

Course Name : Electronics Engineering Group
Course Code : ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU/IU/ED/EI
Semester : Sixth for ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU and Seventh for IU/ED/EI
Subject Title : Embedded System
Subject Code : 17658

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	50#	--	25@	175

NOTE:

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

Rationale:

In the age of computer we are surrounded by the Embedded System - at home, office, colleges, canteen, toys, cell phones, transit, aerospace technology, military application. Out of millions of processor manufactured every year, nearly 95% processors are used in Embedded System. The Embedded Systems design is with or without OS. Most of them are Real Time Embedded Systems.

Due to such tremendous growth of Embedded Systems in recent years, one needs to be familiar with its design aspects, characteristics. Also the knowledge and programming of Real Time Embedded System is must. This subject is the advanced part of the subject Microcontroller.

General Objectives:

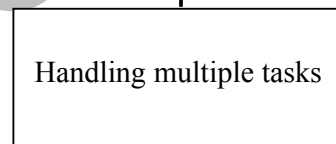
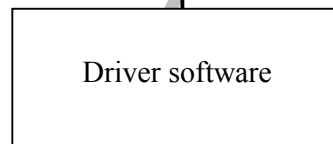
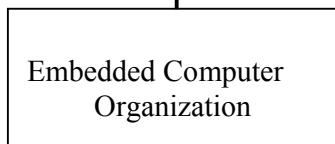
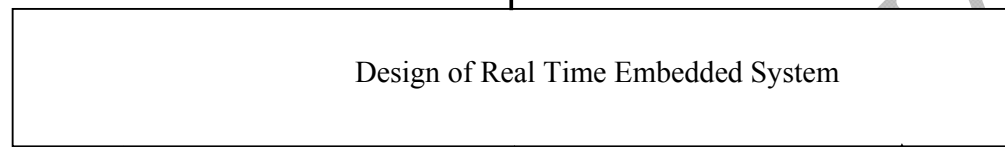
1. Differentiate and decide the architectures of processors for application.
2. Define communication media.
3. Design and development of small Embedded Systems.
4. Development of software.
5. Understand architecture of RTOS.

Learning Structure:

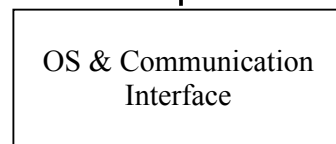
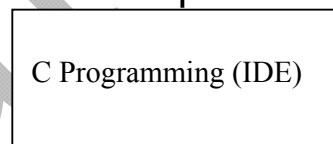
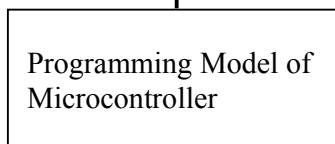
Application



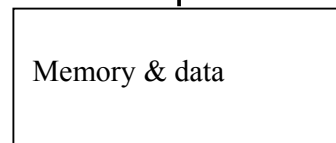
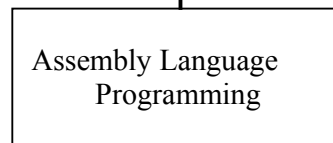
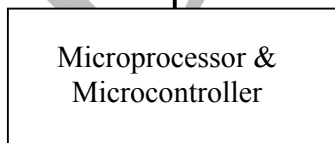
Procedure/Principles



Concepts



Facts



Theory:

Topic and Contents	Hours	Marks
<p>Topic 1: Architecture of Microprocessor and Microcontroller</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Study of Architecture of microcontroller 89C51. ➤ Distinguish Microprocessor and Microcontroller architectures. <p>Contents:</p> <p>1.1 Architecture of Microcontroller 89C51 GPR, SFR</p> <ul style="list-style-type: none"> • Address, Data & Control bus generation. • Memory structure (Data and Program memory) • IO Ports, Interrupts, • Timer/Counter, Serial Communication <p>1.2 Block diagram and description of architectures of Processors:</p> <ul style="list-style-type: none"> • Von Neumann • Harvard • RISC • CISC • DSP • Multi Core Processor 	08	08
<p>Topic 2: Programming Microcontroller 89C51 with ‘C’</p> <ul style="list-style-type: none"> ➤ Use Integrated Development Tools ➤ Develop Program logic with ‘C’. <p>Contents:</p> <p>2.1 Software Development Tools: Operation and selection (08 Marks)</p> <ul style="list-style-type: none"> • Integrated Development Environment (IDE): Cross-Compiler, Emulator and Flash/OTP Programmer. • In-Circuit Emulator (ICE), debugger, JTAG port • Embedded C: Assembly Language V/S Embedded C. • Programming Microcontroller 89C51 with C. • ‘C’ Compiler for Microcontroller 89C51: SPJ Systems, Keil • Program downloading tools: ISP/IAP <p>2.2 Programming with ‘C’: (16 Marks)</p> <ul style="list-style-type: none"> • Input/output operation. • Bit/Byte operations. • Arithmetic and Logical operations on data. • Time delay routines. • Timer/Counter operations. • Generation of patterns on port lines. • Serial Communication. • Use of Assembly Instruction in ‘C’ program. 	12	24
<p>Topic 3: Communication Protocols</p> <ul style="list-style-type: none"> ➤ Use of communication modes and protocols. <p>Contents:</p> <ul style="list-style-type: none"> • Need of communication interface in embedded system. • Serial V/S Parallel Communication, Synchronous V/S Asynchronous Communication • RS232: DB9-pin functions, MAX 232, MAX 233, Microcontroller 8051 connection with RS232 and RS485 • Communication protocols 	06	16

