GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: MICROPROCESSOR AND CONTROLLER APPLICATIONS
(COURSE CODE: 3350904)

Diploma Programme in which this course is offered	Semester in which offered
ELECTRICAL ENGINEERING	5th Semester

1.   RATIONALE

In modern process industries and power stations use of microprocessor, microcontroller, PLC is very common in order to control, monitor and process various parameters and data. Microprocessor and Microcontroller is specialized and essential field where the industries need highly skilled manpower. Hence this course is designed to develop skills to maintain microprocessor based system and the programming practices will develop the skills to indigenous real time applications.

2.   LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in students so that they are able to acquire following competency:

*   **Maintain Microprocessor, Microcontroller, PLC and SCADA-based   electrical systems**

3.   COURSE OUTCOMES

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

i.   Distinguish Micro processors, microcontrollers and PLC based control systems.
ii.   Maintain microprocessor-based systems.
iii. Maintain microcontroller-based systems.
iv.   Maintain PLC-based systems.
v.   Maintain SCADA-based systems.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
4	0	2	6	70	30	20	30	150

Legends: **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5.   COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (outcomes in Cognitive Domain)	Topics and Sub-topics
UNIT – I Control Systems Components	1a. Describe basic control actions 1b. Differentiate open and closed loop of control systems	1.1 Role of control system in instrumentation 1.2 Open and close loop control system, types and Block diagram
	1c. Explain servomechanism and regulator circuits	1.3 Servomechanism and regulators with suitable examples
	1d. Define the following: Derivative, Integral control, Proportional derivative (PD), Proportional integral (PI), P Proportional integral and Derivative (PID) control	1.4 Basic control actions - On-off, Proportional, Derivative, Integral control, Proportional derivative (PD), Proportional integral (PI), P Proportional integral and Derivative (PID) control
	1e. Explain working principle & application of basic control system components	1.5 Basic control system components –AC/ DC Servo motor, AC/ DC Tacho generator, Stepper motor and Synchro
Unit– II Basics of Microprocessor	2a. Describe functions of each block of generalize microprocessors 2b. List Advantages and disadvantages of microprocessor control	2.1 Introduction to microprocessor 2.2 Advantages and disadvantages of microprocessor control
	2c. Explicate microprocessor architecture with the help of suitable block diagram 2d. Describe memory organization of 8085 microprocessor. 2e. Explain importance of timing and control section	2.3 Structure of micro processor, Generalized architecture of microprocessor, Functions of each block 2.4 Functional block diagram of 8085 microprocessor with pin diagram, logical block diagram of 8085 microprocessor-Registers, ALU, memory organization, decoder, serial control section, interrupt section, timing and control section
	2f. Classify instruction set of 8085 microprocessor 2g. Develop Basic assembly language program using basic instruction for the given application. 2h. Explain following with the help of timing diagram : machine cycle, T-state	2.5 Assembly language Programming of 8085, Addressing Modes, Instruction classification, Instruction formats 2.6 Basic Assembly Language programming (only simple arithmetic operations-addition,

Unit	Major Learning Outcomes (outcomes in Cognitive Domain)	Topics and Sub-topics
		subtraction)
Unit– III Basics of Microcontroller 8051	3a. Compare microcontrollers and microprocessors 3b. Explain 8051 architecture with block diagram 3c. Describe the function of each pins of 8051 chip 3d. Explain registers and their functions of 8051	3.1 Microcontrollers and microprocessors 3.2 Pin diagram of 8051 microcontroller 3.3 Internal RAM, ROM and Special function Registers in 8051chip
	3e. Program the I/O ports for data transfer 3f. Program the timer and counter for required time delay generation. 3g. Program the I/O ports for interfacing external memory	3.4 I/O ports 3.5 Counters and Timers 3.6 Interfacing with external memory
Unit–IV Microprocessor and Microcontroller Applications	4a. Compare various types of semiconductor memories 4b. Explain interfacing of microprocessor with memory 4c. Describe function of 8255 with the help of suitable block diagram	4.1 Different types of memories: ROM, RAM, PROM, EPROM, EEPROM 4.2 Schematic diagram of memory chips decoder, memory interfacing. 4.3 Memory I/O data transfer scheme for 8255.
	4d. Describe use of microprocessor/microcontroller for switch and LEDs control. 4e. Describe use of microprocessor/microcontroller for temperature control of furnace 4f. Describe use of microprocessor/microcontroller for Traffic light controller 4g. Describe use of microprocessor for SCR firing angle control 4h. Draw block diagram explaining Data acquisition system	4.4 Interfacing of switches and LEDs 4.5 Simple applications of microprocessor and Microcontroller for temperature control of furnace, Traffic light control and SCR firing angle control using micro processor, Data acquisition system.
Unit-V Programmable Logic Controller And SCADA	5a. Explain working of each module of PLC 5b. State the criteria for the selection of PLC for the given application	5.1 PLC:CPU, I/O modules, bus system, power supplies and remote I/Os, counter, timer 5.2 Different PLC's available in market 5.3 Selection of a PLC
	5c. Describe SCADA functions	5.4 SCADA- Concept and Application

6.   SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Control Systems components	10	04	04	04	12
II	Basics of Microprocessor	12	03	04	08	15
III	Basics of Microcontroller 8051	12	03	06	06	15
IV	Microprocessor and Microcontroller Applications	12	02	07	06	15
V	Programmable Logic Controller and SCADA	10	04	03	06	13
Total		56	16	24	30	70

Legends: R = Remember U = Understand; A = Apply and above levels (Bloom's Revised 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.

