# [22MEPS13]

# **Computational Hardware**

LTPC

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## **Objectives:**

- To learn basic concepts of Embedded Systems by familiarizing the functionalities of embedded platforms with development boards.
- To understand the core concepts of GPIO Pins, Functionality of peripherals, Selection of I/O devices, Usage of Internal functions, and Communication protocols.
- To familiarize the current technologies and protocols used in the Internet of Things (IoT) and to learn the Cloud services.

## UNIT I Basics Of Embedded System

9

Embedded Platform: Architecture and working - Factors for Microcontroller/Microprocessor selection. Arduino - Boards and schematics - Toolchain - Setup and Configuration - Input/Output Configurations and Access - Libraries - Digital I/O - ADC - Analog I/O - Timers, Interrupts - Pulse Width Modulation - Display: 7-segment, LCD, OLED.

## UNIT II Basics Of Raspberry Pi

9

Raspberry Pi: Raspberry pi Board - Processor - Setup and Configuration - Installing Python IDLE using Command Terminal - General Purpose I/O Pins - Protocol Pins - GPIO Access - Pulse Width Modulation - Network Libraries - Web services - Twitter APIs - Twitter Bot - Interfacing pi with camera modules.

### UNIT III Sensors And Actuators

9

Interfacing of Sensors and Actuators - Sensors: Introduction, Characteristics: Analog - Potentiometer, Temperature Sensor, Soil Moisture Sensor, LDR - Digital - PIR Sensor, Smoke Sensor, Infrared - Sensor, Ultra- Sonic Sensor. Actuators - Introduction, Characteristics and working with relay, DC motors, Servo motor, Stepper motor and its drivers.

#### UNIT IV Communication Protocols

9

Protocols - Wired: RS232 Standard - UART, SPI, I2C - Comparative study of wired protocols - Implementation of wired Serial Communication protocols Wireless: Standards - Bluetooth, RF - Comparative study of wireless protocols - Implementation of wireless Serial Communication protocols.

## UNIT V Internet Of Things

9

Definition and Architecture of IoT, Building blocks of IoT, Programming with IoT protocols - MQTT, CoAP - Connecting embedded target board to Web, Basics networking in IoT: creating a web page - Creating a server on target board - Controlling I/O peripherals from the webpage, Embedded Application Development, Creating communication between different nodes - Cloud platforms for IoT, Cloud data logging and monitoring, Interfacing with web services.

**TOTAL: 45 PERIODS** 

## **Course Outcomes**

# At the end of the course, learners will be able to:

- Understand and implement the functions & Capabilities of embedded platforms for easy prototyping.
- Identify the type of sensors and actuators for required applications.
- Develop communication between devices using different protocols.
- Develop IoT based systems with wireless network connections and accessing devices over cloud.

## **Text Books**

- Raj Kamal, "Embedded Systems SoC, IoT, Al and Real-Time Systems", 4th Edition, McGraw Hill, 2020
- 2. Mohit Arora, "Embedded System Design", 1st Edition, Learning Bytes Publishing, 2016.
- 3. Elecia White, "Making Embedded Systems", 1st Edition, Shroff/ O' Reilly, 2012.
- 4. Jack Ganssle, "The Firmware Handbook", 1st Edition, Newnes, 2004.

### References

- 1. https://juniorfall.files.wordpress.com/2011/11/arduino-cookbook.pdf
- 2. <a href="https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca">https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca</a> <a href="https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca">https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca</a> <a href="https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca">https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca</a> <a href="https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca">https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca</a> <a href="https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca">https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca</a> <a href="https://drive.google.com/file/d/13s0m3|HPEFP2f2aCuVNRWeBZNKXWKTW5/view?ts=6231ca</a> <a href="https://drive.google.com/f
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