEM 5:** • Submitted dissertation for examination • Outcome of Committee of Examiners meeting

Notes:
Monitoring Panel

1. Chairman & 1 member who is an expert in the field and a supervisor. A fourth member is allowed to be appointed if necessary.
2. The same panel should follow through the proposal presentation and Candidature Defence.
3. It is strongly recommended that one member is appointed as internal examiner.
4. The main responsibilities of the panel should include the following:-
   a) Advise the student to improve the research proposal.
   b) Monitor the progress of the student
   c) Improve the research plan.

*Applicable to all international candidates.
** Applicable to international candidates who are writing their dissertation in languages other than English.

COURSE PLAN FOR MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)
ACADEMIC SESSION 2023/2024

INTAKE SEMESTER I 2023/2024

MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)		Credits	Semester I 2023/2024	Semester II 2023/2024	Semester I 2024/2025
Core Courses					
WOX7001	Research Methodology	3	√		
WOC7004	Architecting Software Systems	3	√		
WOC7014	Framework Based Software Design and Development	3		√	
WOC7015	Software Verification and Validation	3	√		
WOC7016	Software Project Management	3		√	
WOC7021**	Dissertation	21		√ **	√ **
Elective Courses [Students are required to choose any 2 courses from the list below]					
WOA7015	Advanced Machine Learning	3	√		
WOA7017	Security Risk Analysis and Evaluation	3		√	
WOC7017	Big Data Processing	3		√	
WOC7018	Requirements Engineering	3			
WOC7019	User Experience Design Studio	3		√	
WOC7020	Advanced Internet of Things	3	√		

Note:

* Student are required to register Research Methodology course in their first semester

*** Students are only allowed to register for Dissertation after completing six (6) credits of coursework.**

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

COURSE PLAN FOR MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)
ACADEMIC SESSION 2023/2024

INTAKE SEMESTER II 2023/2024

MASTER OF SOFTWARE ENGINEERING (SOFTWARE TECHNOLOGY)		Credits	Semester II 2023/2024	Semester I 2024/2025	Semester II 2024/2025
Core Courses					
WOX7001	Research Methodology	3	√		
WOC7004	Architecting Software Systems	3		√	
WOC7014	Framework Based Software Design and Development	3	√		
WOC7015	Software Verification and Validation	3		√	
WOC7016	Software Project Management	3	√		
WOC7021**	Dissertation	21		√**	√**
Elective Courses [Students are required to choose any two (2) courses from the list below]					
WOA7015	Advanced Machine Learning	3		√	
WOA7017	Security Risk Analysis and Evaluation	3	√		
WOC7017	Big Data Processing	3	√		
WOC7018	Requirements Engineering	3			
WOC7019	User Experience Design Studio	3	√		
WOC7020	Advanced Internet of Things	3		√	

Note:

* Student are required to register Research Methodology course in their first semester

** Students are only allowed to register for Dissertation after completing six (6) credits of coursework.

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

LIST OF COURSES AND COURSE CONTENT

CORE COURSES

Code	Course	Credits
WOX7001*	Research Methodology	3
WOC7004	Architecting Software Systems	3
WOC7014	Framework Based Software Design and Development	3
WOC7015	Software Verification and Validation	3
WOC7016	Software Project Management	3
WOC7021**	Dissertation	21

ELECTIVE COURSES

(Note: Students are required to choose any two (2) courses from the list below)

Code	Course	Credits
WOC7017	Big Data Processing	3
WOC7018	Requirements Engineering	3
WOC7019	User Experience Design Studio	3
WOC7020	Advanced Internet of Things	3
WOA7015	Advanced Machine Learning	3
WOA7017	Security Risk Analysis and Evaluation	3

Note:

* Student are required to register Research Methodology course in their first semester

** *Students are only allowed to register for Dissertation after completing six (6) credits of coursework.*

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

WOX7001   Research Methodology

Course Learning Outcomes

At the end of the course, students are able to:

1. Describe appropriate methodologies used in computer science and information technology research.
2. Devise a plan to be carried out within a feasible duration for answering research problems and questions identified.
3. Demonstrate attitude and character in line with professional and ethical codes in computer science and information technology research.

Synopsis of Course Content

This course gives on overview of the dimensions of research in computer science and information technology. Major considerations and tasks in conducting research in the areas such as review of literature, identify problem statement, formulate research questions and objectives, select an appropriate approach or method to the research, plan and manage the research, tools for research, data analysis, and writing and presentation strategies, will be discussed too.

Evaluation and Weightage

Continuous Assessment	**:**	100%
Final Examination	**:**	0%

WOC7004   Architecting Software Systems

Course Learning Outcomes

At the end of the course, students are able to:

1. Apply different types of architectural styles/patterns in developing software systems.
2. Design software architecture.
3. Evaluate software architecture in a team

Synopsis of Course Content

This course covers advanced architecture design of software systems. It reviews the different architectural structures and views, quality attributes, tactics to achieve quality attributes and common architectural styles/patterns (such as layered, broker, client-server, peer-to-peer, service-oriented architecture, and so on). It covers documenting software architecture.

This course also covers methods to design software architecture (e.g. Attribute-Driven Design method) and evaluate software architecture (e.g. ATAM analysis method). It also covers architecting software product lines, architecting in the Cloud, and supporting tool.

Evaluation and Weightage

Continuous Assessment	**:**	60%
Final Examination	**:**	40%

WOC7014 Framework-Based Software Design and Development

Course Learning Outcomes

At the end of the course, students are able to:
1. Identify the basic principles of framework-based software design and development.
2. Design a framework-based software system.
3. Construct a framework-based innovative software project using associated programming language.

Synopsis of Course Content

This course introduces the design and development of software using framework. It includes specification, implementation and configuration of an innovative software according to a specific framework. Students will learn the framework's programming language as well as the facilities provided by the framework.

Evaluation and Weightage

Continuous Assessment **:** 60%

Final Examination **:** 40%

WOC7015 Software Verification and Validation

Course Learning Outcomes

At the end of the course, students are able to:
1. Discuss the concepts, principles, and techniques of software verification and validation.
2. Design test through appropriate evaluation of chosen techniques from requirements and specifications, design artefacts, or the source code.
3. Calculate small program code behaviours for checking valid path
4. Analyse software system behaviours statically through model checking and probabilistic properties of program codes

Synopsis of Course Content

This course introduces the students the concepts, principles, techniques, and tools of software verification and validation within modern software development together with its formal techniques. The course covers from test design and test plan in test driven development of agile to conduct tests using tools. The course also exposes the students the formal approach of static analysis and model checking in verifying uncertainty in software design models and requirements.

Evaluation and Weightage

Continuous Assessment **:** 50%

Final Examination **:** 50%
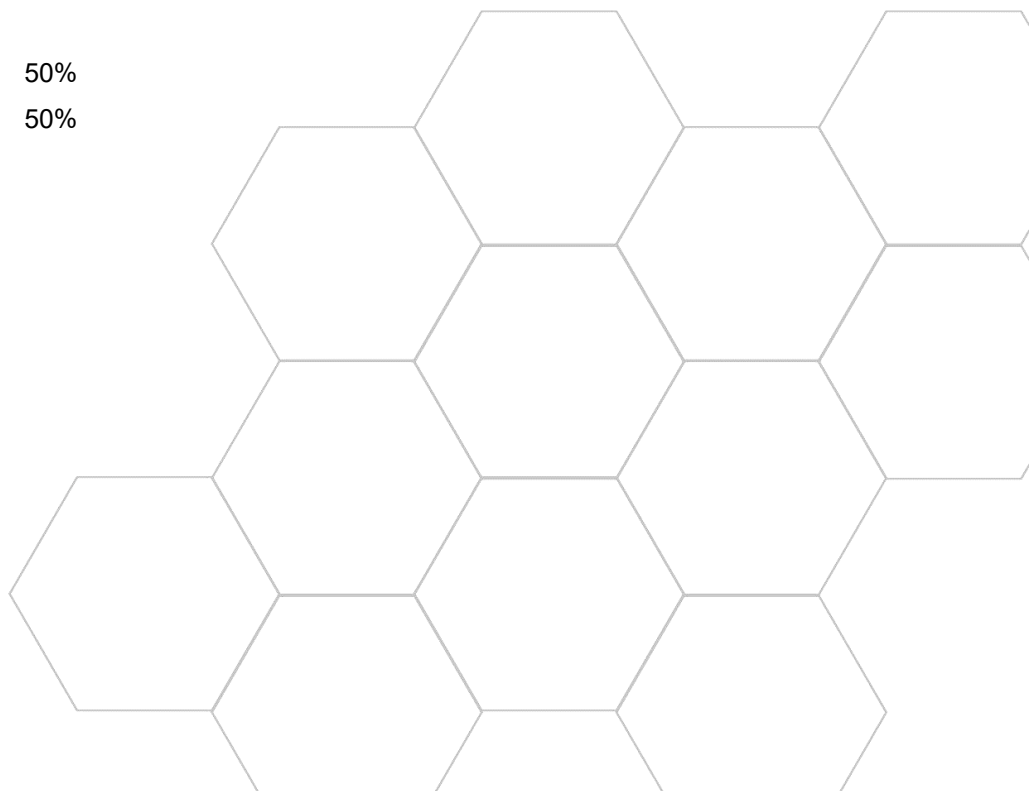
WOC7016   Software Project Management

Course Learning Outcomes
At the end of the course, students are able to:
1. Write a software project management plan by addressing the issues of scope, time, cost, resource and quality.
2. Manage a software project by demonstrating knowledge of project management techniques and skills.
3. Demonstrate attitude and character in line with professional ethics by working on a team project as a project manager or active team member.

Synopsis of Course Content
This course provides an overview of project management principles, techniques and skills. This course covers topics to understand the genesis of project, program, and portfolio management and their importance to software projects. In particular, the main tasks involved in initiating, planning, executing, monitoring and controlling, and closing software projects. The topics also include the knowledge areas that can be applied to manage project integration, scope, time, cost, quality, human resource, communications, risk and procurement.

Evaluation and Weightage

Continuous Assessment	:	60%
Final Examination	**:**	40%

WOC7021   Dissertation

Course Pre-requisite(s)/Minimum Requirement(s)
- Have passed any two courses
- Have taken or taking WOX7001 Research Methodology

Course Learning Outcomes
At the end of the course, students are able to:
1. Report the literature review related to the proposed research project in the approved area.
2. Implement a detailed research project based on the proposed research.
3. Produce a dissertation of the research project.

Synopsis of Course Content
The dissertation is concerned with the guidance rendered by the supervisor to the student on the proper way of conducting a software engineering, computer science or information technology research project, which could be in the form of face-to-face discussion, presentation, demonstration and communication. The dissertation also covers the identification of problem statements, understanding and formulation of the research objectives and research methodology to perform the research project.

Evaluation and Weightage

Continuous Assessment	:	100%
Final Examination	:	0%

*Students have to pass candidature seminars (proposal defence and candidature defence) before submittiing dissertation for examination. Results of candidature seminars will be emailed to the students by the faculty.

*Dissertation will be examined by examiners. Final results will be decided by the committee of examiners.

WOC7017   Big Data Processing

Course Learning Outcomes
At the end of the course, students are able to:
1. Explain the concepts of big data technologies
2. Apply parallel processing techniques for processing big data.
3. Evaluate the suitability of different processing techniques for big data processing

Synopsis of Course Content
It becomes more and more difficult to handle the growing amount of data with traditional data processing methods. There are many parallel processing frameworks and systems have been introduced such as MapReduce, Hadoop, Pig, Hive, Spark and Twister. Many of these frameworks and systems can handle different kinds of big data problems. This course will review and analyse various processing systems, architectures, frameworks, programming languages and programming models and their capabilities for large-scale data. This course will also analyze the advantages and disadvantages of these processing paradigms within the scope of the big data.

Evaluation and Weightage

Continuous Assessment	**:**	60%
Final Examination	**:**	40%

WOC7018   Requirements Engineering

Course Learning Outcomes
At the end of the course, students are able to:
1. Describe current techniques used in core activities in software requirements engineering.
2. Use suitable techniques and tools to develop software requirements specification to fulfill user requirements.
3. Evaluate relevant research issues in improving requirements engineering process.

Synopsis of Course Content
This course covers core activities in requirements engineering process such as requirements elicitation, validation, management and negotiation and techniques, tools and methods for supporting those activities. It also discusses and explores relevant research issues in areas such as requirements prioritization, impact analysis, process change management and requirements traceability.

Evaluation and Weightage

Continuous Assessment	**:**	60%
Final Examination	**:**	40%
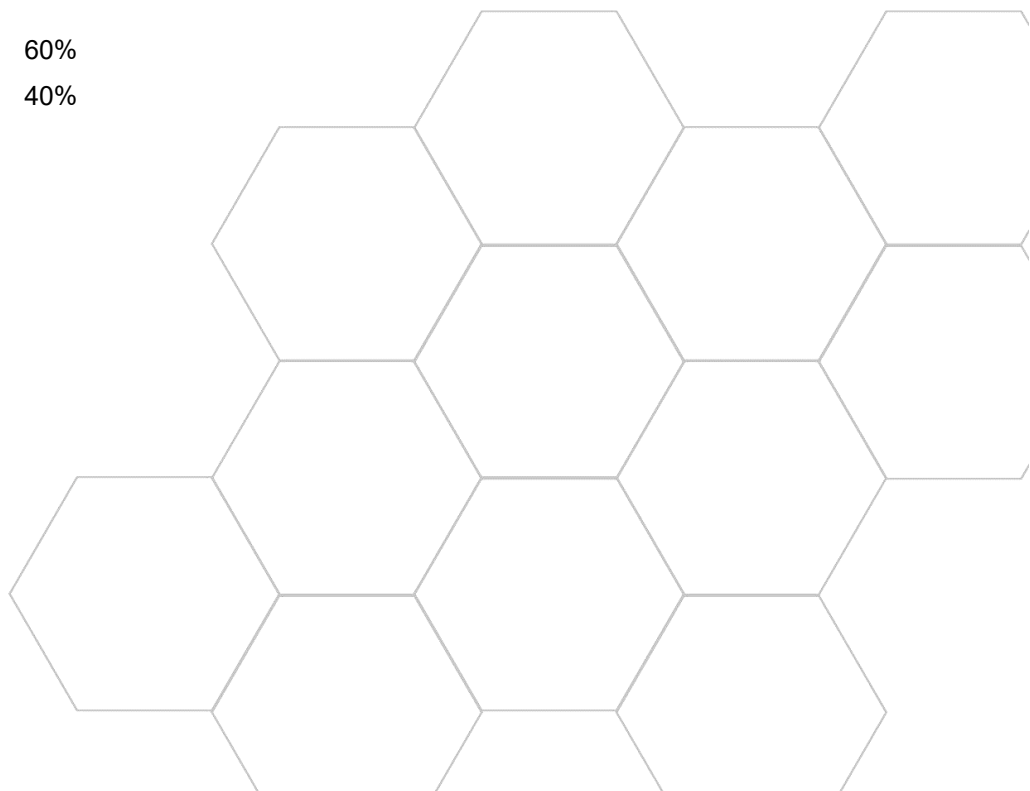
WOC7019   User Experience Design Studio

Course Learning Outcomes
At the end of the course, students are able to:
1. Apply the principles, models and techniques emphasizing the design of user experience (UX) in Human Computer Interactive systems.
2. Develop an Interactive Human Computer system that takes into consideration universal accessibility through Agile and LeanUX.
3. Evaluate the usability of the interactive Human Computer system which includes ethical, societal and cultural factors.

Synopsis of Course Content
This course covers advanced topics related to the human cognition, psychology, software engineering formal methods principles, models and techniques to represent user and interactive environment. Development projects uses Agile and LeanUX methodology taking into consideration universal accessibility for different range of users such as novice to experts, children to elderly, normal to people with disabilities.

Design and implementation of projects include web UX, mobile UX and other intelligent systems. Design and implementation concepts go beyond user interfaces to include sensors, controls, autonomous vehicles, ubiquitous computing in the context of Internet of Things (IoT), social data analytics and visualization. Interactive input may involve gestures, voice, eye movement and facial expression.

Evaluation of the implemented Human Interactive system uses techniques such as expert review, heuristics, usability testing, acceptance test, survey, active observation or control environment. Factors that influence UX evaluation are related to ethical, societal and cultural as well as usability goals.

Evaluation and Weightage

Continuous Assessment	**:**	100%
Final Examination	**:**	0%

WOC7020   Advanced Internet of Things

Learning Outcomes
At the end of this course, the students are able to
1. Explain the architecture and key technologies of internet of things.
2. Identify the challenges in the implementation of internet of things.
3. Solve problems related to internet of things in wireless communications.

Synopsis of Course Content
This course is designed to introduce to students the emerging issues related to internet of things. This course will examine several aspects of internet of things such as application areas related to internet of things technologies, real-time models, local sensors, network components and application-level components. This course also emphasises on solving problems related to wireless communications in developing and deploying internet of things.

Evaluation and Weightage

Continuous Assessment	**:**	50%
Final Examination	**:**	50%

WOA7015   Advanced Machine Learning

Course Learning Outcomes
At the end of the course, students are able to:
1. Practice concepts and techniques for machine learning related to digital and numerical methods.
2. Report the solution to machine learning problems by devising and listing the steps in machine learning applied to solve different types of problems
3. Demonstrate skills and knowledge on machine learning by managing a machine learning project

Synopsis of Course Content
This course introduces advanced concepts and techniques for machine learning. It covers topics such as linear and logistic regression, decision tree, neural network, and support vector machines as well as reinforcement learning.

Evaluation and Weightage

Continuous Assessment	**:**	50 %
Final Examination	**:**	50%

WOA7017   Security Risk Analysis and Evaluation

Course Learning Outcomes
At the end of the course, students are able to:
1. Explain the concepts of security risk assessment.
2. Apply suitable security risk assessment methods.
3. Evaluate a particular security risk assessment method.

Synopsis of Course Content
This course introduces the concepts and techniques used in security risk analysis and evaluation. It includes a comprehensive explanation of the six basic phases of security risk assessment, i.e. project definition, project preparation, data gathering, risk analysis, risk mitigation, and risk reporting and resolution. The course also explains several risk assessment methods and describes techniques to measure the effectiveness of a particular method.

Evaluation and Weightage

Continuous Assessment	**:**	50%
Final Examination	**:**	50%

MASTER OF DATA SCIENCE

MASTER OF DATA SCIENCE
PROGRAMME REQUIREMENTS

1. Programme Type

The type of programme offered for the Master of Data Science is a programme consisting 10 coursework which prepares students for the final capstone project which allows students to apply the knowledge they learned in the taught courses into real world applications.

2. Admission

(a) Qualifications for Admission

    (i) A Bachelor's degree with Honours in Science stream with a minimum CGPA of 3.0 or equivalent;

        OR

    (ii) A Bachelor's degree with Honours in non-Science stream with a minimum CGPA of 3.0 or equivalent with work experience in related fields for at least three (3) years;

        OR

    (iii) Other qualifications approved by the University Senate.

(b) English Language Proficiency

International candidates are required to:

    (i) At least IELTS Band 6 (Academic) or TOEFL score of 550 (paper based) / 213 (computer based) / 80 (Internet based) /PTE Academic/PTE Online with minimum score 57 if their first degree is from a university where English is not the medium of instruction.

3. Duration of Study

The programme of study : two (2) semesters + one (1) special semester, to eight (8) semesters.

4. Programme Structure

(1) The Master of Data Science Programme through coursework shall have a total of forty-two (42) credits.

(2) Through Coursework

    (i) The programme shall consist of two parts:

        (a) Part I comprises:

            (i) **seven (7)** core discpline courses, comprise of three or four credits courses; and

(ii)   **two (2)** elective courses, each four credits

(b)   Candidates may be imposed to enroll in other courses and obtain satisfactory results deemed necessary by the Faculty.

(c)   Part II consist of a ten (10) credits project and shall involve investigation and analysis of a real world case study, leading to the submission of a report.

(3)   Details of courses offered shall be of those approved by the Senate from time to time on the recommendation of the Faculty and shall be made known to the candidates at the start of each session.

(4)   The list of Senate approved courses for the Master of Data Science Programme shall be as indicated in List 1.

PROGRAMME GOALS AND OUTCOMES
MASTER OF DATA SCIENCE

AIM OF THE PROGRAM

To produce graduates who are knowledgeable and skilled in key concepts in the areas of data science. To equip students with technical expertise and soft skills by integrating learning with practical experience in the curriculum.

Objective

The Program objectives are:

1. Knowledgeable in the field of data science, and able to extract meaningful insights to help organizations cope with challenges and issues arising from big data.
2. Establish careers as data science practitioner skilled in developing effective applications for industry or other stakeholders.
3. Lead and contribute to data science team in public or private organization with a full sense of responsibility and good ethics

PROGRAMME LEARNING OUTCOMES

No.	Programme Learning Outcomes	POs	Taxonomic Category
1.	Master the important concepts and theories in the field of data science, that can be utilized in relevant domains such as business and social sciences.	PO1	K
2.	Apply the knowledge in the data science in designing and developing data models, systems, and applications.	PO2	P
3.	Apply knowledge in data science for the good of society and country.	PO3	A
4.	Practice the philosophy, principles, high ethical values in professional practices related to data science.	PO4	A
5.	Communicate clearly and confidently, to successfully implement group project or system development efficiently and effectively.	PO5	A
6.	Solve problems in various disciplines through research, and knowledge of data science and scientific computing.	PO6	K
7	Demonstrate skills in information management and continuous learning.	PO7	P

Total hours of student learning time for the entire program is 42 credits.

(List of 7 domains of learning outcomes in accordance with the MQF program. Please refer to the attachment. Additional learning outcomes can be given if necessary)

Reference notes:
The Domain of the MQF in Programme Learning Outcomes program (PO)

PO	Domain
PO1	Knowledge
PO2	Practical Skills
PO3	Social Skills and Responsibility
PO4	Values, Attitudes and Professionalism
PO5	Communication, Leadership and Team Skills
PO6	Problem Solving and Scientific Skills
PO7	Information Management and Life Long Learning Skills
PO8	Managerial and Entrepreneurial Skills

Reference notes:
Taxonomic Category

K	Cognitive
A	Affective
P	Psychomotor

COURSE PLAN FOR MASTER OF DATA SCIENCE (CONVENTIONAL)
ACADEMIC SESSION 2023/2024

INTAKE SEMESTER I 2023/2024

MASTER OF DATA SCIENCE		Credits	Semester I 2023/2024	Semester II 2023/2024	Semester III 2023/2024
Core Courses					
WOX7001	Research Methodology	3	√	√	
WQD7001	Principles of Data Science	3	√		
WQD7003	Data Analytics	3	√		
WQD7004	Programming for Data Science	4	√		
WQD7005	Data Mining	4		√	
WQD7006	Machine Learning for Data Science	4		√	
WQD7007	Big Data Management	3		√	
WQD7002	**Data Science Research Project	10		√	√
Elective Courses [Students are required to choose any 2 courses from the list below]					
WQD7008	Parallel and Distributed Computing	4	√		
WQD7009	Big Data Applications & Analytics	4	√		
WQD7010	Network and Security	4		√	
WQD7011	Numerical Optimization	4		√	

Note:

**Students are only allowed to register for WQD7002 Data Science Research Project after completing at least three (3) core discipline courses (including WOX7001).

Not all courses will be offered every semester; the actual courses offered will depend on the availability of staff and the number of students registering.

COURSE PLAN FOR MASTER OF DATA SCIENCE (CONVENTIONAL) ACADEMIC SESSION 2023/2024

INTAKE SEMESTER II 2023/2024

MASTER OF DATA SCIENCE		Credits	Semester II 2023/2024	Semester III 2023/2024	Semester I 2024/2025
Core Courses					
WOX7001	Research Methodology	3	√		√
WQD7001	Principles of Data Science	3	√		
WQD7003	Data Analytics	3	√		
WQD7004	Programming for Data Science	4	√		
WQD7005	Data Mining	4			√
WQD7006	Machine Learning for Data Science	4			√
WQD7007	Big Data Management	3			√
WQD7002	**Data Science Research Project	10		√	√
Elective Courses [Students are required to choose any 2 courses from the list below]					
WQD7008	Parallel and Distributed Computing	4			√
WQD7009	Big Data Applications & Analytics	4			√
WQD7010	Network and Security	4	√		
WQD7011	Numerical Optimization	4	√		

Note:

**Students are only allowed to register for WQD7002 Data Science Research Project after completing at least three (3) core discipline courses (including WOX7001).

Not all courses will be offered every semester; the actual courses offered will depend on the availability of staff and the number of students registering.

COURSE PLAN FOR MASTER OF DATA SCIENCE (REMOTE LEARNING) ACADEMIC SESSION 2023/2024

INTAKE SEMESTER I 2023/2024

MASTER OF DATA SCIENCE		Credits	Semester I 2023/2024	Semester II 2023/2024	Semester III 2023/2024
Core Courses					
WOX7001	Research Methodology	3	√		
WQD7001	Principles of Data Science	3	√		
WQD7003	Data Analytics	3	√		
WQD7004	Programming for Data Science	4	√		
WQD7005	Data Mining	4		√	
WQD7006	Machine Learning for Data Science	4		√	
WQD7007	Big Data Management	3		√	
WQD7002	**Data Science Research Project	10		√	√
Elective Courses [Students are required to choose any 2 courses from the list below]					
WQD7008	Parallel and Distributed Computing	4	√		
WQD7009	Big Data Applications & Analytics	4	√		
WQD7010	Network and Security	4		√	
WQD7011	Numerical Optimization	4		√	

Note:

**Students are only allowed to register for WQD7002 Data Science Research Project after completing at least three (3) core discipline courses (including WOX7001).

Not all courses will be offered every semester; the actual courses offered will depend on the availability of staff and the number of students registering.

LIST OF COURSES AND COURSE CONTENT

CORE COURSES

Code	Course	Credits
WOX7001	Research Methodology	3
WQD7001	Principles of Data Science	3
WQD7003	Data Analytics	3
WQD7004	Programming for Data Science	4
WQD7005	Data Mining	4
WQD7006	Machine Learning for Data Science	4
WQD7007	Big Data Management	3
**WQD7002	Data Science Research Project	10

ELECTIVE COURSES

(NOTE: *Students are required to choose any two (2) courses from the list below*)

Code	Course	Credits
WQD7008	Parallel and Distributed Computing	4
WQD7009	Big Data Applications & Analytics	4
WQD7010	Network and Security	4
WQD7011	Numerical Optimization	4

Note :
** *Students are only allowed to register for WQD7002 Data Science Research Project after completing at least three (3) core discipline courses (including WOX7001).*

Not all courses will be offered every semester; the actual courses offered will depend on the availability of staff and the number of students registering.

WOX7001   Research Methodology

Course Learning Outcomes
At the end of the course, students are able to:
1. Describe appropriate methodologies used in computer science and information technology research.
2. Devise a plan to be carried out within a feasible duration for answering research problems and questions identified.
3. Demonstrate attitude and character in line with professional and ethical codes in computer science and information technology research.

