

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI Mechatronics Engineering

Subject Name: **Electromechanical Measurements & Instruments.**

Subject Code: **162005**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Practical (I)
4	0	2	6	70	30	50

A. Mechanical Measurements

Sr. No	Course Content	Total Hrs.
1.	Basic Concepts: Introduction to Measurements and Instrumentation, Significance of Measurements, Standards of Measurements, Methods of Measurements, Modes of Measurements, Classification of Instruments, Basic Standards and Units, Primary, Secondary and Working Standards, Generalized Measurement Systems and its Functional Elements, Input-Output Configurations of Measuring Instruments and Systems.	4
2.	Instrument characteristics: Static Performance Characteristics ,Dynamic Performance Characteristics, Standard Test-Input, Zero, First and Second Order Instruments, First Order System Responses, Second Order System Responses.	5
3.	Errors in Measurements: Introduction, Limiting Errors, Types of Errors, Sources of Errors, Statistical Analysis of Test Data, Curve Fitting, Application of Computers for Data Analysis, Selecting an Instrument, Selection of Measurement System.	4
4.	Speed, Acceleration and Frequency Measurements: Mechanical Tachometer, Electrical Tachometer, Contactless Electrical Tachometers, Piezoelectric Accelerometer, Seismic Acceleration.	3
5.	Force, Torque & Power Measurements: Load Cells, LVDT, Elastic Force Transducer, Mechanical Torsion Meter, Optical Torsion Meter, Strain Gauge Torsion Meter, Electrical Torsion Meter, Mechanical, Hydraulic and Electrical Dynamometry.	5

B. Electrical Measurements

Sr. No	Course Content	Total Hrs.
1.	Principles of Operation of Following types of Electrical Instruments: Permanent Magnet Moving Coil, Moving Iron, Induction and Dynamometric. Measurement of AC and DC Voltage, Current, Power, Power Factor and Energy meter –Electronic trivector meter, Potentiometers, magnetic measurements, measurement of high, medium, low resistance	13
2.	Sensors and Transducers: Resistance Strain Gauges, Thermocouples and Thermistors, Photoelectric and Piezoelectric Sensors, Inductive and Capacitive Transducers. Input impedance Matching Circuits and Bridge Circuit Configuration for above Elements.	6
3.	Data Acquisition and Processing: Circuits for Noise Filtering and Signal Amplification, Sample and Hold Circuits, Analog to Digital and Digital to Analog Conversion, Data Transmission and telemetry, Introduction to Digital Signal Processing.	6
4.	Applications of Sensors in Measurement	1

Text Books:

- (1) D. S. Kumar
Mechanical Measurement and Control
Metropolitan Book Co.
- (2) A.K.Sawhney
A course in Electrical and Electronic
Measurement and Instrumentation
Dhanpat Rai & Sons

Reference Books:

1. E. O. Doebelin
Measurement Systems
McGraw Hill International Edition
2. R. K. Rajput
Mechanical Measurements and Instrumentation
Katson Books
3. T. G. Beckwith
Mechanical Measurements
Narosa Publishing House
4. Nakra B.C. and Chaudhray K. K.
Instrumentation, Measurement and Analysis
Tata McGraw Hill
5. D. V. S. Murthy
Transducers and Instrumentation
Prentice Hall of India

List of experiments:

- 1 To calibrate a bourdon tube pressure gauge using a dead weight gauge tester.
- 2 To find out the effect of temperature on the kinematic viscosity of a fluid.
- 3 Calibration of RTD using liquid in glass thermometer.
- 4 Angular speed measurement of a rotating shaft.
- 5 Torque measurement using dynamometer.
- 6 To study the construction and working of PMMC and Moving iron instruments.
- 7 To study the extension range of an ammeter.
- 8 To study the extension range of a voltmeter.
- 9 To study the characteristics of LVDT.
- 10 To plot the stress-strain characteristics of a Load cell.