Information Booklet cum Syllabus

Of

Internet of Things

Revision-I

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National Institute of Electronics and Information Technology
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CONTENTS

1. About Course

This course takes students through the architecture of an IoT network, covering sensors, devices and analysis. It includes information on concepts such as device communication, streaming data processing, and scalability. We use simulated devices to show the cloud analysis of internet of things projects.

2. NIELIT

National Institute of Electronics and Information Technology, NIELIT, (Erstwhile DOEACC Society) is an autonomous scientific society of the Ministry of Electronics & Information Technology, Government of India. The Society is registered under the Societies Registration Act, 1860. NIELIT was set up to carry out Human Resource Development and related activities in the area of Information, Electronics & Communications Technology (IECT). NIELIT is engaged both in Formal & Non-Formal Education in the areas of IECT besides development of industry oriented quality education and training programmes in the state-of-the-art areas. NIELIT has endeavored to establish standards to be the country's premier institution for Examination and Certification in the field of IECT. It is also one of the National Examination Body, which accredits institutes/organizations for conducting courses in IT and Electronics in the non-formal sector.

3. Objective of Course

The Course is aimed at molding candidates to skill about the use of IoT in daily life devices and makes some new innovative devices using available sensors and embedded systems. Students will be able to identify and articulate IoT business opportunities across a broad spectrum of industries

After completing the module, the learner will be able to:

- Understand in detail the concept of Arduino Board and its components.
- Understand the concept of various sensors, actuators and display devices which are required for every sphere of IoT applications.
- It will laid stress upon how IoT technology can bring a wireless network of sensors and connectivity of devices with cloud servers to collect and analyze data.
- Acquire knowledge to interface NodeMCU board with various IoT devices/components
- Understand the concept of IFTTT and Google Assistant.
- Build IoT based applications and understand how various communication models can be implemented.

4. Job Roles of Course

After successful completion of the qualification the candidates shall be employed in the industries for following occupations:
- IoT Application Developer
- Embedded system engineer

- IoT trainer

5. Eligibility

10+2 passed with Basic Knowledge of any programming Language.

6. Total duration of the Course

80 Hours (Theory: 30 Hrs. Practical/Tutorial: 50 Hrs)

7. Course Details

7.1. Course Outline and Objective of Each Unit

S. No.	Unit Name	Duration (Theory) in Hours	Duration (Practical) in Hours	Total Learning Hrs.	Learning Objectives
1	**Basics of IoT Microcontroller and Arduino IDE**	5	5	10	After completion of this unit of module, Learner will be able to • Understand basics of IoT, its features and applications. • Understand the Arduino board and its layout. • Work on Arduino IDE, Learning about interfacing of LED's • Know the basics of the Sketch Programming • Know the working of LED using loop, conditional statements and user defined function
2	**Interfacing of various display devices and RFID**	4	6	10	After completing this unit, Learner will be able to • Aware with working with POT and Switches • Use Hex-keypad with LED's and buzzers • Handle16X2 LCD module

					• Use 7 Segment Display • Interface RFID for access control
3	**Connecting various sensors with Arduino**	5	10	15	After completing this unit, Learner will be able to • Work with different kinds of Analog/Digital sensors like PIR Motion, Gas, IR, Flame, Ultrasonic, Humidity, Temperature , DHT11 etc, Data Acquisition using PLX/DAQ • Understand the working of Actuators- Servo Motor, DC motor, 2 switch Relay
4	**Networking basics and use of HTML in IoT**	2	3	5	After completing this unit, Learner will be able to • Understand the basics of Networking, IP Addressing Scheme • Learn the basics of HTML and coding, Designing and validating HTML Form • Use Ethernet Shield, Control devices through Web-page using Ethernet Shield
5	**Bluetooth Module and Understanding about Android Studio**	4	6	10	After completing this unit, Learner will be able to • Understand interfacing of Bluetooth (HC-05) device with relay • Learn about Android studio file system • Build own Android app, generating .APK file, installing and con • Create small project on Home automation system
6	**In-Depth understanding about NodeMCU**	5	10	15	After completing this unit, Learner will be able to • Understand about NodeMCU

					Microcontroller • Acquire knowledge of sending of sensor data on Cloud using Node-MCU
7	**Arduino/ NodeMCU Communication with Cloud server**	4	6	10	After completing this unit, Learner will be able to • Know about Adafruit/ThingSpeak cloud platform • Learn about Data analysis on cloud server
8	**IoT Application Using IFTTT and Google Assistant**	1	4	5	After completing this unit, Learner will be able to understand • Implementation of Google Assistant and IFTTT with NodeMCU

