GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3154105
Semester – V
Subject Name: Microcontroller and PLC

Type of course: Professional Elective Course

Prerequisite: NA

Rationale: The modern digital systems including computer systems are designed with microprocessor as central device connected to memory and I/O devices. The subject introduces the students with basics of microprocessor, microprocessor architecture and programming, interfacing microprocessor with memory and various I/O (Input/ Output) devices and introduction to the advance processors.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction To Microcontroller:-** 8051 Architecture**:–** Memory map - Addressing modes, I/O Ports - Counters and Timers - Serial data I/O - Interrupts - Instruction set, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, Assembly Language Programming tools.	**7**
2	**Microcontroller Programming:-** 8051 Assembly Language Programming - Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques.	**8**
3	**Microcontroller Applications:-** Interfacing of Keyboards - Interfacing of Display Devices - Pulse measurement - Analog to Digital and Digital to Analog Converter - Interfacing Hardware Circuit – Serial Data Communication - Network Configuration.	**8**
4	**Programmable Logic Controllers:-** Introduction - Principles of operation - PLC Architecture and specifications - PLC hardware components Analog & digital I/O modules, CPU & memory module - Programming devices - PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions - Manually operated switches - Mechanically operated a Proximity switches - Latching relays.	**9**
5	**Applications Of Programmable Logic Controllers:-** Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions - Data manipulating instructions, math instructions;	**7**

	Applications of PLC - Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.	

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25%	30%	25%	20%	0%	-

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. Muhammad Ali Mazdi, J.G.Mazdi & R.D.McKinlay "The 8051 Microcontroller& Embedded systems Using assembly & C ", 2nd Edition Pearson Education , Inc ,2006.
2. V. Udayasankara & M. S. Mallikarjunaswamy,"8051 Microcontroller, Hardware, Software & Applications", Tata McGraw Hill Education Pvt. Limited. New Delhi,2009.
3. Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson Learning, 2001.

Course Outcomes: After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	The students will learn the basic of microcontroller	18%
CO-2	The students will learn the programming in microcontroller.	21%
CO-3	To know about the different applications of microcontroller	20%
CO-4	The students will learn about the design of systems using Programmable Logic Controllers	23%
CO-5	To know about the different applications of Programmable Logic Controllers	18%

List of Experiments:

1. Write a program to add two 8-bit numbers stored in registers or internal/External memory locations.
2. Write a program to multiply two 8-bit numbers stored in registers or internal/External memory locations.

3. Write a program to multiply two 16-bit numbers.
4. Write a program to add block of data stored in internal/external memory locations.
5. Write a program to transfer block of data from internal memory locations to external memory locations.
6. Write a program to sort block of data in ascending or descending order.
7. Write a program to perform the following.
   a) Keep monitoring P1.2 until it becomes high.
   b) When P1.2 becomes high write value 45H on P0.
   c) Sent a high to low pulse to P2.3
8. A switch is connected to P1.7. Write a program to check the status of switch and perform the following:
   a) If switch = 0, send letter "N" to P2.
   b) If switch = 1, send letter "Y" to P2.
9. Write a program to generate 5 KHz pulse waveform of 50% duty cycle on pin 1.0 using timer 1 in mode 2.
10. Write a program to generate 1 KHz pulse waveform of 70% duty cycle on pin 1.0 using timer.
11. Write a program for the 8051 to transfer letter "A" serially, continuously.
12. Write a program to transfer the message "YES" serially. Do this continuously.
13. Program the 8051 to receive bytes of data serially, and put them in P1.
14. Develop, Simulate and Test Ladder diagram for
    a) A Door Bell Operation
    b) A Combination Lock
15. Develop, Simulate and Test Ladder diagram for Bottle Filling system.
16. Develop, Simulate and Test Ladder diagram for Car Parking system.
17. Develop, Simulate and Test Ladder diagram for stepper motor control in forward and reverse direction.
18. Develop and test PLC program for two axis Robotic arm for pick and place application.

Major Equipment:

- Computers, simulation software, PLCs, Input/ Output devices

List of Open Source Software/learning website:

- http://coep.vlab.co.in/?sub=33&brch=97
- http://www.plcdev.com/book/export/html/9
- http://www.plcmanual.com/
- http://literature.rockwellautomation.com/
- http://www.automation.siemens.com/
- http://nptel.ac.in/video.php