BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

2ME04: MECHANICAL MEASUREMENT AND INSTRUMENTATION
CREDITS - 4 (LTP:3,0,1)

Course Objective:

To illustrate techniques and instrumentation used in mechanical measurement.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				
				Theory		Practical		Total Marks
L	T	P	C	ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Basic Concepts of Measurements:** Introduction to measurement, measuring instruments and industrial instrumentation, Methods of measurement, Modes of measurement, generalized measuring system and functional elements, instruments and its classifications, Static and dynamic performance characteristics of measurement devices, sources of error in measurement, classification and elimination of errors, uncertainty in measurements.	06
2	**Measurement of Displacement, Velocity/Speed, Acceleration, Force, Torque, Power and Strain**: Working principal of Resistive potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Tachometers: Mechanical, Electrical, Photoelectric and Stroboscope, Accelerometers: Piezoelectric, Seismic, Strain gauge accelerometer. Hydraulic force meter, Pneumatic force meter, Strain gauge load cell, Cantilever beams, Proving rings, and Linear variable differential transformers. Measurement of torque and power: Prony brake dynamometer, Rope brake dynamometer, Hydraulic dynamometer, Eddy current dynamometer, Torsion bar dynamometer, Servo-controlled dynamometer. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation.	10
3	**Temperature Measurements:** Methods of temperature Measurement; Expansion thermometers: Bi-metallic, Liquid in glass; Filled System thermometers; Electrical temperature measuring instruments:- Thermocouples, RTD, Thermistors; Pyrometers; Fiber-Optic temperature measurement system; Ultrasonic	06

Unit No.	Topics	Teaching Hours
	thermometers; Calibration of temperature measuring instruments, Temperature measurement consideration.	
4	**Pressure and Flow Measurements:** Pressure standards and methods of pressure measurement; Elastic pressure transducers; Measurement of Vacuum; Force balance pressure gauges; Electrical pressure transducers; Calibration of pressure measuring instruments. Flow measurement: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, Laser Doppler Anemometer (LDA).	05
5	**Sensors and Transducers:** Introduction, Mechanical detector transducer elements, Classifications of transducers, Primary and secondary transducers, Passive and active transducers, Analog and digital transducers, Mechanical and electrical transducers, Selection of transducers.	08
6	**Signal Conditioning, Data Transmission, Telemetry and Recorders**: Introduction, functions of signal conditioning equipments – Amplification, Modulation, Impedance matching, Data processing, Data transmission; Amplifiers – Mechanical, Fluid, Optical, Electrical Electronics; Filters; Transmitters – Smart and intelligent, Force balance, Motion balance, Pneumatic; Telemetry system – Pneumatic, Electrical, Electronic, Pulse, Fiber optic and Radio; Recorders	07
	Total	**42**

List of References:

1. D.S. Kumar, "*Mechanical Measurement & Control*", 4th Edition, Metropolitan Book Co, New Delhi, 2006.
2. B.C. Nakra and K.K. Choudhary, "*Instrumentation measurement and analysis*", 3rd Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2009.
3. A.K.Sawhney and Puneet Sawhney, "*Mechanical Measurement and Instrumentation and Control*", 12th Edition, Dhanpat Rai & Co, 2009.
4. S. K. Singh, "*Industrial Instrumentation and Control*", 3rd Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2009.
5. Thomas G. Beckwith, Roy D. Marangoni and John H. Lienhard V, "*Mechanical Measurements*" (6th Edition), Published by Addison Wesley.
6. Arun K Ghosh, "*Introduction to Measurements and Instrumentation*", 4th Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.

Course Outcomes (COs):

At the end of this course students will be able to …

1. To understand the methods and principles of instrumentations of various systems and Interpret characteristics of measuring instruments
2. Apply measurement techniques for displacement, velocity/speed, acceleration, force, torque, power and strain.
3. Apply measurement techniques for temperature measurements.

4. Apply measurement techniques for pressure and flow measurements
5. To develop competence in sensors and transducers.
6. To develop competence in signal conditioning, data transmission, telemetry and recorders.