<ul style="list-style-type: none"> Serial Communication Protocol: I2C, CAN, USB, Serial Peripheral Interface (SPI), Synchronous Serial Protocol (SSP). Parallel Communication Protocol: PCI, PCI-X Wireless Communication Protocol: IrDA, Bluetooth, Zigbee, IEEE802.11 		
<p>Topic 4: I/O interfacing</p> <ul style="list-style-type: none"> ➤ Interface different devices to Microcontroller 89C51. ➤ Develop logic of program to work with different devices. <p>Contents:</p> <p>Interfacing:</p> <ul style="list-style-type: none"> Interfacing Keys, LEDs and relay and its programming with ‘C’. Interfacing matrix keyboard and its programming with ‘C’. Interfacing LCD and its programming with ‘C’. Interfacing ADC and its programming with ‘C’. Interfacing DAC and its programming with ‘C’ for generation of different patterns. Interfacing Stepper Motor and its programming with ‘C’. Interfacing DC Motor and its programming with ‘C’. 	10	24
<p>Topic 5: Embedded System Design</p> <ul style="list-style-type: none"> ➤ Classify and specify characteristics of embedded system. <p>Contents:</p> <ul style="list-style-type: none"> Embedded System: Introduction, block diagram, applications, advantages and disadvantages. Classification of Embedded System: Small scale, medium scale, sophisticated, stand-alone, reactive/real time (soft and hard real time), Networked, Mobile, Single functioned, Tightly constrained, Design Metrics/Specifications/Characteristics of Embedded System: Processor power, memory, operating system, Reliability, performance, power consumption, NRE cost, unit cost, size, flexibility, time-to-prototype, time-to-market, maintainability, correctness and safety. 	06	12
<p>Topic 6: Real Time Operating System</p> <ul style="list-style-type: none"> ➤ Define, understand and classify operating system. ➤ Define, describe and applications of real time operating system. <p>Contents:</p> <p>Operating System:</p> <ul style="list-style-type: none"> Operating System, functions of operating system. Architecture of Real Time Operating System (RTOS). Scheduling architecture. Multitasking. Share data problem. Semaphore. Dead lock. Inter-task Communication. 	06	16
Total	48	100

Intellectual Skills:

- 1) Use IDE for Microcontroller programming with ‘C’.
- 2) Develop Logic of program.
- 3) Write ‘C’ Program.

Motor Skills:

- 1) Use of IDE for Microcontroller programming.
- 2) Interface Microcontroller Evaluation boards & peripherals.

List of Practical:**Write and execute 'C' Programs:**

- 1) Input and output operation via ports.
- 2) Arithmetic and logic operations on data.
- 3) Use of assembly language instruction in 'C' program.
- 4) Generation of pulse/square wave on port line/s.
- 5) Reading key status and LED ON/OFF.
- 6) Operating Relay to activate connected devices to relay.
- 7) Reading matrix keyboard.
- 8) Read ADC and display it on LCD.
- 9) Generating different patterns with DAC
- 10) Running Stepper motor with different speed (CW/CCW).

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
1	Frank Vahid & Tony Givargis	Embedded System Design A Unified Hardware/Software Introduction	Wiley
2	Raj Kamal	Embedded System Architecture, Programming and Design	Tata McGraw Hill
3	Dr K. V. K. K. Prasad	Embedded/Real-Time Systems: Concept, Design & Programming	Dreamtech Press
4	Jean J Labrosse	Micro C/OS-II The Real Time Kernel	CPM Books
5	Mazidi, Mazidi & McKinlay	The 8051 Microcontroller and Embedded System Using Assembly and C	Prentice Hall
6	Ajay V. Deshmukh	Microcontrollers (Theory and Applications)	Tata McGrawHill

2. Websites:

- 1) <http://developer.apple.com/documentation/mac/devices-313.html>
- 2) http://en.wikipedia.org/wiki/Integrated_development_environment
- 3) http://en.wikipedia.org/wiki/communication_protocol
- 4) <http://en.wikipedia.org/wiki/RS-232>
- 5) http://en.wikipedia.org/wiki/Embedded_system
- 6) http://en.wikipedia.org/wiki/Real_time_operating_system