Synopsis of Course Content
This course gives on overview of the dimensions of research in computer science and information technology. Major considerations and tasks in conducting research in the areas such as review of literature, identify problem statement, formulate research questions and objectives, select an appropriate approach or method to the research, plan and manage the research, tools for research, data analysis, and writing and presentation strategies, will be discussed too.

Evaluation and Weightage

Continuous Assessment   :   100%

Final Examination   :   0%

WQD7001   Principles of Data Science

Learning Outcomes
At the end of this course, students are able to:
1. Summarize the foundations of the data science, its life cycle processes, methods and techniques.
2. Determine the principles of tidy data and data sharing.
3. Apply the most important data science methods, using open-source tools.

Synopsis of Course Content
The course is designed to help the student making sense of the field of data science. It covers the what, when, who, where, why and how (5W 1H) of data science in the era of big data. Also encompass the fundamental principles of data science that underlie the algorithms, processes, methods, and data-analytic thinking. The role of data scientist, the knowledge and skills required is also presented. Diverse technologies, programming languages as well as tools in data science are discussed.

Evaluation and Weightage

Continuous Assessment   :   60%

Final Examination   :   40%

WQD7003   Data Analytics

Course Learning Outcomes
At the end of the course, students are able to:
1. Explain the concepts of data analytics
2. Use suitable technique for data pre processing
3. Apply data analytics and machine learning techniques to solve real world problems.

Synopsis of Course Content
This course aims to develop students' ability to describe, explore and analyze data using suitable data analytics techniques

Evaluation and Weightage

Continuous Assessment	**:**	60%
Final Examination	**:**	40%

WQD7004   Programming for Data Science

Learning Outcomes
At the end of this course, the students are able to:
1. Define the steps of problem solving in programming for disparate datasets.
2. Demonstrate a familiarity with the algorithms and data structures related to data science.
3. Develop programs to solve the problems in data science.

Synopsis of Course Content
This course covers the problem solving and programming that relevant to the data science. The course provide students with the necessary programming skills to statistically process and explore disparate datasets.These include structures for data organization, sorting and searching, basic graph models and algorithms, streaming algorithms, linear and convex programming.

Evaluation and Weightage

Continuous Assessment	**:**	50%
Final Examination	**:**	50%

WQD7005   Data Mining

Learning Outcomes
At the end of the course, the students are able to:
1. Define the own term Data Mining and Data Warehouse, as well as the differences between OLTP and OLAP.
2. Draw a schema diagram for the data warehouse using   Snowflake schema.
3. Create a decision tree (DT) model using the C4.5 algorithm.
4. Find frequent itemsets using FP-growth.
5. Evaluate the differences between Time-series clustering and density-based clustering in big data environment.

Synopsis of Course Content
This course covers topic such as Data Warehouse, Pre-mining, Classification, Association Rules and Clustering Algorithms. It explains how to find patterns in a database and emphasizes on hands-on experience of data mining tools.

Evaluation and Weightage

Continuous Assessment : 50%

Final Examination : 50%

WQD7006 Machine Learning for Data Science

Learning Outcomes

At the end of this course, students are able to:
1. Explain the concepts and techniques for machine learning.
2. Identify appropriate machine learning techniques for various datasets.
3. Evaluate practical solutions to common problems in machine learning.

Synopsis of Course Content

This course introduces fundamental concepts and techniques for machine learning. It covers topics such as linear and logistics regression, decision trees, support vector machines, and reinforcement learning.

Evaluation and Weightage

Continuous Assessment : 50%

Final Examination : 50%

WQD7007 Big Data Management

Learning Outcomes

At the end of this course, students are able to
1. Explain the processes in data pipeline
2. Discuss database concepts and technologies for big data storage and retrieval
3. Apply appropriate models, tools, and technologies to implement storage, search and retrieval systems for large-scale structured and unstructured information systems.
4. Analyse data provenance and data trustworthiness, and its role in sharing and reuse of data.

Synopsis of Course Content
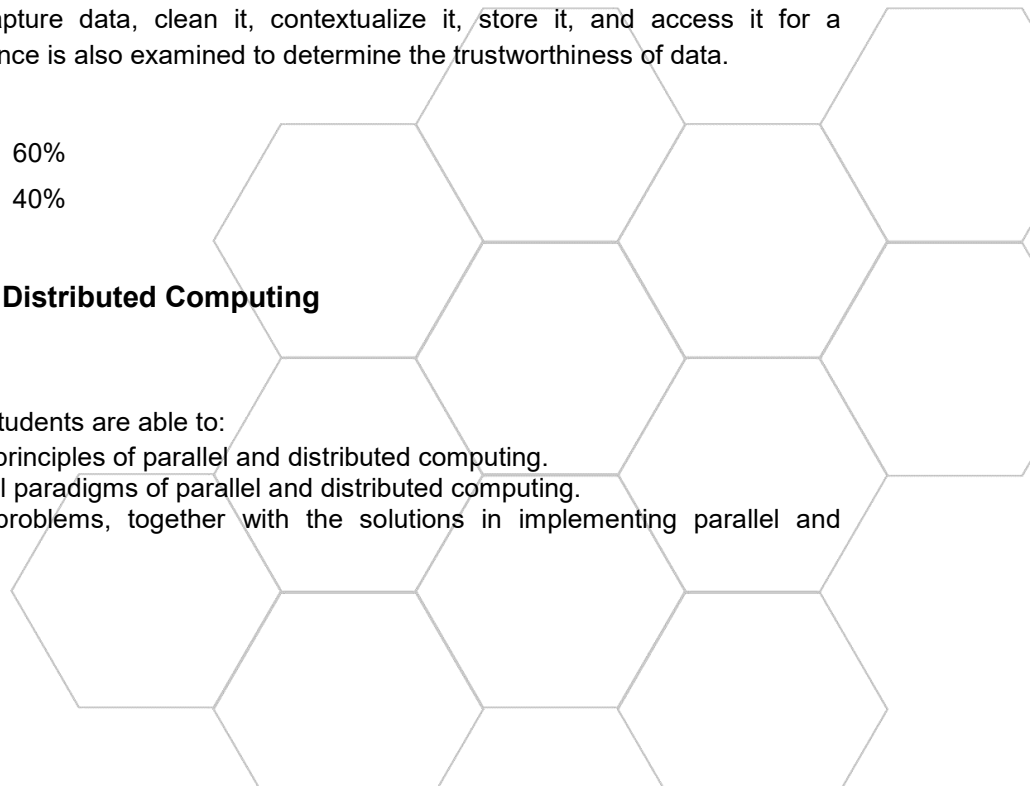
This course prepares students to deal with large-scale collections of data as objects to be stored, searched over, selected, and transformed for use and reuse. It examines the underlying principles and technologies used to capture data, clean it, contextualize it, store it, and access it for a repurposed use. Data provenance is also examined to determine the trustworthiness of data.
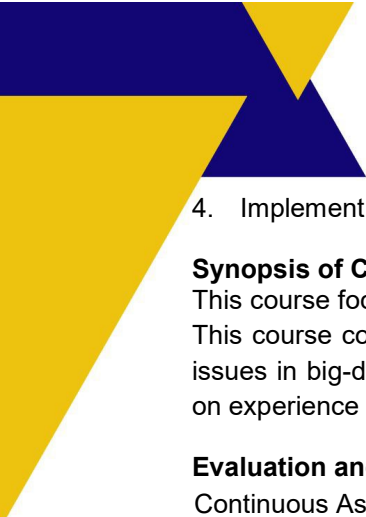
Evaluation and Weightage

Continuous Assessment : 60%

Final Examination : 40%

WQD 7008 Parallel and Distributed Computing

Learning Outcomes

At the end of this course, the students are able to:
1. Recognize the underlying principles of parallel and distributed computing.
2. Determine the fundamental paradigms of parallel and distributed computing.
3. Identify the issues and problems, together with the solutions in implementing parallel and distributed systems.

4. Implement parallel and distributed systems.

Synopsis of Course Content
This course focuses on the design and implementation of parallel and distributed processing systems. This course covers the fundamental concepts of distributed computing and introduces contemporary issues in big-data processing. This course emphasises on both the underlying principles and hands-on experience of data analytic tools.

Evaluation and Weightage

Continuous Assessment   :   50%

Final Examination   :   50%

WQD7009   Big Data Applications and Analytics

Learning Outcomes
At the end of this course, students are able to:
1. Explain the concepts of Big Data Applications and Analytics
2. Use suitable methods and techniques to analyse big data
3. Evaluate big data problems and suggest solutions to a real world problem

Synopsis of Course Content
The course will cover Big data applications and analytics, Data Collection, Sampling and Pre-processing, Predictive Analysis, Descriptive analysis, Survival analysis, Social networks analysis, and Case study of Big data Applications.

Evaluation and Weightage

Continuous Assessment   :   70%

Final Examination   :   30%

WQD7010   Network and Security

Learning Outcomes
At the end of the course, students are able to:
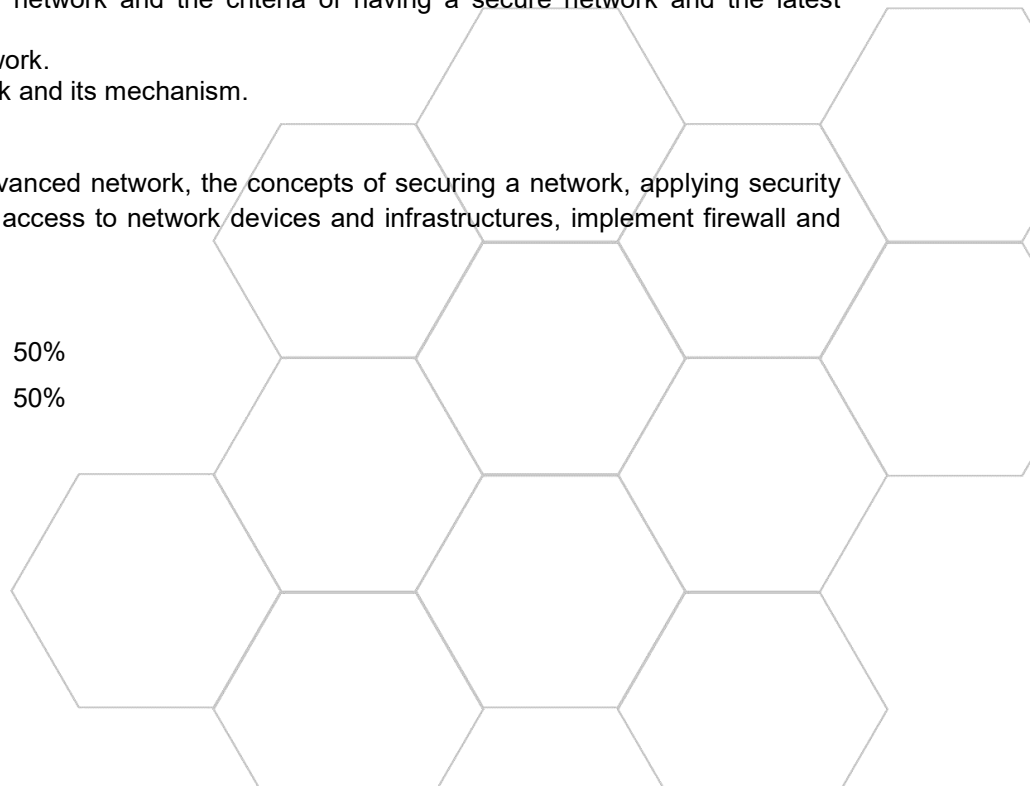
1. Investigate the concept of network and the criteria of having a secure network and the latest network security issues.
2. Experiment a secured network.
3. Evaluate a secured network and its mechanism.

Synopsis of Course Content
The course consists of the advanced network, the concepts of securing a network, applying security perimeters, implement secure access to network devices and infrastructures, implement firewall and IPS.

Evaluation and Weightage

Continuous Assessment   :   50%

Final Examination   :   50%

WQD7011   Numerical Optimization

Learning Outcomes
At the end of the course, students are able to:
1. Explain the key principles and values pertinent to numerical optimization and linear algebra
2. Apply and implement numerical solution methods
3. Interpret the numerical solutions with respect to their accuracy and suitability

Synopsis of Course Content
The course will provide an opportunity for in-depth study of numerical methods and linear algebra. Topics relevant to the course are as follows: Numerical analysis, Polynomial Interpolation, Numerical Integration, Resolution of non-linear systems, Resolution of large linear systems, Eigenvalues approximation, Numerical solution of ODEs and Numerical solution of PDEs

Evaluation and Weightage

Continuous Assessment   **:**   60%

Final Examination   **:**   40%

WQD7002   Data Science Research Project

Learning Outcomes
At the end of the course, the student are able to:
1. Apply data science techniques to solve data science problems in real world environment
2. Professionally present the project plan and results
3. Write a project report

Synopsis of Course Content
The capstone project allows students to use public data or create data product by applying their knowledge in foundations, theory and methods of data science to address problems in industry and government. During the project, students engage in the entire process of solving a real-world data science project, from collecting and processing data, to designing the best method to solve identified problem, to applying suitable analytic methods, and finally, to implementing a solution.

Evaluation and Weightage

Continuous Assessment   **:**   100%
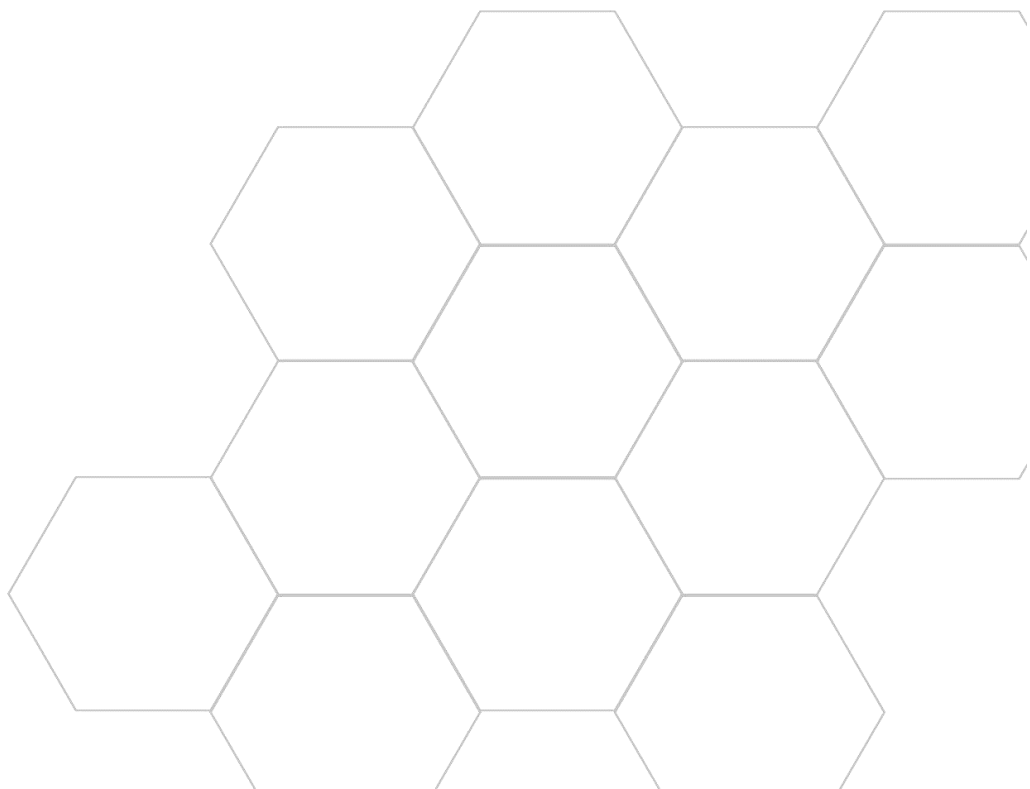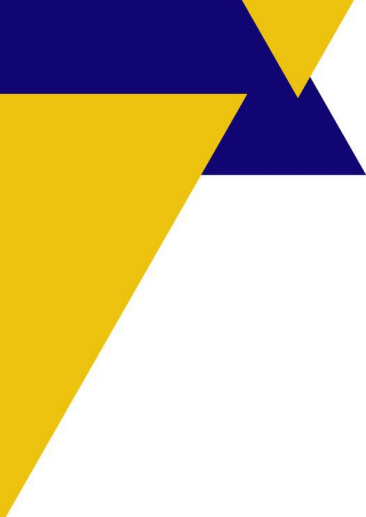
MASTER OF CYBER SECURITY

MASTER OF CYBER SECURITY
PROGRAMME REQUIREMENTS

1. Programme Type

The type of programme offered for the Master of Cyber Security is a programme consisting 10 coursework which prepares students for the final capstone project which allows students to apply the knowledge they learned in the taught courses into real world applications.

2. Admission

(a) Qualifications for Admission

    (i) A Bachelor's degree in Science Computer or related field with a minimum CGPA of 3.0:

OR

(ii) A Bachelor's degree in Science Computer/ related field with CGPA (2.50-2.99) or equivalent with work experience in related fields for at least three (3) years;

OR

(iii) Other qualifications approved by the University Senate.

(b) English Language Proficiency

International candidates are required to:

(i) At least IELTS Band 6 (Academic) or TOEFL score of 550 (paper based) / 213 (computer based) / 80 (Internet based) /PTE Academic/PTE Online with minimum score 57 if their first degree is from a university where English is not the medium of instruction.

3. Duration of Study

The programme of study: two (2) semesters + one (1) special semester, to eight (8) semesters.

4. Programme Structure

(1) The Master of Cyber Security Programme through coursework shall have a total of forty-three (43) credits.

(2) Through Coursework

    (i) The programme shall consist of two parts:

        (a) Part I comprises:

            (i) **eight (8)** core discipline courses, comprise of three or four credits courses; and

            (ii) **two (2)** elective courses, each four credits

(b) Candidates may be imposed to enrol in other courses and obtain satisfactory results deemed necessary by the Faculty.

(c) Part II consist of a ten (10) credits project and shall involve investigation and analysis of a real world case study, leading to the submission of a report.

(3) Details of courses offered shall be of those approved by the Senate from time to time on the recommendation of the Faculty and shall be made known to the candidates at the start of each session.

(4) The list of Senate approved courses for the Master of Cyber Security Programme shall be as indicated in List 1.

PROGRAMME GOALS AND OUTCOMES
MASTER OF CYBER SECURITY

AIM OF THE PROGRAM

To produce high-quality and skilled graduates who are critical thinkers in the field of Cyber Security through research, education and dissemination of knowledge.

Objective

The Program objectives are:
1. Graduates have advanced knowledge with practical skills, capable of using innovative techniques and digital technologies in the field of cyber security.
2. Graduates equipped with professional and ethical practices collaborate with organisations and communities in developing innovative strategies to address present cyber threats.
3. Graduates with a positive attitude, entrepreneurial mindset and sustainable practices progress for lifelong learning towards career and profession development in Cyber Security.

PROGRAMME LEARNING OUTCOMES

No.	Programme Learning Outcomes	POs	Taxonomic Category
1.	Critically analyse advanced knowledge and have capability to further develop related disciplines in the cyber security field.	PO1	K
2.	Evaluate emerging scenarios and innovatively solve relevant issues through mastery of knowledge, analytical and critical skills.	PO2	K
3.	Utilize various practical skills and digital technology methods of cyber security solutions to estimate, analyze, interpret and disseminate information	PO3	K,P
4.	Demonstrate abilities to communicate and work effectively with peers, professional bodies and various communities	PO4	K,P
5.	Design innovative and effective solutions using digital technologies and scientific and numeric skills	PO5	P,A
6.	Equip with leadership qualities and interpersonal proficiency to demonstrate responsibility and autonomy in dynamic educational and organizational settings	PO6	P,A
7	Exhibit positive attitude and commitment to lifelong learning with entrepreneurial mind-set and professional development.	PLO7	K,A

Total hours of student learning time for the entire program is 43 credits.

(List of 7 domains of learning outcomes in accordance with the MQF program. Please refer to the attachment. Additional learning outcomes can be given if necessary)

Reference notes:
The Domain of the MQF in Programme Learning Outcomes program (PO)

PO Domain

PO1   Knowledge

PO2   Practical Skills

PO3   Social Skills and Responsibility

PO4   Values, Attitudes and Professionalism

PO5   Communication, Leadership and Team Skills

PO6   Problem Solving and Scientific Skills

PO7   Information Management and Life Long Learning Skills

PO8   Managerial and Entrepreneurial Skills

Reference notes:
Taxonomic Category

K   Cognitive
A   Affective
P   Psychomotor

COURSE PLAN FOR MASTER OF CYBER SECURITY
ACADEMIC SESSION 2023/2024

INTAKE SEMESTER I 2023/2024

MASTER OF CYBER SECURITY		Credits	Semester I 2023/2024	Semester II 2023/2024	Semester III 2023/2024
Core Courses					
WOX7001	Research Methodology	3	√	√	
WQE7001	Cyber security	3	√		
WQE7002	Advanced Network Security Programming	4	√		
WQE7007	Network Technology and Security	3	√		
WQE7003	Cryptography and Information Hiding	3		√	
WQE7004	Information Assurance	3		√	
WQE7005	Advanced Digital Forensics	3		√	
WOC7020	Advanced Internet of Thing	3		√	
WQE7006	Cyber Security Research Project	10		√	√
Elective Courses [Students are required to choose any 2 courses from the list below]					
WQE7008	Wireless Networking and Mobile Computing	4	√		
WQE7011	Advanced Computer Penetration and Defense	4	√		
WQE7009	Emerging Cyber Security Trends	4		√	
WQE7010	Cloud Computing	4		√	

Note:
*Students are only allowed to register for the *WQE7006 Cyber Security Research Project* after completing at least three (3) core discipline courses (including WOX7001)

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

LIST OF COURSES AND COURSE CONTENT

CORE COURSES

Code	Course	Credits
WOX7001	Research Methodology	3
WQE7001	Cyber security	3
WQE7002	Advanced Network Security Programming	4
WQE7007	Network Technology and Security	3
WQE7003	Cryptography and Information Hiding	3
WQE7004	Information Assurance	3
WQE7005	Advanced Digital Forensics	3
WOC7020	Advanced Internet of Thing	3
WQE7006	Cyber Security Research Project	10

ELECTIVE COURSES

(NOTE: *Students are required to choose any two (2) courses from the list below***)**

Code	Course	Credits
WQE7008	Wireless Networking and Mobile Computing	4
WQE7011	Advanced Computer Penetration and Defense	4
WQE7009	Emerging Cyber Security Trends	4
WQE7010	Cloud Computing	4

Note:
** Students are only allowed to register for the WQE7006 Cyber Security Research Project after completing at least three (3) core discipline courses (Including WOX7001)

Not all courses will be offered every semester; the actual courses offered will depend on the availability of staff and the number of students registering.

WOX7001   Research Methodology

Course Learning Outcomes
At the end of the course, students are able to:
1. Describe appropriate methodologies used in computer science and information technology research.
2. Devise a plan to be carried out within a feasible duration for answering research problems and questions identified.
3. Demonstrate attitude and character in line with professional and ethical codes in computer science and information technology research.

Synopsis of Course Content
This course gives on overview of the dimensions of research in computer science and information technology. Major considerations and tasks in conducting research in the areas such as review of literature, identify problem statement, formulate research questions and objectives, select an appropriate approach or method to the research, plan and manage the research, tools for research, data analysis, and writing and presentation strategies, will be discussed too.

Evaluation and Weightage
Continuous Assessment   **:** 100%
Final Examination   **:** 0%

WQE7001   Cyber Security

Learning Outcomes
At the end of this course, students are able to:
1. Understand cybersecurity operations, network principles, roles, and responsibilities as well as the related technologies, tools, regulations, and frameworks available.
2. Integrate network monitoring tools to identify attacks against network protocols and services.
3. Apply knowledge and skills to monitor, detect, investigate, analyse, and respond to security incidents.

Synopsis of Course Content
This course introduces the core security concepts and skills needed to monitor, detect, analyse, and respond to cybercrime, cyberespionage, insider threats, advanced persistent threats, regulatory requirements, and other cybersecurity issues facing organizations. It includes skills needed to practice cybersecurity operations knowledge in a controlled environment.

Evaluation and Weightage
Continuous Assessment   : 70%
Final Examination   : 30%

WQE7002   Advanced Network Security Programming

Learning Outcomes
At the end of the course, students are able to:

1. Determine the network security methods that can defence against cyber-attacks.
2. Develop a secure network solution to mitigate the cyber threat.
3. Synthesize network in terms of the exposure to potential threats, vulnerability and security.

Synopsis of Course Content

This course covers the networking and security challenges and the use of programming to defence against cyber-attacks and cyber threats. These include the procedures of network connection and endpoint protection. You will also learn how to assess a network's vulnerabilities and develop a secure network solution with the help of Python scripting.

Evaluation and Weightage

Continuous Assessment : 60%
Final Examination : 40%

WQE7003   Cryptography and Information Hiding

Course Learning Outcomes

At the end of the course, students are able to:
1. Explain the principles and mechanism used in cryptography and information hiding.
2. Analyse the cryptographic and information hiding algorithms for their strengths and weaknesses.
3. Evaluate the practical applications of cryptographic and information hiding mechanisms.

Synopsis of Course Content

This course consists of developing an understanding of cryptography, cryptanalysis, Symmetric and Asymmetric cryptographic algorithms (classic and modern algorithms), Introduction to Number Theory, Hash Functions, Message Authentication and Digital Signatures. This course also introduces the concepts and techniques used in information hiding which focuses mainly on watermarking and steganography. Topics includes spatial and transform domain embedding, media specific information hiding and attacks on watermarking and steganography

Evaluation and Weightage

Continuous Assessment : 50%
Final Examination : 50%

WQE7004   Information Assurance

Learning Outcomes

At the end of this course, the students are able to:
1. Analyze the challenges and solutions in Information Assurance involving the triad of people, processes and technologies.
2. Evaluate security solutions to meet security needs for a meaningful society in accordance with the principles in information security.
3. Ideate security solutions based on current challenges and issues in the topic of information security.

Synopsis of Course Content

This course covers and provides a practical view of security that involved the triad of people, policies and procedures and technology, which include: Information Assurance strategy, policy, concepts, Information Assurance planning, risk mitigation, Information Assurance detection and recovery process and application of Information Assurance in selected industries.

Evaluation and Weightage

Continuous Assessment : 60%
Final Examination : 40%

WQE7005   Advance Digital Forensics

Learning Outcomes
At the end of the course, the students are able to:
1. Demonstrate the processes, methodologies, laws and regulations that have a significant relationship with the digital forensic domain.
2. Plan all stages of digital evidence procedures (e.g., collection, recovery, preservation, identification, analysis and presentation).
3. Relate the concept of digital forensics, anti-forensics, network and mobile forensics Find frequent item sets using FP-growth.

Synopsis of Course Content
The student will learn and understand the concept of digital forensics, computer crimes and criminals, acts and laws that have a significant relationship with digital forensic studies; international and local. Students will learn the process of collecting, preserving, recovering and analysing digital evidence. In order to present them in a proper presentation for non-Information Technology practitioners, students will practice the procedure of presenting digital evidence and building a cybercrime case. They also will learn the digital forensic methodologies, anti-forensics and network forensics as well as mobile forensics.

