GUJARAT TECHNOLOGICAL UNIVERSITY
ELECTRICAL ENGINEERING
B. E. SEMESTER: VII

Subject Name: **Industrial Instrumentation**
Subject Code: **170904**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
3	0	2	5	70	30	30	20

Sr. No.	Course Contents	Total Hrs
1.	**Transducers:** Introduction to instrumentation system, static and dynamic characteristics of an instrumentation system, Principles and classification of transducers, Electrical transducers, basic requirements of transducers	04
2.	**Strain Gauge and Strain Measurement:** Factors affecting strain measurements, Types of strain gauges, theory of operation of resistive strain gauge, gauge factor, types of electrical strain gauges, strain gauge materials, gauging techniques and other factors, strain gauge circuits and temperature compensation, applications of strain gauges.	04
3.	**Displacement Measurement:** Resistive potentiometer (Linear, circular and helical), L.V.D.T., R.V.D.T. and their characteristics, variable inductance and capacitance transducers, Piezo electrical transducers-output equations and equivalent circuit, Hall effect devices and Proximity sensors, Large displacement measurement using synchros and resolvers, Shaft encoders.	04
4.	**Forces and Torque Measurement:** Load cells and their applications, various methods for torque measurement. Use of torque wrenches	04
5.	**Pressure Measurement:** Mechanical devices like Diaphragm, Bellows, and Bourdon tube for pressure measurement, Variable inductance and capacitance transducers, Piezo electric transducers, L.V.D.T. for measurement of pressure, Low pressure and vacuum pressure measurement using Pirani gauge, McLeod gauge, Ionization gauge, Pressure gauge calibration.	04

6.	**Flow Measurement:** Differential pressure meter like Orifice plate, Venturi tube, flow nozzle, Pitot tube, Rotameter, Turbine flow meter, Electro magnetic flow meter, hot wire anemometer, Ultrasonic flow meter.	04
7.	**Level Measurement:** Resistive, inductive and capacitive techniques for level measurement, Ultrasonic and radiation methods, Air purge system (Bubbler method).	04
8.	**Temperature Measurement:** Resistance type temperature sensors – RTD & Thermister, Thermocouples & Thermopiles, Different types of Pyrometers. Humidity measurement and Moisture measurement techniques. infrared guns	04
9.	**Recorders:** X - Y, strip chart and circular type graphic recorders - indicating, recording and controlling instruments, multichannel recorders. Introduction to digital recorder.	04
10.	**Digital Data Acquisition systems & control :** Use of signal conditioners, scanners, signal converters, recorders, display devices, A/D & D/A circuits in digital data acquisition. Instrumentation systems. Types of Instrumentation systems. Components of an analog Instrumentation Data – Acquisition system. Multiplexing systems. Uses of Data Acquisition systems. Use of Recorders in Digital systems. Digital Recording systems. Modern Digital Data Acquisition system. Analog Multiplexed operation, operation of sample Hold circuits.	06

Term work and minimum 10 Practicals shall be based on the above syllabus.

Text Books:-

1. Industrial Instrumentation & Control by S. K. Singh.TMH Publication
2. Electrical and Electronics Measurement and Instrumentation,
   By A. K. Shawney, Dhanpatrai & sons publications.

Reference Books:-

1. Principles of Industrial Instrumentation, D Patranabis, 3rd edition, Mc Graw hill
2. Mechanical & Industrial Measurements by R. K. Jain, Khanna pub
3. Principles of Industrial Instrumentation and control systems by Chennakesava R Alavala,Cengage publ
4. Industrial Instrumentation by Rangan, Sharma, Mani
5. Transducers and Instrumentation , Murthy
6. Instrumentation measurement and analysis, 3rd edition, By Nakra Chaudhari, Mc Graw hill
7. Fundamental of Industrial Instrumentation By Alok Barua, wiley India