GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
PROJECT ENGINEERING & MANAGEMENT
SUBJECT CODE: 2181704
B.E. 8th SEMESTER

Type of course: Core Engineering

Prerequisite: Sensor/ transducer, field transmitters, converters, final control element, basic instrumentation symbols, process control modes and techniques, Computer based control system architecture

Rationale: For Instrumentation and Control engineer it is very important to know the kind of standard documents available in manufacturing processes along with necessary design, test and calibration procedure. This subject will help student to understand the project procedures and various stages of project like planning, estimation, designing, installation, testing, calibration and commissioning of instruments and systems. Last topic of the syllabus will introduce student with quality manufacturing process.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	TheoryMarks			PracticalMarks			
				ESE (E)	PA(M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

S. N.	Content	Total Hrs	% Weigh tage
1	**Introduction to project management** Definition of project purpose - Scope, time, quality and organization structure. Basic and detailed engineering: Degree of automation, Project S curves, manpower considerations, inter-department and inter-organization interactions, Multi agency interaction. Types of projects and types of contracts e.g. EPC, BOOT etc.	04	08
2	**Project management functions** Controlling, directing, project authority, responsibility, accountability, interpersonal influences and standard communication formats, project reviews. project planning and scheduling, life project engineering and management cycle phases, the statement of work (SOW), projects specifications, bar charts, milestones, schedules, work breakdown structures, cost breakdown structures and planning cycle.	04	08
3	**Project cost and estimation** Types and estimates, pricing process, salary and other overheads, man-hours, materials and support costs. program evaluation and review techniques (PERT) and critical path method (CPM), estimating activity time and total program time, total	04	08

	PERT/CPM planning crash times, software‘s used in project management.		
4	**Instrument Project Control** **Project engineering documents and drawing:** Process flow sheets, Mechanical flow sheets, Instrument index sheets, loop wiring diagram, panel drawings and specifications, plot plans, installation details, special drawings, purchase requisition, other documents. **Information required:** Process information, Instrument specifications and standards, piping specifications, Electrical specifications, bid documents, Project procedure, project schedule, Equipment Information, Vendor drawing **Work coordination**: Project manager, process engineer, equipment engineer, Piping design supervisor, Structural, architectural and civil, Electrical, purchasing and expediting and others **Planning hints and Project check list**	08	15
5	**Engineering Design criteria** **Pneumatic versus electronics system, Control centers, Future and spare capacity** **Specifications for various measurement and control groups:** Flow, Pressure, Level, Temperature, Control valves, Control panels, Analytical instruments **Transmission systems:** Pneumatic & Electronic – Materials, Distribution, Terminations and Identification **Process connections –** Take-offs and Piping, Location of taps, Sealing instruments from process, Manifolds and gage valves **Miscellaneous Design Criteria:** Mounting instruments, Selections of units, charts, ranges; Instrument identification, Winterizing, Material of construction, Package equipment systems **Electrical safety:** NEC code, Purging and pressurization, Enclosures, Intrinsic safety	08	15
6	**Selecting Measurement Methods and Control valves** **Flow Instruments:** Differentials meters, Rotameters, Magnetic meters, Turbine meters, Target meters, Vortex meters, Positive displacement meters, Primary elements for Differential meters **Level Instruments:** Displacement type, Differential pressure type, Capacitance type, ultrasonic types, Radiation types, and Miscellaneous type **Pressure Instruments:** Manometers, Bourdon elements, Bellows, Diaphragm, Strain gauges, Chemical seals **Temperature Instruments:** Filled systems, thermocouples, RTDs, Thermister, Bimetallic thermometers, Optical and Radiation pyrometers, Miscellaneous types: Pyrometric cones, Temperature sensitive materials, Quartz crystal thermometers, Temperature switch selection **Control valve Selection:** Pressure drop requirement, capacity requirement, Valve rangeability, Choosing the flow characteristic, Choosing body design, Single seat versus Double seat construction, Selection of actuators, Use of valve positioner, Selection of other mechanical features, Manifolds, Split ranging control valve, Valve noise problem, Special purpose valves	15	29
7	**Construction and Start up** **Organizing:** Documents, schedule, cost control **Ordering and Receiving equipment and Material:** Purchase orders, Material status, storage **Installing instrument systems:** Procedures, Coordination, Good installation practices Calibration **Testing:** Process connections, Pneumatic lines, Electrical **Loop checking:** Flow transmitter , Temperature transmitter, Control valve,	06	12

	Miscellaneous checks **Startup:** Placing instruments in service, Tuning loop controls, evaluating process upsets and disturbances, Repairing or replacing defective equipment, special equipment, Additional control		
8	**Introduction to International quality systems - ISO 9000** Quality management practices worldwide, certifying agencies. Quality, customers and ISO 9000 ISO 9000- A management overview ISO 9000- Quality system Inspection, Test standards and Calibration	03	05

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
14	**14**	**14**	**14**	**14**	**0**

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.

Text Books

1. Applied Instrumentation in Process Industries by W.G. Andrew and H.B. Williams, *Gulf Professional Publishing, 3rd ed. 2008*, ISBN-13: 978-0872010475.

2. Project management: A systems approach to planning scheduling and controlling by Harlod Kerzner and Van Nostrand, *John Wiley & Sons, 11th ed., 2013,* ISBN: 978-1-118-02227-6.

3. Successful Instrumentation & Control Systems Design, by Michael D. Whitt, 2nd Edition, 2012, *ISA,* ISBN: 978-1-93600-745-5.

4. ISO- 9000 Concepts, Methods & Implementation by Tapan B. Bagchi, *Wheeler pub., 1995.* ISBN-81-85814-24-4

5. ISO- 9000 Guidelines for the chemical & process industries : By ASQC (American Society of Quality Control) , ISBN-13: 978-0873893527, www.asq.org

Reference Books:

Instrument Engineers Handbook: Process Control by Bela G Liptak, CRC Press, 3rd ed., 1995, ISBN-13: 978-0801982422.

Course Outcome:

After learning the course the students should be able to:

CO1 estimate different types of projects and its management.
CO2 design different documents and evaluate tools to be used.
CO3 prepare different instrumentation documents.

List of Experiments:

1) Study of standards and symbols (ANSI / ISA Std.)
2) Study of specification sheets.
3) Development of Process & Instrument diagram of typical process.
4) Development of Loop Wiring diagram.
5) Cable scheduling.
6) GA and mimic diagram of a control panel.
7) Development of Bar charts for certain project.
8) Prepare the cost estimation sheet for the project under consideration
9) Hands on experience for engineering management software such as MS Project, Primavera, etc.
10) Designing of control valve for liquid/gas/vapor applications as per standard
11) Design of orifice plates for liquid/gas/vapor as per ISO 5167
12) Operating range calculation for transmitters considering different applications.

Design based Problems (DP)/Open Ended Problem:

Consider a typical manufacturing process. For that start from estimation to commissioning stage of instrumentation system, prepare detail report comprising of sample design calculations, justification for selection of instruments and systems, work flow diagram and manpower estimation, necessary engineering diagrams, test and operating procedure, etc.

Major Equipment:

Field instruments (includes sensor/ transducers, transmitters, single loop controllers, Converters, control valve, etc.) for flow, level, pressure, temperature parameters.

Test and calibration instruments at least for temperature and pressure parameters.

List of Open Source Software/learning website:

http://vlab.co.in/
www.isa.org
http://nptel.ac.in/video.php
http://www.idc-online.com/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.