

# MCAST MASTER OF SCIENCE IN INFORMATION TECHNOLOGY & SYSTEMS

CODE: UC7-14-19  
Launching February 2020

**Entry Requisite:** First degree in  
engineering; ICT; Technology,  
IELTS – 6.5



The Master of Science in Information Technology and Systems provides fundamental skills in a variety of advanced ICT areas such as cloud computing, big data and the Internet of Things (IoT), with a focus on developing intelligent solutions through a blend of hardware and software. The programme focuses on software as a service infrastructure, information management, enterprise systems and eLogistics. Also a focus is placed on systems strategy and management, business process innovation and cyber security. Key to the programme is network security and data management technologies, as well as software defined networking, and the new field of distributed hashing and computing, typified by distributed version control systems and blockchain based crypto-currency applications.

## Learning Outcomes

**Upon successful completion of this masters programme the learners will be able to:**

- 1. Understand two complementary problem domains information technology and business management domains;*
- 2. Use the acquired technical and business problem analysis skill set to most effectively propose information system designs matched to the business needs;*
- 3. Select adequate technical means to design a solution that not only solves a specified technical and business problem but is also extendable into the future in response to any additional needs of a growing business organisation;*
- 4. Design an information system that optimally matches specified purpose and business system roles while minimizing design effort and implementation costs;*
- 5. Build systems features that make the overall system use, administration and maintenance team-friendly; perform adequate reengineering of an existing information technology powered business system;*
- 6. Design complementary subsystems to enhance business efficiency; use predictive analytics methods and big data processing to define the market for a new product or service;*

## Academic Year 1

1. [Information Systems and Management](#)
2. [Operating Systems and Cloud Computing](#)
3. [Network Protocols and Network Automation](#)
4. [Data Science and Predictive Analysis](#)
5. [Foundations of Cyber Security](#)
6. [Web Technologies and Secure E-Commerce](#)
7. [Mobile Computing and 5G Networking](#)
8. [Internet of Things \(IoT\)](#)
9. [Financial Computing and Cryptocurrencies](#)
10. [Entrepreneurship and Innovation Management](#)

## Academic Year 2

Dissertation

**Total number of ECTS:** 90

**Duration:** 18 months

## STUDY UNIT 1

### Information Systems and Management

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

This unit takes a critical approach to computing-enabled business management while guiding the learners on how to take practical steps when implementing information technologies to support modern business management and critical decision-making.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Conduct pre-design meetings with the business organisation staff members;
2. Use case diagrams in technical and business problem analysis as a part of the preparation for a structured approach to complex problem solving;
3. Design a business organisation management uml and structure diagram, and determine the key persons as points of contact (poc) and/or decision (pod);
4. Analyse and determine the business information processing and communications needs necessary to achieve a business competitive advantage;
5. Facilitate the evaluation of strategic technical alternatives;
6. Communicate strategic alternatives to facilitate upper management to perform informed decision-making;
7. Facilitate the acquisition, design, development, deployment, and management of information system in the given business enterprise or government related organisation;

## STUDY UNIT 2

### Operating Systems and Cloud Computing

MQF Level 7

6 ECTS

E-learning: Yes

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#### Rationale

This unit covers core hardware and software technologies that are enabling modern systems and represent key elements in systems solutions achieving secure and elastic computing power provisioning through cloud computing systems and software defined data centres. Special attention is devoted to the cost-performance evaluation of traditional data centre solutions versus private, public or hybrid cloud solutions.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Demonstrate conceptual distinction of operating systems entities and demonstrate relevant analytical skills when conducting cost-performance evaluation of alternative hardware and software solutions;
2. Administer systems using systems utilities, system shell commands;
3. Automate commonly repeated systems administration tasks and maintenance routines by writing and automatic scheduling execution of shell scripts;
4. Design storage system using multi-tiered cache-based approach that leverages investment;
5. Prepare, install and configure robust self-repairing filing system such as zfs or ext4;
6. Consolidate data centre hardware infrastructure by virtualisation of redundant systems and better utilise electrical energy consume; be more robust to individual systems failure and be more secure;
7. Select cloud features and capabilities needed in an enterprise;
8. Build private enterprise cloud infrastructure;
9. Recognise state-of-the-art cloud application performance monitoring and analytics;

## STUDY UNIT 3

### Network Protocols and Network Automation

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

Modern distributed applications demand an intelligent and rapidly adaptable network that is capable of providing application level directory services and optimised connectivity services. In order to maximise traffic processing network efficiency, it is essential to start with the proper network design, the adequate protocols selection and the least cost - maximal performance equipment capable of using standardised interface protocols with the central network controllers that may rapidly respond to traffic pattern variations and application plane global commands.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Demonstrate conceptual purpose of the computing network as a facility used for the execution of distributed application programs hosted by the computing nodes physically spread across small or large geographical area;
2. Distinguish hardware nature of line signal processing and computation nature of the data link data processing;
3. Judge the practical application situation and select media/line and appropriate media access protocol;
4. Design ipv4 addressing plan for the network that has to be connected to the internet;
5. Install and configure network interface card manually and automatically;
6. Classify distributed applications according to the multimedia message nature and select proper transport solutions;
7. Build a plan of router and routing protocol selection and configure router;
8. Install and configure DNS network naming server;
9. Simulate simple SDN using mininet simulator;

