MATERIAL AND MECHANICS OF SOLIDS LABORATORY

IV Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB14	Core	-	-	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 24				Total Classes: 24		

OBJECTIVES:

The course will enable the students to:

I. Determination of mechanical properties of different materials.
II. Establish the constitutive relations in metals using destructive methods.
III. Understand the behavior of members during twisting and transverse loading.
IV. Familiarize with standard test specimens.
V. Prepare samples for investigating micro structure of different materials.

COURSE OUTCOMES (COs):

CO 1: Describe the different types of crystal structures.
CO 2: Discuss the phase transformations and equilibrium diagram.
CO 3: Ability to apply the principles of elasticity, plasticity, stresses, strains and their relationships under various types of loads and to analyze the composite bars.
CO 4: Able to draw shear force and bending moment diagrams for various loads.
CO 5: Determination of slope and deflection of various types of beams.

COURSE LEARNING OUTCOMES (CLOs):

The students should enable to:

1. Understand the concepts crystallography, crystal structures, unit cells, crystallographic planes, directions and miller indices.
2. Discuss the crystal imperfections and Frank Reed source of dislocation.
3. Demonstrate the concept of Bauschinger‟s effect, twinning, strain hardening and seasons cracking.
4. Knowledge of yield point phenomenon, cold/hot working, recovery, re-crystallization, grain growth and strengthening of metals.
5. Discuss the constitution of alloys and phase diagrams, constitution of alloys, solid solutions, substitutional and interstitial.
6. Demonstrate the phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions.
7. Construction of iron –Iron carbide equilibrium diagram.
8. Classification of steel and cast-Iron microstructure, properties and application.
9. Discuss Hooke's law, stresses and strains
10. Derive relationship between elastic constants.
11. Describe the concept of poisson's ratio, linear and lateral strains.
12. Construct the Mohr's circle to solve principal stresses and strains.
13. Understand the beams and types transverse loading on beams, shear force and bend moment diagrams.
14. Discuss types of beam supports, simply supported and over-hanging beams, cantilevers.
15. Understand theory of bending of beams, bending stress distribution and neutral axis.
16. Understand the shear stress distribution, point and distributed loads.
17. Understand moment of inertia about an axis and polar moment of inertia.
18. Derive the deflection of a beam using double integration method.
19. Computation of slopes and deflection in beams.
20. Discuss Maxwell‟s reciprocal theorems.

LIST OF EXPERIMENTS	
Week-1	**MICROSTRUCTURE OF PURE METALS**
Preparation and study of the micro Structure of pure metals like iron, cu and al.	
Week-2	**MICROSTRUCTURE OF STEELS**
Preparation and study of the microstructure of mild steels, low carbon steels, high–C steels.	
Week-3	**MICROSTRUCTURE OF CAST IRON**
Study of the micro structures of cast irons.	
Week-4	**MICROSTRUCTURE OF NON FERROUS ALLOYS**
Study of the micro structures of non-ferrous alloys.	
Week-5	**MICROSTRUCTURE OF HEAT TREATED STEELS**
Study of the micro structures of heat treated steels.	
Week-6	**HARDENABILITY OF STEELS**
Hardenability of steels by jominy end quench test.	
Week-7	**HARDNESS OF STEELS**
To find out the hardness of various treated and untreated steels.	
Week-8	**TENSION TEST**
To Find % of elongation and young‟s modulus of a material.	
Week-9	**TORSION TEST**
To find the torsional rigidity of a material.	
Week-10	**HARDNESS TEST**
a) Brinell‟s hardness test. b) Rockwell hardness test.	
WeeK-11	**SPRING TEST**
Testing on compressive and elongation springs.	
Week-12	**COMPRESSION TEST**
Compression test on springs.	
Week-13	**IMPACT TEST**

a) Charpy. b) Izod test.	
Week-14	**SHEAR TEST**
Punch shear test on aluminium sheet.	
Text Books:	
1. Sidney H Avner, "Introduction to Physical Metallurgy", McGraw Hill Education, 2nd Edition, 2008. 2. William, Callister, "Material Science and Engineering", Wiley, 9th Edition, 2014. 3. V Raghavan, "Elements of Material Science", PHI Learning Company Pvt Ltd, 6th Edition, 2015. 4. Er.Amandeep Singh Wadhva, "Engineering Materials and Metallurgy", Laxmi Publications, 1st Edition, 2008. 5. Traugott Fisher, "Material Science", 1st Edition, Academic Press Elsevier, 2013.	
Web References:	
1. https://www.labtesting.com/about/capabilities/metal-and-material-analysis/metallurgical-analysis/ 2. http://www.iare.ac.in	

Course coordinator

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HOD, MECH