

BACHELOR OF SCIENCE (DATA ANALYTICS) WITH HONOURS

Introduction

The Bachelor of Science (Data Analytics) with Honours is designed to provide a program of study that combines data science, statistics, machine learning, and mathematics that is in line with the Industrial Revolution 4.0. The program applies the 2u2i elements through the implementation of 2.5 years of study in the university (university component) and 1 year of study in the industry (industrial component). Upon completion of this program, the students will also obtain SAS Certificate known as "SAS Academic specialization in Data Analytics".

The program curriculum has been fully integrated to meet the increasing need for highly skilled data analysts who can analyze the growing amount of data in a variety of disciplines and transform it into usable information for use in decision-making. The program also aims to address the high industry demand for business and data analysts. Graduates will be trained in the latest data analytics methods, concepts and tools used to make sense of data that are available in various forms through knowledge, skills, and abilities.

Students will have an opportunity to work with the industry through their 4 industry component courses in the form of Work Based Learning (WBL) that are offered in the final year of study. This involves learning in a real-life industrial environment project related to IR4.0. The implementation of the 2u2i mode will expose students to actual learning and practice directly from relevant industry practitioners. Such training will add value to their qualification and increase their employment opportunities

Program Education Objective (PEO)

The students for this programme are aimed to achieve the following objectives:

- PEO1 : Able to apply knowledge (PLO1) and technical skills (PLO2) as well as practical skills supported by intellectual skills (PLO3) in the field of Data Analytics in line with the Industrial Revolution 4.0 (IR4.0)
- PEO2 : Able to communicate effectively in various levels of autonomy (PLO4) as well as the ability to plan, manage relationships in teams and in organizations of different political, cultural and social backgrounds (PLO5)
- PEO3 : Practicing knowledge in an ethical and professional manner, with integrity and accountability (PLO6)
- PEO4 : Able to solve problems in an IR 4.0 environment effectively with the spirit of "esprit de corps" (PLO7) and able to make decisions critically and analytically in various levels of autonomy in the organization (PLO9)
- PEO5 : Able to sharpen the entrepreneurial mindset related to IR 4.0 (PLO8) by leveraging knowledge and digital technology skills (PLO10) supported by quantitative skills to analyze and manage economic, political, social environment and climate change in IR 4.0 environment (PLO11)

Career Prospects

Graduates of the Bachelor of Science (Data Analytics) program with honours can be involved in various fields and service of big data or industrial revolution 4.0 whether in the public or private sector such as finance, insurance, banking, investment, transportation, manufacturing, mining, health, marketing, sport, research, and development and many more. Among the careers that

can be pursued are:

- Data Scientist
- Data Analyst
- Data Engineer
- Data Manager
- Data Architect
- Business/ Marketing Analyst
- Quantitative analyst
- Financial analyst
- Systems Analysts
- Information Security Analyst
- Research & Development
- Business Consultant
- Database developer or administrator

Total of Credits for Graduation

The minimum number of credits to graduate is 125 credit hours. The distribution of credit hours by course category is as follows:

Category	Credit	Percentages
University Core Course	20	16.0
Programme Core Course	68	54.4
Specialization Core Course	22	17.6
University Elective Course	15	12.0
Total	125	100

University Core (20 Credit Hours)

Students can choose 18 credit hours from any course listed by the “*Pusat Pendidikan Asas dan Lanjutan*” as a University Core course.

No	Course Code	Course Name	Credit Hours	Pre-requisite
1.	BBB3013	Academic Writing Skills	3 (3+0)	None
2.	BBB3033	English For Occupational Purposes	3 (3+0)	None
3.	MPU3132	Appreciation of Ethic and Civilizations	2 (2+0)	None
4.	MPU3142	Philosophy and Current Issues	2 (2+0)	None
5.	MPU3223	Basic Entrepreneurship	3 (3+0)	None
6.	COM3112	Communication Arts	2 (2+0)	None
7.	CCM3011	Community Care	1 (0+1)	None
8.	CCXXXXX	Co-Curriculum	2 (0+2)	None
9.	MPU3352	Integrity and Anti-Corruption	2 (2+0)	None
TOTAL			20	

Programme Core (68 Credit Hours)

To fulfill the graduation requirements, students must follow and pass all 15 Core Programme courses with 68 credits.