Evaluation and Weightage

Continuous Assessment   : 50%
Final Examination   : 50%

WQE7006   Cyber Security Research Project

Learning Outcomes
At the end of the course, students are able to:
1. Apply cyber security techniques to solve cyber security problems in real world environment
2. Present the project plan and results professionally
3. Write a project report

Synopsis of Course Content
A research project is a medium-scale project to enable students to do research related to cyber security. Research projects allow students to use public data or create applications by applying knowledge in the basics, theories and scientific methods to solve problems related to cyber security. During the project, students will engage in the overall process of general research, starting with identifying problems, collecting and processing data, recommending solution methods, applying appropriate scientific methods and ending with implementing affordable solutions and evaluations.

Evaluation and Weightage

Continuous Assessment:100 %
Final Examination: 0%

WOC7020   Advanced Internet of Things

Learning Outcomes
At the end of this course, students are able to:
1. Explain the architecture and key technologies of internet of things.
2. Identify the challenges in the implementation of internet of things.

3.   Solve problems related to internet of things in wireless communications.

Synopsis of Course Content

This course is designed to introduce to students the emerging issues related to internet of things. This course will examine several aspects of internet of things such as application areas related to internet of things technologies, real-time models, local sensors, network components and application-level components. This course also emphasises on solving problems related to wireless communications in developing and deploying internet of things.

Evaluation and Weightage

Continuous Assessment   : 50%
Final Examination   : 50%

WQE7007   Network Technology and Security

Learning Outcomes

At the end of the course, students are able to:

1.   Identify the basic technologies that support the implementation of high-speed networks.
2.   Plan, configure, verify and integrate the implementation of various LAN and WAN routing protocols, and security.
3.   Identify and solve the issues in the implementation of network and security aspects.

Synopsis of Course Content

The course will provide knowledge and practical view of network technology. It includes technologies and advanced issues in IPv4 and IPv6, routing protocols, router, switches, network monitoring, high-speed networks and security in devices and routing.

Evaluation and Weightage

Continuous Assessment   : 70%
Final Examination   : 30%

WQE 7008   Wireless Networking and Mobile Computing

Learning Outcomes

At the end of this course, students are able to
1.   Explain the architecture and key technologies of Wireless Networks and Mobile Computing.
2.   Identify the challenges in the implementation of Wireless Networks and Mobile Computing.
3.   Solve problems related to Wireless Networks and Mobile Computing communications.

Synopsis of Course Content

This course is designed to introduce to students the emerging issues related to Wireless Networks and Mobile Computing. This course will examine several aspects of Wireless Networks and Mobile Computing such as application areas related to Wireless Networks technologies, wireless network components and application-level in Wireless Networks and Mobile Computing. This course also emphasises on solving problems related to Wireless Networks and Mobile Computing communications.

Evaluation and Weightage

Continuous Assessment   : 50%
Final Examination   : 50%

WQE7009   Emerging Cyber Security Trends

Learning Outcomes
At the end of this course, students are able to:
1.   Identify the emerging trends in cybersecurity issues, attacks, threats and risks.
2.   Analyse the emerging approaches in mitigating and defending networks from the cyber-attacks.
3.   Apply the suitable approaches in analysing and synthesizing the emerging cyber-attacks and threats.

Synopsis of Course Content
This course covers the understanding of the emerging issues, attacks, threats and risk in cyber security. The topic is not limited to the existing issues, but also covers the possible issues in the near future. This include to analyse and understand how the latest technologies can be used to mitigate and defense the network from the cyber-attacks. This course extends the coverage by applying the suitable approaches in analysing and synthesizing the latest cyber-attacks and threats.

Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQE7010   Cloud Computing

Learning Outcomes
At the end of the course, students are able to:

1.   Recognize the architecture and various basic concepts related to cloud computing technologies.
2.   Demonstrate cloud virtualization, cloud storage, data management and data visualization.
3.   Design cloud computing security using access control strategies.

Synopsis of Course Content
This course covers topics and technologies related to cloud computing various basic concepts and architecture models (such as IaaS, PaaS, SaaS). It also discusses the important features of cloud computing such as cloud virtualization, cloud storage, clustering, data management and data visualization. The theoretical knowledge and practical sessions will be applied to design cloud computing security using access control strategies.

 Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQE7011   Advanced Computer Penetration and Defense

Learning Outcomes
At the end of this course, the students are able to:
1.   Identify the principles and techniques to hack and defend computer systems.
2.   Apply the concepts and techniques to hack and defend computer systems.
3.   Analyze the weaknesses in computer systems and their countermeasures.
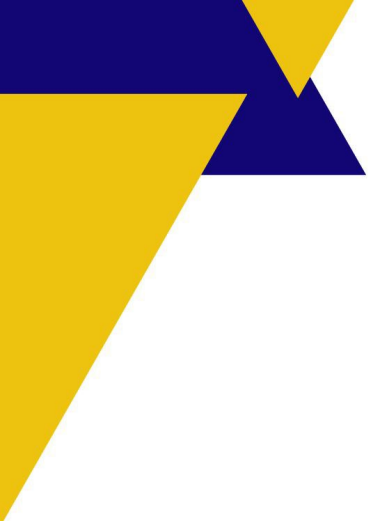
Synopsis of Course Content

This course introduces the concepts and techniques used to hack and defend computer systems with a focus on ethical hacking. The contents of this course cover aspects of hacking such as network scanning, exploitation of vulnerabilities, gaining access to systems, and penetration testing.
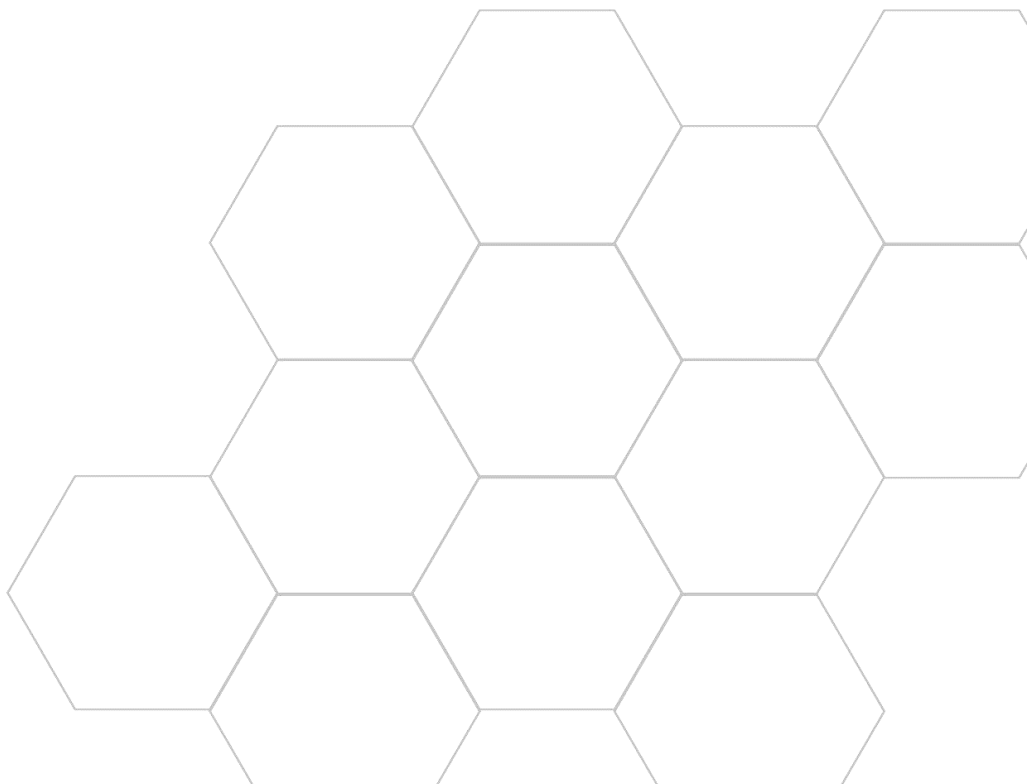
Evaluation and Weightage

Continuous Assessment   : 70%
Final Examination   : 30%

MASTER OF ARTIFICIAL INTELLIGENCE

MASTER OF ARTIFICIAL INTELLIGENCE PROGRAMME REQUIREMENTS

1. Programme Type

The type of programme offered for the Master of Artificial Intelligence is a programme consisting 10 coursework which prepares students for the final capstone project which allows students to apply the knowledge they learned in the taught courses into real world applications.

2. Admission

(a) Qualifications for Admission

   (i) A Bachelor's degree in Science Computer and Information Technology (Science stream) or a related field with a minimum CGPA of 3.0: **or**

     OR

   (ii) A bachelor's degree in Science Computer and Information Technology (Science stream) or a related field with a minimum CGPA of 2.7-2.99 with Computer Science/ Artificial Intelligent experiences minimum 3 years

     OR

   (ii) Other qualifications approved by the University Senate.

(b) English Language Proficiency
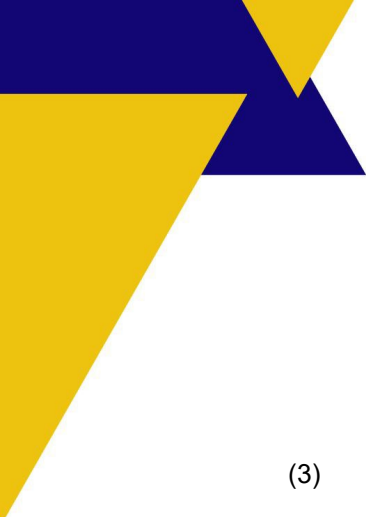
International candidates are required to:

   (i) At least IELTS Band 6 (Academic) or TOEFL score of 550 (paper based) / 213 (computer based) / 80 (Internet based) /PTE Academic/PTE Online with minimum score 57 if their first degree is from a university where English is not the medium of instruction.

3. Duration of Study

The programme of study: two (2) semesters + one (1) special semester, to eight (8) semesters.

4. Programme Structure

(1) The Master of Artificial Intelligence Programme through coursework shall have a total of forty-two (42) credits.

(2) Through Coursework

(i) The programme shall consist of two parts:

   (a) Part I comprises:

     (i) **Eight (8)** core discipline courses, comprised of three or four credits courses; and

     (ii) **two (2)** elective courses, each three credits

(b)   Candidates may be imposed to enrol in other courses and obtain satisfactory results deemed necessary by the Faculty.

(c)   Part II consist of a **ten (10) credits project** and shall involve investigation and analysis of a real-world case study, leading to the submission of a report.

(3)   Details of courses offered shall be of those approved by the Senate from time to time on the recommendation of the Faculty and shall be made known to the candidates at the start of each session.

(4)   The list of Senate approved courses for the Master of Artificial Intelligence Programme shall be as indicated in List 1.
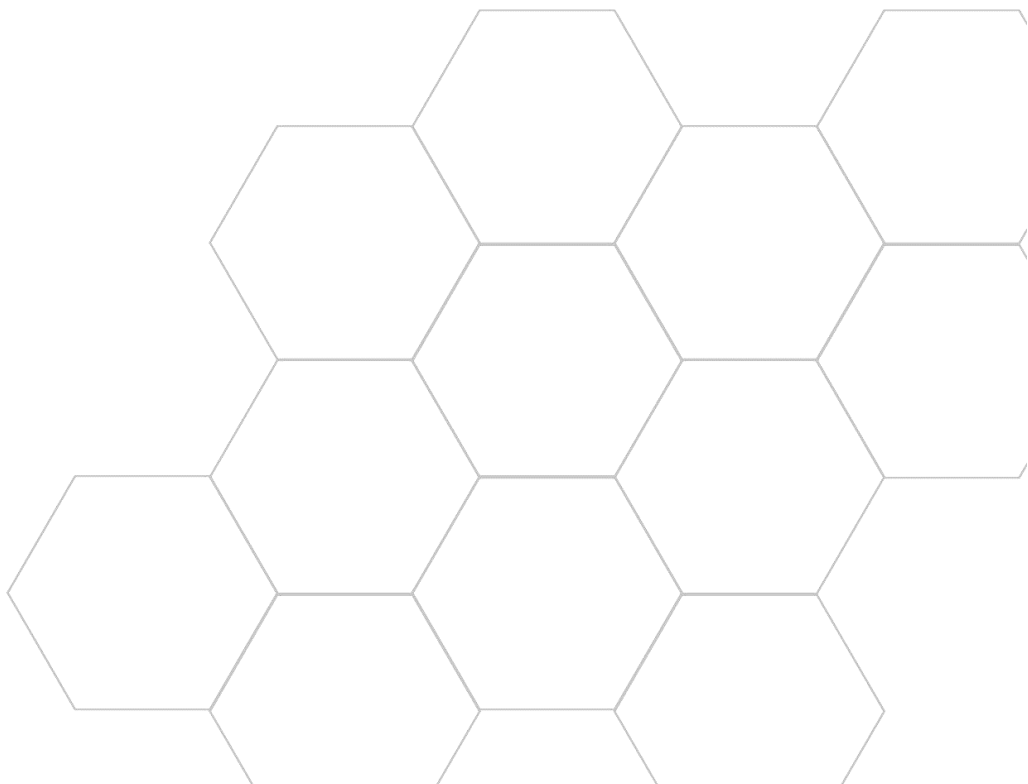
PROGRAMME GOALS AND OUTCOMES
MASTER OF ARTIFICIAL INTELLIGENCE

AIM OF THE PROGRAM

To produce high quality and skilled graduates who are critical thinkers in the field of Artificial Intelligence through research, education and dissemination of knowledge.

Objective

The Program objectives are:

1. Graduates who are skilled in the development of technology based on Artificial Intelligence.
2. Graduates who are involved in research and continuing education activities based on Artificial Intelligence.
3. Graduates who practice a professional and ethical attitude in applying Artificial Intelligence technology.

PROGRAMME LEARNING OUTCOMES

No.	Programme Learning Outcomes	POs	Taxonomic Category
1.	Demonstrate the mastery of knowledge and thorough understanding of technological and scientific principles in the field of Artificial Intelligence.	PO1	K
2.	Recommend innovative solutions that is at the forefront of developments in Artificial Intelligence.	PO2	K
3.	Utilize tools or software to develop useful, efficient, effective AI solutions.	PO3	P
4.	Communicate and interact effectively within a group and with diverse stakeholders by publishing and presenting technical materials in the fields of Artificial Intelligence.	PO4	P,A
5.	Apply a wide range of digital technologies with suitable Artificial Intelligence techniques in designing and planning solutions.	PO5	P
6.	Demonstrate leadership, teamwork, autonomy and responsibility in delivering services in Artificial Intelligence.	PO6	P,A
7	Exhibit capabilities to extend knowledge through life-long learning in Artificial Intelligence.	PLO7	A
8	Uphold professional and ethical practices in conducting research and delivering services in Artificial Intelligence.	PLO8	A

Total hours of student learning time for the entire program is 42 credits.

(List of 7 domains of learning outcomes in accordance with the MQF program. Please refer to the attachment. Additional learning outcomes can be given if necessary)

Reference notes:
The Domain of the MQF in Programme Learning Outcomes program (PO)

PO Domain

PO1   Knowledge

PO2   Practical Skills

PO3   Social Skills and Responsibility

PO4   Values, Attitudes and Professionalism

PO5   Communication, Leadership and Team Skills

PO6   Problem Solving and Scientific Skills

PO7   Information Management and Life Long Learning Skills

PO8   Managerial and Entrepreneurial Skills

Reference notes:
Taxonomic Category

K   Cognitive
A   Affective
P   Psychomotor

COURSE PLAN FOR MASTER OF ARTIFICIAL INTELLIGENCE ACADEMIC SESSION 2023/2024

INTAKE SEMESTER I 2023/2024

MASTER IN ARTIFICIAL INTELLIGENCE		Credits	Semester I 2023/2024	Semester II 2023/2024	Semester III 2023/2024
Core Courses					
WOX7001	*Research Methodology	3	√	√	
WOA7015	Advanced Machine Learning	3	√		
WQF7002	Artificial Intelligence Techniques	3	√		
WQF7006	Computer Vision and Image Processing	3	√		
WQF7007	Natural Language Processing	4	√		
WQF7003	Intelligent Computation	4		√	
WQF7004	Data Analytics in Artificial Intelligence	3		√	
WQF7005	Data Privacy and Artificial Intelligence Ethics	3		√	
WQF7023	Artificial Intelligence Research Project	10		√	√
Elective Courses [Students are required to choose any two (2) courses from the list below]					
WQF7008	Practical Deep Learning	3	√		
WQF7009	Explainable Artificial Intelligence (XAI)	3	√		
WOA7019	Augmented Reality	3		√	
WQF7010	Robotics and Automation	3		√	
WQF7011	Cognitive Computing	3		√	

Note:
*Students are only allowed to register for the *WQF7023 AI Research Project* after completing at least three (3) core discipline courses (including WOX7001)

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

LIST OF COURSES AND COURSE CONTENT

CORE COURSES

Code	Course	Credits
WOX7001	Research Methodology	**3**
WOA7015	Advanced Machine Learning	**3**
WQF7002	Artificial Intelligence Techniques	**3**
WQF7006	Computer Vision and Image Processing	**3**
WQF7007	Natural Language Processing	4
WQF7003	Intelligent Computation	**4**
WQF7004	Data Analytics in Artificial Intelligence	**3**
WQF7005	Data Privacy and Artificial Intelligence Ethics	**3**
WQE7023	Artificial Intelligence Research Project	**10**

ELECTIVE COURSES

(NOTE: *Students are required to choose any two (2) courses from the list below***)**

Code	Course	Credits
WQF7008	Practical Deep Learning	**3**
WQF7009	Explainable Artificial Intelligence (XAI)	**3**
WOA7019	Augmented Reality	**3**
WQF7010	Robotics and Automation	**3**
WQF7011	Cognitive Computing	3

Note:
*Students are only allowed to register for the *WQF7023 AI Research Project* after completing at least three (3) core discipline courses (including WOX7001)

The courses that will be offered every semester are subject to change, depending on the availability of staff and the number of students registering.

WOX7001   Research Methodology

Course Learning Outcomes
At the end of the course, students are able to:
1. Describe appropriate methodologies used in computer science and information technology research.
2. Devise a plan to be carried out within a feasible duration for answering research problems and questions identified.
3. Demonstrate attitude and character in line with professional and ethical codes in computer science and information technology research.

Synopsis of Course Content
This course gives on overview of the dimensions of research in computer science and information technology. Major considerations and tasks in conducting research in the areas such as review of literature, identify problem statement, formulate research questions and objectives, select an appropriate approach or method to the research, plan and manage the research, tools for research, data analysis, and writing and presentation strategies, will be discussed too.

Evaluation and Weightage
Continuous Assessment   **:** 100%
Final Examination   **:** 0%

WOA7015   Advanced Machine Learning

Course Learning Outcomes
At the end of this course, students are able to:

1. Practice concepts and techniques for machine learning related to digital and numerical methods.
2. Report the solution to machine learning problems by devising and listing the steps in machine learning applied to solve different types of problems
3. Demonstrate skills and knowledge on machine learning by managing a machine learning project.

Synopsis of Course Content
This course introduces advanced concepts and techniques for machine learning. It covers topics such as linear and logistic regression, decision tree, neural network, and support vector machines as well as reinforcement learning

Evaluation and Weightage
Continuous Assessment   : 50%
Final Examination   : 50%

WQF7002   Artificial Intelligence Techniques

Course Learning Outcomes
At the end of the course, students are able to:
1. Explain what constitutes Artificial Intelligence and identifying systems with Artificial Intelligence elements.
2. Analyse the applications of Artificial Intelligence techniques in intelligent agents, expert systems, artificial neural networks, and other machine learning models.
3. Apply basic principles of Artificial Intelligence in problem solving, inference, perception, knowledge representation, and machine learning

Synopsis of Course Content

This course introduces the core artificial intelligence concepts and skills that allow machines to mimic human intelligence. It contains a theory component about the concepts and principles that underlie modern AI algorithms, and a practice component to relate theoretical principles with practical implementation. Coverage includes knowledge representation, logic, inference, problem solving, search algorithms, game theory, perception, learning, planning, and agent design

Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQF7006   Computer Vision and Image Processing

Learning Outcomes
At the end of this course, the students are able to:

1. Evaluate suitable image processing techniques to solve artificial intelligence problems.
2. Evaluate performances of image processing methods for a given artificial intelligence scenario.
3. Design and develop image processing systems in the artificial intelligence domain

Synopsis of Course Content

This course explores image processing techniques in solving artificial intelligence problems. Image formation and image models are initial steps involved, It covers pixel and object level operations including histogram, edge, and segment. Image enhancement and restoration are compared. Image registration and image transform operations are included. Finally, image features and recognition processes are given. Deep learning approach for computer vision is included

Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQF7007   Natural Language Processing

Learning Outcomes
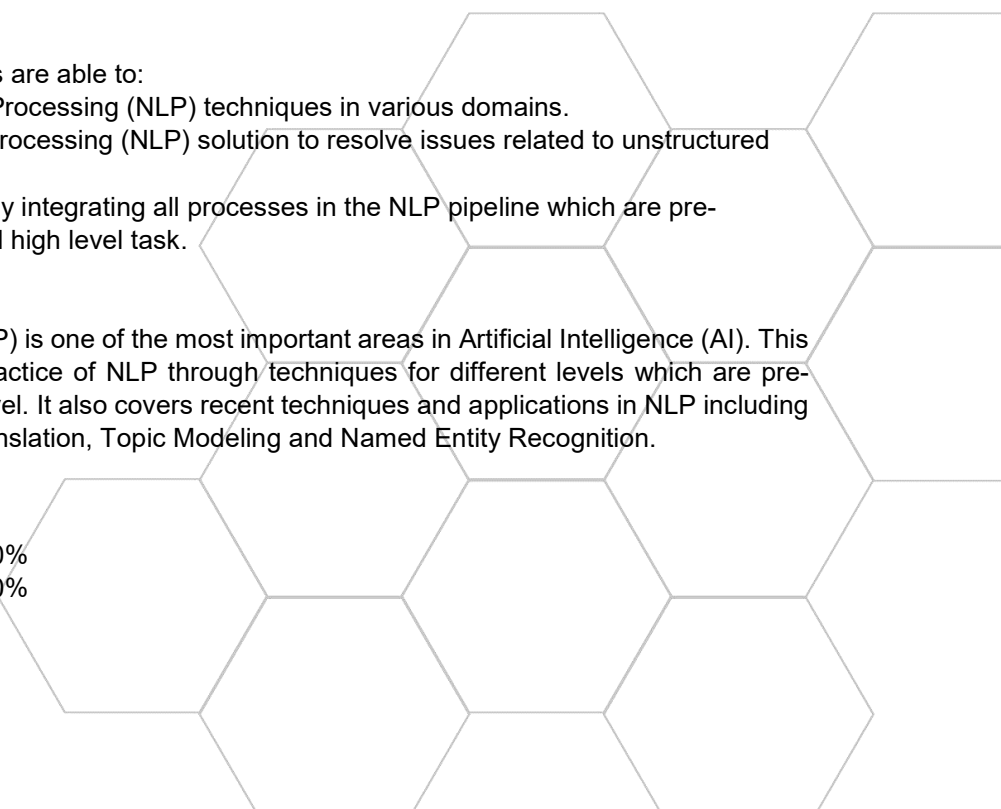At the end of the course, students are able to:
1. Apply the Natural Language Processing (NLP) techniques in various domains.
2. Design a Natural Language Processing (NLP) solution to resolve issues related to unstructured text.
3. Develop an NLP application by integrating all processes in the NLP pipeline which are pre-processing, low level task and high level task.

Synopsis of Course Content
Natural language processing (NLP) is one of the most important areas in Artificial Intelligence (AI). This course covers the theory and practice of NLP through techniques for different levels which are pre-processing, low-level and high level. It also covers recent techniques and applications in NLP including Sentiment Analysis, Machine Translation, Topic Modeling and Named Entity Recognition.

Evaluation and Weightage

Continuous Assessment   : 70%
Final Examination   : 30%

WQF7003   Intelligent Computation

Learning Outcomes
At the end of the course, students are able to:
1. Explain how mathematical theories help in solving AI problems.
2. Solve AI problems with formal reasoning.
3. Combine mathematical techniques in solving artificial intelligence problems.

Synopsis of Course Content
This course covers fundamental mathematical theories that support the development of artificial intelligence. Topics covered include logic and reasoning, linear algebra, graph theory and search algorithms, and probability theory.

This course finds relation with other courses in the program, such as: Advanced Machine Learning where linear algebra, graph theory and search algorithms are used heavily; Computer Vision and Image Processing where linear algebra and probability theory finds their applications; and Natural Language Processing which has relation with graph theory and search algorithms, as well as logic and reasoning. The content of this course is also the fundamental of courses like Practical Deep Learning and Artificial Intelligence Techniques.

Evaluation and Weightage

Continuous Assessment   : 50%
Final Examination   : 50%

WQF7004   Data Analytics in Artificial Intelligence

Learning Outcomes
At the end of this course, students are able to
1.   Explain the basic concepts of data analytics in Artificial Intelligence in various domains.
2.   Design domain-based data analytic pipeline to solve real world Artificial Intelligence problems.
3.   Apply suitable data analytics techniques to solve real world problems for Artificial Intelligence.

Synopsis of Course Content
This course aims to develop students' ability to describe, explore and analyse various types of data (tabular,text and images) using suitable data analytics techniques and do predictive modelling by using different Machine Learning techniques.

Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQF7005   Data Privacy and Artificial Intelligence Ethics

Learning Outcomes
At the end of this course, the students are able to:
1. Assess the importance of data privacy and ethical concepts in the development of Artificial Intelligence system.
2. Check current smart systems and technologies that are less concerned with ethical issues and data privacy.

3. Design Artificial Intelligence technology to be more responsible and in line with the needs of industry and society

Synopsis of Course Content
The course describes the concepts and philosophy of data privacy and ethics in Artificial Intelligence technologies. All strategies for developing a more responsible Artificial Intelligence system will be explained in more detail. The course also analyse and critique issues of data privacy violations or unethical values in current smart systems and technologies

Evaluation and Weightage
Continuous Assessment   : 70%
Final Examination   : 30%

WQF7023   Artificial Intelligence Research Project

Learning Outcomes
At the end of this course, students are able to:
1. Design solution using artificial intelligence techniques for real world problems.
2. Develop Artificial Intelligence-based solution formulated on project objectives.
3. Explain solution in oral and written presentation related to artificial intelligence research.

Synopsis of Course Content
A research project is a medium-scale project to enable students to do research related to artificial intelligence. Research projects allow students to use actual data from industry partners or public data to create applications by applying knowledge in the basic, theories and scientific methods to solve problems related to artificial intelligence. During the project, students will engage in the overall process of general research, starting with identifying problems, collecting and processing data, recommending solution methods, applying appropriate scientific methods and ending with implementing affordable solutions and evaluations. At the end of the course, students are required to submit a project report and perform a project presentation.

Evaluation and Weightage
Continuous Assessment   : 100%
Final Examination   : 0%

WQF7008   Practical Deep Learning

Learning Outcomes
At the end of the course, students are able to:

1. Unifies the knowledge on the fundamentals and architectures of deep learning, and the need for parallel and distributed computing for deep learning.
2. Integrate and develop the requirements for cloud computing infrastructure, GPU and relevant software as well as tools for setting up, modelling, debugging and serving of deep learning projects.
3. Practise the knowledge and skills to design deep learning based solutions.

Synopsis of Course Content

This course is closely linked with the Advance Machine Learning course which is a pre-requisite for this course. It reinforces the knowledge on the fundamental concepts related to deep learning (such as different deep learning architectures) and introduces practical techniques to get started on Artificial Intelligence projects and develop an industry portfolio. Specifically, it will provide the necessary knowledge and skills on how to design a deep learning production system end-to-end: project scoping, data needs, modelling strategies, and system deployment requirements.

Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQF7009   Explainable Artificial Intelligence (XAI)

Learning Outcomes

At the end of the course, students are able to:

1. Categorize the concepts of Explainable Artificial Intelligence (AI) and the current techniques for generating explanations from black-box machine learning methods.
2. Design the Explainable AI methods.
3. Develop the ability to critically assess the state-of-the-art of Explainable AI methods.

Synopsis of Course Content

This course gives an introduction to Explainable AI (XAI), providing an overview of relevant concepts such as interpretability, transparency and black-box machine learning methods. The course provides an overview of state-of-the-art methods for generating explanations, and touches upon issues related to decision-support, human interaction with AI/intelligent systems and their evaluation. In summary, the Explainable AI course covers the following topics: definitions and concepts such as black-box models, transparency, interpretable machine learning and explanations, explainable AI models, methods for Explainable AI, applications and examples.

Evaluation and Weightage

Continuous Assessment   : 60%
Final Examination   : 40%

WQF7010   Robotics and Automation

Learning Outcomes

At the end of the course, students are able to:

1. Design robotic and automation systems using parts like sensors, controllers and actuators.
2. Infer patterns from data collected.
3. Evaluate robotic and automation systems for optimum performance in various applications.

Synopsis of Course Content

This course focuses on developing robotic and automation systems by integrating components such as sensors, controllers, motors and actuators. Students apply data acquisition methods, control methods and also program robot sensing, connectivity, mobility and manipulation to achieve automation. Additionally, students can apply artificial intelligence techniques to analyse collected data for informed decision making.

Evaluation and Weightage

Continuous Assessment   : 70%
Final Examination   : 30%

WQF7011   Cognitive Computing

At the end of the course, students are able to:

1. Assess the relationship between cognitive computing systems, artificial intelligence and and human interaction.
2. Specify requirements and techniques for designing cognitive computing systems.
3. Develop cognitive computing systems as a solution for artificial intelligence applications.

Synopsis of Course Content

The student will learn and understand the concept of cognitive computing systems and its relations with artificial intelligence and big data. Students will also learn the requirements and techniques such as the characteristics, components and architecture needed to design cognitive computing system applications powered by multiple AI technologies encompassing machine learning, reasoning, natural language processing, speech recognition and vision (object recognition), human–computer interaction, dialog and narrative generation. In addition, students will also evaluate how such systems can be used to achieve human-like behaviors that improve the performance of human-machine interactions in various domains

Evaluation and Weightage

Continuous Assessment   : 70%
Final Examination   : 30%

WOA7019   Augmented Reality
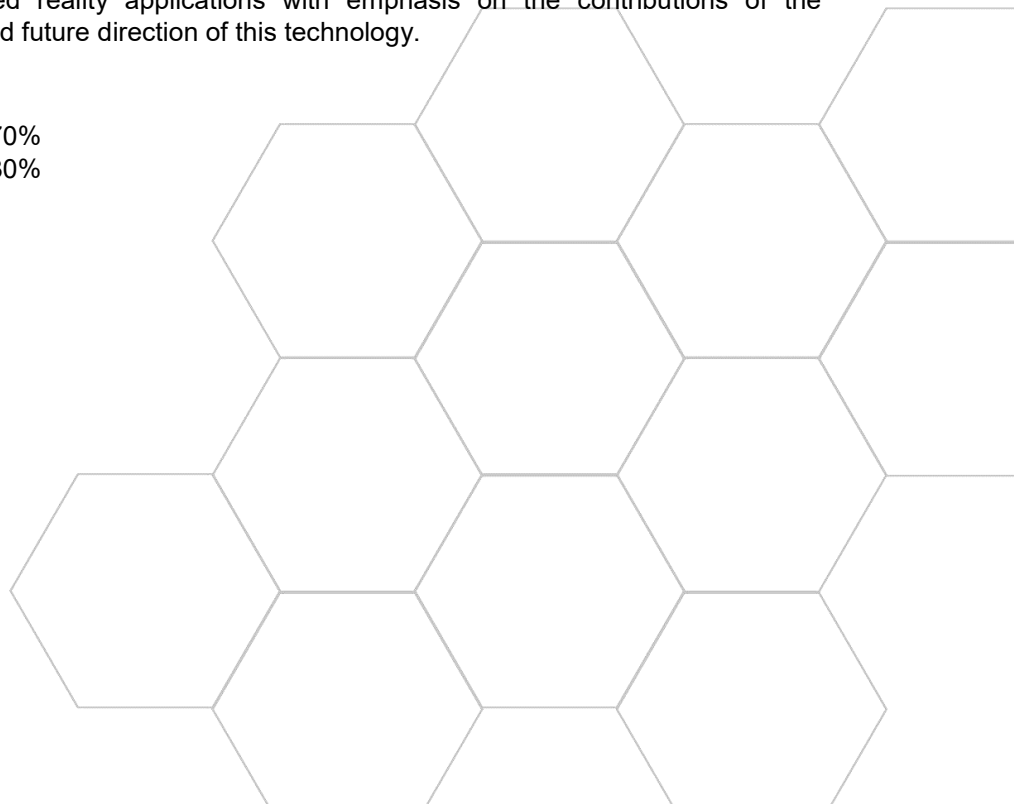
At the end of the course, students are able to:

1. Describe the technologies related to Augmented Reality.
2. Apply the related new technologies in the design of augmented reality applications.
3. Develop interactive augmented reality applications for both PC based and mobile devices using a variety of input devices.

Synopsis of Course Content

This course is designed to introduce students with knowledge related to augmented reality concepts and technology. This is followed with a discussion on how knowledge about human sensory systems can facilitate in designing ergonomic augmented reality devices that match human perceptual capabilities. Students are then trained to develop an augmented application using a suitable programming language and 3D software. Towards the end of the course, there will be discussions on several examples of augmented reality applications with emphasis on the contributions of the augmented reality technology and future direction of this technology.

Evaluation and Weightage

Continuous Assessment   : 70%
Final Examination   : 30%

MASTER OF COMPUTER SCIENCE (BY RESEARCH)

MASTER OF COMPUTER SCIENCE (BY RESEARCH)
PROGRAMME REQUIREMENTS

1. **Programme Type**

   The type of programme offered for the Master of Computer Science by Research is one hundred percent (100%) research leading to the submission of a dissertation.

2. **Admission Requirements**

   (a) Qualifications for Admission

   (i) A Bachelor's degree with Honours or a comparable degree in Computer Science or Information Technology or in a related field;

   OR

   (ii) Other qualifications approved by the University Senate.

   (ii) Priority is given to applicants who have a CGPA of 3.0 and above or equivalent.

   (b) English Language Proficiency

   International candidates are required to:

   At least IELTS Band 6 (Academic) or TOEFL score of 550 (paper based) / 213 (computer based) / 80 (Internet based) /PTE Academic/PTE Online with minimum score 57 if their first degree is from a university where English is not the medium of instruction.
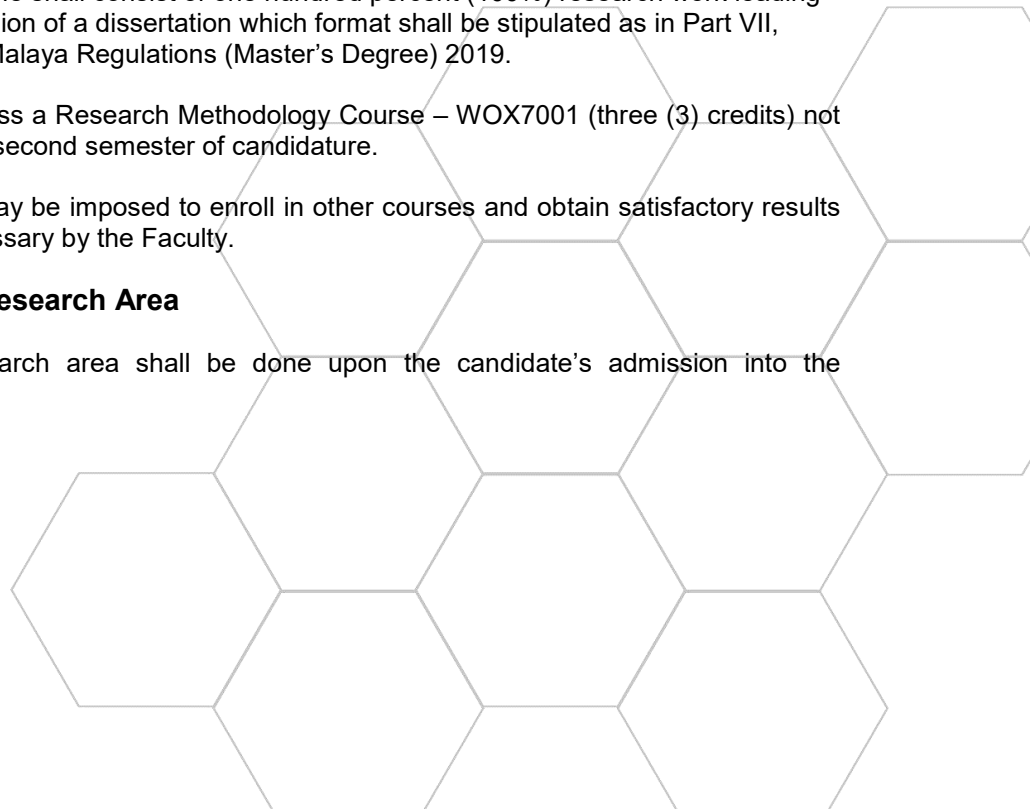
3. **Duration of Study**

   The programme of study : two (2) to eight (8) semesters.

4. **Programme Structure**

   (i) This programme shall consist of one hundred percent (100%) research work leading to the submission of a dissertation which format shall be stipulated as in Part VII, University of Malaya Regulations (Master's Degree) 2019.

   (ii) Attend and pass a Research Methodology Course – WOX7001 (three (3) credits) not later than the second semester of candidature.

   (iii) Candidates may be imposed to enroll in other courses and obtain satisfactory results deemed necessary by the Faculty.

5. **Determination of Research Area**

   Determining the research area shall be done upon the candidate's admission into the programme.

LEARNING OUTCOMES FOR MASTER BY RESEARCH

To be awarded a master's degree by research, a candidate shall:

1. Demonstrate a systematic understanding of knowledge by identifying research problems or insights in a particular field
2. Apply appropriate research methodologies and techniques
3. Relate leadership qualities through communicating and working effectively with peers and stakeholders
4. Conduct research with minimal supervision and adhere to legal, ethical and professional codes of practice
5. Publish in peer-reviewed academic journals in his/her field of study
6. Appraise research findings using scientific and critical thinking skills
7. Manage information for lifelong learning

CANDIDATURE REQUIREMENTS

Master of Computer Science (Master by Research)

No	Requirement
1.	Fulfil the minimum candidature duration of 2 semesters.
2.	Fulfil the University language requirement (Bahasa Malaysia and English) no later than the second (2nd) semester of candidature
3.	Fulfil the residential requirement of 6 months Candidates are considered to have fulfilled the residential requirement if they have completed requirements **4, 5 and 6** and including the following: (a) Face-to-face consultation with the supervisor(s) as imposed by the faculty; and/or (b) Participation in any faculty activities as required by the faculty
4.	Attend at least three (3) credits of the **Research Methodology Course no later than the second (2nd) semester** of candidature.
5.	Present a research proposal at **Proposal Defence** no later than the second (2nd) semester of candidature
6.	Present research progress at **Candidature Defence** no later than the third (3rd) semester of candidature

The candidates must fulfil the following publication requirement before the Examination Committee (Board) meeting:

Publication Requirements

- Master's Degree Candidate pursuing a programme in the field of Science must show proof of acceptance of publication for at least one (1) paper in ISI (WoS) Journals before a Committee of Examiners meeting.

- Master's Degree Candidate pursuing a programme in the field of Social Science must show proof of acceptance of publication for at least one (1) paper in the category A or B refereed journal recognized by Faculty/Academy/Institute/Centre prior to a Committee of Examiners meeting.

Graduate on Time (GOT) Schedule for Masters by Research Candidates

Semester	Activities	Output/Milestone	Comments
1	• Attend Research Methodology Course • Attend Bahasa Melayu course* • Attend English language course** • Familiarization with and use of EndNote, Turnitin, editing software, data analysis and research tools • Attend GOT seminar • Conduct Literature Review • Proposal Defence	• Completed Research Methodology course • Fulfilment of language requirements • Presented research proposal	
2	• Expand research proposal to drafts of chapter 1, 2 & 3 • Conduct pilot study/ planning & setting up of experiment/ start data collection • Begin data analysis • Attend at least 2 courses in Upskill Program • Prepare and present Candidature Defence • Prepare for Publication 1	• Completed outline of dissertation • Submission of Publication 1 • Completed Candidature Defence	
3	• Finalise chapters 1, 2 & 3 • Finalise data analysis • Begin chapter 4 & 5 • Attend at least 1 courses in Upskill Program • Submit 3 Months Notice	• Completed chapters 1, 2 & 3 • Draft of chapters 4 & 5	
4	• Attend Thesis Bootcamp	• Submission of dissertation • Outcome of Committee of Examiners	

Semester	Activities	Output/Milestone	Comments
	• Finalize and submit dissertation • Committee of Examiners meeting	meeting	

Notes:
Monitoring Panel

1. Chairman & 1 member who is an expert in the field and a supervisor. A fourth member is allowed to be appointed if necessary.
2. The same panel should follow through the proposal presentation and Candidature Defense.
3. It is strongly recommended that one member is appointed as internal examiner.
4. The main responsibilities of the panel should include the following:-
   a) Advise the student to improve the research proposal.
   b) Monitor the progress of the student
   c) Improve the research plan.

* Applicable to all international candidates.
** Applicable to international candidates who are writing their dissertation in languages other than English.

COURSE CONTENT OF RESEARCH METHODOLOGY

WOX7001   Research Methodology

Course Learning Outcomes

At the end of the course, students are able to:

1. Describe appropriate methodologies used in computer science and information technology research.
2. Devise a plan to be carried out within a feasible duration for answering research problems and questions identified.
3. Demonstrate attitude and character in line with professional and ethical codes in computer science and information technology research.

Synopsis of Course Content

This course gives on overview of the dimensions of research in computer science and information technology. Major considerations and tasks in conducting research in the areas such as review of literature, identify problem statement, formulate research questions and objectives, select an appropriate approach or method to the research, plan and manage the research, tools for research, data analysis, and writing and presentation strategies, will be discussed too.

Evaluation and Weightage

Continuous Assessment   **:**   100%

Final Examination   **:**   0%

WOX7002   Dissertation
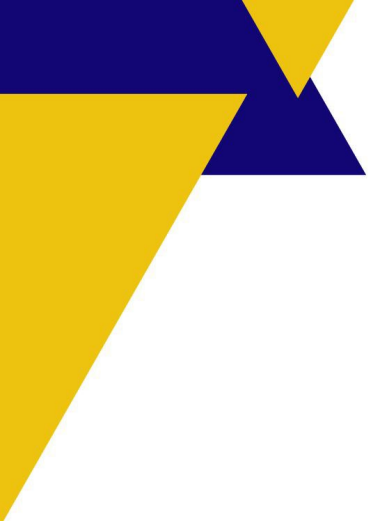
DOCTOR
OF PHILOSOPHY

COURSE CONTENT OF ADVANCED RESEARCH METHODS IN COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

WVX8001   **Advanced Research Methods in Computer Science and Information Technology**

Course Learning Outcomes

At the end of the course, students are able to:

1. Describe the epistemological issues underlying research in computer science and information technology.
2. Explain the approaches and issues involved in conducting research in computer science and information technology.
3. Employ appropriate advanced research designs when conducting computer science and information technology research.
4. Apply appropriate statistical techniques when conducting computer science and information technology research.
5. Prepare a viable doctoral level proposal for a research degree in computer science and information technology.

Synopsis of Course Content

This course covers the scope, types, basic skills and methodological aspects of computer science and information technology research. Topics include design of experimental research, survey research, grounded theory and phenomenological research, case study, action research, role of statistics in research and art of preparing a research proposal.

Evaluation and Weightage

Continuous Assessment   **:**   100%

Final Examination   **:**   0%

WVX8002   **Thesis**

PROGRAMME EDUCATION OBJECTIVES
FOR DOCTOR OF PHILOSOPHY

PEO 1:
Foster innovation of new ideas, methods and techniques in relevant research fields

PEO 2:
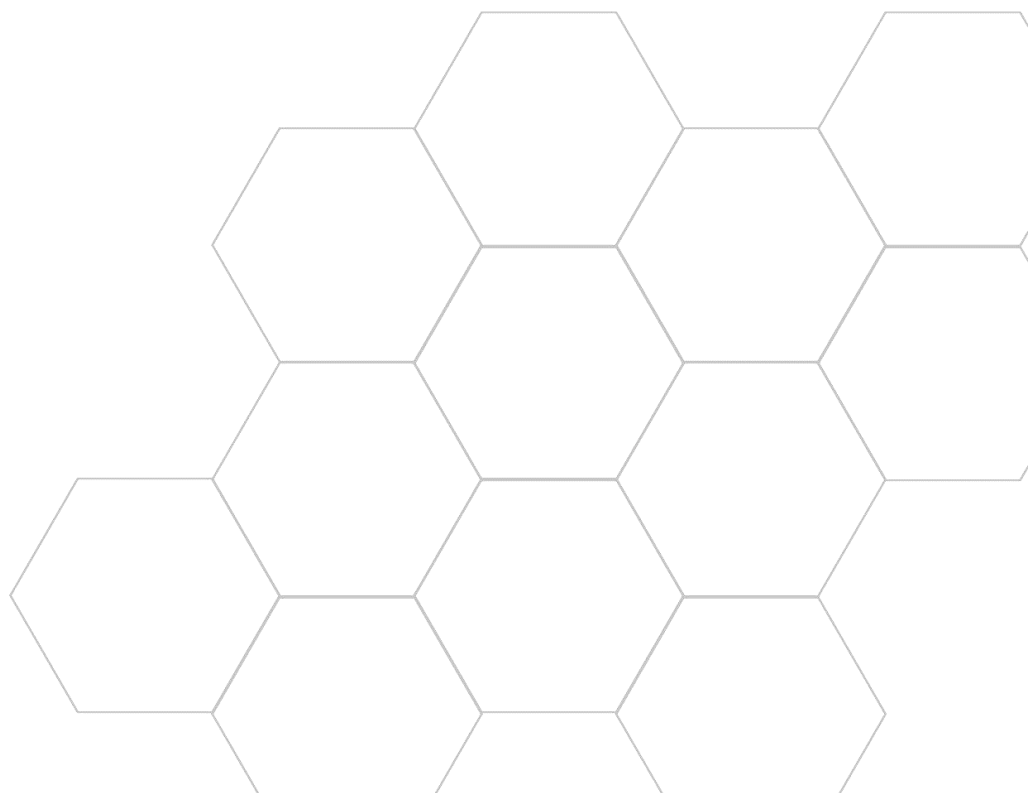Lead research and establish a career as a skilled researcher and/or practitioner

PEO 3:
Disseminate research output and provide expert advice through various mechanisms in an ethical and professional manner

LEARNING OUTCOMES FOR DOCTOR OF PHILOSOPHY DEGREE

1. Synthesis and contribute knowledge in the respective research field.

2. Adapt appropriate practical skills and research methodologies leading to innovative research.

3. Provide expert advice to relevant stakeholders based on respective research output.

4. Conduct research independently and adhere to legal, ethical and/or professional codes of practice.

5. Display leadership qualities through effective communication and collaboration with peers and stakeholders.

6. Address issues in the field of research critically by using appropriate problem solving and/or scientific skills.

7. Integrate information for lifelong learning.

CANDIDATURE REQUIREMENTS

Doctor of Philosophy Degree:

No	Requirement
1.	Fulfil the minimum candidature duration of 4 semesters.
2.	Fulfil the University language requirement (Bahasa Malaysia and English) not later than the second (2nd) semester of candidature.
3.	Fulfil the residential requirement of 6 months Candidates are considered have fulfiled the residential requirement if they have completed requirements **4, 5, 6 and 7** and including the following: (a) Face-to-face consultation with supervisor(s) as imposed by the faculty; and/or (b) Participation in any faculty activities as required by the faculty.
4.	Attend at least 3 credits of **Research Methodology Course** not later than the second (2nd) semester of candidature.
5.	Present your research proposal at **Proposal Defence** not later than the second (2nd) semester of candidature.
6.	Present your research progress at **Candidature Defence** not later than the fifth (5th) semester of candidature.
7.	Present your research progress at **Thesis Seminar** before the submission of thesis for examination.
The candidates must fulfil the following publication requirement before the Viva-Voce and the Examination Committee (Board) meeting:	
8.	**Publication Requirements** • Candidate pursuing a programme in the field of **Science** must show proof of acceptance of publication for at least two (2) papers in ISI (WoS) Journals prior to viva-voce and the Committee of Examiners meeting. • Timing – Publications must be within the candidature of the candidate. • Topics of Publications – Publications must be related and conform to the candidate's research in his/her thesis. • Affiliation – Publications must carry the affiliation of the department and/or faculty where the candidate is registered.

Proposed Graduate on Time Schedule
Major Administrative and Regulatory Milestones for PhD Candidates (Conventional PhD)
(Sciences)

Semester	Activities	Output/Milestone	Comments
1	• Attend Research Methodology Course • Attend Bahasa Melayu course* • Attend English language course** • Familiarization with and use of EndNote, Turnitin, editing software, data analysis and research tools • Conduct Literature Review • Proposal Defence	• Completed Research Methodology course • Fulfilment of language requirements • Presented research proposal	
2	• Complete Literature Review • Conduct pilot study/ planning & setting up of experiment/ start data collection • Attend at least 3 courses in Upskill Program (including GOT seminar) • Prepare for Candidature Defence	• Literature Review • Thesis Plan/Outline of Thesis • Submission of Publication 1 (review paper / experimental design)	• Candidates are strongly advised to use reference management software Eg: Mendeley, Bibtex, EndNote
3	• Investigation and development of the proposed solutions. • Data analysis • Candidature Defence report writing • Attend at least 2 courses in Upskill Program • Candidature Defence	• Completed Candidature Defence	• Candidature Defence report should include data collection, findings, thesis outline
4	• Experimentation and/or data analysis • Thesis write-up (Chapter 1, 2 & 3) • Preparation of manuscripts for submission of	• Submission of Publication 2 • Completed drafts of three chapters	

Semester	Activities	Output/Milestone	Comments
	Publication • Attend at least 2 courses in Upskill Program		
5	• Thesis write-up (complete remaining chapters) • Presentation of Thesis Seminar • Attend Thesis Bootcamp	• Completed thesis draft • Presented Thesis Seminar	
6	• Finalize and submit thesis • Prepare for viva voce	• Submission of thesis • Viva voce	

Notes:
Monitoring Panel
1. Chairman & 1 member who is an expert in the field and a supervisor. A fourth member is allowed to be appointed if necessary.
2. The same panel should follow through the proposal presentation (seminar 1, Candidature Defence and thesis seminar (seminar 2).
3. It is strongly recommended that one member is appointed as internal examiner.
4. The main responsibilities of the panel should include the following:-
   a) Advise the student to improve the research proposal.
   b) Monitor the progress of the student
   c) Improve the thesis plan.

*Applicable to all international candidates.
** Applicable to international candidates who are writing their theses in languages other than English.

Proposed Graduate on Time Schedule
Major Administrative and Regulatory Milestones for PhD Candidates (PhD – Fast Track)
(Sciences)

Semester	Activities	Output/ Milestone	Comments
1	• Attend Research Methodology Course • Attend Bahasa Melayu course* • Attend English language course** • Familiarization with and use of EndNote, Turnitin, editing software, data analysis and research tools • Conduct Literature Review • Proposal Defence	• Completed Research Methodology course • Fulfillment of language requirements • Presented research proposal	
2	• Complete Literature Review • Conduct pilot study/ planning & setting up of experiment/ start data collection • Attend at least 3 courses in Upskill Program (including GOT seminar) • PhD Confirmation Defence • Prepare for Candidature Defence	• Literature Review • Thesis Plan/Outline of Thesis • Submission of Publication 1 (review paper / experimental design) • Results of PhD Confirmation Defence (if unsatisfactory, continue as a Master student – refer to Master by Research GOT Schedule in Semester 3)	• Candidates are strongly advised to use reference management software Eg: Mendeley, Bibtex, EndNote
3	• Investigation and development of the proposed solutions. • Data analysis • Candidature Defence report writing and Candidature Defence • Attend at least 2 courses in Upskill Program	• Completed Candidature Defence report • Completed Candidature Defence	• Candidature Defence report should include data collection, findings, thesis outline

Semester	Activities	Output/ Milestone	Comments
4	• Experimentation and/or data analysis • Thesis write-up (Chapter 1, 2 & 3) • Preparation of manuscripts for submission of publication • Attend at least 2 courses in Upskill Program	• Submission of Publication 2 • Completed drafts of three chapters	
5	• Thesis write-up (complete remaining chapters) • Presentation of Thesis Seminar • Attend Thesis Bootcamp	• Completed thesis draft • Presented Thesis Seminar	
6	• Finalize and submit thesis • Prepare for viva voce	• Submission of thesis • Viva voce	

Notes:
Monitoring Panel

1. Chairman & 1 member who is an expert in the field and a supervisor. A fourth member is allowed to be appointed if necessary.
2. The same panel should follow through the proposal presentation (seminar 1, Candidature Defence and thesis seminar (seminar 2).
3. It is strongly recommended that one member is appointed as internal examiner.
4. The main responsibilities of the panel should include the following:-
   a) Advise the student to improve the research proposal.
   b) Monitor the progress of the student
   c) Improve the thesis plan.

*Applicable to all international candidates.
** Applicable to international candidates who are writing their theses in languages other than English.

MKA/AA/NFA (JPPIT 08.10.2015)

# GENERAL INFORMATION

LEGISLATIONS AND PRESCRIBED RULES

(1) Master's Programmes

Master's candidates are governed by the Universiti Malaya (Master's Degree) Rules and Regulations, 2019.

