SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

Year: B. Tech III (Semester V)

Subject Name: IoT Architecture and Protocols **Subject Code:** BTEA19525
Type of course: Honors (Group: Internet of Things)
Prerequisite (if any): Fundamentals of Internet of Things

Rationale: The course enables students to understand the basics of the Internet of things architecture. Students will also learn about the protocols and understand the concepts of Web of Things. Moreover, they can implement the design of smart IoT system using various protocols and IoT hardware interfacing.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
4	0	2	5	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Contents:

Sr. No.	Topics	Total Hrs
1	**Introduction to protocols for Internet of Things (IoT):** Introduction to protocols for Internet of Things, role, requirements, specifications of protocols in IoT environment, IoT ecosystem, protocol layers in IoT, LoRa protocol for physical layer in IoT	08
2	**Protocols for data link layer:** Study of Protocols for data link layer: IEEE 802.11 ah, IEEE 802.15.4 e, WiFi, Bluetooth, Bluetooth Low Energy, Z-wave, Zigbee: Zigbee Network Layer, APS layer, Zigbee Device Object-ZDO, Zigbee Security, Zigbee cluster library, zigbee application profiles, WirelessHART (advanced encryption technique): architecture	14
3	**ModBus and Wireless M-Bus:** Introduction, ModBus Standardization, ModBus Message Framing and Transmission Modes, ModBus/TCP, M-Bus Architecture, Wireless M-Bus.	08
4	**6LoWPAN and RPL:** Study of Protocols for Network layer: RPL, 6LoWPAN- IPv6 over Low power Wireless Personal Area Networks, IPV6- end-to-end datagram transmission across multiple IP networks., IPV6 over Bluetooth Low Energy	10
5.	**Protocols for Session, application layer, IoT Management layer protocols:** Study of MQTT and COAP protocol for IoT applications: MQTT-protocol designed for M2M and mobile applications, COAP- used in resource-constrained	12

	internet devices, IoT Management layer protocols need and functioning in order to facilitate communication between different layers in IoT	
6.	**Security in IoT protocols:** Need of security, security mechanisms built in the IoT protocols, Trusted Computing Group (TCG) storage interface Interaction Specification	08

Suggested Specification Table of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	30	30	20	0	0

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN
1	Internet of Things: Architecture and Design Principles	Raj Kamal	Mc Graw Hill Education
2.	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	University Press, ISBN: 978-81-7371-9547, Paperback.
3.	The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases	Pethuru Raj and Anupama C. Raman	CRC Press
4.	Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications	Daniel Minoli	Willy Publications
5.	The Internet of Things: Key Applications and Protocols	Olivier Hersent, David Boswarthick, and Omar Elloumi	Wiley Publications
6.	Protocols and Architectures for Wireless Sensor Networks	H. Karl and A. Willig	John Wiley & Sons, India
7.	Internet of Things	Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram	Wiley

Note: Students should refer to the latest editions of books

Course Outcome:

Sr. No.	After learning this subject, students will be able to	Marks % weightage
CO-1	Understand data transmission, network layer, session and application layer protocols.	20
CO-2	Understand the role of all protocols in the network communications.	20
CO-3	Provide overview of popular protocols and standards helping IoT device applications.	20
CO-4	Use various techniques of data storage in the cloud and analytics in IoT.	20
CO-5	Understand IoT security for IoT related technologies.	20

List of Practical:

Sr. No	Practical
1.	Understanding Node MCU (ESP8266), ESP32 and Components
2.	Understanding and connectivity of NodeMCU with a Zigbee module. Write a programme for communication between two devices using Zigbee to on and off remote led.
3.	Interfacing Node MCU with Cloud (Thingspeak API)
4.	Configuring Amazon AWS EC2 Account.
5.	Implement IoT protocols and data upload through DHT11 sensor to Thingview sever.
6.	Installing Apache Web Server in amazon AWS EC2, Installing PHP in Amazon AWS EC2
7.	Create a simple web interface through HTTP protocol and with ESP8266/ESP32 board to control the connected LEDs remotely on the Blynk server.
8.	Accessing Files in python for IoT
9.	MQTT protocol implementation using Adafruit server and soil moisture sensor for observing data on online webserver.

List of equipment:

- Node MCU, ESP32, Sensors, Jumper wires, USB cable

List of Open Source/Learning website:

- https://nptel.ac.in/courses/106105183

It covers Internet of Things Protocols

- http://www.infocobuild.com/education/audio-video-courses/computer-science/IntroductionToIoT-IIT-Kharagpur/lecture-09.html

It covers connectivity technologies

- https://www.udemy.com/course/practical-iot-devices-protocols-servers/

It covers practical based on various protocols and various servers

List of Open Software:

- Arduino 1.8.12
- Adafruit I/O
- Blynk Server