No	Course Code	Course Name	Credit Hours	Pre-requisite
1.	MDA3003	Introduction to Data Science	3(2+1)	None
2.	MDA3044	Industrial Programming Language	4(3+1)	None
3.	MDA3053	Introduction to Machine Learning	3(2+1)	None
4.	MDA3024	Multivariate Calculus	4(3+1)	None
5.	MTM3004	Linear Algebra	4(3+1)	None
6.	MDA3103	Topological Data Analysis	3(2+1)	None
7.	MDA3123	Data Visualisation	3(2+1)	None
8.	MDA3133	Network Science	3(2+1)	None
9.	CSF3013	Data Structure and Algorithm	3(2+1)	None

10.	CSF3123	Database	3(2+1)	None
11.	MDA4003	Scientific Research	3(0+3)	None
12.	MDA4908-I	Industrial Project I	8(0+8)	None
13.	MDA4918-I	Project Management I	8(0+8)	None
14.	MDA4928-I	Industrial Project II	8(0+8)	None
15.	MDA4938-I	Project Management II	8(0+8)	None
TOTAL			68	

Specialization Core Course (22 Credit Hours)

To fulfill the graduation requirements, students must take and pass all 7 Specialization Core courses with 22 credits.

No	Course Code	Course Name	Credit Hours	Pre-requisite
1.	MDA3014*	Probability and Statistics for Data Analytics	4(3+1)	None
2.	MDA3033*	Applied Linear Statistical Models	3(2+1)	None
3.	MDA3063	Experimental Design	3(3+0)	None
4.	MDA3073	Survey Sampling Methods	3(3+0)	None
5.	MDA3083*	Predictive Analytics	3(3+0)	None
6.	MDA3093*	Bayesian Statistics	3(3+0)	None
7.	MDA3113*	Multivariate Statistics	3(3+0)	None
TOTAL			22	

Note: *Courses that come with SAS certification module

University Elective Course (15 Credit Hours)

Students are free to register for any courses offered appropriately based on student interest and maturity. However, students are required to take at least 15 credit hours from the following list of elective courses, or subject to the approval of the Head of Programme:

No	Course Code	Course Name	Credit Hours	Pre-requisite
1.	MKG3033	Scientific Computing	3(2+1)	None
2.	MKG4083	Logic and Computation	3(3+0)	None
3.	MKG4093	Heuristic Techniques for Combinatorial Optimization	3(3+0)	None
4.	MKG4103	Graph Theory	3(3+0)	None
5.	CSF3563	Data Mining	3(3+0)	None
6.	MGM3323-E	Philosophy of Management	3(3+0)	None
7.	ECO3003	Principle of Economic Thinking	3(3+0)	None
8.	MMS3103	Oceans, Atmosphere and Climate	3(3+0)	None
9.	MMS3603	Introduction To Marine Science	3(3+0)	None
10.	MMS3633	Approaches to Marine Management and Policy	3(3+0)	None
11.	MMS3653	Marine Scientific Data Analyses	3(3+0)	None
12.	MMS3663	Fundamental of Marine Science	3(3+0)	None
13.	MKG3002	Principle of Mathematical Modelling	2(2+0)	None
14.	MMT3112	Marine Technology Laboratory	2(0+2)	None
15.	KAS3032	Principles of Environmental Analysis	2(2+0)	None
TOTAL			15	