## STUDY UNIT 4

### Data Science and Predictive Analysis

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

Practical approach to database systems design, implementation and use to support modern applications requires thorough understanding of internal database engine operation. Integrating variety of data sources is essential for decision support analytic systems design and business intelligence applications. To appreciate the power of data science and predictive analytics, a hands-on experience is of essence. The most average learner friendly data science path helping learners gain predictive analytics skills is to use R programming language console.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Differentiate between the information, data, data types and data-codes.
2. Recognise importance of the business side of data processing and algorithms built in the modern information management systems;
3. Conclude inductively how modern rdbms solutions have evolved, and acquire basic knowledge of rdb design phases;
4. Install practical rdbms server and sql command line client program, configure and test connectivity using networking and os utilities. Test sql shell to implement database, use it and manipulate data using crud set of sql-dml commands;
5. Design application queries that are protected against accidental power or connection loss using transaction management system and relevant sql queries;
6. Perform practical enterprise use case, object oriented (oo) and rdb analysis, er modelling, db schema design, db implementation to match the requirements of the oo application layer of software;
7. Use rdbms built-in functions, create stored procedures and integrate rdbms programs and rdb stored programs with application layer code;
8. Identify data that can be organised in a table or up-side-down tree, and select proper data description language and dbms software;
9. Design and install analytical heavily indexed rdb and design and implement nosql database;

10.Design, install and use r-shell as a tool to perform data cleansing, algorithmic data analysis and user-friendly result charting;

## STUDY UNIT 5

### Foundations of Cyber Security

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

This unit presents fundamental concepts of cyber security relevant to all systems levels, such as: Systems firmware; Device firmware; Systems memory; Storage devices; File systems; Network traffic processing devices; User applications. The unit demonstrates management of the operating systems security, distributed application such as RDBMS server security and network security. For safer business and society, at all systems levels it is of the essence to maintain high security resilience.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Recognise vulnerability of hardware systems as well as software systems, and acquire skills to access systems firmware using special hardware UI shells or OS utility programs;
2. Install and use all program development tools when developing simple application program recognising all development phases leading to the runtime.
3. Use proper utilities to focus on program internal activities that may lead to unexpected termination or unplanned performance;
4. Protect systems memory and file system from unauthorised programs and their illegal users;
5. Apply crypto technologies knowledge to externally protect applications and operating systems;
6. Configure systems's front doors and network data traffic processing nodes and apply cryptography to create safe network tunnel paths;
7. Implement systems and network activity monitoring facilities and protect security logs;
8. Distinguish intrusion from extrusion attacks and scheduled from continuous backups mechanisms;



## STUDY UNIT 6

### Web Technologies and Secure E-Commerce

MQF Level 7

6 ECTS

E-learning: Yes

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#### Rationale

E-commerce is expanding at an astonishing rate, offering communities far from the metropolitan areas to acquire and trade goods in the borderless and distance oblivious cyberspace. This unit provides structured foundation of Web technologies necessary to technically implement e-commerce websites or maintain existing e-commerce operation. Vocational specific details are delegated to the vast public computer-based training (CBT) and courseware material that is easy to follow, upon successful completion of this unit. This unit relies on and complements the material covered in the preceding units 1-5.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Conceptualise distributed application development simplification by isolating reusable message exchange protocol and reinforce this development strategy on the example of HTTP protocol;
2. Apply markup languages such as HTML, XML and SVG-XML to control rendered document appearance in the browser's window;
3. Describe browser and Web server framework architecture and show how to benefit from these well-standardised client/server reusable design and framework using extension software engineering principle;
4. Program interactive Web applications using javascript 3GL browser and Web server programming skills;
5. Develop light, interactive and restful Web services based server side application program using php and/or javascript;
6. Reuse open source programs to implement PKI security infrastructure in the ecommerce Web site design;
7. Implement e-commerce PCI compliant payment processing system;
8. Conceptualise cost effective digital marketing strategy and implementing marketing plan;

9. Understand the origins of the Web as the most successful distributed business application architecture, the current state of the Web and anticipate future developments;

