

25UCEL404	MATERIAL TESTING LAB I	Category	L	T	P	R	Credit	Year of Introduction
		PCL	0	0	3	0	2	2025

Preamble: This course provides hands-on experience for students to determine material properties and impart knowledge to identify and apply these properties in various fields of engineering.

Prerequisite: MOS205 Mechanics of Solids

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

CO	Course Outcomes	Knowledge Level
CO1	Calculate the strength and stiffness properties of engineering materials under various loading conditions.	K3 Apply
CO2	Determine mechanical properties of engineering materials using experimental observations and standard calculations.	K3 Apply
CO4	Analyse stress–strain behaviour and failure characteristics of engineering materials under different loading conditions.	K4 Analyse
CO4	Analyse Maxwell’s reciprocal theorem and correlate experimental results with theoretical concepts.	K4 Analyse

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	-	-	3	-	-	-	3	2	-
CO2	3	2	1	3	2	-	-	2	-	-	-	3	2	-
CO3	3	3	1	2	1	-	-	2	-	-	-	3	1	-
CO4	3	3	1	3	2	-	-	2	-	-	-	2	1	-
Avg	3	2.5	1	2.75	1.75	-	-	2.5	-	-	-	2.75	2.5	-

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*	*		*	
CO2	*	*	*	*	*	*		*	
CO3	*	*	*	*	*	*		*	
CO4	*	*	*	*	*	*		*	

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*		*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	50	50	3 hrs

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

1. Preparation and Pre-Lab Work (7 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (7 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and trouble-shooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (6 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (5 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

Submission of Record: Students shall be allowed to attend the end semester examination only upon submitting the duly certified record. The external examiner shall endorse the record

1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (15 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (10 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

SYLLABUS

Expt. No.	Experiments
1	Test on stress-strain characteristics of mild steel and Tor steel by conducting uniaxial tension test on rod specimens
2	Shear test on mild steel rod (Compression Testing Machine and Shear Shackle)
3	Flexural behaviour of steel by conducting a bending test on rolled steel sections (I cross section)
4	Torsional behaviour and estimation of modulus of rigidity of steel by conducting torsion test on rod specimens
5	Estimation of modulus of rigidity of steel and brass/copper materials utilizing the principles of torsional vibrations – Torsion Pendulum
6	Estimation of toughness of steel specimens by conducting (a) Izod & (b) Charpy impact tests
7	Estimation of hardness properties of engineering materials such as brass, aluminium, copper, steel etc. by performing Brinell hardness test

8	Estimation of hardness properties of engineering materials such as brass, aluminium, copper, steel etc. by performing (a) Rockwell hardness test (b) Vicker's hardness test	* A
9	Estimation of modulus of rigidity of steel by performing tension and compression tests on spring specimens	
10	Flexural behaviour of timber material by performing bending tests on beam specimens	
11	Estimation of compressive strength of timber specimen	
12	Experiment on verification of Maxwell's reciprocal theorem	
13	Demonstration of Fatigue Test	
14	Study/demonstration of Strain Gauges and load cells	
15	Bend & Rebend test on M S Rods	
16	Tensile behaviour of polymeric membranes, textiles, fibres etc.	
17	Digital Image Correlation Techniques for the study of material behaviour under various loading conditions	

minimum of 12 experiments is mandatory

Text Books

1. S.P. Timoshenko(2003),History of Strength of Materials,Dover publication
2. Egor P. Popov(2015),Engineering Mechanics of Solids

References

1. IS 1608 : Part 1 : 2022 Metallic materials - Tensile testing - Part 1 : Method of test at room temperature
2. IS 1598 (1977): Method for Izod Impact test of Metals, (Reaffirmed 2020)
3. IS 1757 Part:1(2020) : Metallic materials – Charpy Pendulum Impact test Method
4. IS 5242 (1979) Method of Test for determining Shear Strength of Metals, (Reaffirmed 2022)
5. IS 1500 Part:1 (2019): Metallic materials – Brinell Hardness test Part 1 Test method
6. IS 1500 Part:4 (2019): Metallic materials – Brinell Hardness test Part 4 table of hardness values
7. IS 1501 Part 1 (2020) : Metallic materials – Vickers Hardness test Part 1 Test method
8. IS 1501 Part 4 (2020) : Metallic materials – Vickers Hardness test Part 4 table of hardness values
9. IS 1586 Part 1 (2018) : Metallic materials – Rockwell Hardness test Part 1 Test method
10. IS 1586 Part 3 (2018) : Metallic materials – Rockwell Hardness test Part 3 Calibration of reference blocks (Scale A, B, C, D, E, F, G, H, K, N, T)
11. IS 1717 (2018): Metallic Materials – Wire – Simple Torsion Test
12. IS 883 (2016): Design of Structural Timber in Building- Code of Practice. (Reaffirmed 2021)
13. IS 13325 (1992) Determination of Tensile Properties of Extruded Polymer Geogrids Using the Wide Strip - Test Method (Reaffirmed Year : 2019)
14. IS17415(2023) Metallic Materials torsion test at room temperature.