COURSE SCHEME
BACHELOR OF SCIENCE (DATA ANALYTICS) WITH HONOURS
SESSION 2023/2024

COURSE CODE	COURSE	CREDIT HOURS	PRE-REQUISITE	COURSE CODE	COURSE	CREDIT HOURS	PRE-REQUISITE
SEMESTER 1				SEMESTER 2			
MDA3003	Introduction to Data Science	3(2+1)	-	MDA3033*	Applied Linear Statistical Models	3(2+1)	-
MDA3014*	Probability and Statistics for Data Analytics	4(3+1)	-	MDA3044	Industrial Programming Language	4(3+1)	-
MDA3023	Multivariate Calculus	4(3+1)	-	MDA3053*	Introduction to Machine Learning	3(2+1)	-
MTM3004	Linear Algebra	4(3+1)	-	BBB3013	Academic Writing Skills	3(3+0)	-
MPU3142	Philosophy and Current Issues	2(2+0)	-	COM3112	Communication Arts	2(2+0)	-
CCXXXXX	Co-Curriculum	2	-	CCM3011	Community Care	1(0+1)	-
				MPU3352	Integrity and Anti-Corruption	2(2+0)	-
Total credit		19		Total credit		18	
SEMESTER 3				SEMESTER 4			
MDA3063	Experimental Design	3(3+0)	-	MDA3083*	Predictive Analytics	3(3+0)	-
MDA3073	Survey Sampling Methods	3(3+0)	-	MDA3093*	Bayesian Statistics	3(3+0)	-
CSF3013	Data Structure and Algorithm	3(2+1)	-	MDA3103	Topological Data Analysis	3(2+1)	-
CSF3123	Database	3(2+1)	-	MPU3223	Basic Entrepreneurship	3(3+0)	-
	Elective 1	3	-	MPU3132	Appreciation of Ethic and Civilizations	2(2+0)	-
	Elective 2	3	-		Elective 3	3	-
					Elective 4	3	-
Total credit		18		Total credit		20	
SEMESTER 5							
MDA3113*	Multivariate Statistics	3(3+0)	-				
MDA3123*	Data Visualisation	3(3+0)	-				
MDA3133	Network Science	3(2+1)	-				
MDA4003	Scientific Research	3(3+0)	-				
BBB3033	English for Occupational Purposes	3(3+0)	-				
	Elective 5	3	-				
Total credit		18					
SEMESTER 6				SEMESTER 7			
MDA4908-I	Industrial Project I	8(0+8)	-	MDA4928-I	Industrial Project II	8(0+8)	-
MDA4918-I	Project Management I	8(0+8)	-	MDA4938-I	Project Management II	8(0+8)	-
Total credit		16		Total credit		16	
TOTAL CREDIT TO GRADUATE 125							

*Courses embedded with SAS certificate module

Notes:

1. Students are required to undertake the **Survival and Water Safety Program** as a **condition to graduate**.
2. The number of elective course credit hours that must be taken by students in the programme of study is subject to the **number of elective credit hours** set by the programme of study to meet graduate qualifications and is not subject to the **number** of elective courses taken.
3. The list of elective courses that can be taken by students in the programme of study refers to the course offerings listed in the handbook of the study programme of the faculty and other faculties.

COURSE SYNOPSIS
BACHELOR OF SCIENCE (DATA ANALYTICS) WITH HONOURS

CORE COURSE

MDA3003 Introduction to Data Science

Credit 3 (2+1)

Pre-requisite No

This course introduces the student to the collection, preparation, data acquisition, cleaning, aggregation, exploratory data analysis, modelling and visualization of data, feature engineering, and model creation and validation covering both conceptual and practical issues. Examples from diverse fields will be presented, and hands-on use of statistical and data manipulation software will be included.

MDA3023 Multivariate Calculus

Credit 4 (3+1)

Pre-requisite No

This course discusses the topics like the limit and continuity, multivariable functions, partial derivatives, total derivative and multiple integration. In addition, this course discusses the cylinder coordinate, spherical coordinate and the change of variables in multiple integration.

MTK3004 Linear Algebra

Credit 4 (3+1)

Pre-requisite No

The course discusses the concepts of vector space including row space and column space, linear transformation including covering matrix representation and similarity matrices, orthogonality up to the Gram-Schmidt orthogonalization process, eigenvalues, eigenvectors, eigenspace and numerical linear algebra.

MDA3044 Industrial Programming Language

Credit 4 (3+1)

Pre-requisite No

This course contains basic programming and programming language; Problem solving techniques; flow diagram and structured algorithm; Program coding techniques and instructions to solve formal problems. Hands-on programming exercises will be given to expose students on integration of SQL, TensorFlow, and many other useful functions and libraries for data science and machine learning.

MDA3053 Introduction to Machine Learning

Credit 3 (2+1)

Pre-requisite No

This course discusses the basics of machine learning which include introduction to machine learning, various concepts and methods in machine learning, classification of machine learning algorithms, various types of machine learning such as "Neural Networks", "Support Vector Machine" and ending with language learning

MDA3103 Topological Data Analysis

Credit 3 (2+1)

Pre-requisite No

This course introduces fundamental elements of the emerging science of Topological Data Analysis (TDA) with the underlying principles from computational geometry, algebraic topology, data analysis, and many other related scientific areas. The application of topological techniques to complex data has opened up new opportunities in exploratory data analysis and data mining. This course is intended to cover theory, algorithm and application of TDA for identifying topological signatures of complex datasets, not just massive in size, but rich in features.

