Dr. Annasaheb G. D. Bendale Mahila Mahavidyalaya, Jalgaon
Department of Electronics
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:

1. 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/
5. https://www.electronics-notes.com/articles/digital-embedded-processing/embedded-systems/basics-primer.php
6. https://embeddedschool.in/different-types-of-microcontroller-programming-used-in-embedded-systems/
7. Getting Started with Arduino, Massimo Banzi and Michael Shiloh, 3rd Edition Maker Media, 2014
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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