Program : **Diploma in Electrical and Electronics Engineering**	
Course Code : **6031C**	Course Title : **Microcontroller & PLC**
Semester : **6**	Credits : **4**
Course Category : **Program Elective**	
Periods per week : **4 (L:3 T:1 P:0)**	Periods per semester : **60**

Course Objectives:

- To understand the basic knowledge in the operation, construction, application of microcontroller.

- To acquire basic knowledge in the application and programming of 8051 microcontroller.

- To understand the basic knowledge in the operation, construction, application of Programmable logic controllers.

- To provide basic knowledge in the application and programming of PLC.

Course Prerequisites:

Topic	Course code	Course name	Semester
Digital Electronics		Analog & Digital circuits	3
Basics of programming		Introduction of IT systems	1

Course Outcomes :

On completion of the course, the students will be able to:

COn.	Description	Duration (Hours)	Cognitive Level
CO1	Summarize the architecture. of 8051 microcontroller	13	Understanding
CO2	Develop programs to interface the 8051 microcontroller with internal and external peripherals	17	Applying

CO3	Illustrate the features, block diagram and applications of programmable logic controller.	13	Understanding
CO4	Build up programs to interface the programmable logic controller with internal and external peripherals.	15	Applying
	Series Test	2	

CO-PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	3						
CO3	2						
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcome	Description	Duration (Hours)	Cognitive level
CO1	**Summarize the architecture. of 8051 microcontroller**		
M1.01	Explain the features of 8051 microcontroller and compare it with a microprocessor.	2	Understanding
M1.02	Illustrate the block diagram of microcontroller and summarize the register structure of 8051 microcontroller.	4	Understanding
M1.03	Outline the internal and external memory organization of 8051 microcontroller.	4	Understanding
M1.04	Interpret the pin out diagram of 8051 microcontroller and list the applications of microcontroller.	3	Understanding

Contents:

Organization of a microprocessor based system (block diagram approach) - Introduction to 8051 microcontroller- major features of 8051-comparison between microprocessor & microcontroller.

Schematic block diagram of 8051-architecture of 8051-CPU- oscillator -interrupt control-on chip ROM-on chip RAM- I/O Ports-serial Port- timers/counters.

Register Structure-general Purpose registers -special Function registers (listing)- bit format of PSW, TMOD,TCON, IE, IP registers.

Memory Organisation-internal & external memory organisation.

Pin diagram of 8051-function of each pin- Interrupts in 8051(operation and priority) - Serial communication (elementary concepts only).

List the applications of microcontroller.

CO2	**Develop programs to interface the 8051 microcontroller with internal and external peripherals.**		
M2.01	Interpret the instruction format of 8051 microcontroller	2	Understanding
M2.02	Develop simple ALP for 8051 microcontroller	10	Applying
M2.03	Illustrate the block diagram and control word of 8255 PPI.	2	Understanding
M2.04	Build up circuits to interface 8051 microcontroller with external peripherals.	3	Applying
	Series Test – I	1	

Contents:

Basics of programming-assembly language- machine language-instruction format-addressing modes of 8051
Instruction set of 8051-types of instructions-data transfer- arithmetic-logic-branching and control (explanation of each instruction with example)- simple example programs-
8255 Programmable peripheral interface - block diagram - control word register format
Microcontroller interfacing- LED , Stepper motor, dc motor(Connection diagram only).

CO3	**Illustrate the features , architecture and applications of programmable logic controllers.**		
M 3.01	Summarize the importance of Programmable logic controllers.	3	Understanding
M 3.02	Compare conventional and PLC based control panels.	2	Understanding

M 3.03	Explain the block diagram of programmable logic controller.	6	Understanding
M 3.04	Summarize the applications of PLC and its selection criteria for typical applications.	2	Understanding

Contents:

Programmable Logic Controllers: Introduction to PLC- advantages- disadvantages - Importance of PLC

Advantages of PLC based control panel over conventional relay based control panel- comparison of conventional and PLC based control panel.

Block diagram of PLC based system - major components and their functions-Input and output devices (listing only)-Operation of PLC- scan cycle.

Applications of PLC- factors considered for selecting PLC for a typical application.

CO4	**Build up programs to interface the programmable logic controller with internal and external peripherals.**		
M4.01	Summarize the basics of PLC programming and classification.	2	Understanding
M4.02	Illustrate the ladder logic diagram and rules for writing programs.	2	Understanding
M4.03	Explain the instruction sets for a standard PLC and develop simple ladder programs.	5	Applying
M4.04	Build up programs to interface programmable logic controllers with external peripherals.	6	Applying
	Series Test – II	1	

Contents:

Basics of PLC Programming-Classification of PLC programming.

Ladder logic diagram - Rungs - inputs - outputs - power rails- rules for writing a ladder logic diagram.

Ladder programming (for a standard PLC) - Types of Instructions-basic input/output instructions -timer/counter instructions -math instructions- logical instructions- data handling instructions - comparison instructions- simple example programs.

Develop simple ladder programs to realize logic gates - lighting control circuits (stair case, go- down , traffic light)- motor starters(DOL- Star delta).

Text / Reference

T/R	Book Title/Author
T1	1. Kenneth, Ayala, 8051 Microcontroller Architecture Programming and Application, PHI Learning, New Delhi,ISBN: 978-14018615822.
R1	Mazidi, Mohmad Ali; Mazidi, Janice Gelispe; MckinlayRoline D., The 8051 Microcontroller and Embedded system, Pearson Education, Delhi, ISBN 978-81775890303.
R2	Pal, Ajit, Microcontroller Principle and Application, PHI Learning, New Delhi, ISBN13: 978-81203-4392-44.
R3	Deshmukh, Ajay, Microcontroller Theory and Application, McGraw Hill., New Delhi, ISBN- 97800705859595.
R4	Kamal, Raj, Microcontroller Architecture Programming, Interfacing and System Design, Pearson Education India, Delhi, ISBN: 97881317599056.
R5	Mathur; Panda, Microprocessors and Microcontrollers, PHI Learning, New Delhi, ISBN:978-81203-5231-57
R6	Krishna Kant, Microprocessors and Microcontrollers: Architecture programming and System Design, PHI Learning New Delhi, ISBN: 978 -81-203- 4853- 0.
R7	Muhammed Ali Mazeedi, Rolin D McKinlay & Danny Causey. PLC Microcontroller and Embedded Systems: Using Assembly and C Pearson Prentice Hall.
R8	Muhammed Ali Mazeedi . AVR Microcontroller and Embedded Systems: Pearson Education Ltd.

Online Resources

Sl No	Website Link
1	https://nptel.ac.in/courses/117104072/#
2	https://nptel.ac.in/courses/108105102/
3	https://www.youtube.com/watch?v=iXSXIJn_Xwc
4	https://www.youtube.com/watch?v=GPz_mR7Flas
5	https://www.youtube.com/watch?v=Yz6UfvkNe5M
6	https://www.youtube.com/playlist?list=PL0E131A78ABFBFDD0