MUC UNIVERSITY
COLLEGE OF TECHNOLOGY

DIPLOMA PROGRAM

Internet of Things (IoT) Diploma

I. Overview:

The Internet of Things (IoT) represents a new stage in the digital revolution, fully contributing to the construction of a digital society. Several sectors of the digital society use or will use the internet of objects to improve deployment, exploitation and industrialization procedures. These include intelligent transport, smart grids, smart city, industry, and so on. The issues concerning the mastery of the technologies and processes around the internet of objects are enormous and require a very high level of expertise with cutting-edge skills in multi-disciplinary areas.

Key Words: Sensors, Actuators, Low-energy communication, Big Data, Data Semantic, Security, Business Intelligence

II. Admission requirements:

To be eligible, Candidates need:

- A 3-years Bachelor's Degree (minimum of 3 years of higher education) in Computer Science, Computer Engineering, Applied Mathematics.
- Demonstrable and strong foundations in Mathematics, Systems and Network Security and Operating Systems.

III. Diploma plan:

Diploma Plan				
Semester 1	Embedded System Design:	Wireless and Mobile Networks	Signals and Systems:	Cloud Systems
Semester 2	Sensors Data Acquisition and Interfaces:	Internet of Things Security	Internet of Things Systems and Platforms	Application Project

IV. IoT Curriculum:

Semester 1:

Semester 1	Embedded System Design:	Wireless and Mobile Networks:	Signals and Systems:	Cloud Systems

Embedded System Design:

One of the primary reasons behind the emergence of IoT is the rise of embedded platforms (low cost, small form factor devices with significant processing power) which are powering a number of IoT applications in a wide variety of domains. This course aims to cover trends and challenges in embedded systems design understanding the hardware-software trade-offs, introduce microcontrollers, interfacing these with digital/analog systems and the ability to program these systems. The focus of this course will be on the following topics: Micro-controllers (MCUs) and computer interfacing with analog and digital systems; Real-time control issues; Assembly language programming methods for control; Design of control software; Input/output methods, data interrupts, and general issues in digital signal processors (DSPs); Differences in the architectures, functions, and applications of DSPs

Wireless and Mobile Network:

IoT is multi-disciplinary and broadly involves leveraging sensing and communication technology to solve problems in a wide variety of domains. The objective of this course is to highlight different verticals where IoT has been and continues to be employed. Ubiquitous connectivity is another key reason behind the emergence of the IoT and therefore, this course aims to cover the history, evolution, and developments in wireless and mobile network systems with a particular emphasis on technologies relevant to the IoT (both short-range and long-range). In particular, this course will cover topics on Wireless HART, IEEE 802.15.4, IEEE 802.11ah, Bluetooth Low Energy, Home Plug Low Power Wide Area Networks and 3GPP Machine Type Communications (MTC).

Prerequisites: Network 1

Signals and Systems:

This course introduces students to continuous-time and discrete-time signals and systems. The course covers linear time invariant (LTI) systems in terms of system properties, convolution sum, and convolution integral representations. LTI systems are also described using differential and difference equations. Throughout this course, topics such as Fourier series, Fourier transform and Laplace Transform will be discussed in detail. All signals and systems manipulations will be done through MATLAB.

Prerequisites: ODE

Cloud Systems:

This course offers an introduction to cloud computing overview, concepts, and models. This course serves as a basis for understanding the standard cloud terminologies and methodologies needed to implement, maintain, and support cloud technologies and infrastructure, with a practical focus on real-world skills. Topics include cloud service and delivery models, various types of disk storage systems network infrastructure and management, virtualization components, performance tuning, systems management, troubleshooting and security. Mobile Device Management (MDM), business continuity and disaster recovery are also covered.

Semester 2:

Semester 2	Sensors Data Acquisition and Interfaces:	Internet of Things Security	Internet of Things Systems and Platforms:	Application Project

Sensors Data Acquisition and Interfaces:

This course covers a selection of sensors, transducers and the signal conditioning necessary for including these in a data acquisition system such as internet of things. It investigates most common types of sensors, the analogue to digital and digital to analogue conversion principles and their practical applications for data acquisition and control. Examples of a selection of output drivers and devices are

also provided. Applications of recording data from sensors (real-time data acquisition and interfaces) in daily life are also provided.

Prerequisite: Signals and Systems, Circuit 1

Internet of Things Security:

This course will examine the security and ethical issues of the vast implementation of smart devices known as the Internet of Things (IoT). It will discuss IoT technology and market-specific topics, relevant case studies of IoT security vulnerabilities and attacks, and mitigation controls. It will also discuss common security architectures that can be applied to IoT systems and discusses regulations and standards that apply to secure IoT systems.

Internet of Things Systems and Platforms:

This course builds on the introductory communication networks course(s) that the students may have taken during their undergraduate education. A brief overview of some of the important topics from the network and transport layer from the undergraduate course is provided followed by treatment of advanced topics, in particular, protocols that have been developed to meet the requirements of the Internet of Things. The specific topics covered will focus on IPv6, network layer protocols such as Routing for Low Power and Lossy Networks (RPL), 6LoWPAN, IPv6 over time slotted channel hopping (6tisch), IPv6 over Bluetooth Low Energy and application layer protocols such as Constrained Application Protocol (CoAP) and Message Queue Telemetry Transport (MQTT). The motivation and overview of different IoT platforms will also be provided in addition to hands-on exercise on how to use the Thingworx platform for building an IoT application.

Application Project:

In this Capstone course, you will design a microcontroller-based embedded system. As an option, you can also build and test a system. The focus of your project will be to design the system so that it can be built on a low-cost budget for a real-world application. To complete this project you will need to use all the skills you have learned above.

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