# COURSE HANDOUT

INTERNET OF THINGS (ECE- 501)

ECE-5TH SEMESTER

ACADEMIC YEAR (2024-25)

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| Course Code | Course Name | Course Type | Cd | L | T | P | Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Sessional | Final Exam | Total |
| ECE-501 | Introduction to Internet of Things | Core | 4 | 3 | 1 | 0 | 50 | 150 | 150 |

**COURSE OUTCOMES**

| At the end of the course the student will be able to: | |
|---|---|
| CO1 | Explain the architecture and protocols of IOT. |
| CO2 | Apply the knowledge for interfacing of Arduino with sensors and actuators. |
| CO3 | Analyse different communication technologies and Internet Protocols used for IOT. |
| CO4 | Design IoT system for data processing and data security. |
| CO5 | Articulate cloud architecture and different development board.. |

**Unit-I**

IoT Architecture**:** Introduction, State of the Art, Architecture Reference Model, Understanding IoT fundamentals, IOT Architecture and protocols, Real-time Examples of IoT, Various Platforms for IoT, Overview of IoT components and IoT Communication Technologies, M2M Vs IOT, Recent developments and Challenges in Internet of Things.

(10 Hours)

**Unit-II**

Arduino Simulation Environment: Setup the IDE, writing Arduino Software, Arduino Libraries, Embedded C programming for Arduino. Interfacing LED, push-button, buzzer and LCD with Arduino. Developing IoT Solutions: Introduction to Raspberry Pi, Raspberry Architecture and Pin Configuration, Basic Setup, Cloud Computing, Sensor-Cloud, Fog Computing, Connected Vehicles, Data Aggregation in IoT.

(12 Hours)

**Unit-III**

**Interfacing of Sensor & Actuators:** Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino. Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino.

(10 Hours)

**Unit- lV**

Basic Networking with Wi-Fi module: Basics of Wireless Networking, Introduction to ESPXX, ESP8266, and NodeMCU. Various Wi-Fi libraries, Web server- introduction, installation, configuration, posting sensor(s) data to web server. IEEE802.15.4- BACNet Protocol, Modbus, KNX, Zigbee, Network layer, APS layer, Security.

. (8 Hours)

**Unit-V**

**Applications and Cloud Platforms:** Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services - SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, Thing Speak API and MQTT, Interfacing ESPXXXX with Web services. IOT Applications for Industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Wearable, Agriculture, IoT- A, Hydra, PIoT.

(12 Hours)

**Textbooks**

| S.No | Name of the Books | Name of the Author | Publisher Name | Edition (Pub.Yr.) |
|---|---|---|---|---|
| 1 | Introduction to IoT | Sudip Misra, Anandrup Mukherjee, Arjit Roy | Cambridge | 1st (2021) |
| 2. | An Introduction to IoT Internet of Things Connecting Devices, Edge Gateway and Cloud with Applications | Rahul Dubey | Cengage | 1st (2019) |
| 3. | Internet of Things | Mayur Ramgir | Pearson | 1st (2022) |

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|---|---|---|---|---|
| | Architecture, Implementation and Security | | | |

**Reference Books**

| S.No | Name of the Books | Name of the Author | Publisher Name | Edition (Pub.Yr.) |
|---|---|---|---|---|
| 4 | Internet of Things: A Hands-on Approach | Arsheep Bagha, Vijay Madisetti | Orient Blackswan Private Limited New Delhi | 1st (2015) |

