MICROCONTROLLERS AND APPLICATIONS
(ELECTIVE-I)

Course Code: 13EC1124

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Prerequisites:

Requires pre-knowledge of switching theory and logic design, microprocessors and interfacing

Course Educational Objectives:

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

Course Outcomes:

Student will be able to

- Identify the differences between microprocessor and micro controller instruction set.
- Understand how real time control is achieved using interrupts, timers
- Interpret the applications of microcontroller which includes interfacing to high power devices, ADCs, DACs etc.,
- Understand the various microcontroller architectures ie.,8-bit, 16-bit, 32-bit architectures

UNIT-I (14 Lectures)

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 (12 Lectures)

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 timecontrol – Interrupt interval and density constraints.

UNIT-III (12 Lectures)

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 (10 Lectures)

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 (12 Lectures)

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 EmbeddedSystems"*, 4*th* Impression, PHI, 2000.

REFERENCES:

1. Kenneth J. Ayala, *"The 8051 Microcontroller"*, 3rd Edition, 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.