GIRIJANANDA CHOWDHURY UNIVERSITY

6 Month Certificate Course

In

EMBEDDED SYSTEM AND

INTERNET OF THINGS

Department of Electronics and Communication Engineering

6 month Certificate Course in **Embedded System And Internet Of Things**

1) Course Title: 6 month Certificate in **EMBEDDED SYSTEM AND INTERNET OF THINGS**
2) Department: ECE (GCU)
3) Duration: 6 month
4) Eligibility: Diploma / Graduate
5) Timing: Weekdays
6) Mode: **Offline**
7) Fee structure: ₹15000

Course Objectives:

- To provide the knowledge of architecture and advanced features of embedded processors and microcontrollers.
- To learn Real Time Operating system principles and its components.
- To learn about IoT and its application.

Course outcome:
Upon the completion of this course

•Students will understand the real time embedded system and its components
•Students will understand basic components and building blocks of Internet of Things
• Students will be able to Apply skills to conduct interfacing of embedded boards with components, actuators and sensors

6-month certificate in Embedded System And Internet Of Things

Course structure

Course Code	Course Name	Hours/ week	Credits No. of	Internal Assess.	Theory	Practical	marks Max.
ESOT -1	Embedded Processors and Microcontrollers	4	4	30	70	-	100
ESOT -2	Embedded Operating System	4	4	30	70		100
ESOT -3	IoT Sensors & Actuators	4	4	30	70		100
ESOT -4	Embedded Processors & Microcontroller LAB	4	2	20	-	30	50
ESOT -5	Embedded OS & Device Drivers Lab	4	2	20	-	30	50
ESOT -6	IoT Sensors & Actuators Lab	4	2	20	-	30	50
ESOT	Project	2					
Total		20	18	150	140	90	450

Course Code: ESOT-1
Course name: Embedded Processors and Microcontrollers
Credits: 4
No of contact hours: 4 hrs /week

Module I

Embedded and Microcontroller Concepts: Introduction to embedded processors, Application Areas, Categories of embedded processors, Hardware architecture, Software architecture, Application software, Communication software, Introduction to Harvard & Von Neuman architectures, CISC & RISC Architectures.

Module III

8051 Microcontrollers: Introduction, architecture and memory organization, registers, I/O ports, interrupts, timer, instruction sets, 8051 programming in assembly and C.

Module III

PIC Microcontrollers: Introduction to PIC microcontrollers, architecture and memory organization, registers, I/O ports, interrupts, timer, instruction sets, PIC programming, Sensor interfacing, motor control, SPI bus protocols.

Module IV

ARM: ARM design philosophy, data flow model and core architecture, registers, program status register instruction pipeline, interrupts and vector table, operating modes and ARM processor families. Instruction Sets: Data processing instructions, addressing modes, branch, load, store instructions, PSR instructions, and conditional instructions.

Module V

Raspberry Pi: Raspberry Pi board and its processor, Programming the Raspberry Pi using Python, Communication facilities on Raspberry Pi (I2C,SPI, UART), Interfacing of sensors and actuators.

Module VI

Intel Galileo or Edison microprocessors for Embedded System and IoT.

Course Code: ESOT-2
Course name: Embedded Operating System
Credits: 4
No of contact hours: 4 hrs/ week

Module I
Overview Of Embedded Systems: Embedded System Architecture fundamentals. Hardware and Software abstraction models.

Module II
Operating Systems Overview: Operating Systems fundamentals- Process Creation – Scheduling - Memory Management - Inter Process Synchronization –Inter Process Communication.

Module III
Embedded Operating Systems: Embedded OS overview, Study of Embedded OS principles and requirements. Internal components of Embedded operating systems - Compare and contrast various Embedded OS platforms.

Module IV
Introduction to Device Drivers, The role of Device Driver, Types of DeviceDriver, Character Driver, Bock Driver & Network Driver, Unix/Linux kernel fundamentals-Process Scheduling - Kernel Synchronization, I/O devices - Architecture - Character, VI Editors

Course Code: ESOT-3
Course name: IoT Sensors & Actuators
Credits: 4
No of contact hours: 4 hrs /week

Module 1: Introduction to IoT:
What is IoT, Introduction to IoT, Sensing, Actuation, Basics of Networking, Basics of Networking, Communication Protocols.IoT applications in different domain, Trends in IoT market

Modue 2: Basic Architecture
RFID Story, Opportunities for IoT , Basic knowledge of IOT Architecture, Protocols Introduction (MQTT, AMQP, CoAP)
IoT Layered Architecture and IPV6: a) RF, b) Zigbee , c) Wifi, d) BLE, e) LPWAN/ LoWPAN, f)LoRaWAN / 6LoWPAN

Module III Network Connectivity for IoT:
A simplified IoT network architecture, Room/body-are networks: Bluetooth Low Energy, Extending communication range, Data Processing and Storage: Managing high rate sensor data, Processing data streams, Data consistency in an intermittently connected or disconnected environment, Identifying outliers and anomalies.

Module IV Security in IoT:
Threat models, Defensive strategies and examples HCI in an IoT World: Theory and applications of spoken dialogue for human-computer interaction, Combining speech with other modalities for natural interaction, Robotics and Autonomous Vehicles: Potential benefits of self-driving vehicles and service robots, Sensing and data processing, Simultaneous mapping and localization, Levels of autonomy, Future research challenge

Course Code: ESOT-4
Course name: Embedded Processors & Microcontroller LAB
Credits: 2
No of contact hours: 4 hrs /week

Experiments related to programming and interfacing of 8051 /PIC/ARM/Raspberry Pi with LED, LCD, Keyboard, Temperature Sensor, DC Motor Control, Stepper Motors, Set up of file server, Creation of a wireless access point and projects related to Traffic light controller, Digital weather station, and Keyboard control robot

- **Course Code: ESOT-5**
- **Course name: Embedded OS & Device Drivers Lab**
- **Credits: 2**
- **No of contact hours: 4 hrs /week**

1. Task management and Software timers.
2. Real-time message queues, semaphores, and mutexs.
3. Process management and Thread management.
4. Scheduling policies and preemptions.
5. Embedded Linux Development environment set-up.
6. Linux Kernel configuration.
7. Building Embedded Linux Device Trees.
8. Linux Kernel Modules and Device model.
9. Sysfs, Char device / drivers.
10. Platform device/driver.

- **Course Code: ESOT-6**
- **Course name: IoT Sensors & Actuators Lab**
- **Credits: 2**
- **No of contact hours: 4 hrs /week**

1. Study and Install IDE of Arduino and different types of Arduino.
2. Write program using Arduino IDE for Blink LED.
3. Write Program for RGB LED using Arduino.
4. Study the Temperature sensor and Write Program foe monitor temperature using Arduino
5. Study and Implement RFID, NFC using Arduino.
6. Study and implement MQTT protocol using Arduino.
7. Study and Configure Raspberry Pi.
8. WAP for LED blink using Raspberry Pi.
9. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.