





## **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



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#### A. General information about the course:

<b>1. C</b> o	1. Course Identification				
1. C	redit hours: ( 3	)			
2.0					
	ourse type				
Α.	☐ University	□ College	☐ Department	□ Track	□ Others
В.	□ Required		□ Elect		
		nich this course i	s offered: ( Leve	el 8/4th)	
4. C	ourse General I	Description:			
to a how crite dev	nalyze various I v to find approperia. This course	evices, actuation of architectures priate communice covered the mornet. In addition echnology.	to build a robus cation networks ost important lo	st loT system. Yo based on loT o oT protocols tha	ou will be taught communications t connected IoT
5. Pre-requirements for this course (if any):					
CNET 313 Computer networks					
6. Co-requisites for this course (if any):					
No	No				
7. C	ourse Main Ob	jective(s):			
•Ide	<ul> <li>Understand general concepts of Internet of Things (IoT)</li> <li>Identify various devices, sensors and applications</li> <li>Analyze various IoT architectures</li> <li>Procegnize various of communication networks based on IoT communication</li> </ul>				

- •Understanding the IoT data Management and cloud computing technology
- •Create IoT solutions using sensors, actuators and Devices
- 2. Teaching mode (mark all that apply)



criteria



No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100
2	E-learning	-	-
	Hybrid		
3	<ul> <li>Traditional classroom</li> </ul>	-	-
	<ul><li>E-learning</li></ul>		
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.	К2	[Lectures / Presentations] with inductive organization.	Assignments Written Exams (Mid-Exam /Final)
1.3	<b>Define</b> kinds of IoT Applications, Smart Objects <b>current</b>	К3	Visual & Verbal [Lectures /	Assignments





2.1 Architectures and Layers in IoT  With deductive organization.  S2 Visual & Verbal [Lectures / Assignments]		Course Learning	Code of DLOs aligned	Tooching	Accocamont
devp latest technologies  Presentations] with deductive organization.  2.0 Skills  S5 Visual & Verbal Class Participation in the lectures and Layers in loT  Design & Analyze Application Protocols for IoT  Design & Analyze Application Protocols and techniques in IoT  S2 Visual & Verbal [Lectures / Presentations/ labs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ labs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ labs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ labs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ labs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ labs] with inductive organization  S4 Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  Active Class participation as Group Activity with inductive organization  Presentations by Student Groups  Presentations by Student Groups	Code				
technologies  deductive organization. /Final)  2.0 Skills  Visual & Verbal Class Participation in the lectures and Labs with deductive organization.  Design & Analyze Application Protocols for IoT  S2 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Written Exams (Mid-Exam /Final)  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Written Exams (Mid-Exam /Final)  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Written Exams (Mid-Exam /Final)  S4 Visual & Verbal [Lectures / Presentations /			with the program	_	
2.0 Skills  2.1 Analyze Kinds of Architectures and Layers in loT  Design & Analyze Application Protocols for IoT  2.2 Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  2.3 Apply Latest tools and techniques in IoT  Demonstrate Self Studies in IoT  S5 Visual & Verbal (Lectures / Presentations / Iabs) with inductive organization  S3 Visual & Verbal (Lectures / Presentations / Presentations / Iabs) with inductive organization  S3 Visual & Verbal (Lectures / Presentations / Presentations / Iabs) with inductive organization  Apply Latest tools and techniques in IoT  Active Class participation as Group Activity with inductive organization  Presentations Presentations Presentations by Student Groups		_		<del>-</del>	
2.0 Skills  2.1 Analyze Kinds of Architectures and Layers in IoT  S2 Visual & Verbal Class Participation in the lectures and Labs with deductive organization.  S2 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Written Exams (Mid-Exam /Final)  S3 Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Written Exams (Mid-Exam /Final)  S4 Apply Latest tools and techniques in IoT  S5 Apply Latest tools and techniques in IoT  S6 Apply Latest tools and techniques in IoT  S7 Apply Latest tools and techniques in IoT  S8 Apply Latest tools and techniques in IoT  S9 Apply Latest tools and techniques in IoT  S9 Apply Latest tools and techniques in IoT  S9 Apply Latest tools and techniques in IoT  Assignments Written Exams (Mid-Exam /Final)  Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  Apply Latest tools and Labs with inductive organization  Assignments Written Exams (Mid-Exam /Final)  Assignments Written Exams (Mid-Exam /Final)  Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  Apply Latest tools and Labs with inductive organization  Apply Latest tools and Labs with inductive organization  Apply Latest tools and Labs with inductive organization  Apply Latest tools and Labs with		technologies		deductive	`
Analyze Kinds of Architectures and Layers in IoT  Design & Analyze Application Protocols for IoT  Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  Demonstrate Self study to perform Case Studies in IoT  Assignments Written Exams (Mid-Exam /Final)  Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Visual & Verbal [Lectures / Presentations/ Iabs] with inductive organization  Assignments Written Exams (Mid-Exam /Final)				organization.	/Final)
Analyze Kinds of Architectures and Layers in IoT  Design & Analyze Application Protocols for IoT  Apply Latest tools and techniques in IoT  Apply Latest tools and techniques in IoT  Demonstrate Self study to perform Case Studies in IoT  Assignments Written Exams (Mid-Exam /Final)  Apply Latest tools and techniques in IoT  Apply Lat	2.0	Skills			
2.2 Design & Analyze Application Protocols for IoT  S3  Apply Latest tools and techniques in IoT  Demonstrate Self study to perform Case Studies in IoT  S3  [Lectures / Presentations/ labs] with inductive organization  S3  Visual & Verbal [Lectures / Presentations/ Inductive organization]  Assignments Written Exams (Mid-Exam / Final)  Assignments Written Exams (Mid-Exam / Final)  Assignments Written Exams (Mid-Exam / Final)  Assignments Organization	2.1	Architectures and	S5	Verbal Class Participation in the lectures and Labs with deductive	Written Exams (Mid-Exam
2.3 Apply Latest tools and techniques in IoT    Comparison of the	2.2	Application Protocols	S2	[Lectures / Presentations/ labs] with inductive	Written Exams (Mid-Exam
3.0 Values, autonomy, and responsibility  Demonstrate Self study to perform Case Studies in IoT  V2  Active Class participation as Group Activity with inductive organization  Presentations by Student Groups	2.3		S3	[Lectures / Presentations/ labs] with inductive	Written Exams (Mid-
Demonstrate Self study to perform Case Studies in IoT  Active Class participation as Group Activity with inductive organization  Active Class participation as Group Activity with inductive organization  Presentations by Student Groups	•••				
Demonstrate Self  3.1 study to perform Case Studies in IoT  Demonstrate Self participation as Group Activity with inductive organization  Presentations by Student Groups	3.0	Values, autonomy, and	d responsibility		
	3.1	study to perform Case	V2	participation as Group Activity with inductive	by Student

