

**Sarvajani University**  
**Sarvajani College of Engineering & Technology, Surat**  
**Bachelor of Technology (B. Tech.)**  
**Instrumentation and Control**

**B. Tech. III Semester – V**

**Subject Name: Applied Instrumentation**

**Subject Code: BTIC15501**

**Type of course:** Open Elective Course

**Prerequisite (if any):** Engineering physics, Basic electronics

**List of Courses where this course will be prerequisite :** Not Applicable

**Rationale:**

Any engineer, with irrespective of his/ her engineering background, working in manufacturing/ process industries have to deal with various types of instruments and instrument systems. This course describes the basic principles and operation of various instruments primarily used to measure important parameters/ variables in industries.

**Teaching and Examination Scheme:**

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	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**

**Content:**

S. N.	Content	Total Hrs	Module Weightage
1	<b>Basic of Control loop</b> Open loop/ Close loop, Loop instruments and their function Pneumatic instruments - flapper nozzle system Electronic instruments- basic block Instrumentation symbols	3	7 %
2	<b>Temperature Measurement</b> Temperature scale, change in dimensions, Change in electrical properties, Thermo- electricity, Fibre-optic sensors, Quartz thermometer, Radiation pyrometers.	5	11 %
3	<b>Pressure Measurement</b> Pressure units and conversion, comparison with known dead-weights, force-summing devices, Secondary transducers, Vacuum measurement	5	11 %

<b>4</b>	<b>Level Measurement</b> Mechanical level indicators, Optical level indicators, electrical level indicators, Radioactive methods, Magnetic switches	<b>5</b>	<b>11 %</b>
<b>5</b>	<b>Flow Measurement</b> Reynolds numbers and flow patterns, Mechanical flowmeters, Electronic flowmeters	<b>5</b>	<b>11 %</b>
<b>6</b>	<b>Strain Measurement</b> Stress-strain relations, Resistance strain gauges, Fiber-optic strain gauges	<b>4</b>	<b>9 %</b>
<b>7</b>	<b>Miscellaneous Measurements</b> Humidity and moisture, pH, Turbidity, Basic of chromatography	<b>5</b>	<b>11 %</b>
<b>8</b>	<b>Control Room</b> Control room layouts, Control Panel Types, Flat face Panels, Breakfront Panels, Consoles, Comparison Of Panel Types, Panel Layout, Face Layout, Rear Layout, power requirements,	<b>4</b>	<b>9%</b>
<b>9</b>	<b>Control Valve</b> Valve Terminology, Valve Capacity, Valve rangeability, - Valve type based on body design, Flow Characteristic, Actuators , Positioners, Control Valve Accessories.	<b>5</b>	<b>11%</b>
<b>10</b>	<b>Transmitter, Indicator, Recorder and Alarm annunciator</b>	<b>4</b>	<b>9%</b>

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>20 %</b>	<b>30 %</b>	<b>20 %</b>	<b>10 %</b>	<b>10 %</b>	<b>10 %</b>

**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	Introduction to Measurements and Instrumentation	A. K. Ghosh	PHI publications ISBN: 9788120346253	2013	4 <sup>th</sup>
2	Instrument Engineers' Handbook - Process Measurement and Analysis	B. G Liptak	Butterworth-Heinemann Ltd ISBN: 9780750622547	1995	3 <sup>rd</sup>
3	Encyclopedia of Instrumentation and Control	D.M.Considine,	McGraw-Hill Inc.,US ISBN: 9780070124240	1971	1 <sup>st</sup>
4	Industrial Instrumentation	<u>K Krishnaswamy,</u> <u>S. Vijyachitra</u>	New Age International ISBN: 9788122427509	2020	2 <sup>nd</sup>

**Course Outcomes:** After learning this course, students will be able to

Sr. No.	CO statement	Marks % weightage

CO-1	interpret various performance criteria of instruments.	20
CO-2	discuss the principle of operation and working of various measuring instruments.	20
CO-3	evaluate the performance of various measurement methods according to the different applications	20
CO-4	analyze measurement constraint of various measurement techniques.	20
CO-5	do testing and calibration of measuring instruments	20

#### Mapping with POs:

	PO1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO 11	PO 12	PSO1	PSO 2	PSO3
CO-1	2	2	1	1	1					1	1		1	1	1
CO-2	3	2	2	2	2	1	1			1	1	1	3	1	1
CO-3	2	2	2	2	1	1	2	1		1	1	1	3	1	1
CO-4	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1
CO-5	2	2	1	1	1	3	2	1	1	1	1	1	3	1	1

**Rationale\*** : This subject will develop skill like analyze, evaluation, testing and other among the students. The CO-PO-PSO mapping is reflecting it.

#### List of Open learning website:

1. <http://nptel.ac.in/video.php?subjectId=108105064>
2. [http://www.onlinevideolecture.com/electrical-engineering/nptel-iit-kharagpur/industrialinstrumentation/?course\\_id=514](http://www.onlinevideolecture.com/electrical-engineering/nptel-iit-kharagpur/industrialinstrumentation/?course_id=514)
3. <https://www.isa.org>
4. <https://instrumentationtools.com/instrument-calibration-lab-exercise/>
5. <http://www.iceweb.com.au/Test&Calibration/Test%20and%20Calibration.htm>

**List of Open Source Software:** Not applicable

#### FOR LAB SESSIONS:

#### List of Experiments:

1. Study of Basic instrumentation symbols.
2. Characterization of Thermocouples (J/T/K/R/S)
3. Characterization of RTD (PT100)
4. Measurement of flow using Rotameter
5. Measurement of flow using DP cell Equipment
6. Calculation of Flow coefficient of Orifice plate and Venturi tube
7. Study of Bourdon tube, diaphragm and bellows in context of pressure measurement
8. Calibration of pressure gauge using dead weight pressure tester
9. Measurement of Level using Capacitance type of Level Sensor
10. Measurement of weight using strain gauge
11. Study of pH electrode, hydrometer and hygrometer
12. Study of Control valve characteristics and calculating Cv for different type of control valves.
13. Study of flapper-nozzle system used in pneumatic transmitter/ controllers/ indicators.

14. Study of P/I, I/V, V/I, F/V and V/F converters

15. Study of working and testing of indicators and recorders used to monitor various parameters.

**Major Equipment Needed:** Dead weight tester, universal calibrator, Temperature bath, Voltage/ current Simulator, RTD/ Thermocouple calibrators, Flow meters, etc.