Certificate Course in IoT (Internet of Things) based system Design (CCIoT)
(In collaboration with Dept. of Computer Science)

Structure of Course

CCIoT – I Basics of IoT and Microcontrollers	30 Marks
CCIoT – II Sensors, Actuators and Arduino Programming	30 Marks
CCIoT – III Practical Based on CCIoT – I & CCIoT – II	40 Marks

Sr. No	Papers	Theory/ Practical	Teaching Hours	Maximum Marks Allotted	Passing
1.	CCIoT – I	Theory	30	30	12
2.	CCIoT – II	Theory	30	30	12
3.	CCIoT - III	Practical	30	40	16

1. Objectives

- To provide knowledge of different Smart System applications
- To develop skill for MCU Based system design.
- To develop skills to design IoT based application for agriculture, Healthcare etc.
- To familiarize students with Arduino as IDE, programming language & platform
- 2. Duration → 3 Months
 3. Medium of Instruction → English
 4. Eligibility → 12th
 5. Intake Capacity → 60
 6. Mode → Part Time

7. Course Outcomes:

- · Learn how to prototype circuits with a breadboard
- Learn the Arduino programming language and IDE
- Program basic Arduino examples
- Prototype circuits and connect them to the Arduino
- Program the Arduino microcontroller to make the circuits work
- Understand the key components that make up an IoT system
- Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis

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Syllabus: Paper - I

CCIoT I: Basics of IoT and Microcontrollers

Unit 1: Introduction to IOT Understanding IoT fundamentals

- IOT Architecture and protocols
- Various Platforms for IoT
- Real time Examples of IoT
- Overview of IoT components and IoT Communication Technologies
- Challenges in IOT

Unit 2: Basics of Microcontrollers

- Central Processing Unit (CPU)
- Program Memory (ROM Read Only Memory)
- Data Memory (RAM Random Access Memory)
- Timers and Counters
- I/O Ports (I/O Input/Output)
- Serial Communication Interface
- Clock Circuit (Oscillator Circuit)
- Interrupt Mechanism

Unit 3: Understanding Embedded Systems

- Embedded systems basics
- Embedded systems hardware
- · Embedded systems software
- Embedded systems design tools

Unit 4: Types of Microcontroller and Architectural Basics

- PIC Microcontroller
- ARM Microcontroller
- 8051 Microcontroller
- AVR Microcontroller
- MSP Microcontroller

References:

- 1. Internet-of-Things (IoT) Systems, Dimitrios Serpanos Marilyn Wolf, Springer
- 2. Architecting for the Internet of Things, Ryan Betts, 1st edition, O'Reilly 2016
- 3. https://www.electronicshub.org/microcontrollers-basics-structure-applications/
- 4. https://www.electronics-notes.com/articles/digital-embedded-processing/embedded-systems/basics-primer.php
- 5. https://embeddedschool.in/different-types-of-microcontroller-programming-used-in-embedded-systems/
- 6. The 8051 Microcontroller and Embedded Systems using Assembly and C -by Muhammad Ali Mazidi, Pearson Publication

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Syllabus: Paper - II

CCIoT II: Sensors, Actuators and Arduino Programming

Unit 1. Sensor & Actuators with Arduino Overview of Sensors working

- Analog and Digital Sensors
- Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with
- Arduino boards and its types, Arduino Interfacing of Actuators with Arduino.
- Interfacing of Relay Switch and Servo Motor with Arduino

Unit 2. Basic Networking with ESP8266 WiFi module Basics of Wireless Networking

- Introduction to ESP8266 Wi-Fi Module
- Various Wi-Fi library
- Web server- introduction, installation, configuration
- Posting sensor(s) data to web server(using Thingspeak etc)

Unit 3. Arduino Simulation Environment Arduino Uno Architecture

- · Setup the IDE, Writing Arduino Software
- Arduino Libraries
- What is an Embedded System?
- Programming Embedded Systems
- Factors for Selecting the Programming Language
- Introduction to Embedded C Programming Language
- Difference between C and Embedded C
- Basics of Embedded C Program
- Keywords in Embedded C
- Data Types in Embedded C

Unit 4: Designing IoT Applications using Embedded C Programming

- Basic Structure of an Embedded C Program (Template for Embedded C Program): Comments, Pre-Processor directives, Global declaration, local declaration, main() function.
- Different Components of an Embedded C Program
- Basic Embedded C Program
- Examples of Embedded C Program
- Case studies: IoT for smart cities, health care, agriculture, etc.

References:

- Getting Started with Arduino, Massimo Banzi and Michael Shiloh, 3rd Edition Maker Media, 2014
- 2. Official reference of Arduino : https://www.arduino.cc
- 3. The Ultimate Beginner's & Intermediate Guide to Learn Arduino Programming Step by Step, Ryan Turner, Nelly B.L. International Consulting Ltd, 2019
- 4. Getting Started with Arduino, Massimo Banzi, Make Community, 2014
- · 5. SENSORS AND TRANSDUCERS, Dr R. Krishna Priya, Notion Press

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> Syllabus: Paper - III CCIoT III: Practical Based on CCIoT I and II

Experiments:

- 1. Addition/Subtraction of two 8-bit hexadecimal numbers using 8051 kit/simulator
- 2. Multiplication/division of two 8-bit hexadecimal numbers using 8051 kit/simulator
- 3. LED ON OFF using ARDUINO UNO/MEGA etc.
- 4. Analog Input/ouput using ARDUINO UNO/MEGA etc
- 5. Digital Input/ouput using ARDUINO UNO/MEGA etc
- 6. Motor control using Arduino
- 7. Heart rate monitor using Arduino and send data over network
- 8. Visualise data using IoT Analytics
- 9. Interface potentiometer
- 10. Interface Push Button
- 11. Scrolling LED
- 12. Interface Photo-resistor

References:

- 1. Internet-of-Things (IoT) Systems, Dimitrios Serpanos Marilyn Wolf, Springer
- 2. Architecting for the Internet of Things, Ryan Betts, 1st edition, O'Reilly 2016
- 3. Getting Started with Arduino, Massimo Banzi and Michael Shiloh, 3rd Edition Maker Media, 2014
- 4. https://www.electronicshub.org/microcontrollers-basics-structure-applications/
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- 6. https://embeddedschool.in/different-types-of-microcontroller-programming-used-inembedded-systems/
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- 8. Official reference of Arduino: https://www.arduino.cc
- 9. The Ultimate Beginner's & Intermediate Guide to Learn Arduino Programming Step by Step, Ryan Turner, Nelly B.L. International Consulting Ltd, 2019
- 10. Getting Started with Arduino: The Open Source Electronics Prototyping Platform (Make) 3rd Edition, Massimo Banzi, Make Community, 2014

11. SENSORS AND TRANSDUCERS, Dr R. Krishna Priya, Notion Press

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