GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3724702
Semester – II
Subject Name: Advance Microcontrollers and Logic Controllers

Type of course: Engineering

Prerequisite: N.A.

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

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 16 bit microcontroller: MSP430 series microcontrollers, Timer and various modes of operation, Watch dog timers, GPIO ports & programming, Low power operating modes	06
2	Comparators : Operation and applications, Basics of Analog to Digital Conversion: Successive Approximation Register architecture basics, Digital to analog converters in microcontrollers	06
3	Communication protocols: Synchronous Peripheral Interface (SPI) signals and modes of serial communications with SPI interface, Universal Asynchronous Receiver Transmitter (UART) interface, Basics of Inter-Integrated Circuit (I2C) Bus.	06
4	Introduction to 32-bit ARM microcontroller STM32F4xx, Architecture: Features of STM32F4XXDSC, Memory and bus architecture, Multilevel AHB bus matrix, Memory organization	05
5	PLC Basics: Introduction to PLC based systems, PLC hardware, PLC architecture, Input/output modules, scan cycle and scan time	03
6	Basic PLC programming: Programming On/Off Inputs to Produce On Off Outputs, Relation Of Digital Gate, Creating Ladder Diagrams From Process Control Descriptions	04

7	PLC Functions: Timer functions, Counter functions, Analog Input/output functions, number comparison functions, Arithmetic functions, Jump function, data move function, close loop control using PLC.	**10**
8	Programming of PLC using Mnemonic codes (Instruction List programming).	**02**

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
40	**30**	**15**	**5**	**5**	**5**

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

Course Outcomes:

After learning the course the students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand alternative implementation of programmable automation.	25
CO-2	Evaluate PLCs and other programmable devices as programmable devices and embedded controllers.	40
CO-3	Compare the operation, Functionality, Advantages and limitations of PLC simulators.	35

List of Experiments:

1. Programming the I/O ports of Msp430
2. Programming the timers of Msp430
3. Reading the internal temperature sensor of Msp430
4. Programming the ADC of Msp430
5. Programming the serial communication bus SPI of Msp430
6. Programming the serial communication bus I2C of Msp430
7. Simulation of control of water level in a tank using PLC
8. Control of forward reverse operation of DC motor using PLC
9. Control of conveyor belt operation using PLC
10. 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

Major Equipment:

Hardware Tool to be used: MSP430 Launch pads, 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.

List of Open Source Software/learning website:

NPTEL