Course Specification
— (Bachelor)

Course Title: Internet of Things	
Course Code: CNET 455	
Program: BS in Computer And Network Engineering	
Department: Electrical and Electronic Engineering	
College: Engineering and Computer Science	
Institution: Jazan University	
Version: 2	
Last Revision Date: 2 October 2024	

Table of Contents

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: (Level 8/4th)

4. Course General Description:

This course provides an introduction to Internet of things and its applications, including sensing devices, actuation, processing and communications. You will able to analyze various IoT architectures to build a robust IoT system. You will be taught how to find appropriate communication networks based on IoT communications criteria. This course covered the most important IoT protocols that connected IoT devices to the Internet. In addition this course covered IoT Data Management and cloud computing technology.

5. Pre-requirements for this course (if any):

CNET 313 Computer networks

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

No

7. Course Main Objective(s):

•Understand general concepts of Internet of Things (IoT)
•Identify various devices, sensors and applications
•Analyze various IoT architectures
•Recognize various of communication networks based on IoT communication criteria
•Understanding the IoT data Management and cloud computing technology
•Create IoT solutions using sensors, actuators and Devices

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100
2	E-learning	-	-
3	Hybrid ● Traditional classroom ● E-learning	-	-
4	Distance learning	-	-

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	26
2.	**Laboratory/Studio**	26
3.	**Field**	-
4.	**Tutorial**	-
5.	**Others (specify)**	8
Total		60

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Outline** the Basic Concepts and Terminologies of Internet of Things.	K1	[Lectures / Presentations] with deductive organization.	Assignments Written Exams (Mid-Exam /Final)
1.2	**Describe** Fundamental Concepts and Models.	K2	[Lectures / Presentations] with inductive organization.	Assignments Written Exams (Mid-Exam /Final)
1.3	**Define** kinds of IoT Applications, Smart Objects **current**	K3	Visual & Verbal [Lectures /	Assignments

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	devp latest technologies		Presentations] with deductive organization.	Written Exams (Mid-Exam /Final)
2.0	**Skills**			
2.1	**Analyze** Kinds of Architectures and Layers in IoT	S5	Visual & Verbal Class Participation in the lectures and Labs with deductive organization.	Assignments Written Exams (Mid-Exam /Final)
2.2	**Design** & **Analyze** Application Protocols for IoT	S2	Visual & Verbal [Lectures / Presentations/ labs] with inductive organization	Assignments Written Exams (Mid-Exam /Final)
2.3	**Apply** Latest tools and techniques in IoT	S3	Visual & Verbal [Lectures / Presentations/ labs] with inductive organization	Assignments Written Exams (Mid-Exam /Final)
...				
3.0	**Values, autonomy, and responsibility**			
3.1	**Demonstrate** Self study to perform Case Studies in IoT	V2	Active Class participation as Group Activity with inductive organization	Presentations by Student Groups
...				

C. Course Content

No	List of Topics	Contact Hours
1.	1. **Introduction** a. Historical background of The IoT b. M2M to IoT c. M2M vs IoT An Architectural Overview d. IoT potential and Impact e. IoT definition	6T+4P

	2. IoT system stack
	   a. Sensor Layer and Sensor Aggregators
	   b. Gateway and Network layer
	   c. Management Service Layer
	   d. Application Layer
	3. Kinds of IoT Applications: review
	   a. Smart Home
	   b. Smart City
	   c. Smart Grid
	   d. Smart Health Care
	   e. Smart Agriculture
	   f. Smart Manufacturing
	   g. Smart Transportation	

2.	**1. Kinds of IoT Architecture**
	   a. The IoT World Forum (IoTWF) Standardized Architecture
	   b. The Core IoT Functional Stack
	   c. IoT Data Management and Compute Stack
	2. Layer 1: "Things" Sensors and Actuators:
	   a. Battery-powered or power-connected:
	   b. Mobile or static
	   c. Low or high reporting frequency
	   d. Simple or rich data
	   e. Report range
	   f. Object density per cell
	3. Layer 2: Communications Network Layer
	   a. Access Network
	   b. Gateways and Backhaul
	   c. IoT Network Management
	4. Layer 3: Applications and Analytics Layer
	   a. Analytics Versus Control Applications
	   b. Data Versus Network Analytics
	   c. Data Analytics Versus Business Benefits
	   d. Smart Services
		4T+4P

3	**IoT & Cloud Technology:**
	   a. IoT Data Management and Compute Stack
	   b. MCC (Mobile Cloud Computing)
	   c. Edge Computing
	   d. Fog Computing
	   e. MEC (Mobile Edge Computing)
		2T+2P

4	**1. Smart Objects: The "Things" in IoT**
	   a. Sensors
	   b. Actuators
	   c. Smart Objects, Trends in Smart Objects
	   d. Wireless Sensor Networks (WSNs)
	
	2. Connecting Smart Objects: Communications Criteria
	   a. Range
		6T+6P

	b. Frequency Bands
	c. Power Consumption
	d. Topology
	e. Constrained Devices
	f. Data Rate and Bandwidth
	g. Latency
	h. Payload
	3. Connecting Smart Objects: Communications Technology
	    a. Non-IP Based IoT WLAN and WPAN
	    b. IP Based IoT WPAN and WLAN
	    c. IoT LPWANs (Low-Power Wide Area Network)
	    d. IoT & Mobile Communication Networks	

5	**1. IP as the IoT Network Layer**
	    a. The Key Advantages of Internet Protocol
	    b. The Need for Optimization
	    c. Optimizing IP for IoT
	    d. Authentication and Encryption on Constrained Nodes
	    e. Profiles and Compliances
	2. Application Protocols for IoT
	    a. The Transport Protocols use for IoT Application Protocols
	    b. SCADA
	    c. MQTT
	    d. CoAP
	    e. AMQP
	    f. DDS
		4T+4P

6	**1.** IoT Operating systems **2.** IoT Security **3.** IoT Applications	4T+6P
7	Review of all course contents	2T+2P
8	Final Exam	2T+2P
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	ASSIGNMENT-1	6th week	10%
2.	MIDTERM	7-8th week	20%
3.	ASSIGNMENT-2	11th week	10%
4.	LAB EXAM	14th week	20%
5.	FINAL EXAM	15th week	40%

6. *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	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by Hanes David, Gonzalo Salgueiro, 1st Edition, ISBN 978-1-58714-456-1, Cisco Press
Supportive References	IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security, by Lea, Perry, 2nd Edition, ISBN 978-1-83921-480-6, Packt Publishing.
Electronic Materials	https://lms.jazanu.edu.sa/webapps/login/ (Blackboard)
Other Learning Materials	

2. Required Facilities and equipment

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

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Course evaluation survey form
Effectiveness of teaching	CRC / QAU / HoD	Course reports / result analysis
Effectiveness of Students assessment		
Quality of learning resources	Track leaders / CRC	Review meetings and star rating with suggestions for further modification and improvements
The extent to which CLOs have been achieved		
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	ENGCSEEE2411
DATE	10/10/24