Semester IV

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY			
Course Code	**21MEL46**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0-0-2*-0	SEE Marks	50
Credits	01	Exam Hours	03

**** Additional one hour may be considered for instructions, if required***

Course objectives:

Students will be able

- To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
- To illustrate the use of various measuring tools & measuring techniques.
- To understand calibration techniques of various measuring devices.

Modern computing techniques are preferred in estimation and analysis.

Sl.NO	Experiments
1	Study of instruments for Liner measurement and angular measurements: Slip gauges- Measurement of angle- sine bar, Sine centre, Angle gauges, Optical instruments for angular measurements.
2	Study of Autocollimator-Applications for measuring straightness and squareness.
3	Study of different Comparators and calibration of Dial indicator, Electrical comparators, LVDT, Pneumatic comparators
4	Study of Terminology of screw threads and Measurement of major diameter, Minor diameter, Pitch, Angle and Effective diameter of screw threads by 2- wire and 3-wire methods
5	Gear tooth measurement using Gear tooth Vernier and Parkinson Gear Tester
6	Various parameter measurement using computerized profile projector
7	Surface topology measurement using Surface Roughness Tester
8	Calibration of Pressure gauge, Thermocouple and Load cell
9	Determination of modulus of elasticity and modulus of rigidity of a mild steel specimen using strain gauges
10	Calibration of Micrometer and Vernier caliper using slip gauges
11	Circularity measurement using Electronic and Mechanical comparator
12	Demonstration of Measurement using Coordinate Measuring Machine (CMM) / Laser Scanner
13	Choose any product used in the day to day life based on his/her choice, prepare a measurement plan and implement the measurement with existing tools)

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand Calibration of pressure gauge, thermocouple, LVDT, load cell, micrometer.
- Apply concepts of Measurement of angle
- Demonstrate measurements using Optical Projector/Tool maker microscope, Optical flats.
- Analyse Screw thread parameters using 2-Wire or 3-Wire method, gear tooth profile using gear tooth Vernier/Gear tooth micrometre
- Understand the concepts of measurement of surface roughness.
- Demonstrate the use of Coordinate Measuring Machine (CMM) / Laser Scanner

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Engineering Metrology and Measurements, N.V.Raghavendra and L. Krishnamurthy, Oxford University Press

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