

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	INTERNET OF THINGS & IT's AI APPLICATIONS
Desired Requisites:	Computer Networks

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	MSE	ISE	ESE	Total
Tutorial	-	30	20	50	100
Credits: 3					

Course Objectives

1	To comprehend the foundational principles underlying IoT and AI technologies to develop a IoT applications
2	To examine the design methodology and diverse IoT hardware platforms
3	To explore the concepts surrounding IoT Data Analytics and AI
4	To discriminate between various IoT case studies and industrial applications, enabling the identification of unique features, challenges etc using AI techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Demonstrate the fundamentals of IoT and the design methodology by analyzing various hardware platforms of IoT AI systems.	III	Apply
CO2	Apply analytical skills to examine and arrange data effectively within IoT contexts using AI.	III	Apply
CO3	Differentiate several AI-enabled IoT applications across industrial and real-world context..	IV	Analyse
CO4	Implement IoT AI System by incorporating current technological standards.	V,VI	Evaluate ,Create

Module	Module Contents	Hours
I	FUNDAMENTALS OF IoT -Introduction to IoT, How does Internet of Things Works, Features of IoT, Advantages and Disadvantages of IoT , IoT World Forum (IoTWF) standardized architecture, Simplified IoT Architecture, Core IoT Functional Stack, , IoT Data Management and Compute Stack ,Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Challenges, IoT Network Architecture and Design,	7

II	IoT COMMUNICATION PROTOCOLS- IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, 6LoWPAN, Business Case for IP, Optimizing IP for IoT, The Transport Layer, IoT Application Transport Methods -SCADA, Application Layer Protocols: CoAP and MQTT. Communication technologies Used in IoT: Bluetooth, Wi-Fi, Li-Fi, RFID, Cellular, Z-Wave	7
III	FUNDAMENTALS OF AI- Problems and search: What is AI, AI Problems; AI Techniques; Problem Space and Problem Search techniques; Defining the problem as a state space search, production systems; Problem characteristics, production system characteristics. Use of AI in IoT System to solve the issues.	5
IV	DESIGN AND DEVELOPMENT OF AI ENABLED IOT APPLICATIONS- IoT Interfacing: Component selection criterion for Implementing IoT application, Hardware Components- Computing (NodeMCU, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino). Sensors interfacing: Interfacing of Temperature, humidity, light, accelerometer, ultrasonic, IR/PIR, Camera etc. Communication and I/O components Interfacing: Bluetooth, WiFi, GSM, Displays and touch sensor etc. Introduction to cloud storage models and communication. Introduction to Amazon Web Services (AWS) IoT platform, Microsoft Azure IoT platform, Google Cloud Platform, IoT, IBM Watson IoT platform, Google IoT, ThingSpeak, Thing Work IoT platform	7
V	DATA ANALYTICS USED IN AI ENABLED IOT APPLICATIONS: Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Structured Versus Unstructured Data, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics. Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M.	7
VI	CASE STUDIES/INDUSTRIAL AI ENABLED APPLICATIONS: Solution framework for IoT applications, Implementation of Device integration, Data acquisition, Organization and integration and analytics. Device data storage- Unstructured data storage on cloud/local server, authorization of devices, role of Cloud in IoT, Security aspects in IoT. Case Study: Smart Cities, Smart Homes, Automobiles, Industrial IoT, Agriculture etc. Case studies: Activity Monitoring in Agriculture, Weather, Healthcare, Environment related applications.	6

Textbooks

1	"Internet of Things – A hands-on approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
2	"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", Pethuru Raj and Anupama C. Raman, CRC Press, 1st edition, 2017
3	"The Internet of Things – Key applications and Protocols", Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012
4	"Artificial Intelligence: A Modern Approach", Russell & Norvig, Third Edition, Prentice-Hall, 2010

References

1	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint).
2	Andrew Minter, "Analytics for the Internet of Things (IoT)" Packt Publications, Jul 2017
3	Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.

4	Adrian McEwen, Hakim Cassimally, ” Designing the Internet Of Things”, Wiley, 1st Edition, 2013
5	Giacomo Veneri , Antonio Capasso ,” Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0”, 29 Nov 2018
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2	https://www.coursera.org/learn/introduction-iot-boards?action=enroll
3	https://www.coursera.org/learn/iot-software-architecture

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2												
CO2	2	3	2	2									2	
CO3		2	2	2	2								2	
CO4	2	2		2			1							
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
<p>The assessment is based on MSE, ISE and ESE.</p> <p>MSE shall be typically on modules 1 to 3.</p> <p>ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.</p> <p>ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.</p> <p>For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)</p>

Introduction to IoT and Azure IoT Services

- Business Opportunities for IoT
- Introduction to IoT Solution Architecture
- IoT Hardware and Cloud Services
- Explain how IoT and Azure IoT could be applied to their business
- Describe the core components of an Azure IoT Solution Architecture
- Describe the Azure IoT Services and how they relate to an IoT solution
- Create an Azure account and use the Azure portal to create an IoT Hub and DPS service

Serving web pages with dynamic data.

Project –

Sensor data – Azure IoT Hub- Azure Storage

Sensor Data- Azure IoT Hub – Azure Stream Analytics- Power BI

IoT Data integration with MongoDB

One End to end use case Sensor data – Azure IoT Hub – ML Model