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

COURSE CONTENT

SOLID MECHANICS AND MATERIALS								
III Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AMED06	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:48**		
Prerequisite: Engineering Mechanics								

I. COURSE OVERVIEW:
Mechanics of Solids provide students an understanding of deformation of rigid bodies under static loading conditions. It covers the concepts of engineering mechanics of materials and the behavior of the materials and components under applied loads. The purpose of the course is application of strength of materials concepts with respect to mechanical engineering design and analysis.

II. COURSES OBJECTIVES:
The students will try to learn

I. The concepts of stress analysis, theories of failure, relationship between mechanical and metallurgical properties to design and analyze commonly used machine.
II. The variations of normal and shear stresses, slope and deflections throughout the span and cross section of solids in relation to the applied loads.
III. The theory of pure torsion, bending to draw, analyze shear stress distribution diagrams in circular shafts and bending moment distribution diagrams in various cross sections of beams for different loading types.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO 1 Explain the concepts of stress-strain, material constitutional relationship and strain energy induced in linear, elastic, homogeneous and isotropic materials subjected to forces.
CO 2 Illustrate the shear force and bending moment distribution in beams, for analyzing the structural behavior under various loads.
CO 3 Analyze the theory of simple bending for illustrating the distribution of bending stresses across the section beams under loading.
CO 4 Make use of the maximum shear stress and shear stress distribution across the depth of symmetric and unsymmetrical beams loaded with various loads for the safe design of aircraft components.
CO 5 Utilize Maxwell's reciprocal theorem, double integration method and moment area method for determining.
CO 6 Demonstrate the principal stresses, principal planes and torsional stresses acting on any arbitrary plane with in a structure using analytical and Mohr's circle methods.

IV. COURSE CONTENT:

MODULE – I: SIMPLE STRESSES & STRAINS (09)
Elasticity and plasticity, types of stresses & strains, Hooke's law, stress & strain diagram for mild steel, working stress, factor of safety, lateral strain, Poisson's ratio & volumetric strain, elastic moduli & the relationship between them, bars of varying section, composite bars, temperature stresses.

Module – II: SHEAR FORCE AND BENDING MOMENT DIAGRAMS (10)
Definition of beam, types of beams, concept of shear force and bending moment, S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., U.V.L. and combination of these loads – point of contra flexure, relation between S.F., B.M, and rate of loading at a section of a beam.

MODULE – III: PRINCIPAL STRESSES (10)
Principle stresses and strains-computation of principal stresses and strains on inclined planes: Uni-axial problems, Bi axial problems, Mohr's circle: Uni axial problems, Bi axial problems.

Theory of Failure- Minimum principal stress, strain, shear stress and strain energy theories.

MODULE – IV: FLEXURAL STRESSES, DEFLECTION OF BEAMS (10)
Beams and types transverse loading on beams shear force and bend moment diagrams types of beams supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads. moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.

MODULE – V: TORSION, SPRING, STRESSES IN THIN SHELLS AND COLUMNS (09)
Theory of pure torsion, derivation of torsion equations $T/J = q/r = G\theta/L$, assumptions made in the theory of pure torsion, torsional moment of resistance, polar section modulus, introduction to springs: deflection of springs, thin cylinders, thin seamless cylindrical shells, derivation of formula for longitudinal and circumferential stresses, hoop stress, longitudinal and volumetric strains, changes in diameter, and volume of thin cylinders, thin spherical shells, and efficiency of a joint, Euler's column theory.

V. TEXT BOOKS:

1. R. Subramaniam, "The Strength of Materials", Oxford publishers, 4th edition, 2018.
2. Dr. Sadhu Singh, "The Strength of Materials", Khanna Publishers, 12th edition, 2019.
3. S. Ramamrutam, "Strength of Materials", Dhanpat Rai Publishing Company, 18th edition, 2014.

VI. REFERENCE BOOKS:

1. Robert J Asaro, Vlado Lubarda, "Mechanics of Solids and Materials", Cambridge University Press, 4th edition, 2006.
2. Vazirani, Ratwani, "Analysis of Structures", Khanna Publishers, 19th edition, 2014.

VII. ELECTRONIC RESOURCES:

1. http://www.efunda.com/sm _home/sm.cfm
2. http://www.ocw.mit.edu/resourcs/#sm
3. http://www.som.com.

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper - I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation