

MASTER OF SCIENCE (DATA SCIENCE)

PROGRAMME SPECIFICATIONS

The Master of Science (Data Science) is a coursework programme offered on a full-time basis at the UTM Main Campus in Johor Bahru. The duration of study for the full-time programme is subjected to the student's entry qualifications and lasts between one and half (1 1/2) years to a maximum of four (4) years.

The coursework programme is offered based on a 2-Semester per academic session. In this programme, the candidate will learn not only to apply data science, but they will acquire insight into how and why methods work so they will be able to construct solutions to new challenges in data science. Furthermore, students will also be able to work on problems specific to a scientific discipline and to combine knowledge domain with the latest data analysis methods and tools.

General Information

1. Awarding Institution	Universiti Teknologi Malaysia			
2. Teaching Institution	Universiti Teknologi Malaysia			
3. Programme Name	Master of Science (Data Science)			
4. Final Award	Master of Science (Data Science)			
5. Programme Code	MCSDA1AJA			
6. Professional or Statutory Body of Accreditation	<i>Malaysian Qualification Agency (MQA)</i>			
7. Language(s) of Instruction	English and Bahasa Melayu			
8. Mode of Study (Conventional, Distance Learning, etc)	Conventional			
9. Mode of Operation (Franchise, Self-govern, etc)	Self-governing			
10. Study Scheme (Full Time/Part Time)	Full Time			
11. Study Duration	Minimum: 1 year 6 months (3 semesters) Maximum: 4 years (8 semesters)			
Type of Semester	No. of Semesters		No of Weeks/Semesters	
	Full Time	Part Time	Full Time	Part Time
Normal	3	-	8	-
Short	-	-	-	-

Course Classification

No.	Classification	Credit Hours	Percentage
i.	University Courses	3	6.66%
ii.	Core Courses	21	46.67%
iii.	Elective Courses	9	20.00%
iv.	Master Project	12	26.67%
	Total	45	100%
Total Credit Hours to Graduate		45 credit hours	

COURSE MENU

SYLLABUS	SEM 1	SEM 2	SEM 3	TOTAL
University Elective Course			(Choose 1) U*** 6**3	3
Faculty Compulsory Courses	MCSD1113 MCSD1013 MCSD1123 MCSD1043 MCSD1053	MCSD2123 MCSD2213		21
Faculty's Elective Courses	(Choose 1) MCSD1123 MCSD1103 MCSD1133 MCSD1143 MCSD1153	(Choose 1) MCSD1123 MCSD1103 MCSD1133 MCSD1143 MCSD1153	(Choose 1) MCSD1123 MCSD1103 MCSD1133 MCSD1143 MCSD1153	9
Master Project		MCSD6215	MCSD6227	12
Total Credits	18	14	13	45

Programme Educational Objectives (PEO)

Code	Intended Educational Objectives
PEO1	Mastery of knowledge and competency in advanced areas of Data Science field.
PEO2	Practice professionalism and high standards of ethical conducts within organization and society.
PEO3	Responsive to changing situations by continuously acquiring new knowledge and skills.

Programme Learning Outcomes (PLO)

After having completed the programme, graduates should be able to demonstrate the following competencies:

Code	Intended Learning Outcomes
PLO1	Synthesize complex information, specialized concepts, theories, methods and practice independently in the field of Data Science. (Knowledge and Understanding)
PLO2	Solve complex problems critically and integratively using systematic approaches. (Cognitive Skills)
PLO3	Apply practical skills to solve problems in the field of Data Science. (Practical Skills)
PLO4	Demonstrate effective collaboration with stakeholders professionally. (Interpersonal Skills)
PLO5	Communicate effectively the knowledge, skills and ideas using appropriate methods to peers, experts and communities. (Communications Skills)
PLO6	Use digital technologies and appropriate softwares competently to enhance study and practice. (Digital Skills)
PLO7	Evaluate numerical and graphical data critically using quantitative or qualitative tools in solving problems. (Numeracy Skills)
PLO8	Demonstrate leadership, autonomy and responsibility in managing resources. (Leadership, Autonomy and Responsibility)
PLO9	Engage self-advancement through continuous learning or professional development. (Personal Skills)
PLO10	Initiate entrepreneurial projects supported by relevant knowledge and skills. (Entrepreneurial Skills)
PLO11	Demonstrate respectable ethical conducts and professionalism skills in an organization and society. (Ethics and Professionalism Skills)

GRADUATION CHECKLIST

To graduate, students must pass all the stated courses in this checklist. It is the responsibility of the students to ensure that all courses are taken and passed. Students who do not complete any of the courses are not allowed to graduate.

*Please attach a copy of results for previous semesters and a copy of registration slip for current semester.				
University Common Elective (Choose 1 course)		Credit	Grade	Pass
UHAP6013	Seminar on Global Development, Economics and Social Issues	3		
UHAW6023	Philosophy of Science and Civilization	3		
UECS 6013	IT Project Management	3		
UHAZ 6123	Malaysian Society and Culture	3		
Core Subject (Compulsory)				
MCSD1013	Business Intelligence and Analytics	3		
MCSD1043	Research Design and Analysis in Data Science	3		
MCSD1053	Data Science Governance	3		
MCSD1113	Statistic for Data Science	3		
MCSD1123	Big Data Management	3		
MCSD2123	Massive Data Mining and Streaming	3		
MCSD2213	Advanced Analytics for Data Science	3		
Elective Subject (Choose 3 courses)				
MCSD1103	Data Visualization	3		
MCSD1133	Operational Research and Optimization	3		
MCSD1143	Supply Chain Analytic	3		
MCSD1153	Human Based Computing	3		
MCSD1123	Big Data Computing	3		
Master Projects				
MCSD6215	Master Project I	5		
MCSD6227	Master Project II	7		
Total		45		

COURSE SYNOPSIS

CORE COURSES

MCSD1013 - Business Intelligence and Analytics

Business intelligence and analytics refers to the solutions implemented by enterprises such as businesses, non-profits and governments using data to gain insights for making better decisions. Business intelligence and analytics is applied in operations, marketing, finance and strategic planning among other functions. The ability to use data effectively to drive rapid, precise and profitable decision has been critical strategic advantages for companies. With the increasing availability of broad and deep sources of information-so called “Big data”-business intelligent and analytics are becoming an even more critical capability for enterprises of all types and all sizes to identify trends and understand the information that can drive business change and support sustained successful business practices.

MCSD1043 - Research Design and Analysis in Data Science

This course will cover the fundamental steps and implementation on developing the initial ideas to formal academic writing accordingly. Students will be given the mechanisms on how to transform and digest the literature reviews that leads to the proposed title. The theoretical and practical aspects of implementing draft project proposal will be the milestone of this course. Ordered, Critical and Reasoning Exposition of knowledge through student efforts.

MCSD1053 - Data Science Governance

Data governance is a mandatory requirement for a successful organization which aims to be data driven, achieve master data management, build business intelligence, improve data quality or efficiently manage documents. This course provides an overview of the data governance life cycle. Students will learn why data governance is needed, how to design, initiate, and execute a program and how to keep the program sustainable. The governance in the aspect of big data will be explored for the best practice in managing and manipulating large amount of data. At the end of the course, students should be able to understand the design and the implementation of data governance and its importance to an organization

MCSD1113 - Statistic for Data Science

This course provides a fundamental concept in statistics for data science. Students will learn descriptive statistics, statistical inference including estimation, hypothesis testing and nonparametric tests. Further, students will be introduced to linear regression and analysis of variance. R will be used to apply these statistical methods. At the end of the course, students should be able to apply the statistical methods to real large data sets.

MCSD1123 - Big Data Management

This course provides a basic fundamental of big data modeling, management and architecture. Students will learn the big data processes and the current big data technologies that are available. The big data management will be explored for the best practice in managing and manipulating large amount of data. At the end of the course, students should be able to understand the architecture and management of big data and also can develop simple application of big data handling using particular platform in assignment.

MCSD2123 - Massive Data Mining and Streaming

This course aims to introduce students to basic principles and methods of machine learning algorithms that are typically used for mining large data sets. This course also will provide students with the skill and knowledge to build system and capable of analyzing huge amount of data. It explains the principle of distributed file systems and shows map reduce as a tool for creating parallel algorithms. Typically, it covers the algorithms that used for analyzing networks, fundamental principles of techniques such as decision trees and support vector machines and finally neural network architecture. The students will gain practical understanding through a coding exercise where they will implement and apply one machine learning algorithm on a particular large dataset.

MCSD2213 - Advanced Analytics for Data Science

This course provides a basic yet solid understanding on the use of analytics approach in the examination of data or content to discover deeper insights and make predictions using sophisticated techniques and tools on real world problems. Students will learn descriptive analytics using analytics tools to gain insight into the past. Students will also acquire understanding of predictive analytics using statistical and machine learning techniques to understand future outcome. The prescriptive analytics provides knowledge in simulation and optimization to quantify the effect of future decision to advise possible outcomes before decision is made. The analytical abilities to be acquired by students in this course are to reliably select analytic techniques or method and specify steps involve in the analysis process for descriptive and predictive analysis. At the end of the course, students should be able to apply the knowledge on analytical techniques or tools in real world problems to be able to make an informed decision through analytical interpretations of results.

ELECTIVE COURSES

MCSD1103 - Data Visualization

This course is an introduction to the principles and techniques for visualization to transform and visualize the large datasets to aid knowledge discovery and decision-making. Students will learn the principles, techniques, and practical skill necessary to communicate information about data clearly and effectively through data visualization. Further, students will be exposed to techniques for visualizing different types of data including categorical, time series, spatial, and multiple variables data. Additionally, students will utilize available tools to visualize the dataset. At the end of the course students should be able to implement and apply the theory and use tools to communicate information out of the data clearly and effectively through graphical means.

MCSD1133 - Operational Research and Optimization

The aim of the course is to introduce students to some applications of data science that can be formulated and solved by operational research and optimization techniques. Students will learn the theory and how to practice it for modeling (formulate, analyze and solve) optimization problems arising in data intensive environments. Further, students will be exposed to use appropriate operational research or optimization software

MCSD1143 - Supply Chain Analytics

The course aims to improve operational efficiency and effectiveness by enabling data-driven decisions at strategic, operational and tactical levels. The student will be able to perform analysis using data analytics methods and analytical tools necessary in the areas of predictive, descriptive and prescriptive analytics to efficiently manage demand and supply networks. Through the analysis and discussion of case studies they will discover business insights in order to optimize the value of supply chain processes and operations. The topics covered including designing the supply chain network, planning demand and supply in a supply chain, retail analytics, inventory management and transport analytics. Software packages such as R, Python and Tableau will be utilized.

MCSD1153 - Human-based Computing

This course offers students a new perspective on the study of human biological systems to human computing system. This course will emphasize on the theoretical of human computing aspect which includes dendrite, immune, membrane and cell computing. The fundamental concept of this course will be designed to come out with algorithmic computing based for solving meta complex data in chaotic environment.

MCSD1163 - Big Data Computing

This course is designed to be suitable for an introductory course at master levels. This course covers intensive exploration on GPU computing with CUDA programming. The foundations of the CUDA programming will be addressed in terms of the concept, design, architecture and programming model to deal with the needs of big data computing. Students will also be exposed to the current needs of big data era in which the big data computing accessory will be given especially on the implementation of high-performance computing in executing GPU Machine Learning Library (GPULib).

MASTER PROJECT

MCSD6215 - Master Project 1

This is the initial part of a 2-part Master project that every student must fulfill successfully. Students are required to propose a suitable research topic under the supervision of a lecturer as a supervisor. Students must meet regularly with supervisor who will monitor their continuous progress. At the end of this course, students are required to prepare a report and present their proposal.

MCSD6227 - Master Project 2

This is the second part of a 2-part Master project that every student must fulfill successfully. In this phase, students are required to execute the next phases of their development plan from Part 1 (Project 1). Students are now required to code and integrate the different modules that make up the proposed project. Students will test the developed modules and the final fully-integrated project following programming code development and research testing practices. Students must meet regularly with supervisor(s) who will monitor their continuous progress. Students are required to prepare a report and present their final work.

UNIVERSITY COMMON ELECTIVE COURSES

UECS6013 IT Project Management

This course presents a hands-on perspective to Information Technology project management. This course will assist post-graduate students to plan and implement their post-graduate projects as well as other IT projects effectively. The subject is organized into three main sections, that covers: i) Basic concepts, life cycle and framework of project management, ii) Detailed description of each project management knowledge areas under the Project Management Institute (PMI) Body of Knowledge (PMBOK) and its applications, and iii) Real Project Initiation, Planning, Executing, Monitoring and Closing. The Project Management areas include – project integration, scope, time, cost, quality, human resource, communications, risks and procurement management. Students will also be utilizing latest tools for understanding, reviewing, communicating and developing Business Model for a project. Teams of students are expected to perform real projects and achieve agreed Key Performance Indicators (KPI).

UHS6013 Philosophy of Science and Civilization

This course discusses the meaning and nature of the philosophy of science and civilization. It seeks first to explore the different denotation, connotation, and cognitive substance of philosophy, science, and civilization, as independent concepts. It then seeks to understand these terminologies individually in their historical perspectives and their relationship to each other. Understanding the meaning and import of culture is necessary to our understanding of civilization. The study of the nature and meaning of religion is therefore significant in our appreciation of culture and civilization. Historically, Islam and the Muslims have always been intricately connected to the Western world. Thus, the discussion also includes comparative studies of Islamic and western philosophy and universal values. The final discussion is about the contribution of Islam to the world's civilization, education, culture and scientific development.

UHLM6013 Malay Language for Post Graduates

This course is offered to international students of the Masters and PhD programmes, from Indonesia, Brunei, Southern Thailand and Singapore. In this course students are given exposure on how to write scientific works (in Malay). The focus of this course is the spelling aspect, punctuation, sentence variety, language adjustment, paragraph writing and writing style. In addition, students will be exposed on writing formats such as literature writing, citations, bibliographies, abstracts and editing.

