LESSON PLAN
MATERIAL TESTING LABORATORY

MTPC215 | PR:3 | 60 Syllabus Hours | 4P/Week | Teaching Plan: 06 August 2026 – 05 November 2026

L	T	P	Course Code	MTPC215	
0	0	4	Total Marks	50	
Total Contact Hours	Practical : 60 Hrs	End Term Exam	15	Progressive Assessment	35
Branch	Metallurgical Engineering		Name of the Teaching faculty	Tushar K. Pattanayak	

Category of Course: PC

Course Outcomes (COs)

Upon successful completion of the Material Testing Laboratory course, students will be able to:

CO	Course Outcome
CO1	Conduct mechanical tests (tensile, compression, impact, and hardness) on different materials and interpret the results to assess material properties like strength, ductility, and toughness.
CO2	Evaluate the performance of materials under various loading conditions (e.g., fatigue, creep) and understand the influence of these conditions on material behavior and failure.

CO Mapping: CO1 – Mechanical Testing and Interpretation | CO2 – Material Performance under Creep/Fatigue Loading and Failure.

Period-wise Lesson Plan with CO Mapping

Period	Date	Day	Unit	Experiment / Integrated Coverage	Key Content / Learning Focus	Suggested Method	CO Mapping	Assessment / Record
1	11-08-2026	Tuesday	UNIT–1	Lab Orientation, Safety & Testing Workflow	Objectives; safety; specimen identification; machine overview; test sequence; observation and reporting format.	Demonstration + safety briefing	CO1, CO2	Observation + data entry
2	11-08-2026	Tuesday	UNIT–1	Tensile Testing – Principle, Specimen & Machine	Tensile test of metallic materials; specimen geometry; UTM; stress and strain; precautions.	UTM demonstration	CO1	Observation + data entry
3	11-08-2026	Tuesday	UNIT–1	Tensile Testing – Experimental Run	Conduct tensile test; record load-extension/stress-strain data; observe yielding, UTS and fracture.	Hands-on UTM	CO1	Observation + data entry
4	11-08-2026	Tuesday	UNIT–1	Tensile Test – Calculations	Yield strength, UTS, percentage elongation and fracture behaviour.	Calculations + data analysis	CO1	Observation + data entry
5	18-08-2026	Tuesday	UNIT–1	Tensile Stress–Strain Curve	Plot and interpret steel stress-strain curve; elastic	Graphing + interpretation	CO1	Observation + data entry

					region, yield, UTS, necking, fracture.			
	18-08-2026	Tuesday	UNIT–1	Virtual Lab: Tensile Test & Stress-Strain Curve	Virtual Lab on Tensile Test and Stress Strain Curve of Steel; compare observations.	Virtual Lab	CO1	Virtual Lab observation + record
7	18-08-2026	Tuesday	UNIT–1	Tensile Test – Result, Error & Record	Result validation; error/uncertainty; fracture observation; final record.	Report + viva	CO1	Record submission / verification
8	18-08-2026	Tuesday	UNIT–1	Compression Testing – Principles & Setup	Compression testing; loading arrangement; compressive stress/strain; ductile vs brittle response.	Demonstration	CO1	Observation + data entry
9	25-08-2026	Tuesday	UNIT–1	Compression Test – Ductile Material	Compression test; barreling; stress-strain behaviour of ductile material.	Hands-on practical	CO1	Observation + data entry
10	25-08-2026	Tuesday	UNIT–1	Compression Test – Brittle Material	Compression behaviour and failure characteristics of brittle material.	Hands-on/demo	CO1	Observation + data entry
11	25-08-2026	Tuesday	UNIT–1	Compression Test – Analysis & Record	Stress-strain curves; ductile/brittle comparison; calculations and report.	Graph + report	CO1	Record submission / verification
12	25-08-2026	Tuesday	UNIT–1	Hardness Testing – Principles	Brinell, Rockwell, Vickers and microhardness; indenter/load selection; precautions.	Instrument demonstration	CO1	Observation + data entry
13	01-09-2026	Tuesday	UNIT–1	Brinell Hardness Test	Perform Brinell testing; indentation measurement and hardness calculation.	Hands-on	CO1	Observation + data entry
14	01-09-2026	Tuesday	UNIT–1	Rockwell Hardness Test	Perform Rockwell test; scale selection and comparison.	Hands-on	CO1	Observation + data entry
15	01-09-2026	Tuesday	UNIT–1	Vickers & Microhardness Testing	Vickers hardness and microhardness testing on metals.	Practical demonstration	CO1	Observation + data entry
16	01-09-2026	Tuesday	UNIT–1	Hardness Comparison	Compare Brinell, Rockwell, Vickers and microhardness; method selection.	Comparative analysis	CO1	Observation + data entry
17	08-09-2026	Tuesday	UNIT–1	Virtual Lab: Bulk & Micro Hardness	Virtual Lab on Bulk and Micro Hardness Test of Materials.	Virtual Lab	CO1	Virtual Lab observation + record
18	08-09-2026	Tuesday	UNIT–1	Hardness Record & Viva	Results, error sources, precautions and record verification.	Record + viva	CO1	Practical assessment / viva
19	08-09-2026	Tuesday	UNIT–1	Instrumented Indentation – Principle	Instrumented indentation; load-displacement response; comparison with conventional hardness.	Demonstration	CO1	Observation + data entry
20	08-	Tuesday	UNIT–1	Virtual Lab:	Virtual Lab on	Virtual Lab	CO1	Virtual Lab