7.   SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills *(outcomes in psychomotor and affective domain)* so that students are able to acquire the competencies/course outcomes. Following is the list of practical exercises for guidance.

*Note: outcomes in psychomotor domain are listed here as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty members should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Hrs. required
1	I	Control angular displacement using Synchro.	2
2	I	Regulate speed of DC motor using tacho generator.	2
3	II	Develop assembly language program for arithmetic addition	2

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Hrs. required
		of two numbers using µP 8085 kit.	
4	II	Develop assembly language program for arithmetic subtraction of two numbers using µP 8085 kit.	2
5	II	Develop assembly language program for arithmetic multiplication of two numbers using µP 8085 kit.	2
6	III	Interface seven segment LED display with 8051 kit.	
7	III	Interface LCD display with 8051 kit.	
8	III	Control speed of stepper motor using 8051 kit.	
9	IV	Interface programmable device like 8255 with µP 8085	2
10	IV	Interface switches and LEDs using µP 8085	2
11	IV	Control temperature using the 8085 application module	2
12	IV	Use µP 8085 for SCR firing angle control.	2
13	IV	Control Traffic light system using µP 8085	2
14	V	Use arithmetic function of PLC for a typical application.	2
15	V	Use timer function of PLC for a typical application(introduce delay).	2
		Total	**30**

8.   SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:
  i.   Build various trainer kits for control system applications.
 ii.   Interface microprocessor and microcontroller with external devices for developing mini project.
iii.   Prepare flow chart and assembly language programming for basic arithmetic operations.

9.   SPECIAL INSTRUCTIONAL STRATEGIES (if any)
  i.   Industrial visit to process industries.
 ii.   Programming practice on 8051, 8085 simulators

10.   SUGGESTED LEARNING RESOURCES

A)   List of Books

S. No.	Title of Book	Author	Publication
1.	Microprocessor Architecture, Programming and Applications with 8085	Gaonkar, Ramesh S.	Penram International Publishing (India)Pvt.Ltd. New Delhi (5th Edition)
2.	Fundamentals of Microprocessors and Microcontrollers	Ram, B.	Dhanpat Rai Publications, New Delhi
3.	Microprocessors and Interfacing Programming and Hardware	Hall, Douglass V.	TMH publication, New Delhi, (latest Edition)
4.	The 8051 Microcontroller Architecture, Programming and Applications	Ayala, Kenneth J.	Penram International Publishing (I) Pvt. Ltd. New Delhi

S. No.	Title of Book	Author	Publication
5.	The 8051 Microcontroller and Embedded Systems using Assembly and C	Ali, Muhamad Mazidi, Janice Mazidi Gillispie, Rolin D. Mckinleay	PHI Learning, New Delhi, (latest Edition)
6.	Programmable Logic Controllers And Applications	Webb, John W Ronald Reis. A.	Prentice Hall of India, New Delhi, (latest Edition)
7.	Control Systems Engineering	Nagarath I. J., Gopal M.	New Age Publishers, New Delhi, (latest Edition)

B) List of Major Equipment/ Instrument with Broad Specifications
  i.   Trainer kit of speed control and speed regulation of DC motor using Techo Generator.
  ii. Trainer kit of Synchro transmitter and receiver.
  iii. Microprocessor 8085 kit with necessary accessories.
  iv. 8255 interfacing kit.
  v.   Microcontroller 8051 kit with necessary accessories.
  vi. Kit for add on cards for performing different applications of PLC.
  vii. Add on cards for interfacing different types of inputs and out puts.
  viii. Power supply for above kits and applications

C) List of Software/Learning Websites
  i.   www.keil.com/
  ii. www.allaboutcircuits.com
  iii. www.nmbtc.com
  iv. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/Course_home1_1.htm

11.   COURSE CURRICULUM DEVELOPMENT COMMITTEE

  Faculty Members from Polytechnics
- **Prof. J C Gadani,** Lecturer in Electrical Engineering, C U Shah Polytechnic, Surendranagar.
- **Prof. B R Shrotriya,** Lecturer in Electrical Engineering, Government Polytechnic, Ahmedabad
- **Prof. H. I. Joshi**, Lecturer in Electrical Engineering, Government Polytechnic, Ahmedabad.
- **Prof. K. K. Kansara,** Lecturer in Electrical Engineering, NMGPI Ranpur.

  Coordinator and Faculty Members from NITTTR Bhopal
- **Dr.(Mrs.) Anjali Potnis**, Assistant Professor, Department of Electrical and Electronics Engineering