GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS (47)

ADVANCE MICROCONTROLLERS AND LOGIC CONTROLLERS

SUBJECT CODE: 2724702

M.E. 2ND SEMESTER

Type of course: Engineering Science

Prerequisite: NA

Rationale: This subject deals with fundamentals of controllersand its applications, which are useful for Mechatronics engineers.

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)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No	Contents	Teaching Hrs	Weightage (%)
1	Introduction to 16 bit microcontrollers: MSP430 series microcontrollers ,Timerand various modes of operation: up mode, down mode, continuous mode, Pulsewidth modulated wave generation, Capture mode of timers, Watch dog timers,Real Time Counters	**07**	**13**
2	Comparators : Operation and applications	**02**	**04**
3	Basics of Analog to Digital Conversion: Successive Approximation Registerarchitecture basics and its special function registers for operation inmicrocontrollers	**05**	**10**
4	Digital to analog converters in microcontrollers	**02**	**04**
5	Serial Interface Protocols: Synchronous Peripheral Interface (SPI) signals andmodes of serial communications with SPI interface, Universal AsynchronousReceiver Transmitter (UART) interface, Basics of Inter-Integrated Circuit (I2C)Bus, Operations of serial interface protocols handled in microcontrollers throughspecial function registers	**07**	**13**
6	Low power mode of operations in advance microcontrollers	**02**	**04**
7	PLC Basics: Introduction to PLC based systems, PLC hardware, PLC architecture, Input/Output modules, scan cycle and scan time	**04**	**08**
8	Basic PLC programming: Programming On/Off Inputs To Produce On-OffOutputs, Relation Of Digital Gate, Logic to Contact/Coil Logic, Creating LadderDiagrams From Process Control, Descriptions	**04**	**08**
9	PLC Functions: Timer functions, Counter functions, AnalogInput/Outputfunctions, number comparison functions, Arithmetic functions, Jump function,Data move function, close loop control using PLC, PID control	**15**	**28**
10	Programming of PLC using Mnemonic codes	**04**	**08**
	TOTAL	**52**	**100**

Reference Books:

1. MSP430 Microcontroller Basics by John H. Davies, Newness Publishers.
2. W. Bolton , "Programmable Logic Controllers", 4th Edition by, Newness/ ELSEVIERPublication.
3. John W Webb, Ronald A Reis, "Programmable Logic Controllers, Principles andApplications" Prentice Hall of India Pvt. Ltd.

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

- Understand alternative implementation of programmable automation.
- Evaluate PICs and other programmable devices as programmable devices and embedded controllers.
- Compare the operation, Functionality, Advantages and limitations of PLC simulators.

List of Practicals

1. Introduction to MSP430 Lauchpad and Programming Environment with program to work with Ports.
2. Use Timer in association with output mode to generate signals of different frequencies on Port pins.
3. Read Temperature of MSP430 with the help of ADC.
4. Use Timer to trigger ADC for reading sinusoidal signal.
5. Implement Full Duplex SPI communication between Master and Slave module.
6. Simulation of control of water level in a tank using PLC
7. Control of forward reverse operation of DC motor using PLC
8. Control of conveyor belt operation using PLC
9. Use of timers in PLC
10. Use of counters in PLC
11. Control of flash light operation using PLC
12. Analog Input/Output operations in PLC

Design based/open ended problem
Student may be given a task to exhibit the knowledge of the course studied during the academic year.

Major Equipment:

Hardware Tool to be used: MSP430 Launchpads, Digital Storage Oscilloscope, Function Generator
Software Tools to be used: IAR Embedded Workbench,Suitable programming and communicating software for PLCs
List of Equipments :PLC with different input and output modules, Power supply, Conveyor belt system etc.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.