(2) Ph.D Programme

Ph.D candidates are governed by the Universiti Malaya (Degree of Doctor of Philosophy) Rules and Regulations, 2019. In addition to the above, all postgraduate candidates are also governed by the Universities and University Colleges Act, 1971 Constitution of the Universiti Malaya, and all other statutes, rules and regulations currently applicable in the University including the Universiti Malaya (Discipline of Candidates) Rules 1999.

The full texts of the above rules and regulations are available at https://umsitsguide.um.edu.my. As registered candidates of the Universiti Malaya, the candidates have the responsibility to be aware of and abide by the rules and regulations of the University, the policies and requirements of their respective faculties, and the advice contained in this handbook.
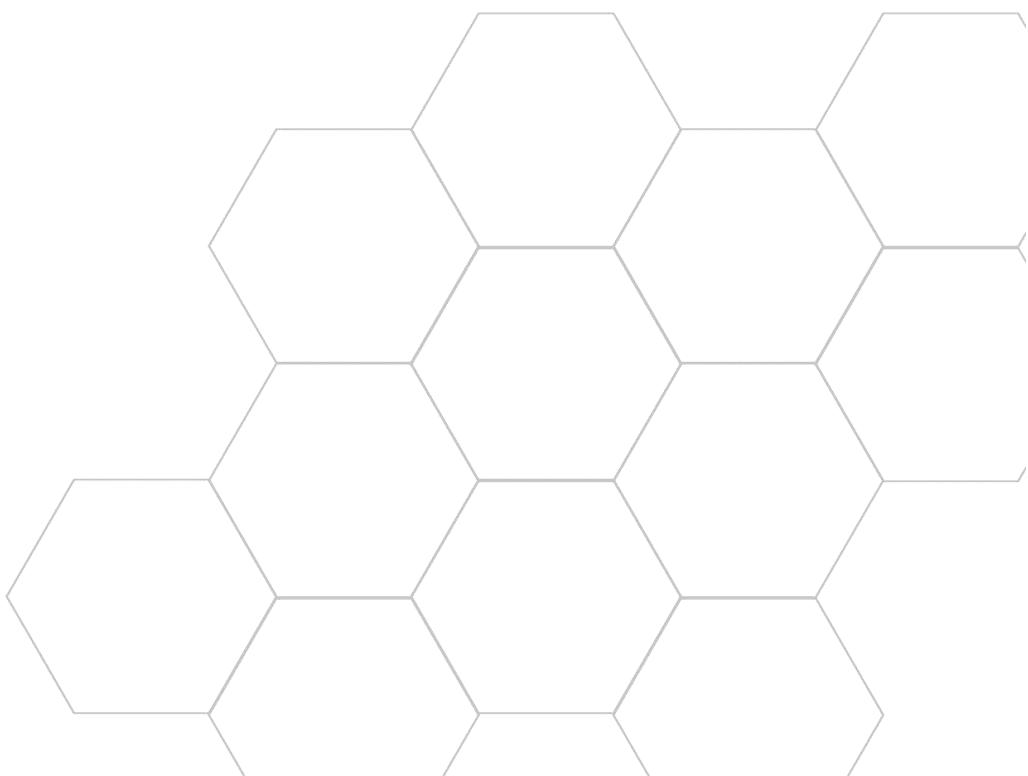
MARKING SCHEME AND GRADE POINT AVERAGE

The assessment for the examination of the coursework component is based on the following marking scheme:

MARKS	GRADE	GRADE POINT	MEANING
90.00 - 100.00	A+	4.00	HIGH DISTINCTION
80.00 - 89.99	A	4.00	DISTINCTION
75.00 - 79.99	A-	3.70	
70.00 - 74.99	B+	3.30	PASS
65.00 - 69.99	B	3.00	
60.00 - 64.99	B-	2.70	FAIL
55.00 - 59.99	C+	2.30	
50.00 - 54.99	C	2.00	
45.00 - 49.99	C-	1.70	
40.00 - 44.99	D+	1.50	
35.00 - 39.99	D	1.00	
0.00 - 34.99	F	0.00	

RESEARCH GUIDANCE

RESEARCH GUIDANCE

PROGRESS REPORT

All postgraduate research candidates are to submit a progress report online at the end of each semester as stipulated. The supervisor shall evaluate the progress report and submit the progress report to the Deputy Dean of Higher Degree/Head of Department. A candidate whose progress is satisfactory will be recommended for continuous of his/her candidature.

The Faculty shall terminate the candidature of a candidate whose progress is not satisfactory for **TWO** consecutive semesters. A candidate who fails to submit his progress report within the stipulated period shall be barred from registering for the following semester.

**SUPERVISION POLICY OF POSTGRADUATE CANDIDATES AT
THE UNIVERSITI MALAYA**

1. **Purpose**

   This policy was created with the following objectives:

   (1) To explain the criteria for the appointment of the supervisor and the role and responsibilities of the supervisor to the candidate in the research mode and the coursework and research modes.

   (2) To assist the Responsibility Centre (RC) in making plans for the infrastructure, the workload of the academic staff and intake of candidates.

   (3) To ensure the quality of supervision is assured and that the research produced by the candidate is consistent with the mission and vision of the University.

   (4) As a guide for academic staff and candidates in the Universiti Malaya in executing the responsibilities as a supervisor and research candidate.

2. **Appointment of Supervisor**

   The appointment of a supervisor must meet the following criteria:

   (1) It is encouraged to appoint at least two (2) supervisors for each candidate. If only one supervisor is appointed, the supervisor must have the experience of supervising until graduation at least two (2) candidates.

   (2) The appointed supervisor must have a minimum qualification equivalent to the degree or at par with the program registered by the candidate.

   (3) If the supervisor does not have the qualification stated, experience in the research field or related industry can be considered as the criteria for appointment as a Supervisor.

   (4) The appointment of a Supervisor shall take into account the research skills and experiences which are consistent with the research field of the candidate.

(5) Supervisors suggested by prospective candidates, are given priority to supervise, except in cases where the RC feels that other supervisors are more qualified to supervise.

(6) Academic staff on sabbatical leave may be allowed to supervise until the end of the leave, provided the leave does not affect the candidate's supervision. However, based on some specific reasons, the Supervisor may apply to not supervise the candidate while on leave and the decision is based on the discretion of the relevant RC.

(7) For academic staff who will be coming to the end of their services, the RC should ensure that a replacement supervisor is appointed at least six (6) months prior to the end of the service date of the initial supervisor so that both of them can co-supervise without affecting the progress of the candidate's research.

(8) For academic staff have left the service in Universiti Malaya but is still doing academic work elsewhere, they may be appointed as co-supervisor and the number of candidates supervised shall be limited to five (5) persons, where the candidates must be in their final stage of their studies.

(9) Appointment of an external party (either academic or non-academic) as co-supervisors can be considered if the external party is able provide research facilities and the expertise which will in turn assist the candidates in their research.

(10) Academic staff should attend training programs in supervision or enhancement courses prescribed by the Universiti Malaya.

(11) If the RC would like to appoint a supervisor who is not in compliance with all the criteria of appointment specified in the policy, the RC shall submit a letter of application together with a strong justification to the Dean of Graduate Studies Institute of Graduate Studies for consideration and approval.

(12) Appointment of supervisors shall be managed by the RC in compliance with all the criteria specified in this policy. Appointment made shall take into account the space, resources and expertise to support and assist candidates, with their research.

(13) If the appointment of a new supervisor is required for some reason, the appointment shall be made according to merit and this case is considered as a special case. This case cannot be referred to and be an example or a precedent for a case to come.

(14)   In the event of problems of supervision between supervisor and candidate, the RC should address this problem. If the problem cannot be resolved, the matter may be submitted to the Dean, Institute of Graduate Studies for further action.

3.   Ratio between Supervisor and Candidate

(1)   The maximum ratio for candidates to obtain quality supervision are as follows: -

Research Fellow 1:3
Lecturer 1:5
Senior Lecturer 1:7
Associate Professor 1:10
Jusa C Professor 1:15
Jusa B Professor 1:20
Jusa A Professor 1:25

(2)   RC may approve a higher maximum number of candidates provided that supervisor has shown excellent supervision performance.

(3)   RC can also set a different maximum number of students from above to meet the requirements of relevant professional bodies.

(4)   In calculating the supervisory workload, three (3) candidates of the mixed-mode is equal to two (2) candidates of the research mode.

4.   Change of Supervisor

Change of supervisor can be implemented as follows:

(1)   If there is strong justification and excuse, the candidate may apply to change the supervisor, not more than once during the period of candidature.

(2)   If there is a supervisor who did not perform the supervisory duties satisfactorily, the Dean of the RC may appoint any other qualified academic staff to replace the said supervisor.

5.   Family Links

(1)   Supervisors appointed shall not have a close family link to the candidate.

(2)   Both the appointed supervisors also must not have any family relationship with each other.

6. **Role and Responsibilities of the Supervisor**

The appointed supervisor shall exercise his/her role and responsibilities as set out in Appendix A.

7. **Role and Responsibilities of the Candidate**

The candidate shall also be responsible for the candidature and research throughout their status as a student in the Universiti Malaya as set out in Appendix B.

ROLE AND RESPONSIBILITIES OF THE SUPERVISOR

1. Before starting, the supervisor to the candidate will need to know the latest university rules and regulations relating to higher degree programs.

2. Supervisors should have adequate knowledge, enhanced theoretical and conceptual framework, and is up to date in the field of research of the candidate.

3. Supervisors should be knowledgeable about the work schedule provided for the completion of a research project so that it complies with the provisions of certain degrees. This is to ensure the smooth running of the candidate's research project.

4. Supervisors are responsible for providing relevant and adequate guidance and academic support to students during the supervision period to enable the candidate to carry out excellent research and writing. This responsibility includes guiding the careful planning of the research, the background and library research, the need to attend courses to complete the research, including scientific methods. Awareness about the impact of fraud and plagiarism should be informed to the candidate.

5. Supervisors should interact with the candidate at least two (2) times per month in the first semester and once (1) a month for the next semester. For the first meeting, the supervisor and the candidate must talk face to face, while, the next meeting may be conducted via other methods such as on-line.

6. Supervisors are responsible to ensure that candidates could communicate with relevant experts should the research area requires so. In certain cases, an additional supervisor or consultant may be appointed.

7. Each supervisor should be appointed to the candidates should know their responsibilities respectively and explained to the candidates on the aspects that will be monitored. In the event that two (2) supervisors were appointed for each candidate, the effective working relationship between all parties needs to be maintained together.

8. Supervisors need to help candidates in the preparation with regards to the presentation at conferences, seminars, meetings and workshops.

9. Supervisors are encouraged to record every meeting and discussion with the candidate about the study and research of the candidate by providing and updating the file on record of achievement and progress of research projects for each candidate.

10. Supervisors should evaluate the progress of the candidates by getting a written report and monitor the performance in a relative manner according to the quality set for a certain degree. Candidates should be informed if the quality of her work did not reach the required standard. If progress of the candidates is not satisfactory, the supervisor must take action to help the candidates improve their performance. Progress report for each semester for each candidate must be submitted by the supervisor to the Academic / Faculty / Institute / Centre as scheduled.

11. Supervisors should help candidates in academic writing, presentations in conferences and submitted for publication. For all the academic papers submitted for publication, written jointly by the supervisor and candidate, both have to agree to publish them together.

12. Supervisors need to help manage and secure any funds (example: Vote PPP, UMRG etc.) for research projects.

13. Supervisors must ensure work safety rules are followed during the research and are carried out in accordance with health and safety ethics policy specified by the University.

14. Supervisors should provide constructive and critical comments on the candidate's drafts of the thesis within a reasonable time and advise the candidate regarding the format of the thesis as specified by the University.

15. Supervisors should suggest and advise the Post Graduate Office of the RC in the process of nomination and evaluation of expertise of internal and external examiner. The supervisors also need to ensure that there are no delays in the process.

The Role of Supervisor in the Board of Examiners

1. The role of supervisor in the Board of Examiners is as the advisor. The supervisor is not involved in any discussions relating to the results of work submitted by the candidate. The supervisor does not function as an examiner.

2. The supervisor's attendance in the Board of Examiners shall be by invitation only.

3. Supervisors are expected to provide supervision reports in the required format within a specified time to the Post Graduate Office for the Board of Examiners meeting.

4. The supervisor should also help the candidates on the corrections to be done based on the comments raised by the Board of Examiners and continue to oversee the candidate in cases where the thesis is referred back for further study.

ROLE AND RESPONSIBILITIES OF THE CANDIDATE

1. Candidates should understand and fulfil all of the conditions contained in the letter of offer, rules and regulations applicable to the program. Examples are as follows:

    (A)   Book of the Universiti Malaya (Master's Degree) Regulations 2010 and the Universiti Malaya (Master's Degree) 2010;

    (B)   Book of the Universiti Malaya (Degree of Doctor of Philosophy) 2007 and Regulations of the Universiti Malaya (Degree of doctor of Philosophy 2007);

    (C)   Program handbook, and

    (D)   Postgraduate Handbook.

2. Candidates should interact with the supervisor at least two (2) times per month in the first semester and once (1) a month the next semester. For the first meeting, the candidate and supervisor should talk face to face, while, the next meeting can be conducted via other methods such as online.

3. Candidates shall record meetings and discussions on their research each time they meet with the supervisor.

4. Candidates should have a good working relationship with the supervisor.

5. Candidates must plan the project schedule and comply with the maximum period of study.

6. Candidates should discuss and agree with the supervisor on consultation times.

7. Candidates must submit progress as specified without falsifying the research outcome and is free of plagiarism.

8. Candidates must notify their supervisor of any problems that may interfere with the research.

9. Candidates shall engage in academic activities organized by the department or the RC.

10. Candidates must plan and ensure sufficient time to do the research and write the thesis.

11. Candidates should ensure that their candidature is always active by renewing their registration each semester.

12. A candidate shall give three months' notice to the supervisor or inform the supervisor the date for submission of the thesis for examination purposes, so there is no delay in the appointment of examiners.

13. Candidates are solely responsible for the content, the presentation of thesis and viva-voce presentation.

14. Candidates are responsible for ensuring that corrections are made in a given period after the Board of Examiner's meeting / viva-voce and the Senate.

UNIVERSITI MALAYA	**GUIDELINES FOR THE PREPARATION OF RESEARCH REPORT, DISSERTATION AND THESIS**

TABLE OF CONTENTS

PREFACE

In the process of completing a postgraduate programme and being awarded the degree by the Universiti Malaya, a candidate may be required to submit a research report or dissertation or thesis, depending on the requirements of the specific programme.

The terms "research report", "dissertation" and "thesis" are defined as follows:

- Research Report refers to the documentation of research prepared and submitted by the candidate for the award of a Master's degree by Coursework or Master's Degree by Clinical which may include research paper, research project, project paper, project report and research outcome concerned known by whatsoever name;
- Dissertation refers to the documentation of the original research prepared and submitted by the candidate for the award of a Master's degree by Research, and Master's Degree by Mixed Mode as well as Doctoral degree by Coursework and Doctoral degree by Clinical;
- Thesis refers to the documentation of the original research prepared and submitted by the candidate for the award of a Doctoral degree by Research and Doctoral degree by Mixed Mode.

This guideline will assist the candidates to meet the minimum format requirements set by the University to complete the final form of a research report, dissertation or thesis. However, the format may differ in each individual Academy/Faculty/Institute/Centre with its own additional requirements. In this guideline, the term 'faculty' will be used to refer to Academy/Faculty/Institute/Centre.

CHAPTER 1: FORMAT OF WRITING

A research report, dissertation or thesis can be written in one of the following formats:
- Conventional format;
- Article style format;
- Format of published papers (this option is only available for Doctoral programme by research candidates)

These formats serve as a generic guideline for the postgraduate candidates in writing a research report, dissertation or thesis. Minor variation of the format as recommended by the faculty is allowed. Candidates are advised to discuss with their supervisors to determine which format is best suited for the nature of their research work.

1.1   Conventional Format
The conventional format follows the traditional monograph structure (Table 1.1). This is the most common form of research report/dissertation/thesis used by the candidates.

Table 1.1: The general structure that follows the conventional format

Preliminary
▪ Title Page
▪ Original Literary Work Declaration
▪ Abstract
▪ *Abstrak*
▪ Acknowledgements
▪ Table of Contents
▪ List of Figures
▪ List of Tables
▪ List of Symbols and Abbreviations
▪ List of Appendices
Main Body
▪ Chapter 1: Introduction
▪ Chapter 2: Literature Review
▪ Chapter 3: Methodology
▪ Chapter 4: Results
▪ Chapter 5: Discussion
▪ Chapter 6: Conclusion
▪ References (A consolidated list of references for all chapters)
Supplementary
▪ List of Publications and Papers Presented
▪ Appendix

1.2   Article Style Format

Apart from the conventional style of writing, a research report/dissertation/thesis can also be presented in the chapters that are in the format of journal article (Table 1.2). The number of chapters to be included is at the discretion of the author, depending on the suitability of the chapters in answering the research questions.

This format is also applicable to candidates of Doctoral Degree by Research using **Concurrent or Prospective Publication**. The candidate submits a thesis/conspectus[1] which incorporates publications that may have multiple authors since registration. The candidate may also present a portfolio of interconnected, published research papers or articles encapsulated in a coherent thesis/conspectus, demonstrating overall an original contribution to knowledge. Such publications may include papers, chapters, monographs, books, scholarly editions of a text, technical reports, creative work in relevant areas, or other artefacts. The thesis (with the publications or equivalent works) must meet the criteria and outcomes established for a doctoral award and assessed through a *viva voce*.

The article style format should not be confused with the format for thesis by retrospective or prior publication. Similar to the conventional format, a research report/dissertation/thesis in the article style format should be written extensively to elucidate the different aspects of the research work in great details.

The main body of a research report/dissertation/thesis in the article style format should contain the following chapters:

(a) General Introduction
   The General Introduction gives an overview of the research by outlining the objectives, novelty as well as the research questions addressed. This chapter should also explain the correlation among the articles/chapters.

(b) Literature Review
   The Literature Review provides extensive background information on past studies and current knowledge pertaining to the research topic.

(c) Article 1, Article 2, Article 3 or more
   Each article should address a specific research objective or a related topic of the study. Each article forms a separate chapter and must be written in a cohesive manner with a logical and coordinated progression from one article/chapter to the other. The article/chapter should consist of its own sections on Introduction, brief Literature Review, Methodology, Results, Discussion and Conclusion.

(d) Conclusion and Recommendation
   The Conclusion chapter summarizes the findings in all articles and suggests the future direction for research.

The format specifications of the research report/dissertation/thesis must conform to the general research report /dissertation/thesis requirements as outlined in Chapter 2.

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[1] A critical review which locates the artefact/s within a coherent theoretical framework and field/s of study.

Table 1.2: The general structure that follows the article style format

Preliminary
▪ Title Page
▪ Original Literary Work Declaration
▪ Abstract
▪ *Abstrak*
▪ Acknowledgements
▪ Table of Contents
▪ List of Figures
▪ List of Tables
▪ List of Symbols and Abbreviations
▪ List of Appendices

Main Body
▪ Chapter 1: General Introduction
▪ Chapter 2: Literature Review
▪ Chapter 3: Article 1*
3.1 Introduction
3.2 Literature Review
3.3 Methodology
3.4 Results
3.5 Discussion
3.6 Conclusion
▪ Chapter 4: Article 2*
4.1 Introduction
4.2 Literature Review
4.3 Methodology
4.4 Results
4.5 Discussion
4.6 Conclusion
▪ Chapter 5: Article 3*
5.1 Introduction
5.2 Literature Review
5.3 Methodology
5.4 Results
5.5 Discussion
5.6 Conclusion
▪ Chapter 6: Conclusion
▪ References (A consolidated list of references for all chapters)

> ***Note:***
> **Article is written with a specific title which normally refers to the research done*

Supplementary
▪ List of Publications and Papers Presented ▪ Appendices ▪ Co-authors Consent

1.3 Format of Published Papers

The University also permits the presentation of thesis for the programme of Doctoral Degree by Research i.e. Doctor of Philosophy (PhD) in the format of published and/or submitted papers, where such papers have been published or accepted by high impact journals (e.g. journals indexed by Web of Science), monographs, books, research-based chapters in books, electronic publications, creative works, artefacts in the field before or during the period of candidature (Table 1.3).

Papers submitted as a PhD thesis must be based on a particular theme or focus and form a cohesive research write up. The quality of a thesis by published papers should be in accordance with PhD-level research and must meet the criteria and outcomes established for a doctoral award. The following aspects should be taken into consideration before opting for this format of writing:

(a) Type of Publications

The thesis may comprise published papers and/or manuscripts accepted for publication by high impact journals (e.g. journals indexed by Web of Science), monographs, books, research-based chapters in books, electronic publications, creative works, artefacts in the field which have not been used to obtain other awards or deemed a part of those awards.

(b) Number of Publications

For candidates under the programme of **Doctoral Degree by Retrospective or Prior Publication**, the minimum number of publications or productions is at least five (5) and these works must be those published retrospectively within a period not exceeding 10 years from the date of application. However, in some disciplines a larger number of papers is required to meet the expectations of scope and quality in accordance with PhD-level research.

(c) Authorship

Where the papers have more than one author, the candidate must be the first author or creator of five (5) of the published works or productions submitted with the contributions of others clearly defined.

(d) Co-authors Consent

Candidates must obtain the consent from other co-authors for all papers and/or manuscripts and/or publications or production used as part of their PhD thesis. The consent can be in the form of a verification from the journal publisher or letter or email communication with the co-authors.

(e) Structure of Thesis

The thesis in the format of published papers shall consist of the following:

(i) An **abstract**, which summarises the most important findings presented in each published paper or accepted manuscript or production. It should indicate how the included works are thematically linked or tied to a particular research framework and how, when considered together, they contribute significantly to knowledge in the discipline.

(ii) The **Introduction** chapter should include the following:
- description of research problem investigated;
- objectives of the study;
- list of publications and/or accepted manuscripts or production;
- the account of research progress linking the publications.
  The account of research progress must link together the various papers or production submitted as part of the thesis so that the reader can understand the logic behind the progression of the research programme.

(iii) The **Literature Review** chapter must contain, in accordance with the relevant discipline's norms, a critical review of relevant literature, identify the knowledge gaps and the relationship of the literature to the area of research.

(iv) The **Methodology** chapter (where applicable).

(v) The core chapter of the thesis consist of the published papers or accepted manuscripts or production in their **original publication format** and should NOT be retyped or reformatted. They must be presented coherently in the thesis according to the requirement of the University of Malaya Doctoral Degree Regulations (latest version), including any accompanying declarations. The following must be indicated for any jointly written paper:

- Acknowledgment of co-authors and verification of originality.
- A clear statement of the contribution made by each author in any joint published work or production. For example, a statement of contribution from a 3-author academic research publication is as follows:

  Tang, J.M.Y., Adli, D.S.H., & Belabut, D. (2011). Histological development of selected neural structures of Dark-sided Chorus Frog,

Microhyla heymonsi (Amphibia: Anura). *Malaysian Journal of Science*, *29*(1), 11-18.

Tang, J.M.Y. participated in all experiments, coordinated the data analysis and contributed to the writing of the manuscript. Adli, D.S.H. supervised the development of work and edited the manuscript. Belabut, D. gave technical support and conceptual advice, and helped in data interpretation.

(v) The **Discussion** chapter explains the cumulative effect of the papers, the significance of the findings and the knowledge claimed in the thesis.

(vi) The **Conclusion** summarizes the findings in all published works or production and suggests the future direction for research.

(vii) The **References** chapter lists all works and sources that are cited in the Introduction, Literature Review and Conclusion chapters.

In general, the examination process for theses in the format of published papers is similar to that of conventional theses. However the aspects of thesis being evaluated by the examiners may slightly differ.

Candidates under the programme of **Doctoral Degree by Retrospective or Prior Publication** are required to refer to the *Guidelines for Admission To The Universiti Malaya Doctoral Degree By Research Programme Via Retrospective or Prior Publication* (latest version) for further details.

Table 1.3: The general structure that follows the format of published papers

Preliminary
- Title Page   - Original Literary Work Declaration   - Abstract   *Abstrak*   - Acknowledgements   - Table of Contents   - List of Figures   - List of Tables   - List of Symbols and Abbreviations   - List of Appendices
Main Body

- Chapter 1: Introduction   - Chapter 2: Literature Review   - Chapter 3: Methodology *(where applicable)*   - Chapter 4: *Published Paper 1
     *Published Paper 2
     *Published Paper 3 and so on   *Note: Authors' contributions must be indicated for each published paper*   - Chapter 5: Discussion   - Chapter 6: Conclusion   - References (List of references for chapters of Introduction, Literature Review and Conclusion)

Supplementary
- List of Publications and Papers Presented   - Appendices   - Co-authors Consent

CHAPTER 2: SEQUENCE OF CONTENTS

The structure of the research report, dissertation or thesis is based on a standard format which contains the three main sections; **Preliminary**, **Main Body** and **Supplementary**.

2.1 Preliminary

This section consists in order of the following:

- Title Page
- Original Literary Work Declaration Form
- Abstract
- *Abstrak*
- Acknowledgements
- Table of Contents
- List of Figures
- List of Tables
- List of Symbols and Abbreviations
- List of Appendices

2.1.1 Title Page

The title page is the first page after the front cover and should include:

(a) The final research title which has been approved by the faculty;

(b) Name of candidate according to the registration records;

(c) A statement according to the mode of programme (Table 2.1); and

(d) The year of submission.

Table 2.1: Statement on Title Page according to mode of programme

Master's Degree		
Research report (by Coursework or by Clinical)	**Dissertation (by Mixed mode)**	**Dissertation (by Research)**
RESEARCH REPORT SUBMITTED TO THE (name of the Faculty) UNIVERSITI MALAYA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF (Name of Programme)	DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF (Name of Programme)	DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF (Name of Programme)
Doctoral Degree		
Dissertation (by Coursework or by Clinical)	**Thesis (by Mixed mode)**	**Thesis (by Research)**
DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF (Name of Programme)	THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF (Name of Programme)	THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF (Name of Programme)

This page is the first page of Roman numeral page number but it is not numbered. The text should be typed using font type **Times New Roman**, font **size 14 with 1.15 pt. line spacing**.