	09-2026			Instrumented Indentation	Instrumented Indentation of Materials; interpret load-displacement data.			observation + record
21	22-09-2026	Tuesday	UNIT–1	Integrated Hardness Practical	Select appropriate hardness method for a material/component; perform and justify.	Problem-based practical	CO1	Observation + data entry
22	22-09-2026	Tuesday	UNIT–1	Hardness Data Analysis & Assessment	Consolidated hardness analysis; short practical assessment.	Assessment	CO1	Practical assessment / viva
23	22-09-2026	Tuesday	UNIT–1	Impact Testing – Charpy & Izod Principles	Dynamic loading; Charpy/Izod; impact energy; toughness; specimen precautions.	Demonstration	CO1	Observation + data entry
24	22-09-2026	Tuesday	UNIT–1	Charpy Impact Test	Conduct/observe Charpy test; absorbed energy and fracture behaviour.	Hands-on/demo	CO1	Observation + data entry
25	29-09-2026	Tuesday	UNIT–1	Izod Impact Test	Conduct/observe Izod test; absorbed energy and comparison with Charpy.	Hands-on/demo	CO1	Observation + data entry
26	29-09-2026	Tuesday	UNIT–1	Ductile–Brittle Transition	Toughness and fracture under dynamic loading; ductile-brittle transition temperature.	Fracture study	CO1	Observation + data entry
27	29-09-2026	Tuesday	UNIT–1	Virtual Lab: Charpy & Izod	Virtual Lab on Charpy and Izod Impact Testing of Materials.	Virtual Lab	CO1	Virtual Lab observation + record
28	29-09-2026	Tuesday	UNIT–1	Impact Report & Viva	Impact calculations; fracture observations; Charpy/Izod comparison; record.	Report + viva	CO1	Practical assessment / viva
29	06-10-2026	Tuesday	UNIT–II	Creep Testing – Demonstration	Creep testing (demonstration only, if available); time-dependent deformation under constant load and temperature.	Demonstration	CO2	Observation + data entry
30	06-10-2026	Tuesday	UNIT–II	Creep – Experimental/Virtual Observation	Creep stages; influence of load and temperature; virtual high-temperature creep test.	Demo + Virtual Lab	CO2	Observation + data entry
31	06-10-2026	Tuesday	UNIT–II	Virtual Lab: High-Temperature Creep	Virtual Lab on Creep High Temperature Test of Materials; deformation-time response.	Virtual Lab	CO2	Virtual Lab observation + record
32	06-10-2026	Tuesday	UNIT–II	Creep Data Analysis	Interpret creep curve; primary, secondary, tertiary stages; failure implications.	Graph + case study	CO2	Observation + data entry
33	13-	Tuesday	UNIT–	Fatigue Testing –	Cyclic loading;	Demonstration	CO2	Observation