| COURSE PLAN | | |
|---|---|---|
| **Unit-I IoT Architecture** | | |
| **S.No** | **Topics** | **Recommended Books** |
| 1 | Introduction, State of the Art of IoT | Book 3, Ch.4 |
| 2 | Architecture Reference Model, Understanding IoT fundamentals | Book 3, Ch.4 |
| 3 | IOT Architecture and protocols | Book 3, Ch.2 |
| 4 | Real-time Examples of IoT | Book 1, Ch.2 |
| 5 | Various Platforms for IoT | Book 1, Ch.3 |
| 6 | Overview of IoT components and IoT Communication Technologies | Book 1, Ch.8 |
| 7 | M2M Vs IOT | Book 1, Ch.3 |
| 8 | Recent developments and Challenges in Internet of Things | Book 3, Ch.1 |
| **Unit-II Arduino Simulation Environment** | | |
| 8 | Arduino Simulation Environment | Book 1, Ch.16 |
| 9 | Setup the IDE, writing Arduino Software | Book 1, Ch.16 |
| 10 | Arduino Libraries, Embedded C programming for Arduino | Book 1, Ch.16 |
| 11 | Interfacing LED | Book 1, Ch.16 |
| 12 | Interfacing push-button, buzzer and LCD with Arduino | Book 1, Ch.16 |
| 13 | Developing IoT Solutions: Introduction to Raspberry Pi | Book 1, Ch.16 |
| 14 | Raspberry Architecture and Pin Configuration, Basic Setup | Book 1, Ch.16 |
| 15 | Cloud Computing, Sensor-Cloud | Book 1, Ch.10 |
| 16 | Fog Computing, Connected Vehicles | Book 1, Ch.10 |
| 17 | Data Aggregation in IoT | Book 3, Ch.5 |
| **Unit- III Interfacing of Sensor & Actuators** | | |
| 19 | Overview of Sensors working | Book 1, Ch. 5 |
| 20 | Analog and Digital Sensors | Book 1, Ch. 5 |
| 21 | Analog and Digital Sensors | Book 1, Ch.13 |
| 22 | Interfacing of Temperature, Humidity | Book 1, Ch.13 |
| 23 | Motion, Light and Gas Sensor with Arduino | Book 1, Ch.13 |
| 24 | Interfacing of Actuators with Arduino | Book 1, Ch.4 |
| 25 | Interfacing of Relay Switch and Servo Motor with Arduino | Book 1, Ch.16 |
| **Unit-IV Basic Networking with Wi-Fi module** | | |

| | | |
|---|---|---|
| 26 | Basics of Wireless Networking | Book 2, Ch.4 |
| 27 | Introduction to ESPXX | Book 2, Ch.4 |
| 28 | ESP8266, and NodeMCU | Book 1, Ch.4 |
| 29 | Various Wi-Fi libraries | Book 3, Ch.7 |
| 30 | Installation, configuration | Book 1, Ch.3 |
| 31 | Posting sensor(s) data to web serve | Book 2, Ch.3 |
| 32 | IEEE802.15.4 | Book 1, Ch.7 |
| 33 | BACNet Protocol, Modbus | Book 2, Ch.4 |
| 34 | KNX, Zigbee, Network layer | Book 1, Ch.4 |
| 35 | APS layer | Book 1, Ch.4 |
| 36 | Security | Book 2, Ch.3 |
| **Unit-V IoT Applications and Cloud Platforms** | | |
| 38 | IoT Applications and Cloud Platforms | Book 1, Ch.10 |
| 39 | Virtualization concepts and Cloud Architecture | Book 1, Ch.10 |
| 40 | Cloud computing, benefits | Book 1, Ch.10 |
| 41 | Cloud services - SaaS, PaaS, IaaS | Book 3, Ch.4 |
| 42 | Cloud providers & offerings | Book 1, Ch.10 |
| 43 | Study of IOT Cloud platforms | Book1, Ch. 15 |
| 44 | Thing Speak API and MQTT | Book 1, Ch.8 |
| 45 | Interfacing ESPXXXX with Web services | Book 2, Ch.4 |
| 46 | IOT Applications for Industry | Book2, Ch. 8 |
| 47 | Future Factory Concepts, Brownfield IoT | |
| 48 | Smart Objects, Smart Applications, Wearable | Book 3, Ch.7 |
| 49 | Agriculture, IoT- A, Hydra, PIoT | Book 1, Ch.12 |

**ADDITIONAL WEB RESOURCES**

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|---|---|
| 1. | **MOOC:** Introduction to Internet of Things<br>https://onlinecourses.nptel.ac.in/noc20_cs69/preview |
| 2. | **NPTEL:** Video lectures on Introduction to Industry 4.0 and Industrial Internet of Things by Prof. Sudip Misra, IIT Kharagpur<br>https://onlinecourses.nptel.ac.in/noc20_cs69/preview |

**GRADING AND ASSESSMENT**

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

**COURSE POLICIES**

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

**FACULTY INFORMATION**

- **Office Hours**

  Tuesday (12:05 PM - 12:55 PM)
  Thursday (12:05 PM - 12:55 PM)

- **Contact Information**
  satyendra.ece@mietjammu.in