GUJARAT TECHNOLOGICAL UNIVERSITY

Power Electronics

B. E. SEMESTER: VI

Subject Name: **Microcontrollers for Power Electronics**
Subject Code: **162402**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Practical (I)**
4	0	2	6	70	30	50

Sr. No.	Course Contents	Total Hrs
1.	**Introduction:** • Review of register transfer logic, processor logic design, control logic design of processor etc. • Computer design, Concept of microprocessor, Generalised microprocessor based system organization • Concepts of different Microcontrollers/ Microprocessors architectures • Requirements of Data transfer between external hardware and microprocessor/microcontroller and data transfer schemes • History of microprocessors and microcontrollers	6
2.	**Basic Architecture of Mcs 51 Family:** • Architecture, memory organization, Program and Data memory, On chip and Off chip memory, • Special Function registers, I/O ports, Timers/ Counters, Serial ports, Interrupt structure, PSW • Control registers for on chip peripherals • Concept of other derivatives of other microcontroller of the family	6
3.	**Mcs 51 Family Instruction Set:** • Instructions, addressing modes, classification of instructions • Data transfer instructions • Arithmetic, Logic and Boolean variable manipulation instructions • Program Branching and other instructions	6

4.	**Assembly Language Programming:** • Software development process, concept of simulator, emulator, concept of assembly language programming • Assembler, Assembler directives • Stack memory • Concept of subroutine • Programs for Simple data operations on data blocks, code conversion, data sorting, data transfer etc	8
5.	**Advanced Programming Techniques And Hardware Control:** • Floating point representation and operations, array handling • Counter and delays • Handling subroutines • Handling interrupts, priority of interrupts • Writing data to output port, reading data from input port • Generating PWM, controlling external hardware etc	10
6.	**Programming In High Level Programming Language And Rtos:** • Programming using C cross compiler • Simple programs using C language • Concept and requirements of Real time operating systems (RTOS)	6
7.	**Interfacing with Real World Hardware:** • Switches, keyboard, key debounce, different methods of interfacing with keyboards • Display devices, Interfacing with seven segment displays, multiplexed display, requirements of blanking in multiplexed displays, Interfacing with different types of LCDs • ADC, DAC, Motors, optical transducers etc	8
8.	**External Memory Interfacing And Serial Communication Concepts:** • Expanding memory, external Data and program Memory, serial memory • Concept of serial communication, Serial communication standards, RS-232C, RS-485, RS-422 etc • Concept of I^2C and interfacing with serial devices	6

Laboratory Work Guidelines:

There should be at least 12 experiments to be performed to achieve excellence in programming of MCS-51. The suggested experiments are as give below. The experiments are in three groups. Sufficient number of experiments should be performed from each group.

Group – I

Objectives of this experiment group are making the student understand
1. Assembler directives
2. Basic instructions and their effects through simple programs
3. Use of compiler
4. Good programming practice

1.	Study of data transfer instructions using different addressing modes.
2.	Study of arithmetic and logic instructions and their effects using simple arithmetic and logical operations on data.
3.	Study of Boolean variable manipulation instructions using simple programs to set or reset bit variables.
4.	Study of reading and writing data to and from the I/O ports and SFR.
5.	Study of loops and program branching using simple programs (e.g. Moving or copying a data block from given memory location, carrying out an operation on all bytes of array etc.)
6.	Study of simple operation on data arrays (e.g. Addition of elements of an array, addition of two arrays of given length, finding largest, smallest or middle element in a given array etc.)

Group – II

Objectives of this experiment group are making the student understand
1. Concept of subroutine and use of instructions for subroutines
2. Writing and calling subroutines
3. Good programming practise for subroutines.
4. Interrupt service routine, the instructions related to it and writing good ISR.

1.	Study of subroutines, necessary instructions for writing subroutines and effects of these instructions through simple subroutines and test programs for the subroutine.
2.	To write and verify program to convert an 8 bit binary number in to its packed BCD equivalent with and without subroutine.
3.	To write and verify program to convert a 2 digit packed BCD number into equivalent binary number with and without subroutine.
4.	To write and verify program to multiply two unsigned 16 bit numbers with and without subroutine.
5.	To write and verify program to divide a 16 bit unsigned number by an 8 bit unsigned number with and without subroutine.
6.	To write and verify program to multiply two BCD numbers with and without subroutine.
7.	To write and verify program to generate first 5(or any number) elements of the Fibonacci (or any other series) with and without subroutine.
8.	To write and verify program to sort given data array in ascending (or descending) order with and without subroutine.
9.	To write and verify program to convert a given 8 bit binary number into equivalent Gray code with and without subroutine.
10.	To write and verify program to convert a BCD code into seven segment code with look up table using subroutine.
11.	To write and verify interrupt service routine for internal timer in various modes.

Group – III

Objectives of this experiment group are making the student understand
1. Concept of writing and testing programs in C
2. Make student understand concept of Embedded C

The Experiments to be performed should be selected from the experiments performed from the group –II

Text Book:

1. The 8051 Microcontroller and Embedded Systems →Mazidi

Reference Books:

1. 8051 Microcontroller →Subrata Ghoshal
2. 8051 Microcontrollers →Satish Shah
3. The 8051 microcontroller & Embedded systems →K.J.Ayala and D.V.Gadre
4. Digital Logic and Computer Design →M. Morris Mano
5. Embedded C → Michael J. Pont