(a)

TITLE OF RESEARCH REPORT

NAME OF CANDIDATE

SUBMITTED TO THE GRADUATE
SCHOOL OF BUSINESS AND
ACCOUNTANCY UNIVERSITI
MALAYA, IN PARTIAL FULFLMENT
OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF BUSINESS
ADMINISTRATION

202x

(b)

TITLE OF DISSERTATION

NAME OF CANDIDATE

DISSERTATION SUBMITTED IN
PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE
OF MASTER OF LINGUISTICS

NAME OF FACULTY / ACADEMY /
INSTITUTE / CENTRE
UNIVERSITI MALAYA
KUALA LUMPUR

202x

(c)

TITLE OF DISSERTATION

NAME OF CANDIDATE

DISSERTATION SUBMITTED IN
FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE
OF MASTER OF PHILOSOPHY

NAME OF FACULTY / ACADEMY /
INSTITUTE / CENTRE
UNIVERSITI MALAYA
KUALA LUMPUR

202x

(d)

TITLE OF DISSERTATION

NAME OF CANDIDATE

DISSERTATION SUBMITTED IN
PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF MANAGEMENT

NAME OF FACULTY / ACADEMY /
INSTITUTE / CENTRE
UNIVERSITI MALAYA
KUALA LUMPUR

202x

Figure 2.1, continued

(e)

> TITLE OF THESIS
>
> NAME OF CANDIDATE
>
> THESIS SUBMITTED IN PARTIAL
> FULFILMENT OF THE
> REQUIREMENTS FOR THE DEGREE
> OF DOCTOR OF PUBLIC HEALTH
>
> NAME OF FACULTY / ACADEMY /
> INSTITUTE / CENTRE
> UNIVERSITI MALAYA
> KUALA LUMPUR
>
> 202x

(f)

> TITLE OF THESIS
>
> NAME OF CANDIDATE
>
> THESIS SUBMITTED IN
> FULFILMENT OF THE
> REQUIREMENTS FOR THE DEGREE
> OF DOCTOR OF PHILOSOPHY /
> MEDICINE
>
> NAME OF FACULTY / ACADEMY /
> INSTITUTE / CENTRE
> UNIVERSITI MALAYA
> KUALA LUMPUR
>
> 202x

Figure 2.1: Examples of title page

(a) Master's research report by coursework and by clinical, (b) Master's dissertation by Mixed mode, (c) Master's dissertation by research, (d) Doctoral dissertation by coursework and by clinical, (e) Doctoral thesis by mixed mode, and (f) Doctoral thesis by research.

(e)	(f)
TITLE OF THESIS NAME OF CANDIDATE THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PUBLIC HEALTH NAME OF FACULTY / ACADEMY / INSTITUTE / CENTRE UNIVERSITI MALAYA KUALA LUMPUR 202x	TITLE OF THESIS NAME OF CANDIDATE THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY / MEDICINE NAME OF FACULTY / ACADEMY / INSTITUTE / CENTRE UNIVERSITI MALAYA KUALA LUMPUR 202x

Figure 2.1: Examples of title page

(a) Master's research report by coursework and by clinical, (b) Master's dissertation by Mixed mode, (c) Master's dissertation by research, (d) Doctoral dissertation by coursework and by clinical, (e) Doctoral thesis by mixed mode, and (f) Doctoral thesis by research.

2.1.2 Original Literary Work Declaration

This form must be completed by the candidate and signed by a witness (Supervisors or Head of Department/Deputy Dean of Postgraduate). The original signed form must be included in all copies of the research report/dissertation/thesis. The form can be downloaded from the MAYA website in two (2) languages (English and Bahasa Malaysia). If the research report/dissertation/thesis is written in English, hence the English version of the form is used and vice versa.

Figure 2.2: Original Literary Work Declaration
(a) English, (b) Bahasa Malaysia

2.1.3 **Abstract**

An abstract is a short summary of the research report/dissertation/thesis. An abstract should briefly describe the objectives of the research (problem statement), the significance of the research, research methodology, as well as the findings and conclusion of the research.

The Abstract page begins with the title of research report/dissertation/thesis (in uppercase) that is approved by the faculty. Candidates are not allowed to change the title without the approval of the faculty.

An abstract must not exceed 500 words, typed in a single paragraph with double-spacing, and written in Bahasa Malaysia and English language. A maximum of five (5) keywords should also be listed below the abstract (Figure 2.3).

Where the language of the thesis is other than Bahasa Malaysia [Malaysia] or English [United Kingdom], an abstract in that language must also be included. The sequence of abstracts is as follows:

- For research report /dissertation/thesis written in Bahasa Malaysia, the abstract in Bahasa Malaysia is followed by the English version.
- For research report /dissertation/thesis written in English, the abstract in English is followed by the Bahasa Malaysia version.
- For research report /dissertation/thesis written in Arabic, the abstract in Arabic is followed by its version in Bahasa Malaysia and English.

The Abstract page is assigned Roman numeral "iii" and the following pages should be numbered consecutively.

[TITLE OF RESEARCH REPORT/DISSERTATION/THESIS]

ABSTRACT

The purpose of this aesthetic evaluation is two-fold. First, I examine J.R.R. Tolkien's literary illustration of space, place, and atmosphere in a series of locations across Middle-earth. I focus on the aesthetic facets of the physical environments, the possible aesthetic experiences generated from the visual layers of landscapes and atmospheres, and finally, the philosophical implications obtained through the moments of reflection in those locations. Second, I investigate the possibility of considering Tolkien's depiction of space, place, and atmosphere as literary artifacts and the construction of the whole Middle-earth as an act of artistic creation. The theoretical framework of this doctoral research is formulated based on the combination of seven critical criteria consisting of formalism, framing, historical/biographical information, imagination, the dialectical, engagement, and aesthetic creation theory taken from environmental aesthetics and art philosophy. These critical terms are tools at hand in aesthetically determined forms of evaluation and appreciation, which allows assessing the qualitative—literary—landscapes from multidisciplinary views to interpret their aesthetic and philosophical significance. Results demonstrate that Middle-earth could be observed as an aesthetico-cultural tapestry on which Tolkien materialized his artistic, creative, moral, social, and environmental concerns regarding the grave era in which he lived. He accomplished this task through the depiction of perceptual aesthetic dimensions of the literary environments. Therefore, Middle-earth could stand as more than a mere background of *The Lord of the Rings;* thus, the shaping of this imagined realm can be identified as an act of art creation. Further, the aesthetic decoration and juxtaposition of the physical environments and artifactual objects in Middle-earth make them eligible to be viewed as literary artifacts. The findings of this research can crucially contribute to our understanding of J.R.R. Tolkien as a literary world-builder who externally depicted the landscapes of Middle-earth with aesthetic features and internally elevated them with philosophical dimensions to convey his moral, philosophical, artistic, and environmental messages. The results could also assist scholars in arts and humanities in illuminating how the representation of imagined geography could be utilized as a powerful aesthetic tool to demonstrate thought-provoking aesthetic-philosophical spaces of contemplation.

Keywords: J.R.R. Tolkien, Middle-earth, literary Landscapes, Aesthetic Creation, Environmental Aesthetics.

(iii)

Figure 2.3: Example of abstract

2.1.4 Acknowledgements

Most research reports, dissertations or theses include a message to convey appreciation to those who have been involved and provided their assistance directly or indirectly in the preparation of the study.

This is optional and should not exceed a single page, which is numbered in Roman numeral accordingly.

2.1.5 Table of Contents

The Table of Contents lists the chapters, topics and sub-topics together with their page numbers. Sub-topics and topics should be labelled according to the chapter, for example:

CHAPTER 1: TITLE
1.1 Topic 1
    1.1.1 Sub-topic 1

CHAPTER 2: TITLE
2.1 Topic 1
    2.1.1 Sub-topic 1

This numbering system provides a clear picture of the relationship between chapters and topics and shows how they are connected.

2.1.6 List of Figures

This list contains the titles of figures, together with their page numbers, which are found throughout the text. For example, figures in Chapter 1 are numbered sequentially: Figure 1.1, Figure 1.2 and so on.

2.1.7 List of Tables

This list contains the titles of tables, together with their page numbers, which are listed in the text. The numbering system is according to chapter, for e.g.: tables in Chapter 1 are numbered sequentially: Table 1.1, Table 1.2 and so on.

2.1.8 List of Symbols and Abbreviations

The symbols, abbreviations, nomenclature and terminology that are used in the text must be listed down accordingly.

For further information on spelling and abbreviations, candidates are advised to refer to the latest edition of the Oxford Advanced Learner's Dictionary published by Oxford University Press.

2.1.9 List of Appendices

This list is optional and contains the titles of appendices placed in the supplementary section

2.2 Main Body

Candidates and supervisors should ensure that the text follows the agreed conventions of the individual faculty. The main body in the research report/dissertation/thesis must be organized following the guidelines as mentioned below:

- Text must be organized in titled chapters.
- The chapter titles must reflect the content of the chapter.
- Every chapter must begin on a new page.
- Chapters can be divided into sub-chapters with corresponding sub-titles.
- Titles and sub-titles must be numbered.

There is no restriction on the total number of chapters in a research report/dissertation/thesis. The number of chapters differs according to the field of study conducted by the candidate whether it is science-based or social science-based. However the content of the chapters may differ according to the candidate's research or conventions of individual faculty.

Generally, a research report/dissertation/thesis will have the following basic structure:

- **INTRODUCTION**
- **LITERATURE REVIEW**
- **METHODOLOGY**
- **RESULTS**
- **DISCUSSION**
- **CONCLUSION**
- **REFERENCES**

Items in the structure are divided into separate chapters and the descriptions of these chapters are as follows:

2.2.1 Introduction

This chapter contains the introduction to the issues in which the research is concerned with, the aims and objectives of the study, and the scope or outline of the research approach as well as the structure of the research report/dissertation/thesis.

2.2.2 Literature Review

A literature review is a description of the literature relevant to a particular field or topic of study. It consists of a critically written and comprehensive account of the published works on a topic by accredited scholars and researchers. A critical literature review is a critical assessment of the relevant literature. It is directly related to the research, providing information on theories, models, materials and techniques used in the research. The literature review should be comprehensive and include recent publications which are relevant to the research.

2.2.3 Methodology

This chapter describes and explains the materials as well as the research methodology used in the study. The sub-topics for this chapter include the key research questions, the research design, and the research procedures adopted. It may also, where appropriate, indicate sampling methods, research instruments and statistical methods employed. The purpose of this is to inform the reader on the methods used to collect the data and generate the findings reported.

2.2.4 Results

This chapter explains the results which are commonly presented in the form of text, figures and tables, complete with data analysis.

2.2.5 Discussion

This chapter contains the interpretation of the results. The findings of the research should be compared and contrasted with those of previous studies presented in the literature review. The purpose of this chapter is to discuss the findings and the outcomes of the research in relation to the results that have been obtained.

2.2.6 Conclusion

In this chapter, the findings are summarized and their implications discussed. This section may include suggestions for future work.

2.2.7 References

All works or studies referred to in the research report/dissertation/thesis in the form of quotations or citations must be included in the references.

The references should be written consistently ~~in the American Psychological Association (APA) format or in another format~~ according to the official citation guide approved by the faculty.

APA Format

Each reference should be written in single spacing format and a double space should be left between references. The list of references must be arranged in alphabetical order and the entries should not be numbered. The list must also have a hanging indentation of 0.5 inch. For example:

> Walmsley, Ben. (2019), *Audience Engagement in the Performing Arts: A Critical Analysis*. Springer Nature.
>
> Wreen, Michael. (2014) "Beardsley's Aesthetics." *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta, Winter 2014, Metaphysics Research Lab, Stanford University.
>
> Tillson, Victoria G. (2010) "A Nearly Invisible City: Rome in Alberto Moravia's 1950s fiction." *Annali d'Italianistica, 28*: 237-256.

Reference citations in text require the following information:
- last name of the author or as specified in the UM Library APA Formatting and Style Guide (latest edition),
- the year of publication,
- the page number for the reference (direct quotes only).

For summaries or paraphrases, the last name of the author and the year of publication must be included for the in-text reference. For examples:

Kingston and Parker (2012) found the biggest challenges in classroom to be ….

The biggest challenges in classroom were …. (Kingston & Parker, 2012).

For direct quotations (which refers to when the exact words of another author are copied), the last name of the author, the year of publication as well as the page number for the reference must be included for the in-text reference. The quotation has to be enclosed in quotation marks. For examples:

In *Unfinished Tales of Numenor and Middle-earth* (1980), Christopher writes that his father illustrated mallorn trees based on familiar Primary World species.

Gollum enter the damned land of Sauron. Tolkien describes the scenery from the eyes of the hobbits and writes, "slowly and painfully they clambered down, groping, stumbling, scrambling among rock and briar and dead wood in the blind shadows" (*The Lord of the Rings*, 917).

If the quoted citation contains more than 40 words, it should be placed within a paragraph of its own with a 0.5 inch indentation. For example:

> Thacker could answer that question too when he contends that "since the early 1990s questions of space and geography have become recognized as legitimate and important topics in many areas of literary and cultural studies, and setting out the sphere of literature, if not life, by some form of map a more familiar hermeneutic strategy" (*The Idea of a Critical Literary Geography*, 57-8).[91] It is, therefore, fruitful to carry out an analysis of Tolkien's watercoloresque melancholic visualization of space, place, and atmosphere and observe them as Tolkien's critique of the destructive nature of modernity that parallels with contemporary environmental concerns.

Please refer to the Universiti Malaya Library APA Formatting and Style Guide. The guide can be downloaded at UM Library website (https://umlibguides.um.edu.my)

Other Citation Format

For reference citation in-text and list of references using other than the APA format, please refer to the official citation guide associated. For example, in *American Chemistry Society* (ACS) style, the citation format for in-text citation is as follows:

> The mineralization of TCE by a pure culture of a methane-oxidizing organism has been reported (*6*).

Meanwhile the list of reference that contains full bibliographic information at the end of the research report/dissertation/thesis should appear as one numerical sequence in the order that the material is cited is as follows:

References

4. Hoppert, M. *Microscopic Techniques in Biotechnology*; Wiley-VCH: Weinheim, 2003; pp 145-158.
5. Klinger, J. Influence of Pretreatment on Sodium Powder. *Chem. Mater.* 2005, 17, 2755-2768.
6. Ford H. L.; Sclafani R. A.; Degregori J. Cell Cycle Regulatory Cascades. In *Cell Cycle and Growth Control: Biomolecular Regulation and Cancer*, 2nd ed.; Stein G. S., Pardee A. B., Eds.; Wiley-Liss: Hoboken, NJ, 2004; pp 42-67.

2.3 Supplementary

Specific items which were not included in the main body of the text, should be put in this Supplementary section. Typically, this section includes the following:

2.3.1 List of Publications and Papers Presented

Published works as well as papers presented at conferences, seminars, symposiums etc. pertaining to the research topic of the research report/dissertation/thesis are suggested be included in this section. The first page of the article may also be appended as reference.

2.3.2 Appendices

Appendices consist of research instruments, additional illustration of data sources, raw data and quoted citations which are too long to be placed in the text. The appendix section supports the written text of the research report/dissertation/thesis by including materials that can provide additional information. These materials include research data, tables, examples of questionnaires, maps, photos and other materials that are too long to be included in the text or are not directly required to comprehend the text can be included as appendices.

Tables and graphics that are more than two pages long are suggested to be included in the Appendix section.

Appendices are labelled as APPENDIX A, APPENDIX B, etc. and they should correspond to the List of Appendices of Preliminary section.

2.3.3 Co-authors Consent

Please refer to 1.3 (d).

CHAPTER 3: FORMAT SPECIFICATIONS

3.1 Paper Quality, Printing and Duplicating

The research report/dissertation/thesis should be printed, single-sided, on high quality white A4 paper (201 × 297 mm; 80 grams). Computer pin-feed printout paper is not permitted.

The research report/dissertation/thesis, in soft cover copies, must be typed and duplicated by offset printing or good quality photocopying. All copies must be clean and neat in order to ensure easy reading.

3.2 Typing and Printing Quality

Texts in research report/dissertation/thesis should be typed on **one side** of the paper only.

They must be typed using font type **Times New Roman, font size 12** (except for tables and figures) and justified, using Microsoft Word version (latest edition) or later, or similar word-processing software. Those written in Arabic should use font type **Traditional Arabic in font size 16.** Words in a language that is different from the language of the research report

/dissertation/thesis must be typed in *italics.* For mathematical texts, the use of Equation Editor or LaTeX is advisable. Script fonts are not permitted.

Chapter titles should be typed with capital letters and centered between the left and right margins. Each chapter must begin on a new page. Chapters and subchapters should be also titled. Titles should be typed in bold without underline.

A high-quality laser or ink-jet printer should be used for the printing.

3.3   Line Spacing
The body of the text should be typed with **double spacing**. Single-spacing is only permitted in tables, long quotations, footnotes, citation and in the references.

The first sentence of a new paragraph should not start at the bottom of a page if the space available can only fit one line.

3.4   Margins
The text should have the following margins:
- Top   : 2.0 cm or 0.79 inch
- Right   : 2.0 cm or 0.79 inch
- Left   : 4.0 cm or 1.57 inch
- Bottom   : 2.0 cm or 0.79 inch

Additional guidelines regarding margin are as follows:
- Do not type more than one sentence after the bottom margin. If it is necessary to do so, it should only be for a footnote or the completion of the last sentence of the chapter, topic or sub-topic or information in a figure.

- All tables and figures must be placed within the specified margins.
- The last paragraph of the page should contain at least two sentences. If it does not, the paragraph should begin on the next page.

3.5   Page Numbering

All page numbers should be printed 1.0 cm from the bottom edge of the page and placed at the right-hand side without any punctuation (Figure 3.1).

The page numbering system must conform to the following rules:
- The page numbers should be placed at the right-hand side without any punctuation.
- Font type Times New Roman and font size 10 recommended for numbers.
- Roman numerals (i, ii, iii, …) should be used in the Preliminary section. The first page of the thesis, the title page, is an unnumbered page 'i'. Numbering begins on the second page with 'ii' for the Original Literary Work Declaration Form.
- Arabic numerals (1, 2, 3, …) are used on the pages of the text (starting with the Introduction page) and Supplementary section.

Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum

In line with text

2 cm

Approximately 1 cm

Figure 3.1: Placement of page number

3.6   Numbering of Chapters and Sub-chapters

Chapters and sub-chapters must be numbered using Arabic numerals (1, 2, 3 etc). Chapters are numbered CHAPTER 1, CHAPTER 2, CHAPTER 3, and so on. Sub-chapters are nested, but its numbering is not indented, up to a maximum of 4 levels as in the example shown below:

CHAPTER 2: FIRST LEVEL (CHAPTER TITLE)
2.1 Level 2 (sub-title);
2.1.1 Level 3 (sub-sub-title);
2.1.1.1 Level 4 (sub-sub-sub-title)

The use of letters in parenthesis in the main body for e.g., (a), (b), (c) is appropriate as a means of differentiating sub-topics of the same topic. However, it is not required to be listed in the Table of Contents.

If a chapter title or chapter sub-title at any level exceeds a single line, the spacing between the lines must be the same as that of the text (double-spacing). Subsequent sub-chapters beyond the fourth nesting level must be numbered using alphabets; (a), (b), (c), and so on.

3.7 Footnotes

There are differences in the use of footnotes in various disciplines. For example, footnotes are commonly used in Social Sciences research but rarely in Sciences research. However, candidates are advised to limit the use of footnotes unless they are proved necessary to the document. Footnotes are used to elaborate or provide additional information regarding matters discussed in that page.

Footnotes are recorded using Arabic numeric and numbered consecutively. Raised superscript numerals in the text refer to explanatory notes and documented sources appearing either at the bottom of the page as footnotes or at the end of the thesis as endnotes in a notes section. The advantage of using notes is that explanatory type of information can be presented along with source citations on the same page or place.

Footnotes should use a smaller font than the text (font size 8).

When using footnote, a number formatted in superscript is inserted following the punctuation mark in the text. Footnotes should be placed at the bottom of the page on which they appear (Figure 3.2). Please refer to the faculty for the recommended convention for writing of footnotes.
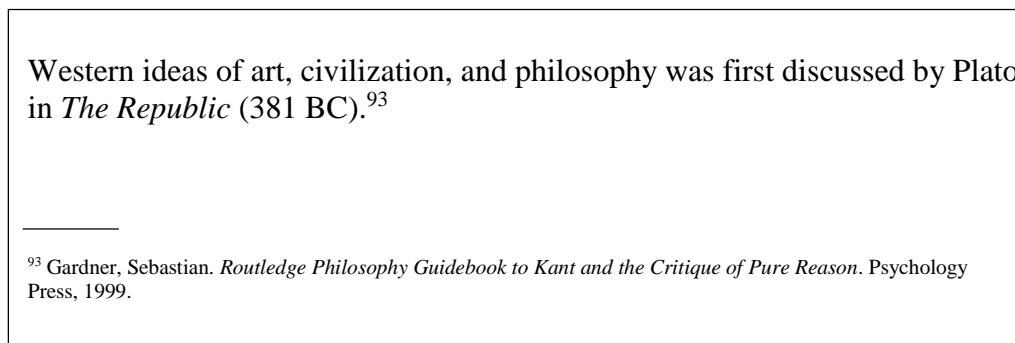

Western ideas of art, civilization, and philosophy was first discussed by Plato in *The Republic* (381 BC).[93]

---

[93] Gardner, Sebastian. *Routledge Philosophy Guidebook to Kant and the Critique of Pure Reason*. Psychology Press, 1999.

Figure 3.2: Example of footnote

3.8   Tables

Tables are printed within the body of the text at the center of the frame and labelled according to the chapter in which they appear. Thus, for example, tables in Chapter 3 are numbered sequentially: Table 3.1, Table 3.2 and so on.

The caption should be placed **above** the table itself (Table 3.1). If the table contains a citation, the source of the reference should be included in the table caption.
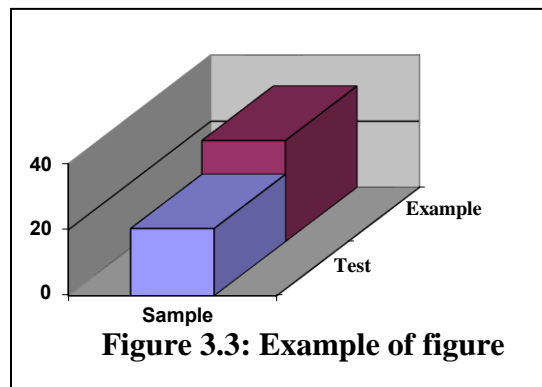
Table 3.1: Example of table

Heading	Heading
Text	Text

If the table occupies more than one page, the continued table on the following page should indicate that it is a continuation, for example: 'Table 3.7, continued'. The header row should also be repeated.

3.9   Figures

Figures, like tables are printed within the body of the text at the center of the frame and labelled according to the chapter in which they appear. Thus, for example, figures in Chapter 3 are numbered sequentially: Figure 3.1, Figure 3.2.

Figures, unlike text or tables, contain graphs, illustrations or photographs and their labels are placed at the **bottom** of the figure rather than at the top (using the same format used for tables) (Figure 3.3).

Figure 3.3: Example of figure

If the figure occupies more than one page, the continued figure on the following page should indicate that it is a continuation: for example: 'Figure 3.7, continued'.

If the figure contains a citation, the source of the reference should be placed after the label.

3.10   Binding

Each copy of the research report/dissertation/thesis submitted shall be bound in one (1) volume. The thesis cover must be of A4 size (210mm x 297mm).

For the purpose of examination, research report/dissertation/thesis submitted should be **soft cover or comb** bound with the following colour (Figure 3.4):

- Research report: Navy blue
- Dissertation: Dark red or maroon
- Thesis: Dark red or maroon

For final submission prior to graduation, research report/dissertation/thesis submitted should be **hard cover** bound in rexine with the following colour (Figure 3.5):

- Research project: Navy blue
- Dissertation: Dark red or maroon
- Thesis: Dark red or maroon

Front Cover Colour of Dissertation/Thesis (Dark red or maroon)
Front Cover Colour of Research Report (Navy blue)
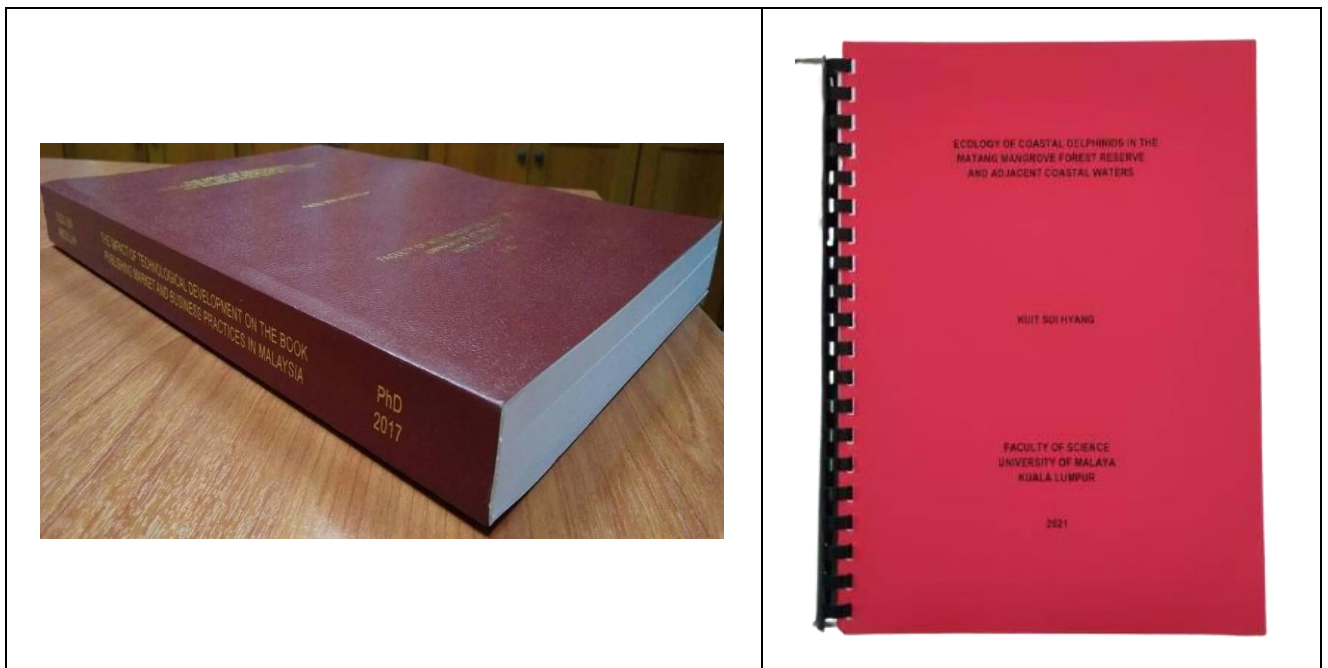
Figure 3.4: Sample of softbound / comb bound copy for first submission for examination

