GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Postgraduate

Branch: Computer Engineering (Cybersecurity)

Course / Subject Code: ME01059081

Course / Subject Name: Introduction to IoT and Security Concern

w. e. f. Academic Year:	: 2024-25
Semester:	: 1
Category of the Course:	: Program Elective Course-II

Prerequisite:	• Fundamentals of computer networking, sensing, databases, programming, and related technology.
Rationale:	• The rapid proliferation of Internet of Things (IoT) devices is transforming various sectors, including healthcare, manufacturing, transportation, and smart cities. As more devices become interconnected, there is an unprecedented opportunity for innovation, efficiency, and convenience. However, with this growth comes a significant increase in security vulnerabilities, making IoT security a critical concern.

- **Course Outcome:**

After Completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level
01	Understanding of the key technologies that enable IoT systems.	UN
02	Differentiate the protocols based on the IoT communication model.	AP
03	Understand the various security challenges associated with IoT devices, networks, and data.	UN
04	Evaluate the effectiveness of different IoT security protocols and solutions.	EL
05	Apply best practices for securing IoT applications in real-world scenarios.	AP

**Revised Bloom's Taxonomy (RBT)*

- **Teaching and Examination Scheme:**

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	ESE (E)	PA/CA (M)	PA/CA (I)	ESE (V)	
03	00	02	04	70	30	20	30	150

- **Course Content:**

Unit No.	Content	No. of Hours	% of Weightage
1	**Unit I: Introduction of IoT:** Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT, IoT Sensing and Actuation, IoT Processing Topologies and Types, IoT Connectivity Technologies. IoT applications.	5	15
2	**Unit II: IoT Communication Technologies and Interoperability:** Introduction, Infrastructure Protocols, Discovery Protocols, Data Protocols, Identification Protocols, Device Management, Semantic Protocols, IoT Interoperability: Introduction, Standards and Frameworks	5	15
3	**Unit III: Associated IoT Technologies:** Cloud Computing, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-cloud: Sensor as service, Fog Computing and its Application: Introduction, View of a Fog Computing Architecture, Fog Computing in IoT, Selected Applications of Fog Computing.	5	15
4	**Unit IV: Security Measures for IoT Devices:** Authentication and Authorization: Strong authentication mechanisms (e.g., Public Key Infrastructure - PKI), Role-Based Access Control (RBAC) and OAuth for IoT, Data Encryption: End-to-End Encryption (E2EE) for IoT, Lightweight encryption techniques (e.g., AES-128, ECC) for constrained devices Secure Communication: Use of VPNs, SSL/TLS in IoT communications, Implementing secure IoT protocols (MQTT-S, DTLS for CoAP)	6	15
5	**Unit V: Domain-specific applications of IoT:** Internet of Medical Things, Home automation, Agricultural IoT, Vehicular IoT applications, Surveillance applications, Other IoT applications. Case studies of the successful implementation of IoT in organizations. Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT Paradigms, Challenges associated with IoT, Emerging Pillars of IoT.	5	15
6	**Unit VI: Developing IoT solutions:** Introduction to Python, Arduino and Raspberry Pi, Implementation of IoT with Arduino and Raspberry, Data Aggregation for the IoT in Smart Cities.	5	10

7	**Unit VII: IoT Analytics:** Introduction of Machine Learning, Implementation of ML algorithms in the IoT application, Performance Metrics for Evaluating ML Algorithms	5	10
8	**UNIT-VIII: Current Trends:** The latest development in the cyber laws, policies and rules	4	05

- **Suggested Specification Table with Marks (Theory):**

Distribution of Theory Marks (in %)					
R Level	**U Level**	A Level	N Level	E Level	C Level
-	40	40	10	10	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

- **References/Suggested Learning Resources:**

(a) Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", 1st Edition, Cambridge University Press, 2021.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT, 2014
3. Cuno Pfister, Getting Started with the Internet of Things, O" Reilly Media, 2011, ISBN: 978-1-4493- 9357
4. IoT Security Issues" by Sudhir Kumar Sharma, Balamurugan Balusamy, and Peter K. Orji
5. "Cybersecurity for the Internet of Things" by Muhammad Azhar Iqbal, Bhawani Shankar Chowdhry, and Saqib Saeed

(b) Open-source software and website:

1. Course-related online MOOCs on NPTEL/SWAYAM platform
2. Recently Published papers/articles in reputed journals
3. Hardware Tools: Raspberry pi, Arduino, IoT kit.
4. Software: Node-Red Simulator, Contiki OS, Eclipse IoT Project, M2MLabs Mainspring.

- **Suggested Course Practical List: If any**

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