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| Department of Computer Engineering | |
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| **Microcontrollers (66426)** | |
| **Total Credits** | **3** |
| **major compulsory** | |
| **Prerequisites** | P1 : Digital Circuit Design II (66321) |

**Course Contents**

Note: The Microcontrollers used will vary from Year to Year Depending on latest in Technology. However, some processors like the old 8051 to give the students a falvor of various micrococntroller Architectures. 1. PIC Architecture MCU architecture. Special Function Registers (SFRs) Data Memory. Program Memory and Stack. Data EEPROM in some PICs Interrupts. 2. Instruction Set of PIC controllers. PIC Instructions. Bit Manipulation SFRs Details. Initialization of a PIC. 3. Building a Basic PIC Controller Reset Circuitry and Oscillator. Serial Port Interface. LCD interface. Program the Basic Circuit Use of the Download Program. 4. Design Example e.g. Microwave Oven Design Build the Hardware for the Oven. Design the software for the system. Keys, LCD programming. Programming Timers. Programming serial ports. Write the complete software for the system. Test the hardware and software. 5. Interfacing Analog Signals Analog Channels. Programming ADC Channels. Generating Analog Outputs. Design Example 6. Miscellaneous Issues for PIC SPI and I2 Programming the Internal EEPROM External Serial EEPROM Real Time Clocks. Advanced Series of PIC controllers 7. Programming PIC 32 using High Level languages PICC C18 Other Compilers 8. Intel MC-8051 Family Overview of 8051 Architecture Instruction Set Memory , Ports and Peripherals 9. PIC32 Microcontrollers PIC 32 Architecture Memory, Ports and Peripherals Programming the PIC32 processors, C32 10. Arm Microcontrollers Overview of Arm Architecture Overview of Arm MC3 Real Time OS

| | Intended Learning Outcomes (ILO's) | Student Outcomes (SO's) | Contribution |
|---|---|---|---|
| 1 | Acquire hardware and software design capabilities of practical microcontroller systems using popular microcontrollers and embedded systems with emphasis on using the original Data sheets and manuals | C | 35 % |
| 2 | Acquire ability to interface Microcontrollers to Input and Output devices: LCD, Serial Interface, Analog devices, Digital and Analog Inputs and Outputs, PWM and others | K | 30 % |
| 3 | Acquire knowledge of Architecture, Interface and Programing of different types of Microcontrollers including advanced Embedded systems and RTOS. | C | 20 % |
| 4 | Design and build a practical microcontroller system project. This is a project that is an Essential and Integral part of the course. | E | 15 % |

**Textbook and/ or Refrences**

The Microchip Manuals for PIC, The Intel Microcontroller Manual, ARM Manuals

| Assessment Criteria | Percent (%) |
|---|---|
| First Exam | 20 % |
| Second Exam | 20 % |
| Projects | 15 % |
| Final Exam | 45 % |

**Course Plan**

| Week | Topic |
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|---|---|
| 1 | PIC Architecture: SFRs, I/O, Memory |
| 2 | PIC18 Instruction Set |
| 3 | Building basic Circuit: Reset, LCD, Using Bootloader. |
| 4 | Programming: Timers, Interrupts, Serial Interface, LCD |
| 5 | Design Example (Microwave Oven): Hardware |
| 6 | Design Example (Microwave Oven): Software |
| 7 | MIDTERM EXAM 1 |
| 8 | Interfacing Analog Signals: Analog Amplifiers, ADCs |
| 9 | Analog Outputs: PWM, Capture, Compare, Comparators. |
| 10 | SPI and I2C, |
| 11 | External EEPROMs, Real Time Clocks. Advanced (PIC32) Microcontrollers |
| 12 | Other Microcontrollers: Intel 8051 Microcontroller overview |
| 13 | Programming using High Level Languages C18, PICC |
| 14 | MIDTERM EXAM 2 |
| 15 | Overview of PIC32. |
| 16 | ARM Microcontrollers and RTOS |