GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: V

INSTRUMENTATION AND CONTROL ENGINEERING

Subject Name: **Industrial Control Systems (Institute Elective-II)**
Subject Code: **151704**

Teaching Scheme				Evaluation Scheme		
Theory	**Tutorial**	**Practical**	**Total**	**University Exam (Theory) (E)**	**Mid Sem Exam (Theory) (M)**	**Practical (I)**
4	0	2	6	70	30	50

Sr. No.	Course content
1.	**Introduction to Process Control:** Introduction, Evolution of Process Control Concept , Definition and Types of Processes Benefits, Difficulties and Requirements of Process Control Implementation , Classification of Process Variables, Open-loop vs Closed Loop control, Servo vs Regulator Operation of Closed Loop System, Feedback and Feedforward Control Configuration, Steps in Synthesis of Control System
2.	**Process Dynamics and Mathematical Modeling:** Introduction, Aspects of the process dynamics, Types of dynamic processes, Common systems, Mathematical Modeling, Types and Uses of mathematical modeling, Examples of mathematical modeling
3.	**Theory of Controllers:** Introduction, Classification of Controllers, Controller Terms, Discontinuous Controllers, Continuous Controllers
4.	**Closed-loop Response:** Introduction, Transfer functions of closed loop, Proportional controller in closed loop, Integral controller in closed loop, Proportional-integral controller in closed loop, Proportional-derivative controller in closed loop, Proportional-integral-derivative controller in closed loop, Integral windup and Anti-windup, Comparison of various controller configurations, Controller Tuning
5.	**Electronic Controllers and Direct Digital Control:** Introduction, Electronic Discontinuous controller, Electronic proportional controller, Electronic Integral controller, Electronic Derivative controller, Electronic Proportional Integral controller, Electronic Proportional Derivative controller, Electronic Proportional Integral Derivative controller, Components and Working Of DDC, Benefits of DDC, Digital controller realization, Discrete domain analysis

6.	**Control Valves:** Introduction, Common abbreviations in the valve industry, Definitions of terms associated with valves, Control Valve characteristics, Valve classifications & types, Selection criteria for control values
7.	**P&I Diagram:** Introduction, Definitions of Terms Used in P & I Diagrams, Instrument Identification, Examples of P & I Diagrams
8.	**Cascade, Feedforward, and Ratio Control:** Introduction, Cascade Control, Feedforward Control, Feedforward- Feedback control configuration, Ratio Controller
9.	**PLC, DCS and SCADA System:** Introduction, Basic parts of a PLC, Operation of a PLC, Basic symbols used in PLC realization, Difference between PLC and Hardwired systems, Difference between PLC and computer, Relay logic to ladder logic, Ladder commands, Examples of PLC ladder diagram realization, PLC timers, PLC counters and examples, Classification of PLCs, History of DCS, DCS concepts, DCS hardware & software, DCS structure, Advantages and disadvantages of DCS, Representative DCS, SCADA, SCADA hardware & software

Reference Books:

1. Process Control: Principles and Applications by Surekha Bhanot; Oxford University Press.
2. Process Control Instrumentation Technology by C. D. Johnson; Prentice Hall India.