هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Internet of Things**
Course Code:	**CEN 1413**
Program:	**bachelor in Computer Engineering**
Department:	**Computer Engineering**
College:	**Faculty of Computer and Information Technology**
Institution:	**University of Tabuk**
Version:	**1.0**
Last Revision Date:	**27 July 2022**

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (10/5)					
4. Course general Description:					
This course describes the fundamental concepts of IoT that includes the Evolution of Internet of Things, Enabling Technologies, IoT Architectures and etc. In addition, it focuses on different IoT protocols of Physical, MAC, Network, Transport and Application Layers. The design and development of the IoT, data analytics and supporting services of Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning, No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics, Network Analytics and some of the Case Studies/Industrial Applications are also focused on this course.					
5. Pre-requirements for this course (if any):					
CEN 1405					
6. Co-requisites for this course (if any):					
N/A					
7. Course Main Objective(s):					
▪ To understand Smart Objects and IoT Architectures. ▪ To learn about various IoT-related protocols. ▪ To build simple IoT Systems using Arduino and Raspberry Pi. ▪ To understand data analytics and cloud in the context of IoT. ▪ To develop IoT infrastructure for popular applications.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning	-	-
3	Hybrid • Traditional classroom	-	-

No	Mode of Instruction	Contact Hours	Percentage
	• E-learning		
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	-
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	-
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To understand the fundamentals, evolution, architecture of IOT**	**K1**	**Lectures, textbooks, provided handouts, references.**	**Exams, quizzes, assignments**
1.2	**To understand the IoT protocols of Application, Transport, Network, MAC and physical layers**	**K1**		
1.3	**To understand the different hardware's functionalities that support to develop the IoT such as Sensors, Raspberry pi/Arduino and etc.**	**K1**		
1.4	**To understand data analytics and cloud in the context of loT.**	**K3**		
1.5	**To study the language: Python.**	**K2**		
2.0	**Skills**			
2.1	**Analyze various protocols for loT.**	**S1**		**Exams, quizzes, assignments**

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	**Design a PoE of an IoT system using Raspberry pi /Arduino**	**S1**	**Lectures, textbooks, provided handouts, references.**	
2.3	**Apply data analytics and use cloud offerings related to loT**	**S3**		
2.4	**Analyze applications of loT in real time scenario.**	**S3**		
3.0	**Values, autonomy, and responsibility**			
3.1	**Acquire and demonstrate the professional and ethical issues in Data Management.**	**V2**	**Lectures, textbooks, provided handouts, references.**	**Exams, quizzes, assignments**
3.2	**The ability to demonstrate work within a team.**	**V2**		

C. Course Content

No	List of Topics	Contact Hours
1.	Fundamentals Of loT: Evolution of Internet of Things - Enabling Technologies	3
2.	loT Architectures: oneM2M, loT World Forum (loTWF) and Alternative loT models	3
3.	Simplified loT Architecture and Core loT Functional Stack - Fog, Edge and Cloud in loT	3
4.	Functional blocks of an loT ecosystem - Sensors, Actuators, Smart Objects and Connecting Smart Objects	3
5.	loT Access Technologies: Physical and MAC layers	3
6.	loT Access Technologies: topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11 ah and LoRaWAN	3
7.	Network Layer: IP versions, Constrained Nodes and Constrained Networks	3
8.	Optimizing IP for loT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks	3
9.	Application Transport Methods: Supervisory Control and Data Acquisition Application Layer Protocols: CoAP and MQTT	3
10.	Design Methodology - Embedded computing logic -	3
11.	Microcontroller, System on Chips - loT system building blocks	3
12.	Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming	3
13.	Structured Vs Unstructured Data and Data in Motion Vs Data in Rest - Role of Machine Learning	3
14.	No SQL Databases - Hadoop Ecosystem - Apache Kafka, Apache Spark - Edge Streaming Analytics and Network Analytics	3
15.	Case Studies/Industrial Applications	3

Total	45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Two Assignments	5,14	10%
2.	Two Quizzes	4,9	10%
3.	Two Midterm Exam	7,12	40%
4.	Final Exam	16	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	David Hanes, Gonzalo Salgueiro, Patrick Grossetete. Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
Supportive References	▪ Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press, 2015 ▪ Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach‖, Universities Press, 2015
Electronic Materials	https://www.arduino.cc/ https://www.ibm.com/smarterplanet/us/en/?ca=v smarterplanet
Other Learning Materials	-

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classroom
Technology equipment (projector, smart board, software)	Data show
Other equipment (depending on the nature of the specialty)	TBA

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of Teaching	Faculty, Program Leaders, and Advisory Board	Both Direct and Indirect
	Students	Indirect
Effectiveness of Students Assessment	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Both Direct and Indirect
Quality of Learning Resources	Faculty, Students, and Advisory Board	Indirect
The Extent to which CLOs have been Achieved	Faculty, Program Leaders, Advisory Board, and Independent Opinion	Direct (as in section B) and Indirect/Surveys
	Students	Indirect
Other	-	-

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	