Suggested Teaching Guidelines for

Microcontrollers Programming

PG-DIOT- *Sept 2022*

Duration: 30 hours of theory + 34 hours of lab/hands-on

Objective: Firmware Design for ARM based microcontrollers and sensor interfacing for IoT based end devices.

Prerequisites: C/C++ programming

Evaluation method:	Theory exam	- 40% weightage
	Lab exam/case study	- 40% weightage
	Internal exam	- 20% weightage

List of Text Books / Other training material

The Definitive Guide to the ARM Cortex-M3, Joseph Yiu

Reference Book:

ARM Cortex M4 Cookbook Paperback by Dr. Mark Fisher/ Packet Publishing Limited

Session 1:

- Introduction to MCU Families
- Overview of ARM Cortex-M architecture
- CMSIS standard

Session 2, 3:

- Registers
- Operation Modes
- Instruction Set
- Thumb-2 Instructions

Session 4:

- Startup code
- Memory Model
- Linker map
- Bus Interface

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Session 5:

- Introduction to Booting Process
- Bootloaders and Vector Table
- Booting from Various Sources

Session 6, 7:

- Clock, Timer Management
- Watchdog timers
- RTC

Session 8:

- Interrupt Handling
- Exception handling
- Mode Switching

Session 9:

- Development environment –arm-gcc, eclipse, Keil MDK etc
- Building phases
- Blinking LED example

Session 10, 11:

- Peripheral management in MCUs
  - GPIO
  - PWM
  - UART

Session 12:

- Peripheral management in MCUs
  - SPI
  - I2C

Session 13:

- Peripheral management in MCUs
  - ADC

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- DAC

- Analog sensor interfacing techniques for low power designs
- MPU6050 and MPU9250 sensor modules (Gyroscope + Accelerometer + Temperature)

Session 14:

- CAN Basics
- Designing CAN Nodes

Session 15:

- Bus Standards – USB, PCI (overview)
- Debugging Support, Techniques
  - JTAG
  - CMSIS DAP
  - Open OCD