NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	M.Tech. in Electronics & Instrumentation Engineering (Robotics and Artificial Intelligence)
Semester:	I
Course Code:	6EC801CC25
Course Title:	Single Board Computer
Course Type:	Core
Year of introduction:	2025 - 26

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

After successful completion of the course, student will be able to –

1. choose a single board computer for a given robotics application (BL3)
2. evaluate the performance of single board computers for sensor interfacing and networking capabilities (BL5)
3. plan a logic for single board computer platform interfacing (BL6)
4. design a wired and wireless control of the robotics system using single board computer. (BL6)

Unit	Contents	Teaching Hours (Total 30)
Unit I	**Single board computers** Introduction to processors and controller architecture, single board computer introduction and applications, Role of single board computers in robotics.	04
Unit II	**Arduino** Introduction, programming Arduino, GPIO basics, interfacing digital and analog sensors with Arduino, using, modifying, and creating Arduino libraries. Network programming in Arduino, Remotely controlling external devices, communicating using I2C and SPI, wired and wireless networking in Arduino.	08
Unit III	**Raspberry Pi** Introduction to Raspberry Pi models, R-Pi setup and management, operating systems for R-Pi and its porting, displays, GPIO basics, programming R-Pi with python, interfacing digital and analog sensors with R-Pi, Programming using R-Pi, Introduction to TCP/IP protocol suite, socket programming, wired and wireless networking using RPi.	08

Unit IV	**ESP8266** Introduction, interfacing digital and analog sensors with ESP8266, Programming ESP8266, over the air update of ESP8266, cloud data monitoring using ESP8266 (Node MCU), Running web server on ESP8266, machine to machine interactions using ESP8266	06
Unit V	**Advance single board computers** Different single board computers, Case studies on advanced computing boards.	04

Self – Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/References:

1. Michael Margolis, Arduino Cookbook, O'Reilly Media
2. Simon Monk, Raspberry Pi Cookbook, O'Reilly Media
3. Marco Schwartz, Internet of Things with ESP8266, Packt
4. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley
5. Jeff Cicolani, Beginning Robotics with Raspberry Pi and Arduino, Apress

Suggested List of Experiments:

Sr. No.	Title	Hours
1.	To program NodeMCU using Arduino IDE and interface the serial monitor of NodeMCU with the computer and perform the given activities	02
2.	To program the Digital Input and Output pins of NodeMCU and perform the given activities	02
3.	To program NodeMCU to scan I2C devices connected to NodeMCU and interface I2C based 16x2 LCD to NodeMCU and perform the given activities	02
4.	To program NodeMCU to get it's MAC address, connect NodeMCU with WiFi network and run a Web Server on NodeMCU and perform the given activities	02
5.	To program NodeMCU to control devices based on commands received from a Mobile Application	02
6.	To interface DHT-11 temperature and humidity sensor with NodeMCU and upload the sensor data on the Cloud and perform the given activities	02
7.	To interface IR proximity sensor and piezo buzzer with NodeMCU and perform the given activities	02
8.	To interface Servo Motor and DC motor to NodeMCU and perform the given activities	02

9.	To program NodeMCU using Arduino IDE and interface the serial monitor of NodeMCU with the computer and perform the given activities	02
10.	Porting of Operating System on RPi	02
11.	To program the Digital Input and Output pins of RPi and perform the given activities	02
12.	To program the Analog Input and Output pins of RPi and perform the given activities	02
13.	To interface the sensors on RPi Hardware Attached to the Top (HAT)	02
14.	To setup communication between NodeMCU and RPi board	02

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. the academic year 2025 - 26 and onwards