7.2. Detailed Syllabus

Unit Name	Contents	Hrs.
Basics of IoT and the Microcontroller platform	• Brief Introduction of IOT • IOT components, Architecture and Classifications • Microcontroller Fundamentals, • Introduction to Arduino Microcontroller • Working on Arduino IDE • Learning basics of sketch programming • Introduction to LED based programming • Condition based LED programming using Arduino • Pattern based programs using Arduino and LED • Introduction to potentiometer	10
Interfacing of various display devices and RFID	• Working with 16X2 LCD display, • Adding LCD Library to IDE • Working with Hex Keypad • Working with 7 segment display, • Adding 7 segment display library • Displaying single and double digits, showing 1-99 and 99-1 numbers • Making timer/counter	10

	• Working with Radio frequency (RFID) device • Introduction to Actuators-Servo motors, DC Motors	
Connecting various sensors with Arduino	• Introduction to Sensors, Difference between Analog and Digital Sensor • Demonstrating Ultrasonic Sensor • Data acquisition using PLX/DAQ Day • Demonstrating PIR Motion Sensor, • IR sensor, Flame Sensor • Demonstrating Gas Sensor,Temperature Sensor • Demonstrating Humidity Sensor, • DHT11 Sensor	15
Networking basics and use of HTML in IoT	• Understanding networks LAN/WAN basics • IP Addressing Scheme • Working with Ethernet Shield • Using HTML form and Ethernet Shield • Controlling devices using URL	5
Understanding about Android Studio	• Introduction to Android Studio, Download and installation, discussion on menu and toolbar • Making first android Activity, • Working with button, text view, edit text etc. • Understating different (Bluetooth & Internet) permissions to XML file, • Making .apk file	10
In-Depth understanding about NodeMCU	• Introduction to Bluetooth Device (HC-05), • 2 switch relays • Working with Microcontroller WiFi Device (NodeMCU) -ESP8266 • Introduction to cloud computing, Sign in-Adafruit IO Using NodeMCU (ESP8266) module • Sending data to cloud server	15
Arduino/NodeMCU Communication with Cloud server	• Sending data to Adafruit -IO using feed to the mentioned blocks, • Analyzing real time data of sensors at Adafruit • Sending multiple sensor data through multiple feed and analyzing it using different blocks • Working with Google Assistant Service	10

	• Home automation using Google Assistant Service	
IoT Application Using IFTTT and Google Assistant	• Sign-in to IFTTT, working with Google Applets using if this then that (IFTTT) • Implementing Email, SMS, and android notification using IFTTT service. • IOT TEST	5

8.   Reference Books/Study Material

a) Introduction to IoT by Sudip Misra

b) IoT for Beginners: Explore IoT Architecture, Working Principles, IoT Devices, and Various Real IoT Projects by Vibha soni

c) Arduino Made Simple by Ashwin Pajankar

d) 21 Iot Experiments by Yashwant kanetkar

e) https://thingspeak.com/

f) https://io.adafruit.com/

g) https://www.tutorialspoint.com/internet_of_things/index.htm

h) https://www.tinkercad.com/

9.   Practical Assignments

Assignment 1:
Write a program to Blink default Light Emitting Diode (LED) on Arduino board with the delay of 5 sec.

Assignment 2:
Write a program to interface switch and buzzer, whenever the button is pressed, and the buzzer gives beep for 400ms and then off.

Assignment 3:
Write   a   program   to   generate   LED   patterns   in   the   following   manner:-
A. led1
      Led1 led2
      Led1 led2 led3
B. led1
Led2 led3
Led4 led5 led6

Assignment 4:
Write a program to use two pots, first one is to control brightness level of LED and other one to control delay.

Assignment 5:
Write a program to interface LEDs at any PWM pins and exhibit LED fading in and out.

Assignment 6:
Write a program to exhibit the varying brightness of LED using POT.

Assignment 7:
Write a program to interface LCD with Arduino board and display 'INDIA fights COVID-19' on second row

Assignment 8:
Write a program to make first line of LCD static and second line movable.

Assignment 9:
Write a program to scroll text "NIELIT" on LCD.

Assignment 10:
Write a program to make a counter 00-99 on 7-segment LED Display.

Assignment 11:
Write a program to interface RFID reader with Arduino, so that when right tag gets detected, green led turns on and red led in case of wrong tag.