#### **C. Course Content**

No	List of Topics	Contact Hours
1.	<ul> <li>1. Introduction</li> <li>a. Historical background of The IoT</li> <li>b. M2M to IoT</li> <li>c. M2M vs IoT An Architectural Overview</li> <li>d. IoT potential and Impact</li> <li>e. IoT definition</li> </ul>	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 City c. Smart Grid d. Smart Health Care e. Smart Agriculture f. Smart Manufacturing g. Smart Transportation  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 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)  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			
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 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 10T & Cloud Technology: a. Iof Data Management and Compute Stack b. MCC (Mobile Cloud Computing) c. Edge Computing d. Fog Computing e. MEC (Mobile Edge Computing)  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		•	
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d. Application Layer  3. Kinds of IoT Applications; review a. Smart Home b. Smart City c. Smart Health Care e. Smart Health Care e. Smart Handing Care e. Smart Handing Care e. Smart Transportation  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 I: "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  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)  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		· ·	
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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  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)  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		b. Mobile or static	
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  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)  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		c. Low or high reporting frequency	
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  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)  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			
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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  lot & Cloud Technology: a. lot Data Management and Compute Stack b. MCC (Mobile Cloud Computing) c. Edge Computing d. Fog Computing e. MEC (Mobile Edge Computing)  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			
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d. Fog Computing e. MEC (Mobile Edge Computing)  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	3		2T+2P
e. MEC (Mobile Edge Computing)  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	3		21121
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<ul> <li>a. Sensors</li> <li>b. Actuators</li> <li>c. Smart Objects, Trends in Smart Objects</li> <li>d. Wireless Sensor Networks (WSNs)</li> </ul> 6T+6P  2. Connecting Smart Objects: Communications Criteria			
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<ul> <li>c. Smart Objects, Trends in Smart Objects         d. Wireless Sensor Networks (WSNs)</li> <li>6T+6P</li> <li>Connecting Smart Objects: Communications Criteria</li> </ul>			
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8	Final Exam	2T+2P
7	Review of all course contents	2T+2P
6	<ol> <li>IoT Operating systems</li> <li>IoT Security</li> <li>IoT Applications</li> </ol>	4T+6P
5	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  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
	<ul><li>b. Frequency Bands</li><li>c. Power Consumption</li><li>d. Topology</li><li>e. Constrained Devices</li></ul>	

#### **D. Students Assessment Activities**

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

<sup>6. \*</sup>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 Methods (Direct, Indirect)** 

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)





## **G. Specification Approval**

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

