GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3164101
Semester – VI
Subject Name: Automation System Design

Type of course: Professional Core Course

Prerequisite: Zeal to learn the course

Rationale: Automation system design is one of the core areas in the field of automation. The concepts of automation design are vitally important to the robotics and automation engineer

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)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Fundamental Concepts Of Industrial Automation** : Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.	9
2	**Transfer Lines And Automated Assembly:** General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines. AS/RS, RFID system, AGVs, modular fixturing. Flow line balancing.	10
3	**Design Of Mechatronic Systems:** Stages in design, traditional and mechatronic design, possible design solutions. Case studies-pick and place robot, engine management system.	8
4	**Programmable Automation:** Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.	9
5	**Design For High Speed Automatic Assembly:** Introduction, Design of parts for high speed feeding and orienting, high speed automatic insertion. Analysis of an assembly. General rules for product design for automation	9

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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
20%	**25%**	**20%**	**20%**	**15%**	-

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. Mikell P Groover, "Automation Production Systems and Computer- Integrated Manufacturing" Pearson Education, New Delhi, 2001.
2. Bolton W, "Mechatronics", Pearson Education, 1999 .
3. Mikell P Groover, "Industrial Robots – Technology Programmes and Applications", McGraw Hill , New York, USA. 2000.
4. Steve F Krar, "Computer Numerical Control Simplified", Industrial Press, 2001.
5. Joffrey Boothroyd, Peter Dewhurst and Winston A. Knight, "Product Design for manufacture and Assembly", CRC Press, 2011

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

Sr. No.	CO statement	Marks % weightage
CO-1	Knowledge of industrial automation by transfer lines and automated assembly lines.	20%
CO-2	Ability to design an automated systems.	25%
CO-3	Understanding of automated controls using pneumatic and hydraulic systems.	15%
CO-4	Ability to understand the electronic control systems in metal machining and other manufacturing processes.	25%
CO-5	To understand advancement in hydraulics and pneumatics systems	15%

List of Experiments:

1. Co-ordinated motion of multiple pneumatic actuators in a desired sequence using Cascade method.
2. Integration of fringe condition modules in multiple actuator pneumatic systems.
3. Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using hard – wire programmed control systems.
4. Co-ordinated motion of multiple actuator, electro – pneumatic systems in a desired sequence using

PLC.

5. Interfacing of an LVDT with a PC for monitoring the displacement of machine slide and raising an alarm if the displacement exceeds specified limit.
6. Inspection using Machine vision System.
7. Control of speed, direction and number of revolutions of a stepper motor using PC.
8. Development of an obstacle avoidance robot using servo motors, ultrasonic and touch sensors.

Major Equipment :

1. Basic Pneumatic Trainer Kit with manual and electrical controls.
2. 8051 – Microcontroller kit with stepper motor and drive circuit.
3. Stepper motors with PC interface cards.
4. Servo motor with PC interface card.
5. Ultrasonic, touch and non contact sensors.

List of Open Source Software/learning website:

PNEUMOSIM software, LABVIEW software.