COURSE SPECIFICATIONS
Form

Course Title: IoT Systems

Course Code: 14016486-3

Date: 2018 –10 – 21.	**Institution**: Umm Al–Qura University
College: College of Computer and Information Systems **Department**: Department of Computer Science	

A. Course Identification and General Information

1. Course title and code: <u>IoT Systems 14016486-3</u>

2. Credit hours: <u>3</u>

3. Program(s) in which the course is offered. <u>Master of Computer Science (Artificial Intelligence)</u>

(If general elective available in many programs indicate this rather than list programs)

4. Name of faculty member responsible for the course <u>Dr. Khaled Termisi</u>

5. Level/year at which this course is offered: <u>2/3</u>

6. Pre-requisites for this course (if any):

7. Co-requisites for this course (if any):

8. Location if not on main campus:

9. Mode of Instruction (mark all that apply):
   a. Traditional classroom   [ ]   percentage?   [100]

   b. Blended (traditional and online)   [ ]   percentage?   [ ]

   c. E-learning   [ ]   percentage?   [ ]

   d. Correspondence   [ ]   percentage?   [ ]

   f. Other   [ ]   percentage?   [ ]

Comments:

B Objectives

1. The main objective of this course

The course Principles and Design of the 'Internet of Things Systems' (IoT) is concerned with the emerging discipline of digitizing the physical world with wireless sensors, analyzing the sensor data to provide actionable information, and influencing the physical world via actuators, with an optional human in the loop.

2. Describe briefly any plans for developing and improving the course that are being implemented.
(e.g. increased use of the IT or online reference material, changes in content as a result of new research in the field)

The contents will be prepared from globally recognized text books, web-based reference materials and latest research in the field. Practical home works and a term project related to latest tools and techniques will also be designed. At the end of the course, a seminar day can be announced in which students can present their course projects and literature review.

C. Course Description (Note: General description in the form used in the program's bulletin or handbook)

Course Description:

The course aims to deliver a sound understanding of the design and analysis of Internet of Things through lectures and practice. The lectures provide the foundational knowledge in sensors and actuators, fusion of data from multiple sensors, sensor data calibration and topics in sensor data analytics: pre-processing and extraction of features in time-series sensor data, and classification methods. The students conduct a major piece of coursework working in pairs to develop an IoT application using the Orient speck platform. Students will experience all the stages in the design and implementation of a complex system, from its specification to the demonstration of a working prototype. They will be exposed to aspects of embedded systems programming, networking algorithms, wireless protocols, user interface design, and system integration and testing.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Introduction to IoT (Sensing, Actuation, Basics of Networking)	1	3
Basics of Networking, Communication Protocols and Sensor Networks	1	3
Interoperability in IoT (Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino)	2	6
Introduction to Raspberry	1	3
Implementation of IoT with Raspberry Pi	2	6
SDN for IoT	1	3
Cloud Computing	1	3

Fog Computing	1	3
Smart Cities and Smart Homes	1	3
Connected Vehicles	1	3
Smart grid	1	3
Industrial IoT	1	3

2. Course components (total contact and credit hours per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other	Total
Contact Hours	Planned	42					42
	Actual	42					42
Credit	Planned	3					3
	Actual	3					3

3. Individual study/learning hours expected for students per week. 9-12

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategies

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and targeted learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy should fit in together with the rest to form an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Curriculum Map

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
1.1	Recognize the essential of design and implementation of IoT systems.	Lecture, discussion, research activities.	Exams, Homework, Quizzes, Reports, presentations
1.2	An ability to recognize the use of IoT in solving real life problems.	Lecture, discussion, research activities	Exams, Quizzes, Reports, Research paper, presentations
2.0	**Cognitive Skills**		

2.1	Apply conceptual understanding of concepts, principles and theories related to IoT systems.	Lecture, Homework, discussion, research activities	Exams, Homework, Quizzes
2.2	Design, implement and evaluate an IoT based system, process, component, or program to meet desired needs.	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
2.3	Investigate real world problems in the context of IoT systems and design innovative solutions	Lecture, Homework, discussion, research activities, case studies, Projects	Exams, Quizzes, Reports, Research paper, presentations
3.0	**Interpersonal Skills & Responsibility**		
3.1	Demonstrate own learning and professional development	Group discussion, Project	Project Report, Project presentation
4.0	**Communication, Information Technology, Numerical**		
4.1	Use of latest information technologies related to IoT systems.	Lectures, research activities, case studies, Projects, Seminars	Exams, Homework, Quizzes
5.0	**Psychomotor (if any)**		
5.1	Ability to operate and construct necessary tools required for an IoT systems	Research activities, Projects	Reports, Research paper, Group presentations

5. Assessment Task Schedule for Students During the Semester			
	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	**Week Due**	**Proportion of Total Assessment**
1	Quiz 1	3	5%
2	Homework 1	2	5%
3	Quiz 2	7	5%
4	Homework 2	6	5%
5	Midterm Exam	8	20%
6	Project	13	30%
7	Final Exam	15	30%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic counseling. (include the time teaching staff are expected to be available per week)

    i.   Office Hours for student counseling and support – Three hours/week

    ii.   Availability of teaching Staff on e-learning resources like uqu20/Piazza

E Learning Resources

1. List Required Textbooks

    i.   Raj, Pethuru, and Anupama C. Raman. The Internet of Things: Enabling Technologies, Platforms, and Use Cases. CRC Press, latest edition.

    ii.   Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach. VPT, latest edition.

    iii.   Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, latest edition.

2. List Essential References Materials (Journals, Reports, etc.)

    i.   Recent Papers in IoT related journal

3. List Electronic Materials, Web Sites, Facebook, Twitter, etc.

    i.

4. Other learning material such as computer-based programs/CD, professional standards or regulations and software.

    i.   MATLAB, Python or similar software

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)

1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)

    i.   One classroom (25 seats)

    ii.   One lab (25 PCs)

2. Technology resources (AV, data show, Smart Board, software, etc.)

    i.   Whiteboard

    ii.   Internet connection

    iii.   Anti-plagiarism software

3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)

G Course Evaluation and Improvement Procedures

1. Strategies for Obtaining Student's Feedback on Effectiveness of Teaching

i.   At the end of semester, course evaluation forms will be filled by the students electronically or on paper. The evaluation forms will be anonymous.
2. Other Strategies for Evaluation of Teaching by the Instructor or the Department
i.   Course file of the course will be maintained and evaluated by some senior faculty member.   ii.   Instructor evaluation is performed for every semester
3. Procedures for Teaching Development
i.   Constant reading of new books and research papers, attending related conferences and workshops, participation in the research groups and blogs etc.
4. Procedures for Verifying Standards of Student's Achievement (e.g. check marking by an independent member teaching staff of a sample of student's work, periodic exchange and remarking of tests or a sample of assignments with staff members at another institution)
i.   A random sample from the marked papers may be evaluated by an independent senior faculty member.   ii.   Departmental quality assurance committee can review the students grades and course files to make sure that high standard of teaching is maintained.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for developing it.
   i.   Department has curriculum committee that periodically review courses.
  ii.   Faculty council review offer program as per need.

Name of Course Instructor: Dr. Khaled Termisi

Signature: *Khaled Termisi*   **Date Completed:** Oct. 22, 2018

Program Coordinator: _____

Signature: _____   **Date Received:** _____