Course Title: Introduction to Embedded Systems

Semester and Year: Autumn, 2021

Credit Structure (L-T-P-Cr): 3-0-2-4

Course Code: EL510

Prerequisites (if any): Basic Electronics, Analog Circuits, Digital Design and Computer Architecture

Instructor’s Name: Prof. Tapas Kumar Maiti

Instructor’s Email: tapas_kumar@daiict.ac.in

Course Objectives: This course will give the students an introductory understanding of embedded systems which includes the programming the ARM based Microcontrollers, interfacing of external peripheral devices to microcontroller, and troubleshooting the embedded systems. The course consists of two parts which are (i) interactive lecture section (3hrs/week), (ii) hand-on (2hrs/week) which will provide a platform to develop an embedded system from scratch. Students will gain knowledge on embedded system functions, embedded components, embedded software, and coding which are required for practical implementation of a real embedded system. Students will acquire skills on embedded system coding, microcontrollers, sensors, and actuators to become a good embedded system engineer. Today, world leading companies are looking for the people who are expertise in the areas of embedded systems, embedded AI, and edge computing, etc. This course will provide a platform to develop skills for which companies are interested to hire professionals.

Suggested Textbook/references:

Mode of Delivery: Google Meet complemented with Google Classroom
Evaluation Scheme

- Labs and Assignments: 40%
- In-Sem Exam: 30%
- End Sem Exam: 30%

Lecture Plan:

<table>
<thead>
<tr>
<th>Topic Name</th>
<th>Detailed Course Contents</th>
<th>No. of lectures</th>
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<tbody>
<tr>
<td>Embedded OS</td>
<td>Overview of Cortex-M OS Support Features, Memory Management, Tasks and Scheduling, FreeRTOS, Embedded Android, Load OS on a Fresh Board, Opening a Port, ssh etc.</td>
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<td>Real-Time Interfacing, Sensors and Actuators</td>
<td>ARM interrupts and interrupt processing, GPIO Polling and Interrupt, UART-Serial Interface, I/O Synchronization, Interfacing ARM/Cortex Microcontroller with Keyboard, Display, Debugging Techniques, and Debugging using Keil μVision.</td>
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<td>Implementation of Embedded Systems</td>
<td>Embedding Sensors and Actuators with ARM/Cortex Microcontroller, ADC (Analog to Digital Conversion), DAC (Digital to Analog Conversion), Numerous Sensors and their Circuits, IMU (Inertial Measurement Unit), Servo-Motor, Pulse-Width-Modulation (PWM), Proportional-Integral-Derivative (PID) Controller, Integration of Sensors and Motors with RaspberryPi ARM Processor/Arduino Boards</td>
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