INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

STRENGTH OF MATERIALS LABORATORY								
III Semester: CE								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
ACEE06	**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: Nil								

I. COURSE OVERVIEW:

This course offers a comprehensive exploration of material behaviour through practical experiments. Students delve into the fundamental principles acquired in the classroom, gaining hands-on experience with a range of equipment. The course covers various testing methodologies, including tensile and compression testing to determine material strengths, flexural testing for bending behaviour, and torsional testing for shear properties. Impact tests assess material toughness, while experiments on deflection and fatigue provide insights into structural performance.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Different mechanical properties of different solid engineering materials used in civil engineering applications.
II. Behavior of various material samples under different loads and equilibrium conditions.
III. Characterization of materials subjected to tension, compression, shear, torsion, bending and impact.
IV. Methods of analyzing material testing data for selection of construction materials

III. COURSE OUTCOMES:

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

CO 1 Analyze young's modulus of a mild steel bar for the calculation of tension using Universal testing machine.
CO 2 Analyze the beams under point loads for computing shear force, bending moment, slope and deflection in designing structures
CO 3 Determine the modulus of rigidity of a given shaft for calculating the angle of twist under torsional loading.
CO 4 Analyze the impact strength of steel specimen using Izod and Charpy test for the characterization under suddenly applied load acting on a specimen.
CO 5 Determine the compressive strength of concrete and grade of concrete for designing structures.
CO 6 Analyze stiffness and modulus of rigidity of the spring wire for designing shock absorbers in aerospace and automobile industries

IV. COURSE CONTENT:

EXERCISE – I: DIRECT TENSION TEST

Evaluate the mechanical (tensile) properties such as modulus of elasticity, yield strength, ultimate tensile strength, percentage elongation of mild steel bar and HYSD bar by conducting tensile test.

EXERCISE – 2: BENDING TEST ON CANTILEVER BEAM

Determine the Young's modulus of the material of the cantilever beam by conducting bending test with single point load, and compare the same with theoretical value.

EXERCISE – 3: BENDING TEST ON SIMPLY SUPPORTED BEAM

Analyze the bending behaviour of a simply supported beam subjected to central point load and compare the same with theoretical value.

EXERCISE – 4: TORSION TEST

Determine the shear modulus by conducting torsion test on round mild steel bar.

EXERCISE – 5: HARDNESS TEST

Determine the Brinell hardness number and Rockwell Hardness Number and calculate the ultimate tensile strength of the metal specimens using empirical relationships.

EXERCISE – 6: SPRING TEST

Determine the modulus of rigidity and stiffness of the spring by conducting spring test on a helical spring under compressive load.

EXERCISE – 7: COMPRESSION TEST

Conduct compression test on concrete cube and cement bricks find the compressive strength.

EXERCISE – 8: IMPACT TEST

Determine the energy absorbed by the specimen using Charpy impact test and Izod impact test and also find the toughness of the specimen.

EXERCISE – 9: SHEAR TEST

Determine the shear strength of the specimen and calculate the modulus of rigidity of the material **Week – 10:**

EXERCISE – 10: VERIFICATION OF MAXWELL'S RECIPROCAL THEOREM ON BEAMS

Verify the Maxwell's reciprocal theorem using simply supported beam and compare practical and theoretical deflections

EXERCISE – 11: ELECTRICAL RESISTANCE STRAIN GAUGES

Determine the elastic constant (modulus of elasticity) of a cantilever beam subjected to concentrated end load by using strain gauges.

EXERCISE – 12: DEFLECTIONS OF CANTILEVER BEAM

Determine the deflection in a continuous beam and hence calculate the Young's modulus of the material of the beam.

EXERCISE – 13: TENSION TEST ON COMPOSITE MATERIAL

Evaluate the mechanical (tensile) properties such as modulus of elasticity, yield strength, ultimate tensile strength of composite bar by conducting tensile test.

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EXERCISE – 14: BENDING TEST ON OVER HANGING BEAM

Analyze the bending behaviour of a over hanging beam subjected to point load at free end compare the same with theoretical value.

V. REFERENCE BOOKS:

1. B. C. Punmia, Ashok K Jain and Arun K Jain, “Mechanics of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 12th edition, 2007.
2. R. Subramanian, “Strength of Materials”, Oxford University Press, 2nd edition, 2010.
3. Hibbeler, R. C., “Mechanics of Materials”, East Rutherford, NJ: Pearson Prentice Hall, 6th edition, 2004
4. R. K. Bansal, “A Textbook of Strength of Materials”, Laxmi publications Pvt. Ltd., New Delhi, 2nd edition, 2007.

VI. ELECTRONICS RESOURCES:

1. https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf
2. http://www.atri.edu.in/images/pdf/departments/SOM%20LAB%20MANUAL.pdf
3. https://www.iitg.ac.in/mech/lab_sml.php