GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3150313
Semester – V
Subject Name: Internet of Things

Type of course: Open Elective

Prerequisite: Sensors, Transducers & Actuators, System Integration, Basics of Programming

Rationale: The objective of this course is to impart necessary and practical knowledge of components of Internet of Things, M2M and develop skills required to build real-life M2M-IoT based projects.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% Weigh tage
1	**Introduction to IoT:** IoT and its characteristics, IoT vision, IoT Conceptual Framework, IoT Architectural overview, Technology behind IoT, Sources of IoT, M2M, IoT to M2M, Difference between M2M & IoT, Examples of IoT.	04	15
2	**IoT Architecture:** Physical design of IoT, Things in IoT, IoT Protocols: Link layer, Network/Internet layer, Transport layer, Application layer, Logical design of IoT, IoT functional blocks, IoT communication models, IoT communication API, IoT Enabling technologies, Wireless sensor network, Cloud computing, advantages of using cloud for IoT, Key challenges of cloud based IoT, Fog computing in IoT, advantages of using Fog for IoT, Key challenges of Fog based IoT, Communication protocols, Embedded systems, IoT levels & Deployment templates, Level-1 to Level-6.	10	30
3	**Things in IoTand IoT Security & Privacy:** **Sensors & Actuators :** IoT sensors, sensor types, sensor characteristics, RFID, Usage & Applications, Actuators, Types of Actuators, Controlling IoT devices. **IoT Security & Privacy:** Introduction, Security challenges & Requirements, Privacy	05	17

	challenges & Requirements.		
4	**Domain Specific Applications of IoT:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Healthcare.	05	20
5	**Introduction to M2M-IoT Design & Prototyping:** Introduction, IoT Development platforms, Types of Arduino Development platforms, Key features of Arduino Hardware development platform, Operating system & programming language for Arduino, Onboard sensors & security features of Arduino board, Arduino IDE, Interfacing Sensors & Actuators with Arduino and programming, M2M-IoT design & Prototyping using Arduino.	04	18
	Total	**28**	**100**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	30	25	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Reference Books:

1. Vijay Madisetti, ArshdeepBahga, Internet of Things, "A Hands on Approach", University Press.
2. Raj Kamal, "Internet of Things: Architecture & Design Principles", Mc Graw Hill.
3. Mohammad Ali Jabraeil Jamali, Bahareh Bahrami, ArashHeidari, Parisa Allahverdizadeh, FarhadNorouzi, "Towards the Internet of Things: Architectures, Security, and Applications", Springer.
4. Qusay F. Hassan, ed., "Internet of Things A to Z: Technologies and Applications", IEEE press, John Wiley & Sons, 2018.
5. Ammar Rayes, Samer Salam, "Internet of Things from Hype to Reality", 2nd Edition, Springer.
6. Adeel Javed, "Building Arduino projects for the Internet of Things", Apress.
7. Cuno Pfister, "Getting Started with the Internet of Things", O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
8. Yashavant Kanetkar, ShrirangKorde, "21 IoT Experiments", 1st Edition, BPB Publication.

w.e.f. AY 2020-21

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Course Outcomes:
At the end of this course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand general concepts of Internet of Things (IoT) & M2M.	15%
CO-2	Illustrate various IoT architectures, Protocols & Levels.	30%
CO-3	Explain Things in IoT and IoT Security & Privacy concept.	17%
CO-4	Analyze domain specific applications of IoT.	20%
CO-5	Create M2M-IoT solutions using Sensors, Actuators and Devices.	18%

Suggested List of Practical:

1. Introduction to Arduino Development platforms and IDE.
2. Study about basics of Arduino Programming.
3. Introduction to various sensors and various Actuators & its Application.
   a) Switches & LEDs
   b) PIRMotion Sensor
   c) RainDrop Sensor
   d) Moisture Sensor
   e) TemperatureSensor
   f) Ultrasonic sensor
   g) Touch Sensor
   h) Infrared Sensor
   i) DC motor
   j) ServoMotor
   k) RFID Sensor
   l) Accelerometer & Gyroscope
   m) Bluetooth Module
   n) Wi-Fi Module.

4. To interface LED/Buzzer with Arduino and write a program to turn ON LED for 1 sec after every 2 seconds.
5. To interface Push button/Digital sensor (IR/LDR) with Arduino and write a program to turn ON LED when push button is pressed or at sensor detection.
6. To interface LCD display with Arduino & display your Personal information.

7. To interface DHT11 sensor with Arduino and write a program to print temperature and humidity readings.
8. To interface motor using relay with Arduino/ and write a program to turn ON motor when push button is pressed.
9. Perform experiment using ArduinoUno measure the distance of any object using Ultrasonic sensor.
10. To interface Bluetooth with Arduino and write a program
    i. to send sensor data to smartphone using Bluetooth
    ii. to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth
11. Creating a webpage and display the values available through Arduino.

OPEN   ended problem : Students are required to submit an IoT based project using the microcontroller and connecting various sensors and actuators.

Major Equipment: PC, Arduino Development Board, IDE

List of Open Source Software/learning website:

https://nptel.ac.in/courses/106/105/106105166/

https://www.udemy.com/internet-of-things-iot-for-beginners-getting-started/

http://playground.arduino.cc/Projects/Ideas

http://runtimeprojects.com

http://www.megunolink.com/articles/arduino-garage-door-opener

http://www.willward1.com/arduino-wifi-tutorial

http://www.electronicshub.org/arduino-project-ideas

http://homeautomationserver.com

http://www.toptechboy.com/arduino-lessons

https://www.eprolabs.com

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