Electronics: Microprocessor Applications (40S)

Instructor: Mr. Pulver
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Course Code: EXD40S
Credit: 1.0
Prerequisite: Microprocessors (EXC40S) and Introduction to Digital Electronics
Suggested Grade Level: Grade 12
Delivery Format: Classroom instruction, Arduino-based projects, sensor interfacing, and prototyping

Course Description

This course provides students with advanced knowledge and hands-on experience in building microprocessor-based systems. Students will write code, interface with peripherals, and build embedded control systems using microcontrollers such as Arduino. Emphasis is placed on programming, circuit design, debugging, and creating real-world applications.

General Learning Outcomes (GLOs)

- Understand microprocessor architecture and control flow.
- Write, test, and debug code in C or Arduino language for embedded systems.
- Interface microcontrollers with sensors, displays, and actuators.
- Apply serial communication protocols like UART, I2C, and SPI.
- Design and prototype control systems using input/output modules.
- Use simulation tools and real hardware for iterative testing and validation.
- Demonstrate professional documentation and project management practices.

Unit Breakdown

Unit 1: Introduction to Microprocessors

- History and evolution of microprocessors
- Microprocessor vs. microcontroller
- Basic system components (ALU, registers, buses)

Unit 2: Microcontroller Architecture and Programming

- Overview of Arduino and AVR microcontrollers
- Programming structure and IDE
- Writing and debugging basic programs

Unit 3: Interfacing and I/O Control

- Digital input/output
- Controlling LEDs, buzzers, and buttons
- Reading analog signals with ADCs

Unit 4: Communication Protocols

- UART, SPI, and I2C communication
- Serial monitor usage
- Interfacing with external devices (sensors, EEPROMs)

Unit 5: Sensors and Actuators

- Using temperature, light, motion sensors
- Driving motors and servos
- Signal conditioning and filtering

Unit 6: Real-World Applications

- Microprocessors in automation, appliances, vehicles
- Home automation and environmental monitoring
- Case studies of microcontroller systems

Unit 7: Capstone Project

- Design, build, and present a working microcontroller system (e.g., smart lamp, security sensor, digital thermometer)

Assessment

- Labs and Assignments 30%
- Quizzes and Midterm 20%
- Capstone Project 30%
- Final Exam 20%

Resources

- Arduino IDE and C-based code libraries
- Arduino Uno boards, breadboards, and jumper wires
- Assorted sensors and actuators (PIR, DHT11, servo motors, etc.)
- Serial monitors and logic analyzers
- Online documentation (Arduino Reference, Tutorials, Datasheets)