GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Instrumentation and Control Engineering

Subject Name: **Instrumentation System**
Subject Code: **161701**

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	Total Hrs.
1.	**Instrument Project Control:** • Document to be produced, Process Flow Sheets, Mechanical Flow Sheets, Instrument Index Sheets, Instrument Specification Sheets, • Loop Wiring Diagram, Panel Drawings And Specifications , Plot Plans, Installation Details, • Special Drawings, Purchase Requisitions, Process Information, Instruments Specifications & Standards, Piping Specifications, • Electrical Specifications, Bid Documents, Project Procedures, Project Schedules, Equipment Information, Vendor Drawing, Work Coordination, • Project Manager, Process Engineer, Equipment Engineer, Piping Design Supervisor, Purchasing & Expediting, Job Execution, Planning Hints, Scheduling, Specifying Instruments, Vendor Selection, Shipping, Receiving & Storing Instruments, • Installation & Checkout, Project Check list, Design Consideration, Equipment Delivery, Conclusion.	9
2.	**Engineering Design Criteria:** • Pneumatic V/S Electronics, Cost, Dependability, Safety, Maintenance, Process Control Requirements, • Control Centers, Location, Layout, Electrical Classification, Utilities, Future & Spare Capacity, Specification For Various Measurement & Control Groups,	8

	• Flow Measurement, Level Measurement, Temperature Measurement, Pressure Measurement, • Control Valves, Control Panels, Analytical Instruments, Transmission Systems, Pneumatic, Electronic, Identification, • Process Connections, Location Of Taps, Sealing Instrument From The Process, Manifolds & Gauge Valves, Mounting Instruments, Selection Of Units, Charts, Ranges, Instrument Identification, Winterizing, Construction Materials, Packaged Equipment Systems, • Electrical Safety, National Electric Code, Purging & Pressurizing Enclosures, Intrinsic Safety.	
3.	**Selecting Measurement Methods:** • Flow Measurements, Differential Meters, Rotameters, Magnetic Meters, Turbine Meters, Target Meters, Vortex Meters, Positive Displacement Meters, Primary Elements For Differential Meters, • Level Instruments, Displacement Types, Differential Pressure Types, Capacitance Types, Ultrasonic Types, Radiation Types, Miscellaneous Type, • Pressure Instruments, Manometers, Bourdon Elements, Bellows Elements, Diaphragm Elements, Strain Gauges, Chemical Seals, Temperature Instruments, Filled Systems, • Thermocouples, Resistance Bulbs, Thermistors, Radiation Pyrometer, Optical Pyrometers, Bimetal Thermometers, Miscellaneous Types, Temperature Switch Selection.	6
4.	**Control Centers and Panels:** • Control Room Layout, • Electric Power Systems, Instrument Power Requirements, Instrument Power Distribution, Control Room Lighting, Communication Systems, Electrical Classifications, • Control Panel Types, Flat face Panels, Breakfront Panels, Consoles, Comparison Of Panel Types, Panel Layout, Face Layout, Rear Layout, Auxiliary Racks & Cabinets, Panel Piping & Tubing, • Air Headers, Tubing Runs, Panel Wiring, Nameplates & Tags, Painting, Graphic Displays, • Panel Bid Specifications, Panel Inspections, Human engineering, Panel enclosure standard, Control center inspection,	9

5.	**Instrument Air Systems:** • Sizing criteria, pressure level, air supply source, • Compressor systems, positive displacement compressors, dynamic compressors, non lubricated compressor, compressor cooling, compressor control, • Oil removal, general considerations, dryers, desiccant type, refrigeration type, necessity for dryers, • Design guideline criteria, distribution systems, general layout, • Header & branch sizing, materials, take off & valving, control room air supply, case purging for electrical area classification.	9
6.	**Construction & Startup:** • Organizing, Documents Required, Planning The Schedule, Cost Control, Ordering & Receiving Equipment & Material, Purchase Orders, Material Status, Storage Of Equipment & Material, • Installing Instruments Systems, Typical Installation Procedures, Co-Ordinating Work Among Crafts, • Check List Of Good Installation Practices, Calibration, Testing, Process Connections, Pneumatic Lines, Electrical, Loop Check, • Typical Flow Transmitter Check Out Procedure, Typical Temperature Transmitter Check Out Procedure, Typical Control Valve Check Out Procedure, Startup, Placing Instruments In Service, Tuning Control Loops, Evaluating Process Upsets & Disturbances, • Repairing Or Replacing Defective Equipment, Special Equipment, Conclusion.	7
7.	**Engineering Graphical Symbols:** • Introduction, Flow Sheet Symbols, Flow Sheet Codes & Line Symbols, Instruments Symbols & Identification, Graphic Symbols For Distributed Control / Shared Display Instrumentation, • Logic And Computer Systems, Graphic Symbols For Logic Diagram, Static Switching Control Devices, Graphical Symbols For Pipe Fittings, Valves & Piping, Graphic Symbols For Fluid Power Diagrams.	4

8.	**Typical Installation Details:** • Introduction, Flow, Level, Pressure, Temperature, • Control Valves, Miscellaneous, Instrument Supports.	4

Text Books:

1. Applied Instrumentation in the Process Industries (Vol. - II) by W. G. Andrew & H. B. Williams; Pub: Gulf Publishing
2. Instrument Engineers' Handbook (Vol. – I) by B. G. Liptak; Pub: CRC Press

Reference Books:

1. Encyclopedia of Instrumentation and Control by D. M. Considine; Pub: Krieger Publication Co.
2. Process Control Principles and Applications by Surekha Bhanot; Pub: Oxford University