METROLOGY AND MEASUREMENTS

Course Code	20ME3602	Year	III	Semester	II
Course Category	Program Core	Branch	ME	Course Type	Theory
Credits	3	L – T – P	3 – 0 – 0	Pre-requisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

CO	Statement	Skill	Blooms Level	Units
CO1	Explain the basic concepts of Metrology and Measurements.	Understand, Communication	L2	1,2,3,4,5
CO2	Illustrate the construction and working of instruments used for linear and angular measurement.	Apply, Communication	L3	1,2,5
CO3	Discuss the methods/ devices used for the measurement of gear and screw thread parameters.	Apply, Communication	L3	3
CO4	Estimate the surface roughness and flatness of machined surfaces.	Apply, Communication	L3	4
CO5	Summarize the principles involved in the measurement of field quantities.	Apply, Communication	L3	2,5

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2								2		2	3	2
CO2	3	2								2		2	3	2
CO3	3	2								2		2	3	2
CO4	3	2			2					2		2	3	2
CO5	3	2			2					2		2	3	2

UNIT	Course Content	Mapped COs
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. **Limits, Fits and Tolerances**: Terminology of limits, fits and tolerances. Hole basis and shaft basis system, interchangeability and selective assembly.	CO1 CO2
II	**Linear and Angular Measurement:** Vernier instruments, Micrometers, Slip gauges, Dial indicators, Tool maker's microscope, Profile projector. Bevel protractor, Sine bar, Spirit level, angle dekkor and use of rollers and spheres to determine taper. Limit gauges and Taylor's principle of gauge design. **Comparators**: **Mechanical**-Johansson, Mikrokator, sigma and reed type, **Pneumatic**-Solex and differential type, **Electrical**- visual gauging and multi gauging.	CO1 CO2
III	**Screw thread Metrology**: Screw thread terminology, errors in threads,	CO1

	measurement of pitch, thread angle, major diameter, minor diameter and effective diameter (two wire and three wire methods). **Gear Metrology:** Gear terminology, Gear measurement: runout, backlash, profile error, tooth thickness (chordal thickness, constant chord and base tangent methods) and Parkinson gear tester.	**CO3**
IV	**Surface Texture:** Orders of geometric irregularities**,** difference between surface roughness and surface waviness, Numerical assessment of surface finish - CLA, RMS and tenpoint 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.	**CO1** **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. **Force Measurement:** Elastic force meters, load cells, **Pressure Measurement**: Bourdon Tube Pressure Gauge, calibration of Bourdon Tube Pressure Gauge using dead weight pressure gauge tester**. Speed Measurement**: Tachometer, Photo and Magnetic pickup transducer, **Flow Measurement** using Rotameter.	**CO1** **CO2** **CO5**

Learning Resources
Text Books:
1. A Textbook of Engineering Metrology, I.C. Gupta, Dhanpat Rai Publications, 2018. 2. Mechanical Measurements, Thomas G Beckwith, Roy D. Marangoni, John H. Lienhard V., Pearson Education, 2020.
Reference Books:
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/