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| | **National Institute of Technology Meghalaya**<br>An Institute of National Importance | **CURRICULUM** |

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|---|---|---|---|
| Programme | **Bachelor of Technologyin Computer Science and Engineering** | Academic Year of Regulation | **2018-19** |
| Department | **Computer Science and Engineering** | Semester | **VIII** |

| Course Code | Course Name | Credit Structure | | | | Marks Distribution | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | INT | MID | END | Total |
| **CS 428** | **Internet of Things** | **3** | **0** | **0** | **3** | **50** | **50** | **100** | **200** |

| Course Objectives | Course Outcomes | | |
|---|---|---|---|
| **To provide the students with some knowledge about the definition and significance of the Internet of Things.** | | CO1 | **Able to demonstrate the basic concept of IoT, the architecture of IoT, and applications of IoT in the real life.** |
| **To develop the student's ability to understand the architecture, operation, and business benefits of an IoT solution.** | | CO2 | **Able to explain the mechanism of various protocols used in different layers of IoT.** |
| **To develop the student's ability to understand different protocols used for communication between various IoT devices.** | | CO3 | **Able to identify the challenges of Interoperability and techniques used for Interoperability in IoT.** |
| **To develop the student's ability to understand the relationship between IoT, cloud computing, and big data.** | | CO4 | **Able to examine different Service and Resource Discovery in IoT.** |
| **To provide knowledge to students about various privacy and security issues in IoT.** | | CO5 | **Able to interpret about various privacy and security issues in IoT communication.** |
| | | CO6 | **Able to imagine and improve the relationship between IoT, cloud computing, fog computing and big data.** |

| No. | COs | Mapping with Program Outcomes (POs) | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | **2** | **0** | **0** | **0** | **0** | **1** | **2** | **0** | **1** | **1** | **0** | **0** | **2** | **1** | **1** |
| 2 | CO2 | **2** | **3** | **1** | **1** | **0** | **2** | **1** | **0** | **3** | **2** | **1** | **2** | **1** | **2** | **2** |
| 3 | CO3 | **3** | **2** | **1** | **0** | **2** | **3** | **0** | **1** | **0** | **1** | **3** | **1** | **3** | **2** | **2** |
| 4 | CO4 | **1** | **0** | **3** | **2** | **0** | **2** | **1** | **0** | **3** | **2** | **1** | **0** | **1** | **2** | **2** |
| 5 | CO5 | **2** | **0** | **1** | **0** | **2** | **3** | **1** | **0** | **1** | **2** | **1** | **0** | **3** | **2** | **3** |
| 6 | CO6 | **1** | **2** | **0** | **3** | **1** | **2** | **0** | **2** | **0** | **1** | **0** | **0** | **2** | **3** | **2** |

SYLLABUS

| No. | Content | Hours | COs |
|---|---|---|---|
| I | **Introduction:**<br>**What is IoT, Ad-hoc and Sensor Networks, Architecture of IoT, Application of IoT: Smart home, Intelligent transportation systems, Industrial aumtomation, Smart healthcare, Smart grids;** | **4** | **CO1** |
| II | **IoT Standards:**<br>**Designing the architecture of an IP-based IoT, Application Protocols: Constrained Application Protocol (CoAP), CoSIP, Message Queue Telemetry Transport (MQTT), Extensible Message and Presence protocol (XMPP), Advanced Message Queuing Protocol (AMQP), Data Distribution Service (DDS); Service Discovery Protocols: Multicast DNS (mDNS), DNS Service Discovery (DNS-SD); Infrastructure Protocols: Routing Protocol for Low Power and Lossy Networks (RPL), 6LoWPAN, IEEE 802.15.4 and ZigBee, Bluetooth Low Energy (BLE), Low-power Wi-Fi, IEEE 802.15.6, EPCglobal, LTE-A, Z-Wave;** | **11** | **CO2** |
| III | **Interoperability:**<br>**Applications in the IoT, The verticals: Cloud-based solutions, REST Architecture: The Web of Things, Messaging Queues and Publish/Subscribe Communications, Session initiations for the IoT, Optimized Communications: the Dual-network Management Protocol, Discoverability in Constrained Environments, Data Formats: Media types for sensor markup language;** | **5** | **CO3** |
| IV | **Discoverability:**<br>**Service and Resource Discovery, Local and Large-scale Service Discovery, Sclable and self-configuring Architecture for Discovery in the IoT, Lightweight Service Discovery in Low-power IoT Networks;** | **3** | **CO4** |
| V | **Security and Privacy in the IoT:**<br>**Security issues in the IoT: Traditional vs Lightweight security, Lightweight Cryptography, Key Agreement, Distribution and Security Bootstrapping, Processing data in the encrypted domain: Secure data aggregation, Authorization mechanisms for secure IoT services;**<br>**Privacy issues in the IoT: The role of Authentication, IoT-OAS: Delegation-based authorization for the IoT, IoT-OAS application scenarios, Hybrid gateway-based communication;** | **7** | **CO5** |
| VI | **Cloud and Fog Computing for IoT:**<br>**Cloud computing, Big data processing pattern, Big stream, Big stream and security, Fog computing and the IoT, Role of the IoT hub: Virtualization and replication, Operational scenarios, Synchronization protocol;** | **6** | **CO6** |
| Total Hours | | **36** | |

**Essential Readings**


1. Cirani S, Ferrari G, Picone M, Veltri L. Internet of Things: Architectures, Protocols and Standards. John Wiley & Sons; 2018.
2. Lea P. Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security. Packt Publishing Ltd; 2018.
3. Buyya R, Dastjerdi AV, editors. Internet of Things: Principles and paradigms. Elsevier; 2016.


**Supplementary Readings**


1. Chou T. Precision-Principles, Practices and Solutions for the Internet of Things. McGraw-Hill Education; 2017.
2. Santos M, Moura E. Hands-On IoT Solutions with Blockchain: Discover how converging IoT and blockchain can help you build effective solutions. Packt Publishing Ltd; 2019.
3. Al-Fuqaha A, Guizani M, Mohammadi M, Aledhari M, Ayyash M. Internet of things: A survey on enabling technologies, protocols, and applications. IEEE communications surveys & tutorials. 2015 Jun 15;17(4): 2347-76.