GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS (24)
MICROCONTROLLER FOR POWER ELECTRONICS
SUBJECT CODE: 2152409
B.E. 5th SEMESTER

Type of course: Engineering Science (Electronics).

Prerequisite: NA

Rationale: NA.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Introduction of Microcomputer System and Semiconductor Memory**: CPU, I/O devices, clock, memory, bussed architecture, tristate logic, address bus, data bus and control bus. Development of semiconductor memory, internal structure and decoding, memory read and write timing diagrams, MROM, ROM, EPROM, EEPROM, DRAM	4	10
2	**Architecture of 8-bit Microprocessor:** Architecture of Intel 8085A microprocessor, Pin description and internal architecture. Minimum system requirements and basic hardware design.	4	10
3	**MCS-51 Family of Microcontroller :** Basic Architecture of MCS-51, Comparison with 8085, Description of internal hardware and on chip peripherals, On chip RAM, ROM, PWM, Timer/Counter, SFR etc.	4	10
4	**Operation and Control of Microcontroller:** Timing and control unit, op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine cycles, interrupt acknowledge machine cycle, state-transition diagram.	6	10
5	**Instruction Set and Assembly Language Programming:** Addressing modes; Data transfer, arithmetic, logical, branch, stack and machine control groups of instruction set, macro RTL and micro RTL flow chart of few typical instructions; Assembler directives, simple examples; Subroutines, parameter passing to subroutines.	8	15
6	**Interfacing:** Interfacing of memory chips, address allocation technique and decoding; Interfacing of I/O devices, LEDs and toggle-switches as examples, memory mapped and isolated I/O structure; Input/ Output	8	15

	techniques: CPU initiated unconditional and conditional I/O transfer, device initiated interrupt I/O transfer.		
7	**Interrupts:** Interrupt structure of MCS-51 microcontroller, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts	8	15
8	**Using on chip Programmable Peripheral Interface:** Timer/Counter, PWM, Serial I/O, I/O port, Interfacing with LED, 7 Segment displays, LCD, ADC, DAC etc.	8	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**25**	**25**	**10**	**10**	**--**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2e, Mazidi
2. The 8051 Microcontroller & Embedded Systems Using Assembly and C, Kenneth J Ayala & D V Gadre
3. 8051 Microcontroller, Subroto GhoshalArchitecture and Programming of 8051 Microcontroller, ALka Kalra, Sanjiv Kalra
4. Digital Logic and Computer Design by Morris Mano, PHI

Course Outcome:

After learning this course, the students should be able to understand following concepts.

1. Importance of microprocessor/ microcontrollers in real world applications.
2. Various architecture of microprocessors and MCS 51 family architecture.
3. Integrated development environment used for firm development.
4. Assembly language, assembler directives etc.
5. Programming and using on chip peripherals like timer, ADC, serial port etc. for real world applications

List of Experiments and Open Ended Projects:

Objectives: The laboratory work is aimed at putting the theory learnt in class in practice and to show the results are nearly matched with theory. In this context, following are the core objectives for laboratory work of this subject.

- Develop understanding of basics of IDE for microcontroller based systems.
- Understand the basics of assembler directives
- Develop understanding of addressing modes of various operations.
- Develop understanding of various operations on digital data.

- Understand the use basic instructions to develop programs.
- Concept of using C language for program development
- Concept of peripheral control, data I/O etc.
- Concept of real world hardware interface.

Directions for Laboratory work:

- ✓ The list of experiments is given as a sample.
- ✓ Minimum 10 experiments should be carried out.
- ✓ Similar laboratory work fulfilling the objectives can also be considered.
- ✓ As far as possible printed manual should be preferred so that students can concentrate in laboratory experiments and related study.
- ✓ Simulation of various experiments should also be given.

The sample list of experiments is given below.

List of Practical and Open Ended Problems:

1. Study of IDE for MCS 51
2. Study of data transfer instructions
3. Study of arithmetic instructions
4. Study of logical instructions
5. Study of bit manipulation instructions
6. Study of execution sequence control
7. Study of subroutines
8. Operation on data arrays
9. Arithmetic operations on 16 bit data
10. Code Conversion
11. ISR and Internal Timer
12. Programming MCS-51 in C

Major Equipment:

- Bread Board, Oscilloscope, Logic Analyser, Multimeter etc.

List of Open Source Software/learning website:

Open Source Software:

- http://www.flashmagictool.com/
- http://sourceforge.net/projects/mcu8051ide/
- http://www.edsim51.com/

Web-base tools for design:

- http://www.atmel.com
- https://www.circuitlab.com/editor/

Open source for Math Tools:

- http://maxima.sourceforge.net/
- http://www.sagemath.org/
- http://www.scilab.org/
- http://www.gnu.org/software/octave/

Learning website:

- http://www.datasheetcatalog.com/
- http://nptel.iitm.ac.in/courses.php
- http://ocw.mit.edu/
- http://www.electrical-engineering-portal.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.