University of Pretoria Yearbook 2022

MIT (Big Data Science) (Coursework) (12254017)

Department	Computer Science
Minimum duration of study	2 years
Total credits	180
NQF level	09

Programme information

This degree programme is presented in English only.
Refer also to G31-G41.
The curriculum is determined in consultation with the programme organiser.
A student will have to apply to the Dean of the Faculty of Engineering, Built Environment and Information Technology if he/she requires more than three years to complete the degree.

Admission requirements

1. Relevant honours degree with a cumulative weighted average of at least 65% for the honours degree **or** relevant four-year bachelor's degree with a weighted average of at least 65% at final-year level and

1. The following modules passed at first-year level:
   a. Mathematical Statistics or Statistics and
   b. Mathematics (preferably Calculus and Linear Algebra) and
   c. Programming
2. A recommendation letter from the employer/line manager, indicating a commitment that they will make time available for the employee to devote to the studies
3. An essay/motivation letter motivating the interest in this degree
4. Comprehensive intellectual CV

Other programme-specific information

Discontinuation of studies
The Dean may, on the recommendation of the admissions committee, cancel the studies of a student who fails more than one module. A module may only be repeated once.

Examinations and pass requirements

The stipulations of the relevant Faculty regulations are applicable.

The Dean may, on recommendation of the relevant head of department, exempt a student from the examination on the dissertation.

The average mark awarded by all the examiners is the final mark, with the pass mark being at least 50%.

Pass with distinction

The degree is conferred with distinction on students who have obtained at least 75% for the mini-dissertation and a minimum of 75% weighted average (not rounded) final mark for the coursework modules and completed the degree within the minimum time.

Curriculum: Year 1

Minimum credits: 70

Additional information:
Students are required to take two (2) elective modules with a minimum number of 10 elective credits.

Core modules

Introduction to big data science 800 (MIT 800)

Module credits	5.00
NQF Level	09
Contact time	2 day workshop
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Quarter 1

Module content

This is the first and introductory module for the MIT degree in Big Data Science. Big Data and Data Science will be defined and students will be exposed to different application domains within the participating academic departments in the MIT degree. These departments include: Computer Science, Electrical, Electronic and Computer Engineering (EECE), Informatics, Information Science, Mathematics and Applied Mathematics, Statistics, and Health Science departments. The presentation of this module will be in the format of a two-day workshop.

Introduction to machine and statistical learning 801 (MIT 801)

Module credits	15.00
NQF Level	09
Prerequisites	First year level higher education modules in Computer Science, Mathematics and Statistics.
Contact time	16 contact hours per semester
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Semester 1

Module content

In this module students will be exposed to different categories of machine and statistical learning algorithms that can be used to manipulate big data, identify trends from the data, modelling trends for prediction purposes as well as modelling for the detection of hidden knowledge. Students will be exposed to various machine and statistical learning algorithms/methods and they will learn how to make the right choice with regard to these. Learning, in a supervised and unsupervised mode will be covered. Furthermore students will develop a practical understanding of methods that can aid the learning process, such as, new developments in regression and classification, probabilistic graphical models, numerical Bayesian and Monte Carlo methods, neural networks, decision trees, deep learning and other computational methods. This module also includes a visualisation component focusing on the encoding of information, such as patterns, into visual objects.

Introduction to data platforms and sources 802 (MIT 802)

Module credits	5.00
NQF Level	09
Prerequisites	First year level higher education modules in Computer Science and Statistics.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Quarter 2

Module content

Students will obtain hands-on experience on the following technologies such as: Python, Spark, Hadoop, R and SAS, Streaming, Data fusion, Distributed file systems; and Data sources such as social media and sensor data.

Introduction to Information Ethics for Big Data Science 803 (MIT 803)

Module credits	5.00
NQF Level	09
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Quarter 1

Module content

The focus in this module is on Information Ethics and its place within the disciplines of Ethics and Philosophy. The following topics will be covered: Information Ethics and PAPAS (privacy, accuracy, property, access, security); Information ethics and the life cycle of big data; Information ethical dilemmas within big data in different disciplines, e.g. science, technology, engineering and mathematics (STEM), health sciences, economics and management sciences, social sciences and the humanities; and Case studies.

Introduction to mathematical optimization for big data science 804 (MIT 804)

Module credits	5.00

NQF Level	09
Prerequisites	First year level higher education modules in Computer Science, Mathematics and Statistics.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Quarter 2

Module content

In this module students will be introduced to Mathematical Optimization through gaining knowledge about the theory and algorithms to solve optimisation problems. Topics will include: Linear programming, unconstrained optimization, equality constrained optimization, general linearly and nonlinearly constrained optimization, quadratic programming, global optimization, Theory and algorithms to solve these problems.

Big data 805 (MIT 805)

Module credits	10.00
NQF Level	09
Prerequisites	First year level higher education modules in Computer Science.
Contact time	10 contact hours
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Semester 2

Module content

This module focuses on tools for Big Data processing. The focus is on the 3 V- characteristics of Big Data namely volume, velocity and variety. Students will learn about the different architectures available for Big Data processing. The map-reduce algorithm will be studied in detail as well as graphical models for Big Data. The module will include a significant component of practical work (hands-on) where students will be exposed to real use cases that are or can be implemented on Big Data platforms.

Big data management 806 (MIT 806)

Module credits	10.00
NQF Level	09
Prerequisites	First year level higher education modules in Computer Science.
Contact time	6 contact hours
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Quarter 4

Module content
Big data management is the governance, administration and organization of large volumes of both structured and unstructured data. Aspects included in big data management are: big data as organizational asset, harnessing big data as disruptive technology for competitive advantage, big data quality and accessibility; management strategies for large and fast-growing internal and external data, big data infrastructure and platform management, and big data policy, strategy and compliance.

