MICROCONTROLLERS AND APPLICATIONS

Course Code: 13EC2204 **L P C**
4 0 3

Pre requisites: Requires pre-knowledge of Switching theory and logic design, microprocessors and interfacing

Course Educational Objectives:

1. To describe the instruction set of 8051
2. To present interrupt structures in microprocessors and MCUs
3. To explain the interfacing of peripherals with the MCUs
4. To discuss advanced microcontrollers like 80196, ARM MCU

Course Outcomes:

Student will be able to

1. Differentiate microcontroller instruction set from that of microprocessor instruction set
2. Understand how real time control is achieved using interrupts, timers
3. Interpret the applications of microcontroller which includes interfacing to high power devices, ADCs, DACs etc.,
4. Differentiate the various microcontroller architectures ie.,8-bit, 16-bit, 32-bit architectures

UNIT- I

8051 FAMILY MICROCONTROLLERS INSTRUCTION SET:

Architecture of 8051microcontroller- internal and external memories, Basic assembly language programming – Data transfer instructions – Data and Bit manipulation instructions – Arithmetic instructions – Instructions for Logical operations on the Bytes among the Registers, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow

UNIT- II

REAL TIME CONTROL: INTERRUPTS:

Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-maskable interrupt sources – Enabling or Disabling of the sources – Polling to determine the Interrupt source and assignment of the priorities among them –Interrupt structure in Intel 8051.

REAL TIME CONTROL: TIMERS

Programmable Timers in the MCUs – Free running counter and real time control – Interrupt interval and density constraints.

UNIT- III SYSTEMS DESIGN :

Synchronous serial-cum-asynchronous serial communication – ADC Circuit Interfacing – DAC Circuit Interfacing – stepper motor - Digital and Analog Interfacing Methods, Switch, Keypad and Keyboard interfacings – LED and Array of LEDs – LCD interface – Programmable instruments interface using IEEE 488 Bus – Interfacing with the Flash Memory – Interfaces –Interfacing to High Power Devices – Analog input interfacing – Analog output interfacing.

UNIT- IV

REAL TIME OPERATING SYSTEM FOR MICRO CONTROLLERS:

Real Time operating system – RTOS of Keil (RTX51) – Use of RTOS in Design – Software development tools for Microcontrollers.

MICROCONTROLLER BASED INDUSTRIAL APPLICATIONS

Optical motor shaft encoders – Industrial control – Industrial process control system – Prototype MCU based Measuring instruments.

UNIT-V

16/32 - BIT MICROCONTROLLERS:

8096/80196 Family: Hardware – Memory map in Intel 80196 family MCU system – I/O ports – Programmable Timers and High-speed outputs and input captures – Interrupts.

ARM 32 Bit MCUs: Introduction to 16/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set.

TEXT BOOKS:

[1] Raj Kamal, "*Microcontrollers Architecture, Programming, Interfacing and System Design*", 2nd Edition, Pearson Education, 2005.

[2] Mazidi and Mazidi, "*The 8051 Microcontroller and Embedded Systems*", 4th impression,PHI, 2000.

REFERENCE BOOKS:

[1] Kenneth J. Ayala, "*The 8051 Microcontroller*", 3rd ed., Cengage Learning, 2007.

[2] A.V. Deshmukh, "*Microcontrollers (Theory & Applications)*"–, 6th Reprint, TMH, 2007.

[3] John B. Peatman, "*Design with PIC Microcontrollers*", 2nd Edition, Pearson Education,2005.