GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Instrumentation and Control Engineering

Subject Name: **Control System Components**
Subject Code: **161703**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Practical (I)**
3	0	0	3	70	30	50

Part – I Process Control Loop Devices

Sr. No	Course Content	Total Hrs.
1.	**PROCESS PARAMETER TRANSMITTER** • Pneumatic transmitter, Electronic Transmitter • Intelligent Transmitter	03
2.	**CONTROL VALVES** • Valve Terminology, Valve Capacity, Valve Rangeability • Body Design, Globe Bodies, Angle, Needle, Ball, Eccentric Rotating Plug, Butterfly, Diaphragm, Pinch, Drag • Flow Characteristic, Trim Design, Mechanical Feature • Actuator, Pneumatic Types, Electric Types, Electro Hydraulic Types • Positioner, Pneumatic, Electro Pneumatic, Positioner Features & Accessories, Control Valve Accessories.	04
3.	**CONTROL VALVE SELECTION** • Function In The System, Pressure Drop Requirements For Good Control, Capacity Requirements, Design Rate, Maximum Rate, Minimum Rate, Valve Rangeability • Choosing The Flow Characteristic, Choosing The Body Design, Sliding Gate, Double Port Globe, Single Port Globe, Three Way Globe, Angle, Diaphragm, Butterfly, Pinch, Vee-Ball • C_V Comparison of Body Design, Body Materials, End Connections, Single Seat V/S Double Seat Constructions, Reduced Capacity Trim • Selection of Actuators, Spring & Diaphragm, Piston or Cylinder, Electro Hydraulic, Electric, Use of a Valve Positioner, Selection of Other Mechanical Features, Hardened Trim, Seals, Extension Bonnets, Packing & Lubrication, Guiding, Soft Seats, Booster Relays, Handwheels, Control Valve Manifolds • Split Ranging Control Valves, Valve Noise Problems, Mechanical, Cavitations, Aerodynamic • Safety Considerations, Special Purpose Valves, Low Flow Applications, High Pressure Drop Applications.	05

4.	**CONTROL VALVE SIZING** • Definition of C_V, Basic Equations, Pressure Drop, Constant Pressure Systems • Variable Pressure Systems, Valve Selection Guidelines	03
5.	**PRESSURE RELIEVING DEVICES** • Purpose, Definition of Terms, Types & Function of Relieving Devices, Relief Valves, Safety Valves, Safety Relief Valves, Pilot Operated Relief Valves, Rupture Discs,	04
6.	**PARAMETER SENSITIVE SWITCHES** • Flow switches, Level switches, Temperature switches and thermostats, Pressure and differential pressure switches • Proximity switches and limit switches	04

Part – II Devices used for Robotics and CNC

Sr. No	Course Content	Total Hrs.
1.	**Relay And Contactors** • Introduction, • Classification of Relays : AC And DC Relays, Electromechanically and Solid State Relays, General Purpose Relays, High Speed Relays, High Voltage Relays, Power Relays, Overload Relays, Power Systems Protection, Frequency Sensitive Relays, Latching Relays, Mercury Operated Relays, Plunger Relays, Miniature Relays, Rotary Relays, Radio Frequency Relays, Sensitive Relays, Snap Action Relays, Telephone Relays, Time Delay Relays, Optoelectronic Relays, Vacuum Relays • Relay Circuits, Construction of The Relay, Logic Relays, Optoelectronic Relay • Relay Problems And Remedies, Relay Race, Actuation and Release Time • Characteristics of Electromechanical Relays, Dynamic Characteristics of Reed Relays, Merits And Demerits of Reed Relays • Contactors : Introduction, Terms and Definitions, Contactor starters for Motor, Rated characteristics of contactors, Tests on Contactors, Application	06
2.	**Motors: DC Servo, Stepper, Induction** • DC Servo : Introduction, Transfer Function of DC Servomotor, Transfer Function of Field Controlled DC Servomotor, Armature Controlled DC Servomotor • Steeper Motor : Introduction, Permanent Magnet Stepper Motor, Variable Reluctance Type Stepper Motor, Hybrid Stepper Motor, Disc Magnet Stepper Motor, Application of Stepper Motor, Drive Circuits for Stepper Motor • Induction Motor : Construction and Theory of Operation of Induction Motor	06

3.	**Gear:** • Introduction, Type of Gears, Gears for Load Matching, Design of a Gear Train, Backlash in Gears, Design of Muli-Mesh Gear Train	03
4.	**Cams And Followers:** • Introduction, Components of Cam, Type of Cams, Types of Followers, Classification of Cams According to Construction, Cam Motions, Cam Terminology, Drawing a Cam Profile, Cam as a Mechanical Function Generator, 3-D Cam	04

Text Books:

1. Applied Instrumentation in the Process Industries (Vol. – I) by W. G. Andrew & H. B. Williams; Pub: Gulf Publishing
2. Control Systems Components by M. D. Desai; Pub: Prentice Hall India
3. Switch Gear Protection and Power Systems by Sunil S. Rao; Pub: Khanna

Reference Books:

1. Instrument Engineers' Handbook (Vol. – I) by B. G. Liptak; Pub: CRC Press