Technical Examination Board, Gujarat State, Gandhinagar

IoT Architecture, Programming of Arduino and NodeMCU

Title	ESDM102: IoT Architecture, Programming of Arduino and NodeMCU
Level	Certificate Course
Course Duration	Four Month (Part time) Three Week (Full Time) 120 Hrs (Th. 48 Hrs Pr. 72 Hrs)
Entry Qualification	B.E./B.Tech/Diploma/B.E. Sem.III onward/ Diploma Sem. IV onward (EC/IC/IT/CE or Similar Branch)/ BCA/MCA/B.Sc./M.Sc./Any other Graduate (with Physics/IT)

Teaching Scheme:

Sub Code	Subject Name	Teaching Scheme		Examination Scheme				Term Work Marks	Total Marks
		Theory	Practical	Theory Marks	Hrs.	Practical Marks	Hrs.		
ESDM102	IoT Architecture, Programming of Arduino and NodeMCU	4	6	50	2	100	4	25	175

Total Week   = 12   Theory   = 1 hour slot

Total Teaching slot/Week   = 04   Practical = 2 hour slot

Theory Periods   = 48   Total teaching
                                          10 hours/week (Part-time)
                                          06 hours/day (Full time)

Practical Periods   = 72

ESDM102: IoT Architecture, Programming of Arduino and NodeMCU

Internet of Things (IoT) is a new paradigm that has changed the traditional way of living into a high-tech lifestyle including Smart city, smart homes, pollution control, energy saving, smart transportation, smart industries. The Internet of Things (IoT) is an emerging paradigm that enables the communication between electronic devices and sensors through the internet in order to facilitate our lives. IoT uses smart devices and the internet to provide innovative solutions to various challenges and issues related to various businesses, governmental and public/private industries across the world. IoT is progressively becoming an important aspect of our life that can be sensed everywhere around us. In whole, IoT is an innovation that puts together an extensive variety of smart systems, frameworks and intelligent devices and sensors.

Course Objectives:

After completion of this course students will be able to

- Test electronics components
- Interface sensors and actuators with IoT Embedded devices
- Write python programs for Raspberry PI and similar boards
- Understand architecture of internet of things
- List applications of Internet of things
- Program embedded device useful for IoT applications
- Understand working of basic electronics components, sensors, actuators
    Solve real life challenges with help of IoT

ESDM102: IoT Architecture, Programming of Arduino and NodeMCU1

Unit-1	Introduction to IoT
1.1	Understanding IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real life examples of IoT, Overview of IoT components and IoT Communication Technologies, Clouds for IoT applications, Challenges in IoT
Unit-2	**Embedded IoT Devices**
2.1	Open-source community for hardware and software, Arduino Uno Architecture, Arduino IDE, Function of each pin of Arduino UNO, Writing Arduino Programs for I/O operation, Arduino program with looping and decision making, Arduino Libraries, Basics of Embedded C programming for Arduino
2.2	Interfacing of Digital I/O devices with program (LED, Switch,7seg LED etc.), Interfacing of Analog I/O devices program (Interfacing POT, LM35, Accelerometer (ADXL3C5C) etc.), interfacing of Keypad with programming (Keypad Interfacing), Serial port programming, Interfacing of ESP8266 with Arduino Uno to get Wi-Fi capability
Unit-3	**NodeMCU Programming**
3.1	NodeMCU Specifications, Pin Diagram, Interfacing and Programming of general-purpose digital input output devices
3.2	Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with NodeMCU, Interfacing of actuators with NodeMCU, Interfacing of Relay Switch and Servo Motor with NodeMCU
Unit-4	**Mobile and Web application for IoT**
4.1	Develop simple applications using open-source MIT App Inventor, Smartphone application for device control using NodeMCU, Web application for device control using NodeMCU, posting sensor data to web server, Uploading sensor data to cloud
4.2	Micro Project

Suggested List of Practicals

Sr. No	Practical Name
1	Install Arduino IDE and write test program for Arduino board and NodeMCU board
2	Interface push button switch to understand interfacing of digital sensor and write program to glow LED based on status of push button switch
3	To interface RGB LED with Arduino board and NodeMCU board. Write program to glow RED, GREEN, YELLOW, BLUE, MAGENTA, CYAN and WHITE light sequence
4	Write a program to count numbers 0 to 10 on a common anode seven segment display.
5	Interface LM35 temperature sensor with Arduino board and NodeMCU board. Write program to transmit temperature data on serial monitor
6	Write and execute Arduino program to display message and numbers on LCD
7	Connect relay with help of relay driver to control using any one GPIO pin Interface switch to another GPIO pin and control relay with help of switch
8	Interface DC Motor with help of L293D motor driver IC and write program to rotate motor in clockwise and anticlockwise direction mode (Arduino or NodeMCU board)
9	Interface Stepper motor with help of ULN2003 or ULN2803 IC and write program to rotate motor in half step as well as full step mode (For Arduino or NodeMCU board)
10	Interface electrical appliances with NodeMCU with the help of a relay board. Control electrical appliances with help of Mobile App as well as web browser
11	A students should implement two case studies from the IOT Projects List (Individually or in small group) 1) Wearable Computer with Temperature Distance Sensors 2) IOT Smart Parking Using RFID 3) IOT Temperature & Mask Scan Entry System 4) IOT based Smart Agriculture Monitoring System Project 5) Contactless IOT Doorbell (Or any other project assigned by faculty) 6) Home automation with voice command 7) Smart Irrigation Pump which can be controlled using a mobile app 8) Testing of water quality using pH sensor

Reference books:

(1) Internet of Things (IoT) A Quick Start Guide by Lele Chitra, BPB Publications
(2) Principle of Electronics by V K Mehta and Rohit Mehta, S. Chand publication.
(3) Professionalism—Skills for Workplace Success, Lydia E. Anderson and Sandra B. Bolt, 4e, Pearson Education/PHI
(4) Internet of Things with Arduino Cookbook, Macro Schwartz, Packt Publication
(5) Python Programming Fundamentals- A Beginner's Handbook by NischayKumar Hegde
(6) Fundamentals of Python – First Programs, Kenneth A. Lambert, CENGAGE Publication
(7) An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications, Rahul Dubey, Cengage India Publication
(8) Programming the Raspberry Pi: Getting Started with Python, By. Simon Monk
(9) Freeduino.begin() The ultimate beginners guide to Arduino platform, By. Siddharth and BhagyashriSharangpani
(10) Sensors and Transducers by D. Patranabi, PHI Learning publication
(11) Transducers and Instrumentation by Murty, D.V.S., PHI Learning publication
(12) Electronic Instrumentation by H. S. Kalsi, McGraw-Hill publication.

Software list:

- Anaconda Python Development Software
- Arduino IDE
- MIT App Inventor

Websites:

- **https://thestempedia.com/**
- **https://www.arduino.cc/education**
- **https://www.raspberrypi.org/**
- **https://www.arduino.cc/education/explore-iot-kit**
- **https://www.kicad.org/**

Software list:

- Windows OS : 10x or higher
- Linux/Ubuntu/Unix OS
- Network Simulation Tool
- Packet Tracer
- LAN Protocol Simulation & Analyzer Software

Subject Course Committee

Prof. C. H. Vithalani, Prof. P. J. Brahmbhatt, Prof. T. P. Chanpura, Prof. M. S. Dave, Prof. P. B. Bhatt, Prof. J. A. Dhumale, Prof. A. S. Patel, Prof. A. K. Konkani