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**		
AMEE09	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes:36**		
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:

CO1 Utilize the concepts crystallography, crystal structures, crystallographic planes, and miller indices to analyse the microstructural properties of materials.
CO2 Make use of the Jominy end quench test apparatus to measure the capacity of steel hardenability in depth under a given set of conditions.
CO3 Distinguish the regions of elasticity and plasticity, stress-strain relationships under various types of loads by conducting a tensile test on universal testing machine.
CO4 Analyze the mechanical properties of a material by conducting compression and torsion tests on different materials.
CO5 Compare the hardness values of ferrous and nonferrous materials by conducting experiments on Rockwell and Brinell's hardness testing machines.
CO6 Determine the impact strength of a material by adopting Charpy and Izod test procedures.

IV. COURSE CONTENT:

EXCERCISE-1: TENSILE TEST ON MILD STEEL
To determine tensile properties such as Young's modulus, yield strength, ultimate tensile strength, and percentage elongation of mild steel

EXCERCISE-2: TENSILE TEST ON NON-FERROUS MATERIAL (ALUMINIUM / BRASS)
To evaluate tensile characteristics of non-ferrous materials and compare them with ferrous materials

EXCERCISE-3: COMPRESSION TEST ON BRITTLE MATERIAL (CAST IRON / CONCRETE)
To determine compressive strength and stress–strain behavior of brittle materials

EXCERCISE-4: SHEAR TEST ON METAL SPECIMEN
To determine shear strength of the given material using a shear testing machine

EXCERCISE-5: TORSION TEST ON CIRCULAR SHAFT
To determine modulus of rigidity and maximum shear stress of a circular shaft under torsion

EXCERCISE-6: BENDING TEST ON BEAMS (SIMPLY SUPPORTED / CANTILEVER)
To verify bending equation and determine Young's modulus of the material

EXCERCISE-7: IMPACT TEST (CHARPY / IZOD)
To determine impact strength and notch sensitivity of materials

EXCERCISE-8: HARDNESS TEST – BRINELL HARDNESS TEST
To determine hardness number of given material using Brinell hardness testing method

EXCERCISE-9: HARDNESS TEST – ROCKWELL AND VICKERS
To measure hardness of materials using Rockwell and Vickers hardness testing machines and compare results

EXCERCISE-10: FATIGUE TEST ON METAL SPECIMEN
To study fatigue behavior of materials and determine endurance limit

EXCERCISE-11: CREEP TEST ON METALLIC MATERIAL
To study creep behavior of materials under constant load at elevated temperature

EXCERCISE-12: DEFLECTION OF BEAM USING STRAIN ENERGY METHOD
To determine deflection of beams and verify theoretical results using strain energy approach

EXCERCISE-13: NON-DESTRUCTIVE TESTING – DYE PENETRANT / MAGNETIC PARTICLE TEST
To detect surface and sub-surface defects using non-destructive testing techniques

EXCERCISE-14: STUDY OF UNIVERSAL TESTING MACHINE (UTM)
To study construction, working principle, and applications of the Universal Testing Machine

V. TEXT BOOKS:

1. Laboratory Manual in Engineering Materials, S.K. Hajra Choudhury, Asian Books Pvt. Ltd.
2. Laboratory Manual for Strength of Materials, J.P. Singh, Katson Books.

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. ELECTRONICS RESOURCES:

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

VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Laboratory Exercises