



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

SOLID MECHANICS AND MATERIALS LABORATORY								
III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMED09	Core	-	-	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes:45			Total Classes:45			
Prerequisite: Engineering Workshop								

I. COURSE OVERVIEW:

This laboratory course concerned with the micro structures of both ferrous and nonferrous materials, mechanical properties of materials such as percentage elongation, modulus of elasticity, hardness of materials, modulus of rigidity etc. Investigating the mechanical properties of materials is highly important before going to fabrication of products for yielding the higher performance.

II. COURSES OBJECTIVES:

The students will try to learn

- I. The processes of cold/hot working, re-crystallization, grain growth and microstructural properties of materials.
- II. The parameters such as factor of safety, Poisson's ratio, three elastic moduli and their relationships in the selection and characterization of a material.
- III. The theory of pure torsion, bending, stiffness, slope and deflection of beams.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

- CO 1 Utilize the concepts crystallography, crystal structures, crystallographic planes, and miller indices to analyse the microstructural properties of materials.
- CO 2 Make use of the Jominy end quench test apparatus to measure the capacity of steel hardenability in depth under a given set of conditions.
- CO 3 Distinguish the regions of elasticity and plasticity, stress-strain relationships under various types of loads by conducting a tensile test on universal testing machine.
- CO 4 Analyze the mechanical properties of a material by conducting compression and torsion tests on different materials.
- CO 5 Compare the hardness values of ferrous and nonferrous materials by conducting experiments on Rockwell and Brinell's hardness testing machines.
- CO 6 Determine the impact strength of a material by adopting Charpy and Izod test procedures.

IV. COURSE CONTENT:

WEEK -1: MICROSTRUCTURE OF STEELS

To investigate the surface characteristics of steels using optical microscope.

WEEK -2: MICROSTRUCTURE OF CAST IRON

To investigate the surface characteristics of Cast Iron using optical microscope.

WEEK -3: MICROSTRUCTURE OF COPPER

To investigate the surface characteristics of copper using optical microscope.

WEEK -4: MICROSTRUCTURE OF HIGH CARBON STEELS

Examination of surface characteristics of High Carbon Steels.

WEEK -5: DEFLECTION OF BEAMS

To determine the deflection of simply supported beams.

WEEK -6: TENSION TEST OF MILD STEEL

To test a mild steel specimen to failure under tensile load to determine the proportional limit, modulus of elasticity, modulus of resilience, yield strength, ultimate strength and elongation percentage from the stress-strain curve.

WEEK -7: TORSION TEST

To test a steel specimen under torsion to determine the torsional rotation of the specimen and compare with analytical result.

WEEK -8: BRINELL HARDNESS TEST

To determine the hardness number from Brinell hardness test.

WEEK -9: ROCKWELL HARDNESS TEST

To find the ultimate tensile strength of the metal specimens from the Brinell hardness number by using empirical relationships.

WEEK -10: SPRING TEST

To determine the stiffness of the spring and shear modulus of the spring material.

WEEK -11: COMPRESSION TEST

To test a mild steel specimen to failure under compression load to determine the proportional limit, modulus of elasticity, modulus of resilience, yield strength, ultimate tensile strength.

WEEK -12: CHARPY IMPACT TEST

To determine the energy observed by the specimen using Charpy Impact test.

WEEK -13: IZOD IMPACT

To test a mild steel specimen to fail under Impact load conditions.

WEEK -14: SHEAR TEST

To test specimen (mild steel) under shear load conditions to determine the shear strength of the specimen.

V. TEXT BOOKS:

1. William, Callister, "Material Science and Engineering", Wiley, 9th edition, 2014.
2. Egor V Popov, "Engineering Mechanics of Solids", Pearson, 2nd edition, 2015.

VI. REFERENCE BOOKS:

1. Philips Rosenthal, "Principles of Metal Castings", TMH, 2nd edition, 2009.
2. B. S.Raghuwamshi, "A Course in Workshop Technology", Dhanpat Rai & Sons, 2014.
3. Kalpakjin S, "Manufacturing Engineering and Technology", Pearson Education, 7th edition, 2014.
4. HMT, "Production Technology", McGraw-Hill Education, 1st edition, 2013.

VII. ELECTRONIC RESOURCES:

1. <https://www.labtesting.com/about/capabilities/metal-and-material-analysis/metallurgical-analysis>.

VIII. MATERIALS ONLINE:

1. Course Template
2. Lab manual

