Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-7 (B.Tech)

Subject: Internet Of Things – BETIT17334

Type of course: Major (Core)

Prerequisite: Students should have a fundamental understanding of programming concepts, preferably in languages such as C, Python, or Java. Basic knowledge of computer networks, including protocols and communication models, is expected. Familiarity with electronics concepts such as sensors, microcontrollers, and embedded systems will be beneficial.

Rationale:

The Internet of Things (IoT) has emerged as a transformative technology that connects physical devices to the digital world, enabling intelligent decision-making and automation across various domains. This course aims to equip students with the knowledge of IoT architecture, communication protocols, sensors, and data processing techniques required to design and develop real-world IoT applications. Understanding IoT is essential for students to meet current industry demands in areas such as smart cities, healthcare, agriculture, and industrial automation.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	**Introduction to Internet of Things (IoT):** Definition and concept of IoT, Evolution of IoT, Characteristics of IoT, IoT architecture (3-layer & 5-layer), Components of IoT (devices, gateways, cloud), IoT vs M2M, Enabling technologies (AI, Big Data, Cloud), Overview of IoT ecosystem and platforms.	12	20%
2	**Sensors, Actuators & Embedded Systems:** Introduction to sensors and actuators, Types of sensors (temperature, humidity, motion, etc.), Working principles of actuators, Microcontrollers and microprocessors, Arduino and Raspberry Pi overview, Interfacing sensors with microcontrollers, Basic embedded system design for IoT applications.	15	25%
3	**IoT Communication & Networking:** Basics of networking in IoT, OSI and TCP/IP models, Communication protocols (MQTT, CoAP, HTTP, AMQP), Wireless technologies (Wi-Fi, Bluetooth, Zigbee, LoRaWAN), IPv6 for IoT, Data transmission techniques, IoT gateways and communication models.	12	20%
4	**IoT Data Processing, Cloud & Security:** Introduction to cloud computing in IoT, IoT cloud platforms (AWS IoT, Azure IoT), Data collection and analytics basics, Edge and Fog computing, Data visualization concepts, Security issues in IoT, Encryption techniques, Authentication and privacy challenges.	12	20%
5	**IoT Applications & Case Studies:** Applications of IoT in smart homes, smart cities, healthcare, agriculture, Industrial IoT (IIoT), Wearable devices, Case studies of real-world IoT implementations, Challenges and future trends in IoT.	09	15%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**End-to-End IoT System Design with Digital Twin Simulation:** Each student will individually design a complete IoT system for a real-world problem (e.g. smart irrigation, smart campus monitoring, or health tracking). They will create a digital twin simulation using tools like Tinkercad or Node-RED to represent real-time device behavior. The system must include sensor layer, communication protocol selection, cloud integration, and data visualization dashboard. Students will justify their design choices and submit a detailed report including architecture diagram, data flow, and simulation outputs in PDF format on the GMIU Web Portal.	10
2	**IoT Security Threat Modeling & Risk Mitigation:** Each student will individually analyze a real-world IoT system (e.g., smart home or industrial IoT) and perform threat modeling to identify vulnerabilities across device, network, and cloud layers. They will design possible attack scenarios (such as data interception or unauthorized access) and propose appropriate security measures including encryption, authentication, and secure communication protocols. The submission must include a threat diagram, attack flow, and mitigation strategy explanation in PDF format on the GMIU Web Portal.	10
3	**Project-Based Intelligent IoT System with Edge Processing & Cloud Integration:** Students will work in a group to design and develop an end-to-end IoT system with hardware-level (Prototyping) implementation using sensors and microcontroller. The system must incorporate edge-level data processing (basic filtering/decision logic) along with cloud connectivity (Firebase/AWS IoT) for real-time data handling. It should support real-time monitoring via dashboard/interface and include an automated response or alert mechanism. The submission should include system architecture, data flow, implementation details, and output screenshots/photos, and must be submitted in PDF format on the GMIU Web Portal.	10
	Total	30

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage %	10%	35%	25%	15%	10%	5%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the fundamental concepts, architecture, components, and enabling technologies of the Internet of Things (IoT).
CO2	Use sensors, actuators, microcontrollers, and embedded systems in IoT applications.
CO3	Apply IoT communication protocols and networking concepts to enable data transmission between devices and systems.
CO4	Analyze IoT data processing techniques, cloud integration, and security mechanisms for reliable and secure IoT systems.
CO5	Evaluate and design IoT-based solutions for real-world applications across domains such as smart cities, healthcare, and industry.

List of Practical

Sr. No	Description	Unit No.	Hrs.
1	Installation and setup of Arduino IDE / Tinkercad. Understanding basic components, board configuration, and running a simple program (LED blink).	01	02
2	Interface a temperature sensor (LM35/DHT11) with Arduino and acquire real-time data using serial monitoring.	02	02
3	Integrate multiple sensors (temperature and humidity) and implement continuous data acquisition for environmental monitoring.	02	02
4	Develop a sensor-based actuator system (LED/buzzer) using conditional logic for automated control.	02	02

5	Implement serial communication to transmit and log sensor data between microcontroller and system.	02	02
6	Configure ESP8266/ESP32 module and establish wireless communication with a network for IoT connectivity.	03	04
7	Transmit real-time sensor data to a cloud platform (ThingSpeak/Firebase) and analyze remote data availability.	04	04
8	Design a real-time IoT dashboard for visualization and monitoring of sensor data using cloud/web tools.	04	04
9	Implement MQTT-based communication using broker-client model for efficient IoT data exchange.	05	04
10	Develop a complete IoT system integrating sensing, communication, cloud storage, and output interface for real-world application.	05	04
		Total	30

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Arshdeep Bahga, Vijay Madisetti – *Internet of Things: A Hands-On Approach* – Universities Press, 1st Edition, 2015.
[2] Raj Kamal – *Internet of Things: Architecture and Design Principles* – McGraw Hill Education, 1st Edition, 2017.
[3] Samuel Greengard – *The Internet of Things* – MIT Press, 1st Edition, 2015.
[4] Adrian McEwen, Hakim Cassimally – *Designing the Internet of Things* – Wiley, 2nd Edition, 2014.
[5] Vijay Madisetti, Arshdeep Bahga – *Internet of Things (A Hands-on Approach)* – VPT Publications, 1st Edition, 2016.