	10-2026		II	Principle & Setup	fatigue mechanism; specimen and machine setup.			+ data entry
	13-10-2026	Tuesday	UNIT–II	Fatigue – Crack Initiation	Observe crack initiation under cyclic loading; factors affecting initiation.	Practical/demo	CO2	Observation + data entry
35	13-10-2026	Tuesday	UNIT–II	Fatigue – Crack Propagation	Observe crack propagation; repeated stress and failure behaviour.	Fracture study	CO2	Observation + data entry
36	13-10-2026	Tuesday	UNIT–II	Virtual Lab: Fatigue Cyclic Load	Virtual Lab on Fatigue Cyclic Load Test of Materials.	Virtual Lab	CO2	Virtual Lab observation + record
37	27-10-2026	Tuesday	UNIT–II	Fatigue Performance & Failure Analysis	Cyclic loading, crack growth and engineering failure prevention.	Case study	CO2	Observation + data entry
38	27-10-2026	Tuesday	UNIT–II	Creep & Fatigue Comparative Record	Compare time-dependent and cyclic failure; consolidated record.	Comparative analysis	CO2	Record submission / verification
39	27-10-2026	Tuesday	UNIT–II	Practical Assessment – Mechanical Tests	Tensile, compression, hardness and impact: specimen, machine, procedure and interpretation.	Practical assessment	CO1	Practical assessment / viva
40	27-10-2026	Tuesday	UNIT–II	Practical Assessment – Special Tests	Creep/fatigue concepts, virtual-lab interpretation and failure mechanisms.	Assessment + viva	CO2	Practical assessment / viva
41	03-11-2026	Tuesday	UNIT–II	Complete Lab Record Verification	Calculations, graphs, observations, results, precautions and conclusions.	Record verification	CO1, CO2	Record submission / verification
42	03-11-2026	Tuesday	UNIT–II	Final Revision & Practical Viva	Complete syllabus revision; principles, results, troubleshooting, safety and viva.	Mock viva	CO1, CO2	Mock practical / viva
43	03-11-2026	Tuesday	UNIT–II	End-Term Practical Preparation	Integrated demonstration and examination-oriented practice.	Mock practical	CO1, CO2	Mock practical / viva
44	03-11-2026	Tuesday	UNIT–II	Final Laboratory Record & Examination Readiness	Final verification of all prescribed experiments, calculations, graphs, observations, precautions, conclusions and practical examination readiness.	Record verification + mock practical	CO1, CO2	Record submission / verification

Coverage Summary

CO	UNIT–1 Mechanical Testing	UNIT–II Special Testing	Overall Coverage
CO1	✓	Supporting	Tensile, compression, hardness, instrumented indentation and impact testing; interpretation.
CO2	—	✓	Creep and fatigue; loading effects, crack initiation/propagation and failure behaviour.

Assessment & Revision

Timing	Activity	Coverage	CO
After Tensile/Compression	Practical record + viva	Procedure, observations, calculations, stress-strain behaviour	CO1
After Hardness	Practical assessment	Brinell, Rockwell, Vickers, microhardness and virtual labs	CO1
After Impact	Record + viva	Charpy/Izod, toughness, fracture and DBTT	CO1
During Creep/Fatigue	Observation + Virtual Lab	Time-dependent and cyclic loading behaviour	CO2
Final Sessions	Integrated practical + viva	All experiments, interpretation, failure analysis and safety	CO1, CO2

Holidays / Non-Teaching Days Considered

Date	Day	Reason	Status
15-09-2026	Tuesday	Nuakhai	Holiday – no lab periods
20-10-2026	Tuesday	Vijaya Dasami	Holiday – no lab periods

Recommended 4-Period Practical Session Architecture

- Period 1: Pre-lab briefing, principle, apparatus identification, safety and specimen preparation.
- Period 2: Demonstration / supervised execution of the test.
- Period 3: Completion of observations, calculations, graphs and interpretation.
- Period 4: Result discussion, error analysis, report completion and viva/assessment.

Course Flow

TENSILE → COMPRESSION → HARDNESS → INSTRUMENTED INDENTATION → IMPACT → CREEP → FATIGUE → FAILURE ANALYSIS

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