MDA3123 Data Visualization**Credit 3 (2+1)****Pre-requisite No**

This course introduces to the principles and basic data visualization design; visualization representation methods and techniques including charts, tables, graphics, effective presentations, multimedia content, animation, and dashboard design for visualizing multivariate, temporal, text-based, geospatial, hierarchical and network data. Hands-on visualization exercises based on common data domains will be given to experience designing data graphics and visualizations, and reporting findings using data visualization tool.

MDA3133 Network Science**Credit 3 (3+0)****Pre-requisite No**

This course introduces fundamental elements of the emerging science of complex networks, with emphasis on social and information networks. Students will learn about mathematical and computational methods used to visualize & analyse networks, methods used to understand and predict behaviour of networked systems, and theories used to reason about network dynamics. Students will also be exposed to current trend in the field, and derive insights on complex structures.

CSF3013 Data Structure and Algorithm**Credit 3 (2+1)****Pre-requisite No**

This course introduces programming methods to solve problems. Topics for this course include the introduction to data structure such as linked list, stack, queue, tree, graph, sorting techniques and searching methods. Emphasis will be given on modular programming technique. This course also introduces algorithm time complexity as a measuring technique of an efficient algorithm. In addition, the time complexity algorithm as an efficient algorithm measurement technique will also be introduced.

CSF3123 Database**Credit 3 (2+1)****Pre-requisite No**

This course introduces database concepts (goals of DBMS, relationships, physical and logical organization, schema and subschema); data models, normalisation (until BCNF), canonical schema and data independence; data description language; query facilities, query functions; design and translation strategies; and data integrity and reliability.

MDA4003 Scientific Research**Credit 3 (3+0)****Pre-requisite No**

This course exposes students to the systematic scientific research, writing good dissertation and effective presentation

MDA4908-I Industrial Project I**Credit 8 (0+8)****Pre-requisite No**

This course introduces the student to the basic requirement of industrial project particularly data science projects at industrial environment.

MDA4918-I Project Management I**Credit 8 (0+8)****Pre-requisite No**

This course introduces students to the concepts and techniques used in managing a project particularly data science projects in industrial environment. Through this project, students will generate project plan and schedule, cost estimation, in addition to preparing the related documents. The aspect that will be accessed here is students' ability in managing project development. This course will be supervised by

industrial supervisor and monitored by UMT.

MDA4928-I **Project Industry II**
Credit **8 (0+8)**
Pre-requisite **No**

This course is a continuation from the Industrial Project I (MDA49781). Through this course, students will be implementing the concepts and techniques used in the Industrial Project I in terms of real industrial environment. The aspect that will be accessed here is students' ability in managing project development with minimum supervision by industrial and UMT supervisors.

MDA4938-I **Project Management II**
Credit **8 (0+8)**
Pre-requisite **No**

This course is a continuation from the Project Management I (MDA49782). Through this course, students will be implementing the concepts and techniques used in the Project Management I in terms of real industrial environment such as the project plan and schedule, cost estimation, in addition to preparing the related documents. The aspect that will be accessed here is students' ability in managing project development with minimum supervision by industrial and UMT supervisors.

Specialization Core Course

MDA3014 **Probability and Statistics for Analytical Data**
Credit **4 (3+1)**
Pre-requisite **No**

This course introduces the student to the important concepts in probability and statistics such as probability, random variables, probability distribution random variables, sampling distribution theory, estimation and hypothesis testing. Examples data from marine and aquatic will be presented, and hands-on use of statistical and data manipulation software will be included.

MDA3033 **Applied Linear Statistical Models**
Credit **3 (2+1)**
Pre-requisite **No**

In this course, we will learn how to develop linear models via simple and multiple linear regression. Mastery of this knowledge is important because statistical methods are widely used today that involve real data and big data.