Assignment 12:
Write a program to rotate shaft of servo motor using POT at various voltage levels.

Assignment 13:
Write a program to rotate two DC Motors using driver IC in alternate directions.

Assignment 14:
Write a program to interface Ultrasonic sensor and display the captured values on LCD after delay of 3 seconds each.

Assignment 15:
Write a program to interface Light Dependent Resistor (LDR) and LED with Arduino board. Whenever there is sufficient light falls on LDR then LED goes off and when there is dark around LDR, the LED goes on.

Assignment 16:
Write a program to interface hex keypad, so that when user enters a wrong password, Buzzer activates and on correct password, LED glows.

Assignment 17:
Write a program to make a calculator using Hex-Keypad.

Assignment 18:
Write a program to interface Motion sensor and DC Motor, to exhibit a real life situation that whenever motion detected, the DC motor (representing fan) starts and when no motion detected, the motor stops.

Assignment 19:
Write a program to make a line-follower vehicle using IR Sensor.

Assignment 20:
Write a program to interface TMP36 sensor with Arduino, so that when temperature goes above 25 degc, fan turns on and off in vice-versa.

Assignment 21:
Write a program to import data of any sensor on excel sheet using PLX-DAQ.

Assignment 22:
Write a program to control home devices using HTML page and Ethernet Shield.

Assignment 23:
Write a program to create own Android app to control devices remotely.

Assignment 24:
Write a program to interface LCD and Bluetooth module, to exhibit the values received from mobile handset via Bluetooth on LCD.

Assignment 25:
Write a program to interface Relay and Bluetooth module to switch on AC load (5W LED bulb, table lamp, etc.) connected to relay if 1 is passed through Bluetooth and switch off the AC Load if 0 is send

Assignment 26:
Write a program to control home appliances using NodeMCU and HTML webpage.

Assignment 27:
Write a program to send device data over ThingSpeak and exhibit it graphically using 2-d chart.

Assignment 28:
Write a program to send device data over Adafruit IO and exhibit it on line chart.

Assignment 29:
Write a program to implement IFTTT service with Google assistant, so that when user speaks "turn on led", LED goes on and vice-versa.

Assignment 30:
Write a program to trigger an e-mail or sms using IFTTT on mobile phone when fire is detected through Flame sensor.

10. Sample Questions(MCQs)

1. Bluetooth is the wireless technology for configuring_____ ?
a) Local area network
b) Personal area network
c) Metropolitan area network
d) Wide area network

2. LDR's are also called _____?
a) Photo voltaic cell
b) Photo resistive cell
c) Photo emissive cell
d) All of these

3. In PIR Sensor, Operating temperature is _____ ?
a) -20° to +80° Celsius
b) -50° to +70° Celsius
c) -60° to +80° Celsius
d) -80° to +90° Celsius

4. Which function calculates the total duration when receiving the wave back to echo pin?
a) delayMicroseconds()
b) map()
c) pulseIn()
d) Pulsein()

5. The resistance of LDR _____when exposed to radiant energy
a) Increases
b) Reaches maximum
c) Decreases
d) Doubles

6. Which pin of Ultrasonic sensor generates ultrasonic waves when get excited?
a) Echo
b) Trig
c) Vcc
d) Impulse

7. Example of passive sensor is_____?
a) LVDT
b) Thermocouple
c) Strain guage
d) IR Sensor

8. Which sensor works on IR rays to use for obstacle avoidance?
a) LDR Sensor
b) Motion Sensor
c) IR sensor
d) Temperature Sensor

9. Which Communication protocol support asynchronous mode?
a) UART
b) SPI
c) I2C
d) None of these

10. Relay IN pin will be controlled by _____?
a) Phototransistor
b) Photodiode
c) Arduino
d) CPU

11. Servo motors have a _____ torque and _____ speed
a) LOW,HIGH
b) HIGH,HIGH
c) HIGH,LOW
d) LOW,LOW

12. Using a _____ library or client you can publish and subscribe to a feed to send and receive feed data
a) I2C
b) USART
c) LiquidCrystal
d) MQTT

13. The SSD's uses seven individual_____
a) Light emitting diodes
b) Schottky diodes
c) Capacitors
d) Inductors

14. Which function maps the keys corresponding to ROW pins and COL pins of HEX KEYPAD?
a) makekeymap()
b) Makekeymap()
c) makeKeymap()
d) makekeYmAp()

15. DC Servo motor has a _____ as a position sensor
a) Decoder
b) Potentiometer
c) DC Motor
d) Gear system