SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology

Bachelor of Technology (B. Tech.)

Instrumentation and Control

B. Tech.Year- III Semester – VII

Subject Name: Instrumentation Project Engineering **Subject Code: BTIC12701**

Type of course: Engineering Science Course

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

List of Courses where this course will be prerequisite : Not applicable

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				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
2	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory non-credit course

Content:

Sr. No.	Content	Total Hrs	Module Weightage
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.	2	7%
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.	3	10%
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 PERT/CPM planning crash times, software‘s used in project management.	3	10%
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	8	27%

	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**		
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 gauge 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	**8**	**27%**
6	**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, and Testing of Process connections, Pneumatic lines, Electrical **Loop checking:** Flow transmitter , Temperature transmitter, Control valve, Miscellaneous checks **Startup:** Placing instruments in service, Tuning loop controls,	**4**	**13%**

	evaluating process upsets and disturbances, Repairing or replacing defective equipment, special equipment, Additional control		
7	**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	**2**	**6%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10 %	**10 %**	**20 %**	**25 %**	**25 %**	**10 %**

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:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Process Control-Instrument Engineers	Bela G. Liptak,	Butterworth-Heinemann	2013	3rd ed.

	Handbook		ISBN-9780801972904		.
2	Applied Instrumentation in Process Industries	W.G. Andrew and H.B. Williams	Gulf Professional Publishing ISBN:978 0872010475	2008	3rd ed
3	Project management: A systems approach to planning scheduling and controlling	Harlod Kerzner and Van Nostrand	John Wiley & Sons ISBN:9781118022276	2013	11th ed.
4	Successful Instrumentation & Control Systems Design	Michael D. Whitt	ISA ISBN:9781936007455	2012	2nd ed.
5	Understanding ISO 9001 : 2015 Quality Management System	Virendra Kumar Gupta	Kojo Press ISBN:9788174890542	2017	2nd ed.

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	analyze current philosophy, technology, terminology, and practices used in automation industries.	20
CO-2	estimate different types of projects and its management.	20
CO-3	design different documents and evaluate tools to be used.	20
CO-4	select different instruments based on applications and standards.	20
CO-5	test and calibrate different instruments to establish traceability with	20

	standards	

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO-1	1	2	1	1	2	2	2	1	1	1	3	3	2	2	3
CO-2	1	1	1	1	1	2	3	3	2	1	1	1	1	1	1
CO-3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO-4	1	1	1	1	1	1	1	2	2	3	3	3	3	3	3
CO-5	1	1	1	1	1	2	2	3	2	2	2	2	3	3	1

List of Open learning website:
http://vlab.co.in/
www.isa.org
http://www.idc-online.com/
http://coep.vlab.co.in/?sub=33&brch=97
http://www.controleng.com/
http://literature.rockwellautomation.com/
http://www.automation.siemens.com/
http://nptel.ac.in/video.php

List of Open Source Software:

https://instrumentationtools.com

FOR LAB SESSIONS:

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.
13. 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 Needed:

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.