MEASUREMENTS AND METROLOGY

Course Code	19ME3701	Year	IV	Semester	I
Course Category	Professional Core	Branch	ME	Course Type	Theory
Credits	3	L – T – P	3 – 0 – 0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes		Levels
Upon successful completion of the course, the student will be able to		
CO1	Explain the basic principles of Measurements and Metrology.	L2
CO2	Illustrate the construction and working of instruments used for linear and angular measurement.	L2
CO3	Discuss the methods/devices used for the measurement of gear and screw thread parameters.	L2
CO4	Estimate the surface roughness and flatness of machined surfaces.	L2
CO5	Summarize the working principles of field quantities measurement.	L2

	Contribution of Course Outcomes towards achievement of Program Outcomes Strength of correlations (3: High, 2: Moderate, 1: Low)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1					1			1	3	1
CO2	3	2	1	1					1			1	3	1
CO3	3	2	1	1					1			1	3	1
CO4	3	2	1	2					1			1	3	1
CO5	3	2	1	2					1			1	3	1

Syllabus		
Unit No.	**Content**	**Mapped CO s**
I	**CONCEPT OF MEASUREMENT:** Generalized measurement system and its functional elements, classification of instruments. Basic standards, primary, secondary and working standards. Instrument characteristics (static and dynamic), errors in measurement, calibration of an instrument. **LIMITS, FITS AND TOLERANCES**: Terminology of limits, fits and tolerances. Hole basis and shaft basis system, interchangeability and selective assembly.	CO1
II	**LINEAR AND ANGULAR MEASUREMENT:** Vernier instruments, Micrometers, slip gauges, Tool maker's microscope and Profile projector. Limit gauges and Tylor's principle of gauge design, Bevel protractor, sine bar and angle dekkor. **COMPARATORS**: Mechanical-Johansson Mikrokator, sigma and reed type, Pneumatic-Solex and differential type, Electrical- visual gauging and multi gauging.	CO2
III	**SCREW THREAD METROLOGY**: Screw thread terminology, errors in threads, measurement of pitch, thread angle, major diameter, minor diameter	CO3

	and effective diameter (two wire and three wire methods). **GEAR METROLOGY:** Gear terminology, Gear measurement: runout, backlash, profile error, tooth thickness (chordal thickness method, constant chord and base tangent methods) and Parkinson gear tester.	
IV	**SURFACE TEXTURE:** Orders of geometric irregularities**,** difference between surface roughness and surface waviness, Numerical assessment of surface finish - CLA, RMS and ten point height method. Measurement of surface finish- Profilometer, Tomlinson surface meter, Taylor Hobson Talysurf. **FLAT SURFACE MEASUREMENT:** Instruments used –straight edges, surface plates, Auto collimator and optical flats.	CO4
V	**STRESS AND STRAIN MEASUREMENTS:** Various types of stress and strain measurements- electrical strain gauge, gauge factor, usage of resistance strain gauge for determining bending, compressive and tensile strains, strain gauge rosettes. **FIELD QUANTITIES MEASUREMENT:** **Displacement Measurement:** Capacitive transducer, LVDT. **Temperature Measurement**: Thermometers, bimetallic strip, thermocouple and Pyrometers. **Pressure Measurement**: Bourdon Tube Pressure Gauge, calibration of Bourdon Tube Pressure Gauge using dead weight pressure gauge tester**.** **Speed Measurement**: Tachometer, Photo and Magnetic speed pickup transducer, **Flow Measurement** using Rotameter.	CO5

Learning Recourse(s)
Text Book(s)
1. I.C. Gupta, "A Textbook of Engineering Metrology", Dhanpat Rai Publications, 2018. 2. G Beckwith, Roy D. Marangoni, John H. Lienhard V, "Mechanical Measurements, Thomas. Pearson Education, 2020.
Reference Book(s)
1. A Textbook of Metrology, M. Mahajan, Danpath Rai & Co. (P), 2010. 2. Metrology for Engineers, by J.F.W. Galyer , Charles Reginald Shotbolt, Cengage Learning EMEA; 5th Edition. 3. Mechanical Measurements & control, Dr. D.S.Kumar, Metropolitan Book Co. Pvt. Ltd., 2015
e-Resources & other digital material
1.https://nptel.ac.in/courses/112/104/112104250/