(a)
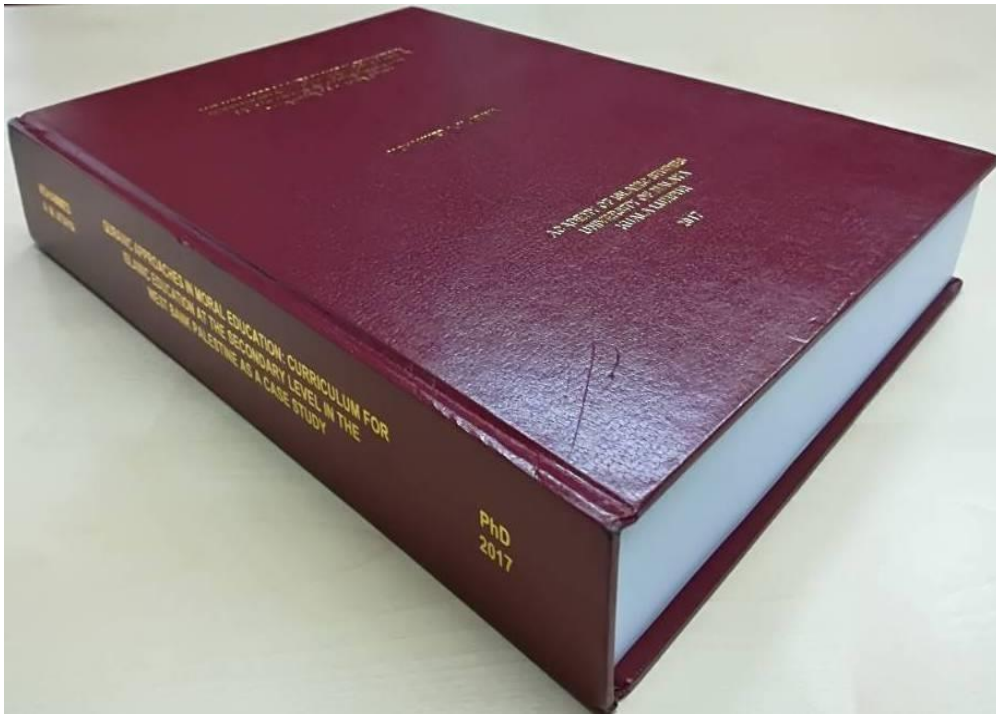
(a)
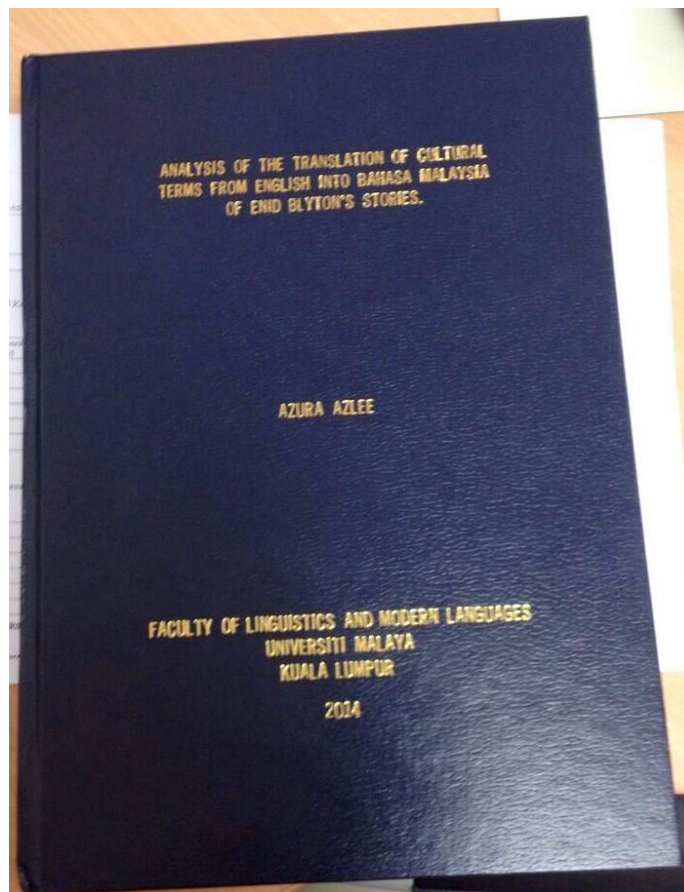
Figure 3.5: Samples of hardbound copy for final submission
(a) Example of hardbound thesis or dissertation (in dark red or maroon);
(b) Example of hardbound research report (in navy blue)

The title of research report/dissertation/thesis, name of author, name of the University and year of submission must be printed on the front cover. The letters for the Front Cover should be printed in **gold letterings** of **font size 16, font type Arial Narrow, bold and in uppercase letters** (Figure 3.6 and 3.7).
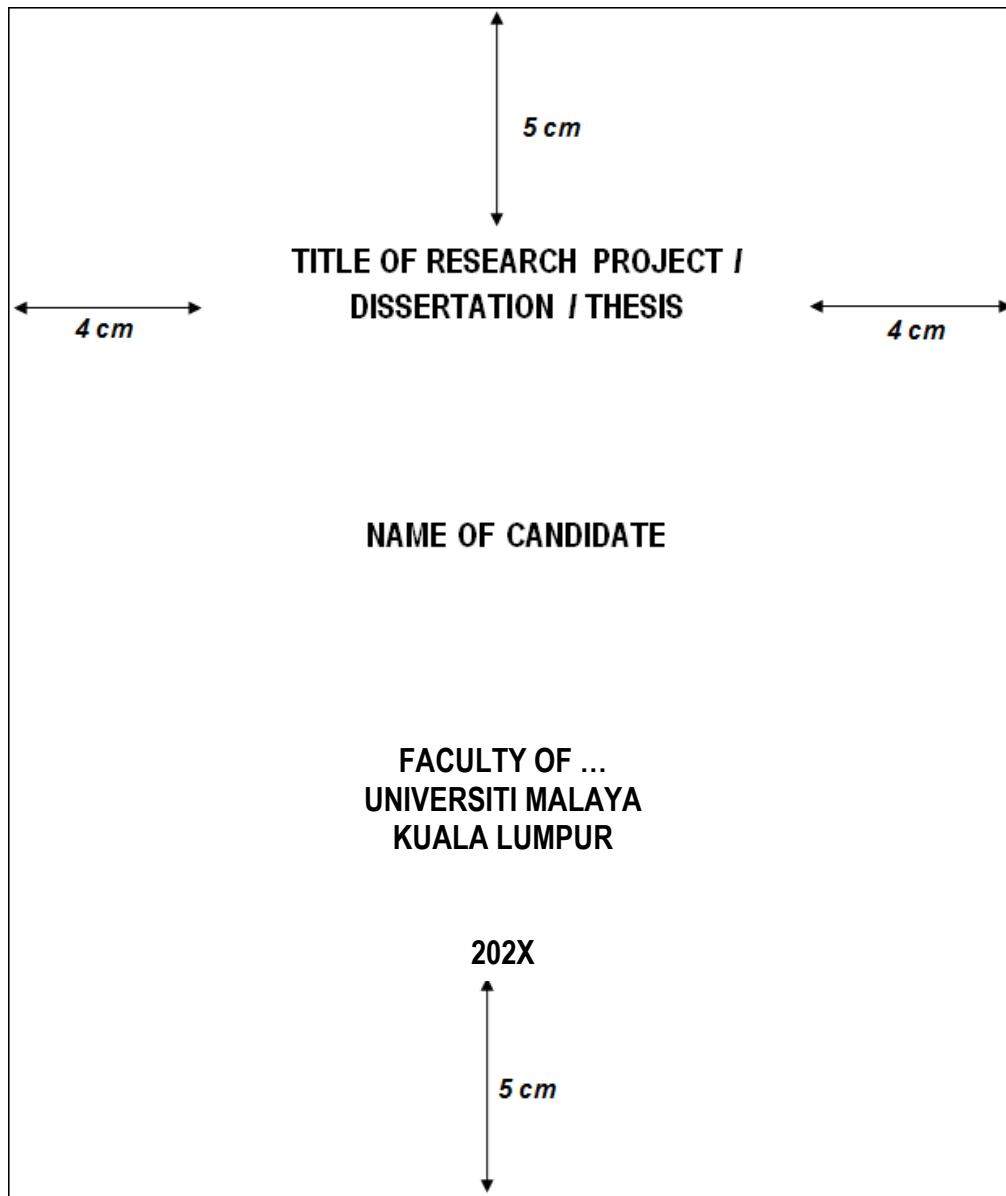
Figure 3.6: Formatting of the front cover of research report/dissertation/thesis
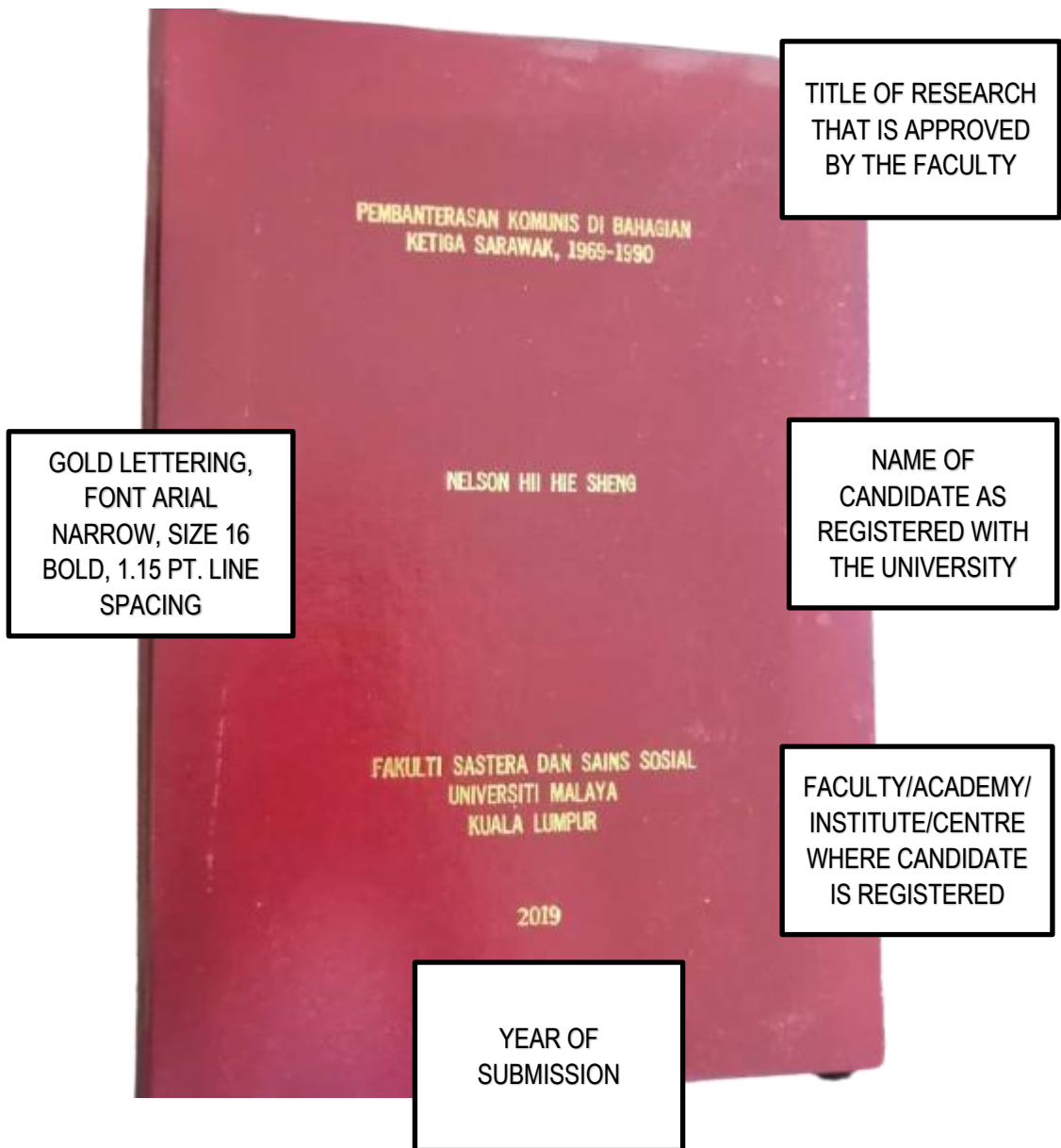
Figure 3.7: Example of the front cover of research report/ dissertation/thesis

The spine of the manuscripts should show the title of research report/dissertation/thesis, name of author, year of submission and name of degree. The year of submission must be in accordance with the year when the research report/dissertation/thesis is submitted (Figure 3.8 and 3.9). If the title of the research report/dissertation/thesis exceeds the space of the spine, a smaller font size can be used (i.e. font size 16 to 14) or alternatively the title can be truncated with ellipses (…) (Figure 3.10).

AMIR GHORBANI	PRIVATIZATION IN ALGERIA: POLICY AND PERFORMANCE	PhD 2017
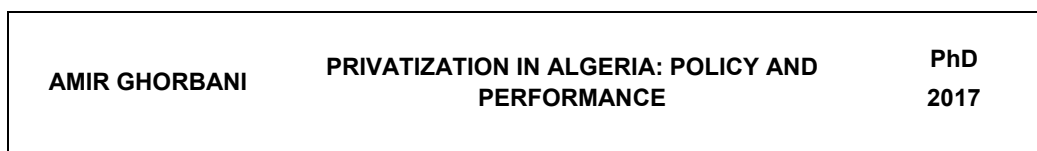
Figure 3.8: Spine format

Figure 3.9: Example of spine format

KWONG SIU YEE	THE EFFECT OF GEOGRAPHICAL REGION ON THE TRANSITION TIME OF CMMI-BASED …	PhD 2017
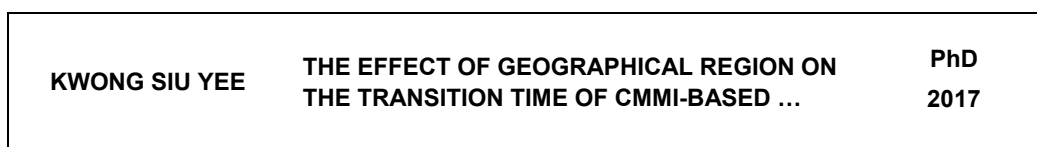
Figure 3.10: Spine format for long title

3.11 Word Limit

The maximum word limit for a submission for examination is shown in Table 3.2.

Table 3.2: Maximum word limit

Master's Programme		
Research Report (by Coursework or by Clinical)	**Dissertation (by Mixed mode)**	**Dissertation (by Research)**
30,000 words	40,000 words	60,000 words
Doctoral Programme		
Dissertation (by Coursework or by Clinical)	**Thesis (by Mixed mode)**	**Thesis (by Research)**
60,000 words	80,000 words	100,000 words

The minimum word limit is determined by the faculty or based on the programme standards according to their respective discipline (if any). The maximum length of words excludes footnotes, references, appendices, tables, figures and prefaces.

Candidates who are unable to meet the word limit set by the University must seek approval from the faculty at least one month before the submission of research report /dissertation/thesis for examination.

3.12   Other Information

A candidate may not resubmit previous research work which he has submitted to this or any other university for the award of a degree. The candidate may, however, incorporate any part of such work, provided that there is a clear indication in the research report/dissertation/thesis of its sources.

The candidate may also include any other printed or published work by an individual or a working group to validate his findings. Where the contribution is from a working group, the candidate is required to provide a statement indicating which part of the work was carried out by the candidate. The statement should be signed by the rest of the group indicating their consent (this may be included in the Appendix).

Approved research report/dissertations/theses or parts of their content are allowed for publication if they are accompanied by a statement that the work was conducted towards the fulfilment of a particular degree.

Candidates of Doctoral degree (all modes) and Master's by research are required to publish papers in Web of Science (WoS) or Scopus or [2]Category A or B refereed journals or book or [3]book chapters publish by publishers listed in the WoS, Universiti Malaya Press, or Dewan Bahasa dan Pustaka or any publishers recognized by the Faculty. Publications must be based on the work during the course of study, and due reference must be made to the University in all such papers.

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[2] Publications in Category A or B refereed journals or book or book chapters are only applicable to candidates pursuing programmes in the field of Social Sciences.
[3] Two (2) book chapters of different books are equivalent to one (1) publication.

CHAPTER 4: SUBMISSION

4.1 Prior to Submission

Postgraduate candidates are required to obtain approval from the supervisor(s) and faculty via MAYA before online submission. This is to allow timely nomination of examiners for research report/dissertation/thesis.

Submission of research report/dissertation/thesis for examination has to be done within the candidature period after title approval by the faculty.

Candidates are strongly advised against copying the formatting done by other candidates as previously submitted research report/dissertation/thesis may not conform to the current formatting requirements. Failure to meet the formatting requirements may result in a thesis/dissertation being rejected at the point of submission.

Postgraduate candidates shall submit their research report/dissertations/theses to the Postgraduate Officer of the respective faculty.

4.2 Required Documents for Submission

Documents required for submission for the purpose of examination are as follows:
- at least two (2) printed softbound/comb bound copies (or such numbers as may be determined by the faculty) of the research report/dissertation/thesis;
- one (1) electronic copy (PDF format); and
- Submission of Thesis / Dissertation for Examination/Re-examination form.

Documents required for final submission prior to graduation after completing the corrections (if any), are as follows:
- at least one (1) printed hardbound copy (or such numbers as may be determined by the faculty) of the final research report/dissertation/thesis;
- one (1) electronic copy (PDF format);
- Final Submission of Thesis/Dissertation form;
- Repository Policy For Universiti Malaya Postgraduate Theses/Dissertation/Research Reports form; and
- Correction Report form (if applicable).

All the required forms can be downloaded from the MAYA portal in the https://umsitsguide.um.edu.my/index.html .

The submitted electronic copy of the research report/dissertation/thesis (in PDF format) in a USB flash drive or any valid source of electronic copy must be labeled with the following details:

- Name
- Registration no.
- Title of research report/dissertation/thesis
- Faculty/Academy/Institute/Centre
- Year of submission (current year)

CHAPTER 5: PLAGIARISM

Postgraduate candidate of the Universiti Malaya are expected to produce original academic work. Plagiarism is defined as an academic fraud arising from the attitude of lying, insincerity, untrustworthiness, dishonesty and disrespect to fellow colleagues. Plagiarism happens when someone else's idea is taken without mentioning the source, and thus giving the impression that the idea is his own. This situation may occur when:

(1) one's idea, taken word for word from an article or book that has been published.

(2) The idea of a person from an article or book is taken using his own words.

(3) A person's idea is taken from discussions whether in conferences, seminars, forums, talks or informal discussions between two parties.

(4) Data, diagrams, tables, photographs or any other illustrative material derived from others is taken as if it were his own.

Postgraduate candidates are strongly advised to read the "How to Avoid Plagiarism: A Handbook for Postgraduate Students", which outlines the rules and regulations pertaining to acts of plagiarism.

The University also requires the usage of Turnitin, an online web-based plagiarism detection application to avoid plagiarism and academic dishonesty. In most cases, the similarity index percentage should be between **10% to 30%.** Please refer to your respective faculty regarding the acceptable similarity index percentage.

THESIS/DISSERTATION SUBMISSION & EXAMINATION IN UM

STEP-BY-STEP GUIDE

Submission of Thesis/ Dissertation for Examination

Examination of Thesis/ Dissertation

Final Submission of Thesis/ Dissertation for Graduation

A.

STEP 1:

Make sure all **candidature requirements** imposed by the University **as well as your respective faculty** have been fulfiled prior to submission of thesis/ dissertation.

✓ **Language Requirement**
✓ **Research Methodology**
✓ **Proposal Presentation** (seminar in the first 2 semester for Master or first 4 semesters for PhD)
✓ **Candidature Defence**

✓ **Thesis Seminar*** (seminar before thesis submission) - *Applicable to PhD candidates by Research*

✓ **Publication Requirement** (must provide proof of acceptance before Committee of Examiners' meeting and/or viva voce)

A.

STEP 2:

Finalize your thesis/ dissertation according to *Guidelines for the Preparation of Research Reports, Dissertations and Theses*.

Available on *http://ips.um.edu.my*

A. SUBMISSION OF THESIS/ DISSERTATION FOR EXAMINATION

STEP 3:

Thesis/Dissertation submission to allow timely nomination of examiners and approval of thesis/ dissertation title.

RESEARCH MODE

Log in to MyUM Student Portal (*http://myum.um.edu.my/*) and go to *Research > Thesis > Thesis/Dissertation Dashboard*

MIXED MODE

Complete the 3 Months Notice Submission form and submit to your respective faculty.

STEP 4:

Notify your **supervisor(s)** to

✓ verify and endorse your notice submission,

✓ approve the title of thesis/dissertation,

✓ nominate the Internal and External Examiners.
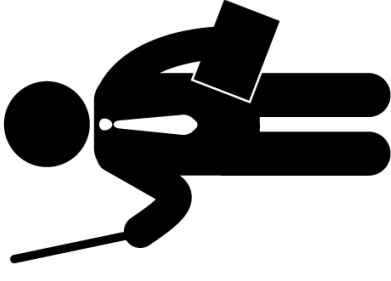
STEP 5:

Check with the respective **faculty** whether the title of thesis/dissertation has been approved. This may take up to 2-3 months.

A. SUBMISSION OF THESIS/ DISSERTATION FOR EXAMINATION

STEP 6:

Complete *Submission of Thesis/ Dissertation for Examination form*.

STEP 7:

After receiving notification from the faculty regarding the approval of thesis/dissertation title, submit **five (5) softbound theses/ dissertations** and its **soft copy (pdf.)** together with the completed form to:

✓ Postgraduate office of respective faculty for Master's candidates

✓ Thesis Unit, IGS for Doctoral candidates

A.
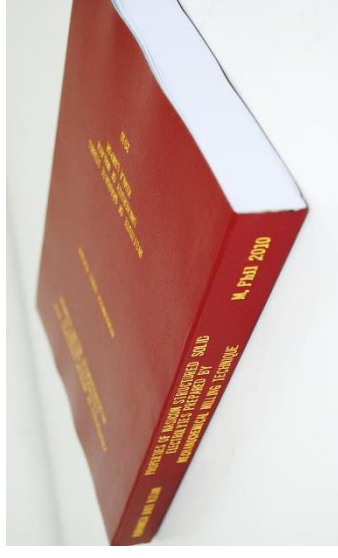
Upon submitting your thesis/dissertation for examination, **you will NOT be required to register for the next semester** unless the Committee of Examiners recommends a re-examination following the Committee of Examiners' Meeting and/or viva voce.

**B.**

WHAT HAPPENS AFTER YOU SUBMIT YOUR THESIS (IPS)/DISSERTATION (Faculty)?

1. Thesis/dissertation is processed within 7 working days after submission

   ✓ Invitation email to examiners to confirm their **acceptance, availability & the correspondence address**

   ✓ Shipping of thesis/dissertation to examiners (2 – 7 days depending on location)

2. Examiner's reports are expected to arrive 2 months after examiners receive the thesis/dissertation

   ✓ Reminder notifications to examiners before deadline and follow-up emails (phone calls) if examiners fail to meet deadline

   ✓ Examination period extension for examiners (if required)

   ✓ Submission of thesis/dissertation to Reserve Examiner for examination if the delay exceeds 4 months.

STEP 1:

Contact the respective offices to check on the progress of the examination process after 3 months from the date of thesis/dissertation submission.

⑦

The examination process usually takes around **three (3) to four (4) months.** However in exceptional circumstances, the process may take longer.
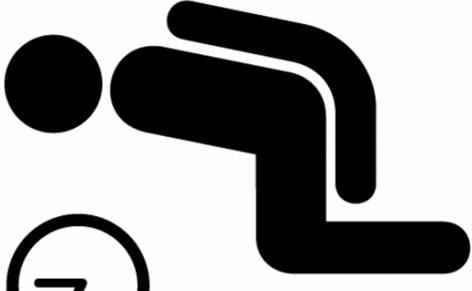
EXAMINATION OF THESIS/DISSERTATION

B.

Examiners will **evaluate** the following aspects of your thesis/dissertation:

Format of thesis/dissertation	Conventional Format	Format of Published Papers*
Robustness of thesis/dissertation	• Suitability of title • Research objectives • Literature review • Research methodology • Analysis of research • Significance of finding(s) • References • Possibility of publication	• Quality of published papers • Coherence of the overall research write-up • Suitability of title • Research questions and objectives • Literature review • Significance of finding(s) • References
Overall style & organization	• Presentation • Mechanical aspect (grammar, spelling, punctuation, numbering)	• Presentation • Mechanical aspect (grammar, spelling, punctuation, numbering)

*The option of writing thesis in the format of published papers is only available for Doctoral candidates.
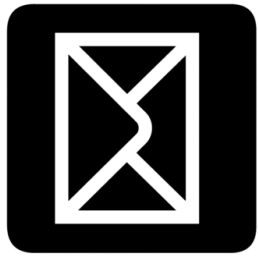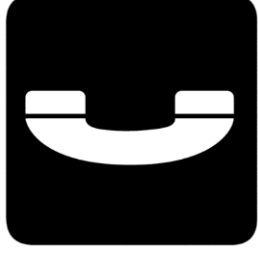
B.

STEP 2:

On receipt of all reports from the examiners, the respective faculty will arrange for the **Committee of Examiners' Meeting** and/or **viva voce**.

The faculty will notify the candidate before the normally 2 weeks scheduled date.

Possible Outcomes of Thesis Examination

DOCTORAL DEGREE

1) Awarded the degree and **Distinction** for thesis, subject to the stipulated rules and conditions.

2) Attained sufficient academic merit for the award of the degree **without amendments/ corrections** to the thesis.

3) Attained sufficient academic merit for the award of the degree subject to **minor corrections** to be made to the thesis within a period of **3 months** as required by the examiners and subject to confirmation of the corrections by the **Supervisor.**

4) Attained sufficient academic merit for the award of the degree subject to **major corrections** to be made to the thesis within a period of **6 months** as required by the examiners and subject to confirmation of the corrections by the **Internal Examiner.**

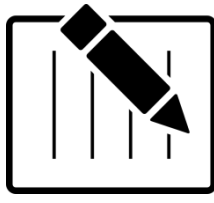## Possible Outcomes of Thesis Examination (Cont.)

DOCTORAL DEGREE

5) Required to undertake further work and submit the thesis for **Reexamination** within a period of **6 to 12 months** from the date of Senate.

6) **Failed** to attain sufficient academic merit in the thesis examination for the Doctoral degree and it is recommended to Senate that a **Master's degree** be awarded subject to the candidate fulfilling the requirement for the award of the Master's degree.

7) **Failed** to attain academic merit and it is recommended to Senate that the candidate has failed in the thesis examination and is not allowed to submit the thesis for re-examination.

B.

Possible Outcomes of Dissertation Examination

MASTER'S DEGREE (RESEARCH MODE)

1) Awarded the Master's degree with **Distinction** – subject to the stipulated rules and conditions.

2) Attained sufficient academic merit for the award of the degree **without amendments/ corrections** to the dissertation.

3) Attained sufficient academic merit for the award of the degree subject to **minor corrections** to be made to the dissertation within a period of **3 months** as required by the examiners and subject to confirmation of the corrections by the Supervisor.

B.

Possible Outcomes of Dissertation Examination

MASTER'S DEGREE (RESEARCH MODE)   (Cont.)

5) Attained sufficient academic merit for the award of the degree subject to **major corrections** to be made to the dissertation within a period of **6 months** as required by the examiners and subject to confirmation of the corrections by the Internal Examiner.

6) Required to undertake further work and submit the dissertation for **Reexamination** within a period of **6 to 12 months** from the date of Senate.