MDA3063 **Experimental Design**
Credit **3 (3+0)**
Pre-requisite **No**

This course begins with Basic principles of experimental design; Randomization; Completely randomized design; Randomized blocks, Latin Squares, Factorial design; Blocking in factorial design; 2k factorial design; Extension of 2k factorials; Blocking and confounding in 2k factorials; Fractional factorial designs; Blocking in fractional factorials; Nested and split-plot designs; Replicated and un-replicated designs; Random effects model.

MDA3073 **Survey Sampling Methods**
Credit **3 (3+0)**
Pre-requisite **No**

The course introduces the student to a set of principles of survey and data analytics that are the basis of standard practices in these fields. This course begins with how to do survey research for data analytics, quality of data, modes of survey data collection, data generation from other sources, sampling technique such as simple random, probability sampling, stratified sampling, ratio and regression estimation, cluster and systematic sampling, two-stage sampling, estimating the population size, total survey error, writing reports and managing the survey process. Examples from diverse fields will be presented, and hands-on.

MDA3083 **Predictive Analytics**
Credit **3 (3+0)**
Pre-requisite **No**

This course introduces student to the knowledge of widely-used forecasting technique, such as the forecasting problem, an introduction to time series methods, time series methods, data reduction and big data. Examples data from marine and aquatic will be presented, and hands-on use of forecasting methods and data manipulation will be included.

MDA3093 **Bayesian Statistics**
Credit **3 (3+0)**
Pre-requisite **No**

The course begins with a brief overview of the probabilities and is followed by Statistics. Topics to be covered in this course include one-parameter models, multiparameter models, Markov Monte Carlo chains and model comparisons

MDA3113 **Multivariate Statistics**
Credit **3 (3+0)**
Pre-requisite **No**

This course covers introduction to multivariate data, multivariate data visualization, application of multivariate models such as principal component analysis, multidimensional scaling, factor analysis and group analysis.

Elective Course

MKG3033 **Scientific Computing**
Credit **3 (2+1)**
Pre-requisite **No**

This course presents the basics elements of scientific computing, in particular the methods for solving or approximating the solution of calculus and linear algebra problems associated with real world problems. Using a non-trivial model problem, sophisticated scientific computing and visualizations environments, students are introduced to the basic computational concepts of stability, accuracy and efficiency. New numerical methods and techniques are introduced to solve more challenging problems.

MKG4083 **Logic and Computation**
Credit **3 (3+0)**
Pre-requisite **No**

This course pursues numerical approach modeling natural phenomena that often can not be solved analytically. This course is divided into two parts. The first part discusses about finite-difference and shooting method to solve linear and nonlinear ordinary differential equations with boundary values. The second part discusses about various numerical approaches to solve hyperbolic, parabolic and elliptic partial differential equations. Students are exposed to solve a wide variety of real problems in science, engineering, and other fields using numerical methods.

MKG4093 **Heuristic Techniques for Combinatorial Optimization**
Credit **3 (3+0)**
Pre-requisite **No**

Optimization using heuristic techniques is one of the frequently used methods for solving various real-world problems. This technique is often used for solving NP-hard problem, for example in transportation, scheduling, network, and bioinformatics. Since there are numerous possible applications using this method, it is important for students to understand it and to be able to apply it in real world applications.

and management as well as the concepts and models adopted, for example the United Nations Convention on the Law of the Sea (UNCLOS). Through understanding the concepts and models used internationally, students will be able to identify their national and regional significance.

MMS3653 Marine Scientific Data Analyses

Credit 3 (3+0)

Pre-requisite No

This course provides exposure to the basics of marine data interpretation, scientific data analysis and presentation of results. Topics of this course include the introduction of the concept of measurement, data collection, data analysis using appropriate statistical analysis, processing and presenting data. Different statistical software is also disclosed to students. In addition, students are also given the experience to explore the data collected or observed in the environment as well as the scope of various statistical techniques appropriate to specific analytical needs.

MMS3663 Fundamental of Marine Science

Credit 3 (3+0)

Pre-requisite No

This course provides a basic understanding of world ocean science, the interaction among marine chemical, biological, geological and physical system on Earth. This course describes the main environment of the oceans, from the coast to the oceans and at the different depths, linking the relationship between humans and the oceans, the importance of the oceans in supplying mineral, food and energy resources. Students also learn how global weather affects the oceans and oceans' function as buffer system. This course also provides an initial exposure to the basics of fieldwork as well as methods of using sampling instruments.