Research methods for big data science 809 (MIT 809)

Module credits	5.00
NQF Level	09
Contact time	6 contact hours
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Semester 2

Module content
Similar to MIT 862; which has the following description: Research methodologies applicable to the IT field as preparation for the mini-dissertation for the A Stream students.

Elective modules

Big data science elective 801 (COS 801)

Module credits	5.00
NQF Level	09
Prerequisites	No prerequisites.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Computer Science
Period of presentation	Semester 2

Module content
Example courses, amongst others, may include: Cyber-security, Digital Forensics, Deep Machine Learning, Image and sound analysis, Feature extraction, and Graph Modelling. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Big data science elective 802 (COS 802)

Module credits	5.00
NQF Level	09
Prerequisites	No prerequisites.

Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Computer Science
Period of presentation	Semester 2

Module content

Example courses, amongst others, may include: Cyber-security, Digital Forensics, Deep Machine Learning, Image and sound analysis, Feature extraction, and Graph Modelling. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Big data science elective 801 (ERZ 801)

Module credits	5.00
NQF Level	09
Prerequisites	No prerequisites.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

Example courses may include: Intelligent systems and Internet of Things. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Big data science elective 802 (ERZ 802)

Module credits	5.00
NQF Level	09
Prerequisites	No prerequisites.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Electrical, Electronic and Computer Engineering
Period of presentation	Semester 2

Module content

Example courses may include: Intelligent systems and Internet of Things. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Big data science elective 820 (INL 820)

Module credits	5.00
NQF Level	09
Language of tuition	Module is presented in English
Department	Information Science
Period of presentation	Semester 2

Module content

Five credits of an elective module can be drawn from Information Science. A module in Research Data Management (RDM) is available as an elective. The following topics would typically be covered: Open Science and the dependency on open (big) data, The research process and the life cycle of big data (data management plans to publishing derivative data sets, licensing and legal implications); managing (curating) big vs long tail data; solving problems with research data vs the business value of big data (data-intensive decisionmaking); managing data as an asset (also data citation); issues and challenges involved in the management of big data (principles and best practices for effective big data governance); trusted data repositories; data stewardship frameworks for big data; and the data steward's toolbox.

Digital economy 845 (MIT 845)

Module credits	15.00
NQF Level	09
Prerequisites	No prerequisites.
Contact time	10 contact hours
Language of tuition	Module is presented in English
Department	Informatics
Period of presentation	Semester 2

Enterprise systems 854 (MIT 854)

Module credits	10.00
NQF Level	09
Prerequisites	No prerequisites.
Contact time	8 contact hours per semester
Language of tuition	Module is presented in English
Department	Informatics
Period of presentation	Semester 2

Statistics elective 801 (STK 801)

Module credits	5.00
NQF Level	09

Prerequisites	As determined by the Department of Statistics.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

Five 5 credits of an elective course can be drawn from the Department of Statistics. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Statistics elective 802 (STK 802)

Module credits	5.00
NQF Level	09
Prerequisites	As determined by the Department of Statistics.
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Statistics
Period of presentation	Semester 2

Module content

Five 5 credits of an elective course can be drawn from the Department of Statistics. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Big data science elective 801 (WTW 801)

Module credits	5.00
NQF Level	09
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Five 5 credits of an elective course can be drawn from Mathematics and Applied Mathematics. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Big data science elective 802 (WTW 802)

Module credits	5.00

NQF Level	09
Contact time	5 contact hours
Language of tuition	Module is presented in English
Department	Mathematics and Applied Mathematics
Period of presentation	Semester 2

Module content

Five 5 credits of an elective course can be drawn from Mathematics and Applied Mathematics. In addition to study-leader approval, elective course selection may be subject to course pre-requisites, course availability, and internal departmental regulations as decided by the Head of the Department.

Curriculum: Final year

Minimum credits: 110

Core modules

Mini dissertation in big data science 807 (MIT 807)

Module credits	90.00
NQF Level	09
Prerequisites	All the core modules must be passed
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Year

Module content

Students may choose a supervisor/co-supervisor from any of the participating departments, which includes, but are not limited to: Electrical, Electronic & Computer Engineering (EECE), Computer Science, Informatics, Information Science, Mathematics and Applied Mathematics, Statistics and Faculty of Health Science departments (Computational biology, Family Medicine, Radiology).

Big data science project 808 (MIT 808)

Module credits	20.00
NQF Level	09
Prerequisites	All the core modules must be passed
Contact time	8 contact hours per semester
Language of tuition	Module is presented in English
Department	School of Information Technology
Period of presentation	Semester 1

Module content

This module provides the opportunity to students for demonstrating the application of the theoretical Big Data Science knowledge gained in the core part of this degree. Students are expected to identify and work with a collaborator who is taking ownership for the project. This collaborator can either be an industry partner or a researcher within one of the participating departments. Projects will be based on the entire big data lifecycle as discussed in this degree programme. This includes the gathering of data of a significant size as well as a final technical report describing the process followed and the deliverables. Depending on the complexity of the project, students can apply to work in groups with a maximum of two members. The proposed project will be subject to approval by the Department Computer Science.

The regulations and rules for the degrees published here are subject to change and may be amended after the publication of this information.

The General Academic Regulations (G Regulations) and General Student Rules apply to all faculties and registered students of the University, as well as all prospective students who have accepted an offer of a place at the University of Pretoria. On registering for a programme, the student bears the responsibility of ensuring that they familiarise themselves with the General Academic Regulations applicable to their registration, as well as the relevant faculty-specific and programme-specific regulations and information as stipulated in the relevant yearbook. Ignorance concerning these regulations will not be accepted as an excuse for any transgression, or basis for an exception to any of the aforementioned regulations.