GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3151708
Semester – V
Subject Name: MEASUREMENT IN INDUSTRY

Type of course: Professional Core Engineering Course

Prerequisite: concepts of physical measurements, basics of sensors and measuring instruments

Rationale: Industrial Measurement instruments are used in different setups and applications: For example in industrial process control where the quality of specific production and joining processes is checked. Certain applications of measuring instruments may be characterized as having essentially a monitoring function, e.g., strain measurement, displacement measurement, analytical parameter humidity, temperature measurement, automotive speedometer and fuel gage. These are the one of the most important classes of measurement application

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Displacement Measurement** Pneumatic Transducers, electrical Transducers, Optical Transducers, Ultrasonic Transducers, Magnetostrictive Transducers, Digital Displacement Transducers, proximity Sensors	6
2.	**Strain Measurement** Stress-strain relations, Resistance strain gauges, Fiber-optic strain gauges	4
3	**Acceleration, Force and Torque Measurement** Acceleration measurement, Force measurement, Industrial weighing system, Torque measurement, Tachometers	8
4	**Miscellaneous Measurements** Humidity and Moisture measurement, Density measurement, Conductivity measurement, Oxidation-Reduction Potential, pH measurement, polarography, Viscosity measurement, Consistency measurement, Turbidity measurement, Opacity measurement	8
5	**Analytical Instrumentation** Industrial gas analysis, Chromatography, Mass spectrometer, Infrared analyser, UV-visible absorption spectrophotometer, X-ray methods, Radiation detectors, Sample handling systems	8

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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
21	**21**	**14**	**7**	**7**	**-**

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:

1. Instrument Engineers' Handbook: Process Measurement and Analysis by B. G. Liptak.
2. Handbook of Applied Instrumentation by D. M. Considine and Sidney David Ross, McGraw – Hill
3. publication.
4. Encyclopedia of Instrumentation and Control by D. M. Considine, Krieger publication Co.
5. Instrumentation Reference Book by Walt Boyes, Butterworth – Heinemann publisher.
6. Introduction to Instrumentation and Control by A. K. Ghosh, 4th edition, PHI publications
7. Industrial Instrumentation by K. Krishnaswamy and S. Vijayachitra, New Age International Publication.
8. Measurement Systems: Application and Design by E. D. Doeblin, McGraw – Hill Publication.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basic measurement principles of displacement, strain, acceleration, force, torque and other analytical parameters.	30
CO-2	Identify the type of sensor and their relevant specification .etc which can be used in a particular process parameter measurement selection.	20
CO-3	Understand the concepts of various analytical methods used for instrumental techniques used for physical, chemical, quantitative and qualitative analysis	20
CO-4	Design and conduct experiments for measurement, characterization and able to analyze and interpret data.	15
CO-5	Understand and identify various instruments for environmental health	15

	monitoring and quality control applications.	

List of Experiments:

1. Characterization and calibration of potentiometer based displacement sensor
2. Characterization and calibration of LVDT as displacement sensor
3. Measurement of strain on a beam using strain gauge.
4. Determine the effect of temperature and electromagnetic interference on Strain Gauge and LVDT respectively.
5. Characterization and calibration of speed measurement system. (Tachometer, Photoelectric and magnetic Pick-up).
6. Characterization and calibration of vibration measurement system. (Piezo-resistive vibration pick-up)
7. Characterize the Proximity sensors (inductive) and study its behavior under environment under study.
8. Identify the absolute position of the shaft using encoders.
9. Study of the detectors (leak detectors, flame detectors, smoke detectors)
10. Case study based on applications of sensors used in auto industry
11. Case study based on applications of sensors used in process industry.
12. To find out transmittance and absorbance of a given sample using colorimeter.
13. To calibrate pH measurement system and to measure pH of given sample.
14. Qualitative and quantitative analysis using UV-Visible spectrophotometer.
15. Study of spectrophotometers.
16. To analyze a given water sample using turbidity meter, DO meter, hygrometer, etc.

Students should be taken for at least one industrial visit of medium scale/ large scale industry to give them exposure towards the topics discussed in the subject.

Design based Problems (DP)/Open Ended Problem: **Nil**

Major Equipment:

Universal calibrator, Temperature bath, Voltage/ current Simulator, Measurement set up for different parameters.