## STUDY UNIT 7

### Mobile Computing and 5G Networking

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

Mobile computing technology, distributed applications running on the mobile networking infrastructure (apps) and relevant security issues are of paramount importance in the situation where mobile application based business volume and development industry is growing at a blazing 43% per year with no signs of slowing this trend. Over 16 billion USD are spent yearly on mobile app development and services, which presents a huge opportunity for part time or full-time employment as well as for the self-started business project.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Understand market driven new technology acceptance and technological evolution by examining the history of data and telephone communication systems focusing on wireless data and telephony;
2. Show how modern mobile telephones are portable high power computer network nodes implementing sophisticated computer architecture, virtual machines, full blown operating systems and wide spectrum of application programs, with only one dedicated to telephony;
3. Describe evolutionary sequence of gsm, cdma, lte, etc., standard cp networking technologies, leading to ims and ip networks and be able to read technical papers describing new developments;
4. Correlate 3g, 4g and 5g cp network systems solutions and recognise the general rule that higher data transmission speeds and wider spectrum of services leads to smaller densely distributed cells and rising costs of providing such services.

5. Integrate wired and wireless networks with the cloud computing infrastructure taking into account diversity of operating systems, variety of hardware platforms and fluctuating quality of connection service;
6. Analyse network diversity traffic, diversity of equipment and protocols employed and learn about options of minimising diversity by applying virtualisation of network functions and software definition based network orchestration;
7. Implement e-commerce pci compliant payment processing system;
8. Use and implement mobile payment systems solutions;

## STUDY UNIT 8

### Internet of Things (IoT)

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

With tens of billions of smart devices in use and their massive network connection, the importance of IoT technologies cannot be downgraded. Technology of networking intelligent things to enhance life quality, safety and productivity is one of the imperatives of the computing powered living of the modern global citizen. A huge emerging job market makes IoT technology course necessary in any modern information technology and systems sort of curricula.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Understand embedding of computing technology and solution options available when building intelligence extension of physical non-electronic objects;
2. Analyse the influence of the falling costs of hardware, software and wireless communications on the emergence of the new markets with universal networking of non-electronic devices and ordinary things;
3. Describe m2m communication protocol options and design procedures of the industrial iot (iiot) and automotive road vehicles iot networks;
4. Design intelligent homes, high-rise buildings, and propose products to be deployed in the smart city systems;
5. Understand the internet and iot interface solutions and features of the required hardware and software to integrate iot and internet;

6. Analyse different opportunities for iot application, focusing on tourist attractions and entertainment performance, and relate analysis results to potential products involving cloud computing services and available development and implementation tools;
7. Integrate various cloud services and the iot network of sensors and actuators;
8. Understand the knowledge and skills needed to secure iot data collection into the cloud based server, perform massive data analytic transformation in the cloud and generate user friendly graphics enhanced reports;

## STUDY UNIT 9

### Financial Computing and Cryptocurrencies

MQF Level 7

6 ECTS

E-learning: No

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#### Rationale

This unit represents a compact introduction to computation driven financial instruments trading, financial markets management, and banking, devoting particular attention to the phenomena of electronic currency and blockchain technologies. This unit relies on the material covered in units 3 and 5.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Understand exchange without value equivalence token use, and money as value equivalence having variable value parameter influenced by the user agreement,
2. Outline the various trading systems such as currency exchange, stock exchange, trading of papers of value, with the focus of defining major financial instruments found in modern financial markets;
3. Identify hash functions and blockchain algorithms;
4. Understand a practical user approach to bitcoin by establishing bitcoin wallet and interacting with bitcoin exchanges,
5. Analyse ethereum capabilities and analyse other bitcoin alternative products;
6. Understand the operation of mobile use in digital currency payment and be able to design digital currency enabled point of sale (pos) system;
7. Recognise digital currency threats and security issues;

## STUDY UNIT 10

### Entrepreneurship and Innovation Management

MQF Level 7

6 ECTS

E-learning: Yes

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#### Rationale

The on-going transformation of the world into a global village with the market globalisation, introduces previously unimaginable opportunities to creative entrepreneurs at all corners of the world. A tsunami of new emerging technologies such as cloud computing, mobile communications and IoT, have elevated the importance of the innovation, particularly incremental innovation, as a vital business element. This unit presents a compact approach to a new profitable business venture establishment that secures growth based on the well-protected original idea or solution. This unit is bridging a gap that commonly exists between mostly technical and mostly business-oriented professionals.

#### Learning Outcomes

**Upon successful completion of this unit, learners will be able to:**

1. Understand the procedure of legally establishing business operation with liability and tax implications involved with different business forms;
2. Understand the basic process of innovation and creative product or service transformation into a successful business;
3. Manage projects to create a sale and to realise all steps necessary to be profitable in business;
4. Maintain business paper documents required by the government that is sponsoring the business environment;
5. Understand the essential local taxation laws and gain awareness of fair business practices and dangers of negligence problems;
6. Plan an effective low cost marketing and promotion campaigns;
7. Produce a business plan outlining how to plan capitalisation fundraising, how to recruit investors, how to sell stock or sell bonds;
8. Understand the common errors made by the new and long-time existing business, with the recommendations how to approach starting a business while minimising failure chances;