UHMS6013 Seminar on Global Development, Economic and Social Issues

This course focuses on different approaches to economic development with reference to economic growth. Discussion on this course also includes issues related to globalization, technology and digital divides as well as the social crisis that has become a global concern. It aims in developing skills in understanding and analyzing global issues and recommending relevant solutions. Issues will be discussed in detail.

UHMZ6023 Malaysian Society and Culture

This course is designed for international postgraduates. This course discusses on the various aspects of the Malaysian culture and society. Topics on belief system, religious festivals, customs and etiquettes of different ethnic groups in Malaysia will be introduced to the students. In addition, students will also be introduced to the Malay Language. At the end of the course students should be able to understand the cultures practiced among Malaysians and adapt themselves to these new cultures.

UHPS6013 Dynamics of Leadership

This course is intended to encourage students discover and develop their personal leadership qualities. Students will be exposed to leadership theories so that they could develop an insight that leadership itself is a dynamic relationship based on mutual influence and common purpose between leaders and followers. Topics covered include Introduction to Leadership, Leadership Traits & Ethics, Leadership Behaviour and Motivation, Influencing: Power, Politics, Networking and Negotiation, Contingency Leadership Theories, Communication, Coaching, and Conflict Skills, The LeaderFollower Relationship, Team Leadership, Leading Self-Managed Teams, Transformational and Level 5 Leadership. Students will be evaluated based on their class leadership role, short talk and personal learning portfolios.

URTS6013 Environmental Ethics

Environmental ethics is the discipline in philosophy that studies the moral relationship of human beings to, and also the value and moral status of, the environment and its nonhuman contents. It covers the challenge of environmental ethics to the anthropocentrism (i.e., human-centeredness) embedded in traditional western ethical thinking; the early development of the discipline in the 1960s and 1970s; the connection of deep ecology, feminist environmental ethics, and social ecology to politics; and the attempt to apply traditional ethical theories, and virtue ethics, to support contemporary environmental concerns. It focus on environmental literature on wilderness, and possible future developments of the discipline.

UMJJ6013 Basic Japanese Language and Culture

At this course, students will be introduced to a simple yet useful familiar everyday expressions and very basic phrases using basic grammars to develop oral communication skills for social purposes. This course is suitable for beginners who wish to develop basic conversational skills in a short period. E-learning will be introduced and students must complete some Kana and communication courses within the time frame by self-learning. After this course, students are expected to speak common phrases in different situations and make simple conversation in Japanese language.

UECS6023 Introduction to Technopreneurship

This course provides an overview of the basic concepts on entrepreneurship focusing on the nature, environment, and risks of new venture formation and building of businesses with IT in the Malaysian context. Students will learn on how to analyse and evaluate the business opportunities using knowledge and skills taught in this course and suggest innovative business ideas, business planning, self-assessment and operating strategies required to start a new small business. Students will also be exposed to current case studies of existing companies involved in the IT business. Active participation by students during class discussions and activities is encouraged & expected so that students can gain hands on experience with

conducting research, develop, write, evaluate, presenting and defending segments of a business plan.

UBSS6023 Business Ethics, Responsibility and Sustainability

Business plays a significant role in societal and environmental well-being. Private and public organizations are no longer responsible to shareholders and those inside the organizations, but to external parties including consumers, politicians, regulators, communities and ordinary citizens. To fulfil the conflicting needs of these stakeholders, business leaders and managers often encounter complex situations that require them to make difficult decisions whereby the lines between right and wrong are blurry. This course aims to provide students the fundamental knowledge about the role of organizations in a society and to develop their skills to sustainably manage organizations that integrate legal, ethical, economic, environmental, and social dimensions into their decision-making. The course intends to develop responsible managers who have high integrity, professionalism and interpersonal skills. The course will also teach strategies on how managers can promote responsible conducts in their companies. The course objectives will be achieved through various teaching and learning methods specifically through critical examination of case studies involving ethical issues and dilemmas on complex and controversial business problems. This course is integrative in nature built upon the understanding and reflection of the main disciplines covered in the core courses in the MBA program.

UBSS6013 Organization Behavior and Development

This course helps students integrate behavioural science theories, tools, concepts, and techniques learned in the lab to an OB application in a "real" organization. Students are expected to conceptualize and apply Organization Behaviour three-level of analysis and synthesize it with the theory and practice of Planned Change for individuals, groups and organizations. Throughout the course, participants are exposed to the important topics central to behaviours of organization and its holistic process for development and change. Some of the topics include multiple views of organizations that influence organizational change, the evolution of organizational development and its challenges. The course also covers the nature of planned change, theories and types of change, the role of values and ethics in organizational change, and the concept of emergent change to enable participants to have an overall view of how available approaches to planned change management can be applied in organizational settings.