Program : **Diploma in Computer Engineering / Information Technology / Cyber Forensics and Information Security**	
Course Code : **6131A**	Course Title: **Internet of Things**
Semester : **6**	Credits: **4**
Course Category: **Program Elective**	
Periods per week: **4 (L:4 T:0 P:0)**	Periods per semester: **60**

Course Objectives:

- Provide knowledge on the basic building blocks of IoT and its applications.
- Familiarise different protocols used in IoT.
- Introduce the relationship between IoT and cloud.
- Explore the implementations of IoT.

Course Prerequisites:

Topic	Course code	Course name	Semester
Embedded Systems		Embedded Systems	5
Computer Networking concepts and Protocols		Computer Communication and Networks.	4
Programming Concepts		Programming in C.	3

Course Outcomes :

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Explain the fundamental concepts of Internet of Things (IoT)	13	Understanding
CO2	Interpret the protocols used in IoT infrastructure.	13	Understanding
CO3	Explain the use of cloud for IoT	12	Understanding
CO4	Illustrate the development of IoT applications with embedded computing boards.	20	Understanding
	Series Test	2	

CO – PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	2						
CO3	2						
CO4	2						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Explain the fundamental concepts of Internet of Things (IoT)**		
M1.01	Outline the key features of Internet of Things (IoT).	2	Understanding.
M1.02	Explain IoT hardware, protocols and software using IoT Stack.	4	Understanding.
M1.03	Summarize different IoT enabling technologies.	3	Understanding.
M1.04	Classify IoT based on the complexity to build and operate.	3	Understanding.
M1.05	Explain challenges in IoT	1	Understanding
Contents: Introduction and Definition of IoT, Applications – Characteristics - Things in IoT - IoT Stack – IoT enabling Technologies – IoT challenges – IoT Levels			
CO2	**Explain the protocols used in IoT infrastructure.**		
M2.01	Outline the protocols for IoT – Messaging, Transport, addressing and Identification	2	Understanding
M2.02	Interpret the messaging protocol MQTT and CoAP in IoT applications	4	Understanding
M2.03	Explain the transport protocols Li-Fi and BLE involved in IoT	4	Understanding
M2.04	Explain IPv4 and IPv6 Addressing	3	Understanding
	Series Test I	1	

Contents: Different protocols in data link, network, transport and application layers (overview only) - Messaging Protocol – MQTT, CoAP – Transport Protocol – BLE, Li-Fi – Addressing – IPv4, IPv6 - URI			
CO3	**Explain the use of cloud for IoT**		
M3.01	Explain the fundamentals of cloud computing.	3	Understanding.
M3.02	Explain challenges of cloud with IoT	3	Understanding.
M3.03	Outline the selection of cloud service provider for IoT applications	2	Understanding.
M3.04	Explain Fog Computing	2	Understanding.
M3.05	Explain the Security and privacy aspects of cloud computing	2	Understanding.
Contents: Fundamentals of cloud computing – Challenges – Selection of cloud services – Introduction to Fog Computing - Security issues.			
CO4	**Illustrate the development of IoT applications with embedded computing boards.**		
M4.01	Illustrate the working of sensors and actuators	2	Understanding
M4.02	Outline the features of embedded computing boards - Arduino/Node MCU & Raspberry PI	2	Understanding
M4.03	*Illustrate the interfacing of basic sensors with embedded computing board - Arduino/Node MCU/ESP32	3	Understanding
M4.04	Recall the programming constructs in Python	3	Understanding
M4.05	*Illustrate the interfacing of basic sensors with embedded computing board - Raspberry PI	5	Understanding
M4.06	Summarize the applications building with IoT - Smart Perishable tracking/Smart transportation, Smart Healthcare, Smart Lavatory maintenance, Smart water through IoT, Smart warehouse monitoring, Smart Retail, Smart Driver assistance system	5	Understanding
	Series Test – II	1	

Contents:

Sensors and Actuators - Role of Sensors and Actuators in IoT - Working of Sensors and Actuators - Examples.

Embedded Computing Boards - features and characteristics of Arduino/Node MCU & Raspberry PI, Interfacing basic sensors with Computing boards Python - data types, control structures, modules, packages, input/output.

Programming Raspberry Pi with python, Interfacing sensors and actuators with Raspberry PI.

Case Study - Applications building with IoT- Smart Perishable tracking/Smart transportation, Smart Healthcare, Smart Lavatory maintenance, Smart water through IoT, Smart warehouse monitoring, Smart Retail, Smart Driver assistance system.

*(sensors for applications like agricultural (temperature, humidity), pollution (gas/pollution), industrial (fire alarm),)

Text / Reference

T/R	Book Title/Author
T_1	RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, **Internet of Things,** Wiley Publications
R_1	Vijay Madisetti, Arshdeep Bahga, **Internet of Things: A Hands-On Approach,** Orient Blackswan
R_2	Raj Kamal, **Internet of Things : Architecture And Design Principles,** McGraw Hill Education
R_3	Gary Smart, **Practical Python Programming for IoT,** Packt Publishing
R_4	Marco Schwartz, **Internet of Things with Arduino Cookbook,** Packt Publishing

Online Resources

Sl.No	Website Link
1	https://nptel.ac.in/courses/106/105/106105166/
2	https://www.raspberrypi.org/blog/getting-started-with-iot/
3	https://learn.adafruit.com/category/internet-of-things-iot
4	https://www.arduino.cc/en/IoT/HomePage
5	http://esp32.net/