7) **Failed** to attain academic merit and it is recommended to Senate that the candidate has failed in the dissertation examination and is not allowed to submit the thesis for re-examination.

Possible Outcomes of Dissertation Examination

MASTER'S DEGREE (MIXED MODE)

1) Awarded the Master's degree with Distinction – subject to the stipulated rules and conditions.

2) Attained sufficient academic merit for the award of the degree without amendments/ corrections to the dissertation.

3) Attained sufficient academic merit for the award of the degree subject to minor corrections to be made to the dissertation within a period of 3 months as required by the examiners and subject to confirmation of the corrections by the Supervisor and Internal Examiner.
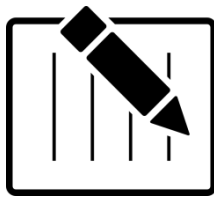
Possible Outcomes of Dissertation Examination

MASTER'S DEGREE (MIXED MODE) (Cont.)

5) Required to undertake further work and submit the dissertation for **Reexamination** within a period of **3 to 6 months** from the date of Senate.

6) **Failed** to attain academic merit and it is recommended to Senate that the candidate has failed in the dissertation examination and is not allowed to submit the thesis for re-examination.
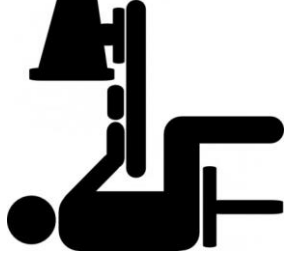
C.
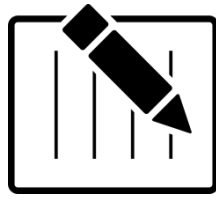
FINAL SUBMISSION OF THESIS/DISSERTATION

STEP 1:

Make necessary **corrections** (if any) to your thesis/dissertation according to the examiners' reports and comments suggested by the Committee of Examiners within the stipulated time and prepare the *Thesis/Dissertation Correction Report*.


Per 3(2) Lampiran A

UNIVERSITY OF MALAYA
DISSERTATION / THESIS CORRECTION REPORT

NAME :
MATRIC NO. :
SEMESTER :
PROGRAMME : Masters / Doctoral
TITLE OF DISSERTATION / THESIS:

SESSION :

Correction as Required by Examiners			Correction/Comments by Candidate	Comments/ Confirmation by Supervisor	Comments/ Confirmation by Internal Examiner
Section/ Chapter	Page	Comment			
External Examiner 1					
External Examiner 2					
Internal Examiner					

Verified by:

(1) Supervisor's signature

Name:
Date:

(2) Supervisor's signature

Name:
Date:

(3) Internal examiner's signature

Name:
Date:
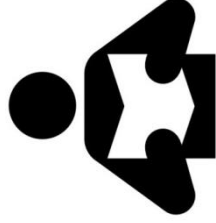
C.

STEP 2:

Complete the following:

✓ *Final Submission of Thesis/ Dissertation for Examination form*

✓ *Repository Policy (Thesis/Dissertation Embargo) Form*

KEEP CALM you're ALMOST there

C. FINAL SUBMISSION OF THESIS/DISSERTATION

STEP 3:

Submit **two (2) hardbound copies** (or such numbers as may be determined by the Faculty) of the final thesis/dissertation and its **soft copy (pdf.)** together with the *Thesis/Dissertation correction report* and the completed forms to:

✓ Postgraduate office of respective faculty for Master's candidates

✓ Thesis Unit, IGS for Doctoral candidates

c.
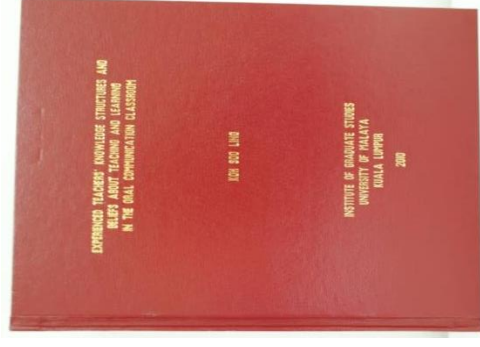
STEP 4:

Wait for your Senate letter confirming your graduation and the award of your degree.
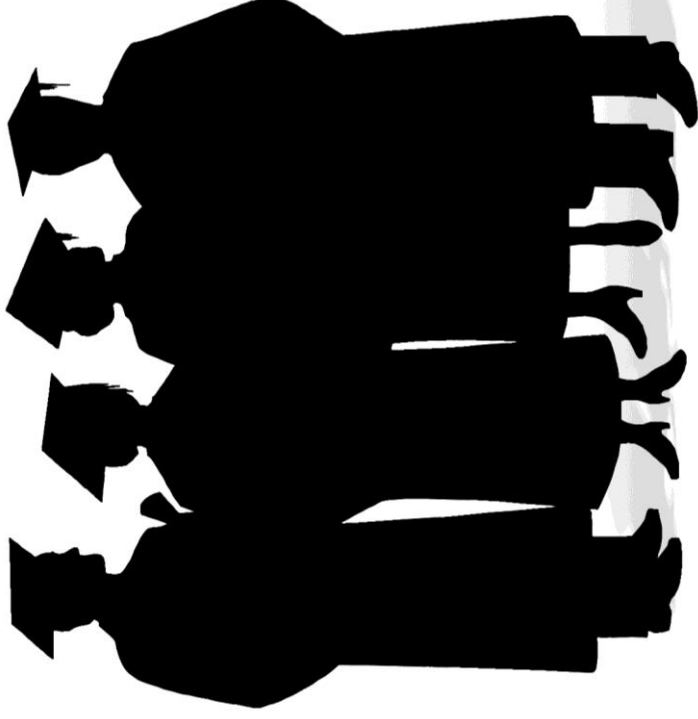
TIMELINE

1
- Approval of Title
- Nomination of Examiners

Duration ≈ 3 months

2 Submission of Thesis/Dissertation to Postgraduate offices

3 Processing of Thesis/Dissertation to Examiners

4 Examination of Thesis/Dissertation
Duration ≈ 3 to 4 months

5 Committee of Examiners meeting and/or viva-voce
Duration ≈ ½ to 1 month after receipt of complete reports

OVERALL ESTIMATED DURATION
(step 1 to 5)
≈ 6½ to 8 months
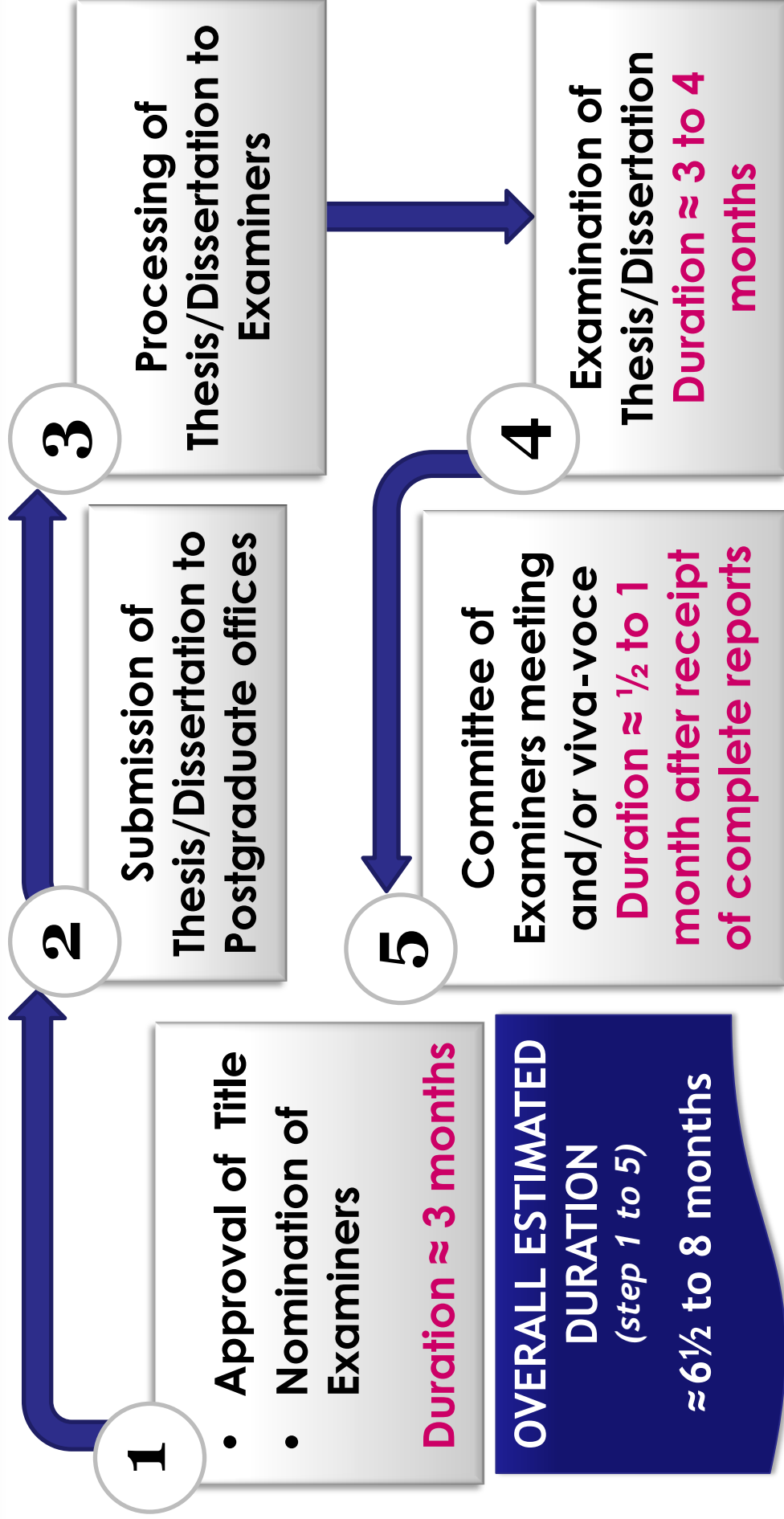
GUIDELINES FOR PUBLICATION IN FULFILMENT OF GRADUATION REQUIREMENTS FOR POSTGRADUATE CANDIDATES

Publication(s) produced by postgraduate candidates in fulfilment of graduation requirements must comply with the following criteria:

CRITERIA	REMARK

1. Type of Publications	(1) Research article or review article in journals indexed in:
	  (a) Web of Science (WoS) Core Collection databases (https:apps.webofknowledge.com)
	    • Science Citation Indec Expanded TM
	    • Social Sciences Citation Index and
	    • Arts & humanities Citation Index
	  (b) *Scopus (https://www.scopus.com/);or
	  (c) *Malaysian Citation Index (MyCite)(http://www.mycite.my/)
	
	(2)*Books published by publishers listed in:
	  (a) Web of Science (WoS) Master Book List (http://wokinfo.com.com/mbl/publishers/)
	  (b) Malaysian Scholarly Publishing Council or Majlis Penerbitan Ilmiah Malaysia (MAPIM) (https://www.um.edu.my/research-and-community/information-for-researchers/downloads/myra)
	  (c) Any publishers listed and recognized by Academic Responsible Centre (PTj)
	
	*Only applicable to candidate pursuing programmes in the field of Arts and Social Sciences.

2. Authorship	Publications **must be published with the supervisor(s).** The supervisor shall act as the corresponding author. In the event that the candidate has more than one supervisor, one of them shall be the corresponding author. The candidate must be the first author, or either the second or subsequent author after the supervisor(s), or the first student author. In the event, two or more candidates co-author in an article, only one candidate is allowed to use this article to fulfil his/her graduation requirement.
3. Authorship Agreement	Candidate must provide a copy of authorship document that was submitted to the respective publishers (e.g. Authorship Agreement/Form or Statement of Authorship or cover letter of article submission), confirming all the named authors have agreed to publication.
4. Timing	Publications accepted must be within the candidature of the candidate.
5. Topic of publications	Publications must be related and conform to the candidate's research in his/her thesis/dissertation.

6. Affiliation	Publications must carry the affiliation of the department and/or faculty where the candidate is registered.
7. Blacklisted journals	Publications in journals blacklisted by the Malaysian Ministry of Higher Education (MoHE) are not accepted: (1) Academic Journal (www/academicjournals.org); (2) Euro Journal Inc (www.eurojournals.com); (3) Common Ground Publishing (www.commongroundpublishing.com)' (4) Africa World Press Inc. (www.africaworldpressbooks.com) (5) Publications in Probable Predatory Journals according to Beall's List (http://scholarlyoa.com/publishers/) The list of blacklisted journals is subject to change from time to time according to MoHE.
8. Completion Period	Candidates who have completed the examination of their thesis /dissertation must fulfil the publication requirement as set by the University before the expiry of their maximum period of candidature. If the candidates fail to fulfil the publication requirement within the approved period, they will be terminated from the program of study and considered as failed.

Updated Senate: 25.02.2021

AVOIDING PLAGIARISM

As an enrolled student and member of the Universiti Malaya candidates are expected to produce original academic work. Failure to acknowledge the work of others in their work means the candidate is guilty of plagiarism. A candidate who is found to have plagiarized his assignments or any written work that is part of the assessment in a course or programme may be subjected to disciplinary action under the Universiti Malaya .

Candidates are advised to check their work for originality by using the Turnitin software. Details on Turnitin software can be accessed at https://www.turnitin.com

INTELLECTUAL PROPERTY

The UM ―Intellectual Property Policy‖ covers intellectual property (IP) ownership. As an enrolled student of UM, candidates are required to report to the University all IP with commercial potential. This does not mean that candidates lose their IP rights as their invention still belongs to them unless they have previously assigned it to another party. However, UM may make a claim for joint ownership if, for example, candidates are employed by the University to do research. In such a case, the candidates' contract may assign ownership to the Universiti Malaya.

POSTGRADUATE ACTIVITIES

UM3MT Competition 2023

Research talk & Exchange MOU ceremony by EUREKA Robotics Centre, Cardiff Metropolitan

PHD VIVA

TEACHING AND LEARNING FACILITIES

FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

(A)   TEACHING LABS

The Faculty of Computer Science and Information Technology provide 9 laboratories for teaching and learning purposes. The laboratories are as follows:

BLOCK A

Micro Lab 1 (MM1)
This lab has 47 units of computer that are connected to Windows Active Directory servers and the Internet. The operating system for these PCs is Windows 10. This lab is opened to all FSKTM undergraduate students.

Micro Lab 2 (MM2)
This lab has 12 units of computer that are connected to Windows Active Directory servers and the Internet. The operating system for these PCs is Windows 10. This lab is opened to all FSKTM undergraduate students.

Postgraduate Lab (ML)
This lab has 33 units of computer. All the computers are connected to Windows Active Directory servers and the Internet. The operating system for these PCs is Windows 10. This lab is opened to all FSKTM postgraduate students.

CCNA LAB (CCNA)
This lab has 41 units of computer. The operating system for these workstations is Windows 10. There are also 25 units of Cisco 1700 Series Router, 4 units Cisco 1760 Series Router and 12 units switch Cisco 2950 CATALYST Series. This lab is opened to all FSKTM students.

Robotic Teaching Lab
The Robotic Teaching Lab @ FCSIT is part of the Department of Artificial Intelligence effort to provide conducive intelligent learning environment to students taking the 'Intelligent Robotics' course. Equipped with six mobile robots, the lab allows space for hands-on and robotic experiments designed to help students understand the concept of robotic intelligence and acquire the needful skills for the course.

BLOCK B

Micro Lab 3 (MM3)
This lab has 61 units of computer that are connected to Windows Active Directory servers and the Internet. This lab is opened to undergraduate and postgraduate students.

Micro Lab 4 (MM4)
This lab has 61 units of computer that are connected to Windows Active Directory servers and the Internet. This lab is opened to undergraduate and postgraduate students.
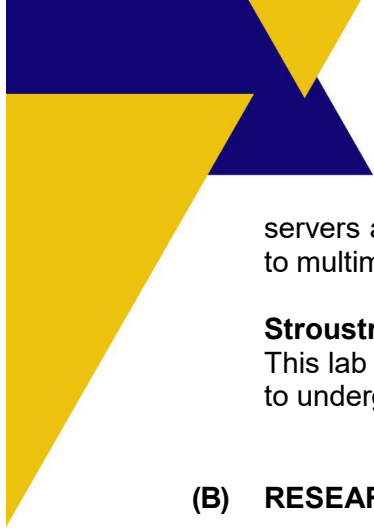
Micro Lab 6 (MM6)
This lab has 45 units of computer that are connected to Windows Active Directory

servers and the Internet. This lab is opened to all FSKTM students but priority is given to multimedia courses. Operating system – Windows 10.

Stroustrup Lab 1
This lab has 42 units of computer that are connected to the Internet. This lab is opened to undergraduate students. Operating system – Windows 10.

(B)   RESEARCH LABS

29 research labs to support postgraduate students research activities, managed by various departments in the faculty:

BLOCK A

Computer Technology Lab
This lab is opened to post-graduate student, priority given to students who are taking courses related to the field Computer Technology.

Information Science Research Lab
This lab is used to develop application software related to the field of Information Science.

BLOCK B

Artificial Intelligence Research Lab
Qualitative reasoning, qualitative modeling, Intelligent Tutoring System, Case-based System, Intelligent Interactive Multimedia System.

Artificial Intelligence 4 U (AI4U)
AI-based Machine Vision essentials. Key objective is to transfer 'AI-based machine vision' knowledge to university lecturers and students.
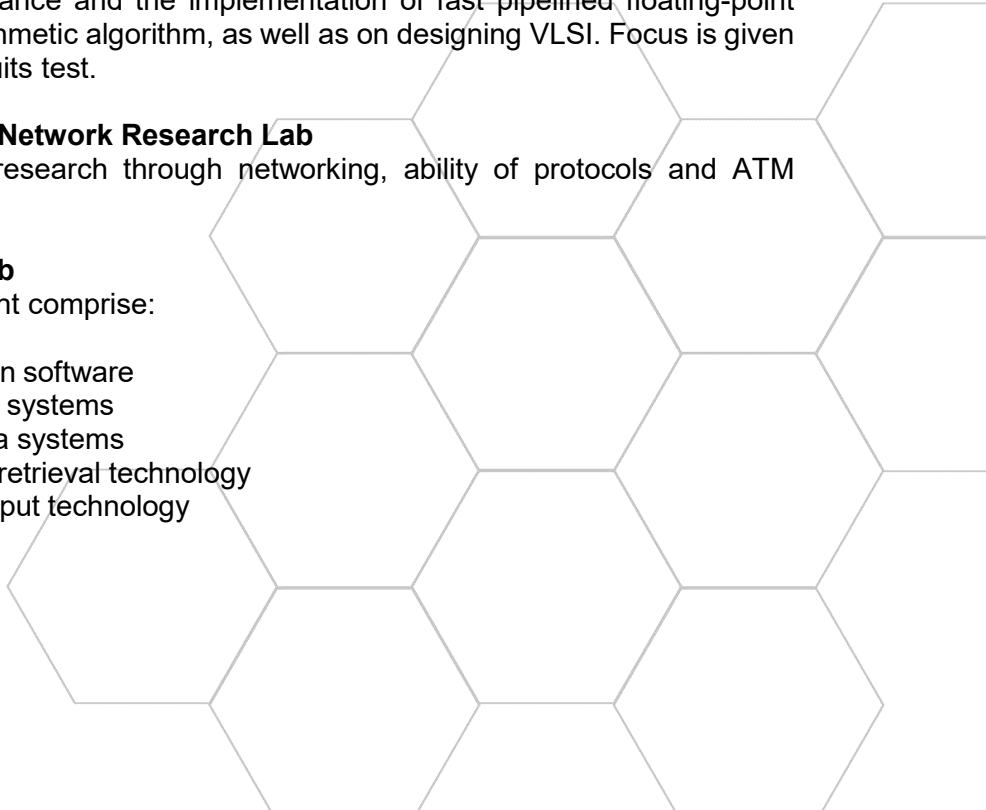
VLSI Research Lab
The study of the performance and the implementation of fast pipelined floating-point arithmetic circuits and arithmetic algorithm, as well as on designing VLSI. Focus is given to the aspect of VLSI circuits test.

Computer Systems and Network Research Lab
Focus on data security research through networking, ability of protocols and ATM studies.

Multimedia Research Lab
Research and development comprise:
● Corporate training
● Smart school education software
● Distributed multimedia systems
● Web-based multimedia systems
● Multimedia Storage & retrieval technology
● Multimedia input & output technology

Human Computer Interaction (HCI) Research Lab
This lab used is for conducting research on usability area, computer support cooperative work (CSCW) and task analysis. It involves task analysis hierarchy chart for user understandability test in implementing any task.

Information System Research Lab
This lab is used for conducting research on dissimilar information systems integration in heterogeneous environment including operating system, hardware, language and the use of the latest software industrial standard to integrate information systems.
Research and development on:
● Business Oriented Systems/ Electronic Government Systems
● Geographic Information Systems
● Inter-organizational Information Systems
● Web-based Information Systems
● Smart Card Application

Stroustrup Lab 2
This lab has 18 units of computer that are connected to the Internet. This lab is opened to undergraduate students taking courses related to electronic circuit.

Wisma R&D (10th and 15th floor):

● Empirical Software Engineering Lab
● Network Analytics Lab
● Mobile Ad Hoc Technology Lab
● Mobile Cloud Computing Lab
● Multimedia Lab
● Software Requirement, Architecture and Reuse Engineering Lab
● Cognitive Science Lab
● Advanced Robotic Lab
● I-Interact
● Software Engineering Process Lab
● Multimedia Signal Processing Lab
● Informetric Lab
● Data Science
● Multimodal Interaction Lab
● Security Lab
● Knowledge Engineering Lab
● AIED/ ES/ NLP/ Intelligent System Lab
● Web Based Information System Lab
● Hypermedia

OTHER FACILITIES
FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

1. **Prayer Room (surau)**
   Air-conditioned prayer rooms (surau) (one for Men, and the other for Women) are provided in Block A for Muslims to pray. The surau for Men is located at the second floorand surau for women is located at the first floor in the building. Users are not allowed tosleep and eat in the surau. Users are also responsible for the cleanliness of the surau.

2. **Vending Machine (Drinks)**
   There are 4 units of vending machine for cold drinks located at Block A and Block B.

3. **Cafeteria**
   Cafeteria is located at the back of Block A.

4. **Postgraduate Lounge & Student Centre**
   Space provided for student to relaxing their mind, having informal discussion and makea small gathering. A few facilities such as sofas, computers, discussion rooms and pantry are ready to use.

5. **Parking Lot**
   The Faculty also provides parking lots for students to park their car or motorbike. Students can park their car or motorbike at the back of Block A. There are 150 parking lots for the motorbike and 45 for the car. Students are not allowed to park their car in front of both buildings because the parking lots are reserved for the faculty staff and visitors.

6. **Water Purifiers**
   Water purifiers are provided in both buildings and placed at every floor.

7. **Internet Access at the building of FCSIT**
   There are WIFI Internet Access provided to students at every floor in each building. Students must obey the rules and regulations during the usage of these facilities.

8. **SPeCTRUM (Student Powered e-Collaboration Transforming UM)**
   This facility is for easy accessibility for student to upload their notes and information regarding their courses.

   All faculties (excluding Faculty of Medicine & Faculty of Dentistry) and PASUM can browse the SPECTRUM website at s**https://spectrum.um.edu.my/**

   For Faculty of Medicine and Faculty of Dentistry, SPECTRUM website can be browsed at **https://spectrumx.um.edu.my/**

   All queries and suggestions can be directed to **https://helpdesk.um.edu.my/**

9. **Door Access**
   Students must register for door access for using research labs, Student Center and Postgraduate Lounge.

LABORATORY REGULATIONS

1. Only registered users are allowed to use the facilities in the lab.

2. Effective from 1st April 2006, it is compulsory for users to wear the matric card in the lab at all times. Users who do not wear the matric cards are not allowed to enter the lab. Lab staff has the right to ask the user to leave upon refusing to wear or show his/her name tag.

3. Ensure use of good quality of CD, thumb drives, external hard disk and virus-free data. The faculty reserves the right to examine before use.

4. Users are strictly prohibited from making copies of software without the knowledge of the staff on duty.

5. Users are prohibited from installing any software onto the hard disk without the knowledge of the staff on duty (eg; KAZAA, BitTorent, P2P software). The faculty reserves the right to remove such installations without any prior notice.

6. Any hardware problems must be reported to the staff on duty. The faculty will not be responsible for any accidents or damage because of negligence and misuse of the equipment by users.

7. Users are prohibited from playing games, chat or browse the web for pornography materials.

8. Users are prohibited from bringing in friends or students from other faculties/universities into the lab.

9. Users are prohibited from making noise and disturbing others. Any discussions should be conducted outside the lab.

10. Smoking, bringing-in bags and foodstuffs is strictly prohibited in the lab.

11. Users are responsible for the safekeeping of the data, hardware and cleanliness of other equipment in the lab including tables and chairs.

12. Users must be properly attired inside the lab. Slippers, shorts and indecently dressed users are strictly prohibited.

13. Users are prohibited to change administrator password as security reason and maintenance work.

Disciplinary action will be taken by the Faculty against those who breached the rules andregulations mentioned above.

ENQUIRIES ON TECHNICAL PROBLEMS

Users who have problems using the equipment and software can contact the technical staff working in the laboratory as in the table below:

LAB	STAFF ON DUTY	TEL. NO.	EMAIL
Micro Lab 1 (MM1)	Haryati Marsilan	03-79676364	haryati@um.edu.my
Micro Lab 2 (MM2)	Jamal Amran	03-79676364	jamalamr@um.edu.my
Postgraduate Lab (ML)	Azzyaty Razali	03-79676406	azzyaty@um.edu.my
CCNA Lab (MC)	Wan Mohd. Hasanul Isyraf Wan Yusoff	03-79676394	isyraf@um.edu.my
Micro Lab 3 (MM3)	Huswadi Hussain	03-79676391	huswadi@um.edu.my
Micro Lab 4 (MM4)	Huswadi Hussain	03-79676391	huswadi@um.edu.my
Micro Lab 6 (MM6)	Aini Munira Ahmad	03-79676394	aini_munira@um.edu.my
Stroustrup Lab 1 (MS1)	Mohd. Farhan bin Abdul Rahman	03-79676320	farhan.rahman@um.edu.my
Robotic Teaching Lab	Jamal Amran	03-79676364	jamalamr@um.edu.my

Operation Hours:

DAY	TIME
Monday - Thursday	8.00 a.m. – 5.30 p.m. (extended upon request according to class timetable)
Friday	8.00 a.m. – 12.15 p.m. 2.45 p.m. – 5.30 p.m. (extended upon request according to class timetable)

*** Computer Laboratories will be closed during maintenance work, and public holidays.*

Disclaimer

Whilst every effort has been made to ensure accuracy of the information contained in this handbook, changes may occur. Students are advised to check the faculty web site http://www.fsktm.um.edu.my for any changes and current information.

The Faculty cannot be held responsible for any errors or omissions in this handbook, and accepts no liability whatsoever for any loss damage howsoever arising.