SARVAJANIK UNIVERSITY
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# SARVAJANIK UNIVERSITY
## Sarvajanik College of Engineering and Technology
## Master of Technology

## M.Tech. II Year: Semester – III

**Subject Name:** Internet of Things **Subject Code:** MTEC15301
**Type of Course:** Open Electives
**Prerequisite:** Basic knowledge of Computer Networks and Communication

**List of Courses where this course will be prerequisite: --**

**Rationale:** This course provides a platform for students to understand the working of wifi modules; architecture designing aspects of Internet of Things, Cloud Computing, Open source clouds, User Interface. This is one of the foundation courses which are required for students to develop their technical knowledge which helps to make a smart city, smart irrigation system, smart healthcare system and many more.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | | Theory Marks | | | Practical Marks | | Total |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | C | TEE | CA1 | CA2 | TEP | CA3 | |
| 3 | 0 | 0 | 3 | 60 | 25 | 15 | 0 | 0 | 100 |

**Content:**

| Sr.No. | Content | Total Hrs | Module Weightage |
|---|---|---|---|
| 1 | Evolution of IoT: Definition and Characteristics of IoT, Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle. | 7 | 10 |
| 2 | IoT protocols and softwares: MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols | 6 | 15 |
| 3 | IoT point to point communication technologies:IoT Communication Pattern,IoTprotocol Architecture, Selection of Wireless technologies ( 6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA,Lifi,Widi) | 6 | 10 |

| | | | |
|---|---|---|---|
| 4 | Introduction to Cloud computation and Big data analytics: Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Introduction to big data analytics and Hadoop. | 5 | 10 |
| 5 | Sensors interfacing: Sensors interfacing techniques- Port Programming, ADC, SPI thermometer, I2C thermometer, PWM generation and demodulation, DTH11, single wire thermometer, Frequency counters. | 5 | 15 |
| 6 | IoT Physical Devices and Endpoints: Introduction to NodeMCu -wifi module, Arduino IDE programming, Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins. | 4 | 15 |
| 7 | IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs Web Server – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API | 4 | 10 |
| 8 | IoT security:Need for encryption, standard encryption protocol, lightweight cryptography, Quadruple Trust Model for IoT-A – Threat Analysis and model for IoT-A, Cloud security | 4 | 5 |
| 9 | IoT applications and its Variants.Case studies: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0,IoT standards, Contemporary issues | 4 | 10 |

**Reference Books:**

| Sr.No. | Title of book /article | Author(s) | Publisher and details like ISBN | Year of publication | Publication Edition |
|---|---|---|---|---|---|
| 1. | Internet of Things – A Hands-on Approach | Arshdeep Bahga and Vijay Madisetti, | Universities Press, ISBN: 9788173719547 | 2015 | |
| 2. | Getting Started with Raspberry Pi, | Matt Richardson & Shawn Wallace, O'Reilly (SPD), | ISBN: 9789350239759 | 2014 | |

| | | | | | |
|---|---|---|---|---|---|
| 3. | Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model | Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner | Springer Open, | 2016 | |
| 4. | From Machine to Machine to Internet of Things | Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle | Elsevier Publications, | 2014 | |
| 5. | The Internet of Things: From RFID to the Next-Generation Pervasive Network. | LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning | Aurbach publications, | March,2008 | |
| 6 | Mobile Computing | Asoke K Talukder and Roopa R Yavagal, | Tata McGraw Hill, | 2010 | |
| 7 | Cloud Computing Bible | Barrie Sosinsky | Wiley-India, | 2010 | |
| 8 | Cloud Security: A Comprehensive Guide to Secure Cloud Computing, | RonaldL. Krutz, Russell Dean Vines, | Wiley-India, | 2010 | |

**Course Outcomes:**

| Sr.No. | CO statement | Marks % Weightage |
|---|---|---|
| CO-1 | To introduce the concept of M2M (machine to machine) and IoT with protocols | 25 |

| | | |
|---|---|---|
| CO-2 | Discuss on IoT reference layer and various protocols and software. | 25 |
| CO-3 | To build IoT systems using Raspberry PI, NodeMCU, sensors, actuators and open source IoT platforms. | 25 |
| CO-4 | To introduce the implementation of web based services on IoT devices | 25 |

**PROGRAM OUTCOMES**

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO-1** | 1 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| **CO-2** | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 1 | 1 |
| **CO-3** | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO-4** | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| **Rationale*** | | | | | | | | | | | | | | | |

Rationale* : Explaining why it is matching this particular program outcome

**List of Open Source Software:**

- Arduino IDE
- Thonny

**Learning website:**

**https://onlinecourses.nptel.ac.in/noc19_cs65/preview**

Basics of Networking, Communication Protocols, Sensor Networks, Machine-to-Machine Communication, Interoperability in IoT, Introduction to Arduino ProgrammingI, Integration of Sensors and Actuators with Arduino, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi, Introduction to SDN, SDN for IoT,Data Handling and Analytics, Cloud Computing, Sensor-Cloud, Fog Computing, Smart Cities and Smart Homes,Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

**https://www.coursera.org/specializations/internet-of-things**

Basics of Internet of Things, Microcontroller and Interfacing Techniques for IoT Devices, IoT Protocols & Security, Location Tracking, Deep learning for IoT, IoT Applications