

SCHEME OF COURSE WORK

Course Details:

Course Title	: Microcontrollers and Applications		
Course Code	: 13EC2204	L T P C	: 4 0 0 3
Program:	: M.Tech.		
Specialization:	: Communications and Signal Processing		
Semester	: I		
Prerequisites	: Switching Theory and Logic Design, Microprocessors and Interfacing		
Courses to which it is a prerequisite	: Embedded systems		

Course Outcomes (COs):

1	Comprehend the architecture and instruction set of microcontrollers
2	Acquire knowledge on real time control interrupts & timers
3	Design interface control peripherals and high power devices
4	Analyze real time operating system for MCUs & MCU based industrial applications
5	Comprehend the architecture of 16-bit (8096/80196) & ARM microcontrollers

Course Outcomes versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	M	M	M						
CO2	S	S	S	S	S	M						M
CO3	S	S	M	M	S							
CO4		M	M		M	M						
CO5		S	M	M								M

S - Strongly correlated, M - Moderately correlated, Blank - No correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam
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Teaching-Learning and Evaluation

Week	Topic / contents	Course outcomes	Sample questions	Teaching-learning strategy	Assessment method & schedule
1	Introduction to Microcontroller Architecture of 8051 microcontroller, internal and external memories	CO-1	1. Describe the Architecture of 8051 microcontroller. 2. Explain the Pin Configuration.	□ Lecture □ Discussion	Assignment 1/ Quiz1/ Mid1
2	Basic assembly language programming, Data transfer instructions, Data and Bit manipulation instructions, Arithmetic instructions,	CO-1	1. Describe the instruction set with examples. 2. Write ALP on add, sub, mul, sorting, Searching, factorial, BCD to Binary, Binary to BCD etc.	□ Lecture □ Discussion □ Program solving	Assignment 1/ Quiz1/ Mid1
3	Instructions for Logical operations on the Bytes among the Registers, Internal RAM, and SFRs, Program flow control and Interrupt control flow instructions.	CO-1	1. Explain memory organization of 8051. 2. Explain MOVC and MOVX instructions with example.	□ Lecture □ Discussion	Assignment 1/ Quiz1/ Mid1
4	Interrupt handling structure of an MCU, Interrupt Latency and Interrupt deadline. Multiple sources of the interrupts, Non-maskable interrupt sources,	CO-2	1. Explain the interrupt structure in 8051. 2. Define Interrupt Latency, Interrupt deadline, Interrupt interval and density constraints.	□ Lecture □ Discussion	Assignment 1/ Quiz1/ Mid1
5	Enabling or Disabling of the sources, Polling to determine the Interrupt source and assignment of the priorities among them, Interrupt structure in Intel 8051.	CO-2	1. Explain IE register. 2. Explain SCON register 3. Explain PCON register	□ Lecture □ Discussion	Assignment 1/ Quiz1/ Mid1
6	Programmable Timers in the MCUs, Free running counter and real time control – Interrupt interval and density constraints.	CO-2	1. Explain TMOD and TCON register and mod 0,1,2,3 configurations. 2. Design a square wave generator. 3. Explain Free running counter.	□ Lecture □ Discussion □ Program solving	Assignment 1/ Quiz1/ Mid1

7	Synchronous serial communication asynchronous serial communication – ADC Circuit Interfacing – DAC Circuit Interfacing – stepper motor	CO-3	1. Explain frame format of UART. 2. Designing H/W for ADC, DAC, stepper motor, interfacing and writing the necessary software.	□ Lecture □ Discussion □ Program solving	Assignment 1/ Quiz1/ Mid1
8	Digital and Analog Interfacing Methods, Switch, Keypad and Keyboard interfacing – LED and Array of LEDs – LCD interface –	CO-3	1. Designing hardware for Keyboard interfacing and writing the necessary software. 2. Designing hardware for LED interface, Array of LEDs interface, LCD interface and writing the necessary software.	□ Lecture □ Program Solving	Assignment 1/ Quiz1/ Mid1
9	Mid-Test 1				
10	Programmable instruments interface using IEEE 488 Bus – Interfacing with the Flash Memory – Interfaces –	CO-3	1. Explain IEEE 488 Bus Standards. 2. Designing hardware for Flash memory interfacing and writing the necessary software.	□ Lecture □ Discussion □ PPT	Assignment 2/ Quiz2/ Mid2
11	Interfacing to High Power Devices – Analog input interfacing – Analog output interfacing.	CO-3	1. Explain how High Power Devices are interfaced to microcontrollers 2. Explain how Analog input is interfaced to microcontrollers.	□ Lecture □ Discussion	Assignment 2/ Quiz2/ Mid2
12	Real Time operating system, RTOS of Keil (RTX51), Use of RTOS in Design, Software development tools for Microcontrollers.	CO-4	1. Explain the basics of RTOS with examples. 2. What are the different Software development Tools.	□ Lecture □ Discussion □ PPT	Assignment 2/ Quiz2/ Mid2
13	Optical motor shaft encoders, Industrial control, Industrial process control system, Prototype MCU based Measuring instruments.	CO-4	1. Explain how optical shaft encoder and measuring instruments are interfaced to microcontrollers. 2. Explain industrial process control system.	□ Lecture □ Discussion	Assignment 2/ Quiz2/ Mid2

14	80196 Architecture, Memory map in I/O ports.	CO-5	1. Explain 80196 Architecture. 2. Explain memory organization of 80196.	▫ Lecture ▫ Discussion	Assignment 2/ Quiz2/ Mid2
15	Programmable Timers and High-speed outputs and input captures, Interrupts.	CO-5	1. Explain 80196 Timers and High-speed outputs and input captures. 2. Discuss the interrupt structure in 80196.	▫ Lecture ▫ Discussion	Assignment 2/ Quiz2/ Mid2
16	Introduction to 16/32 Bit processors ARM architecture and organization	CO-5	1. Explain the ARM architecture and its organization	▫ Lecture ▫ Discussion	Assignment 2/ Quiz2/ Mid2
17	ARM / Thumb programming model, ARM / Thumb instruction set.	CO-5	1. Describe ARM and Thumb instruction set with examples.	▫ Lecture ▫ Discussion	Assignment 2/ Quiz2/ Mid2
18	Mid-Test 2				
19/20	END EXAM				