INSTITUTE	**DIPLOMA STUDIES**
PROGRAM	**DIPLOMA ENGINEERING (MECHANICAL ENGINEERING)**
SEMESTER	**3**
COURSE TITLE	**STRENGTH OF MATERIAL**
COURSE CODE	**09ME2303**
COURSE CREDITS	**4**

Objective:

1 In Applied Mechanics, students have studied the effects of different force systems in previous semester. Different mechanical components subjected to load in different ways and react in a different way. In this subject, students will study analysis of structure under transverse loading, direct, lateral loading along with shear loading. Also studies the analysis of components which are subjected to torsional stress. This subject will build strong foundation to analysis and design of machine elements.

Course Outcomes: After completion of this course, student will be able to:

1 Understand effect and behavior of direct stress and combined stress on member.

2 Calculate moment of inertia of symmetric and asymmetric sections.

3 Draw shear force and bending moment diagram for statically determinant beams.

4 Apply theory of banding to determine stresses in beams and deflection induced in static beam.

5 Understand behavior of torsional members, column and strut.

6 Determine principal stresses on a plane in strained structural material.

Pre-requisite of course: Applied Mechanics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

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Contents : Unit	Topics	Contact Hours
1	**Direct Stress & Strain** Different types of structures and loadsDifferent types of structures and loads, Direct Stress, linear strain, Hook's law, calculate numerical on Direct stress and Linear strain, Stress Strain curve of Mild steel, Modulus of Elasticity, Yield Breaking & Ultimate Stress and Factor of Safety, Lateral Strain and Poisson's Ratio, Temperature Stress & Strain with & without yielding, Shear stress, shear strain and shear modulus, Bulk Modulus & Volumetric Strain, Differentiate Sudden, Gradual & Impact load, Strain energy & proof resilience for sudden, gradual & impact load with numerical problems	9
2	**Moment of Inertia** Moment of Inertia & its Importance, Parallel & Perpendicular Axis Theorem, Formula of Moment of Inertia of solid & hollow sections like rectangle, triangle, circle, Moment of Inertia of I section, Channel section, Angle section and T section	5
3	**Shear Force & Bending Moment Diagram** Statically Determinate beams like Cantilever, Simply Supported & Over Hang Beam, Relation between Shear Force and Banding Moment, Sagging & Hogging Bending Moment and its Importance, Point of Contra flexure & its importance, S.F. & B.M. diagram for cantilever, simply supported & over hang beam elements subjected to point load and/or UDL	7
4	**Stress and deflection in Beam** Bending Theory Equation, Bending stress, sectional Modulus Neutral Axis, Application of Bending theory to statically determinate beams elements having rectangular or circular section to determine stress, Slope & Deflection, Formulation for cantilever Beam subjected to Point load at free end and with full UDL, Formula for S. S. Beam subjected to point load at MID Span and with full UDL, Numerical problems on slope and deflection for above both	7
5	**Column & Strut** Column & Strut, Short & Long column, End condition of column and effective length of column & modes of failure in columnEnd condition of column and effective length of column & modes of failure in column, Radius of Gyration, Slenderness ratio, Euler's crippling load & its numerical, Rankin's load buckling load & its numerical	4
6	**Combine Direct & Bending Stresses** Eccentricity, Formula for combined direct & Bending stresses, Limit of Eccentricity, Core section for rectangular & Circular, Numerical on combined stresses for rectangle & circular section	3
7	**Principal Plane & Principal Stress** Formulas for normal, tangential & resultant stresses due to direct orthogonal stresses & shear stress, Numerical on Principal plane & principal stress, Formulas for principal stresses and for location of principal planes & Numerical	4

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Contents : Unit	Topics	Contact Hours
8	**Torsion** Torsion, Angle of Twist, Polar Moment of Inertia, Torsional Rigidity, Formula of Torsional Stress & Numerical, Formula for Power Transmitted/ Consumed for shaft of solid and hollow sections subjected to Torsion, Numerical	3
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Problems based on direct stress and strain** Problems based on direct stress and strain	4
2	**Calculate Moment of Inertia of various cross sections.** Calculate Moment of Inertia of various cross sections	4
3	**Shear force and bending moment diagrams for simply supported beams** Shear force and bending moment diagrams for simply supported beams	2
4	**Shear force and bending moment diagrams for cantilever beams** Shear force and bending moment diagrams for cantilever beams	2
5	**Problems based on bending stress induced in beam.** Problems based on bending stress induced in beam.	2
6	**Problems based on shear stress induced in beam.** Problems based on shear stress induced in beam.	2
7	**Problems based on deflection of beam.** Problems based on deflection of beam	2
8	**Problems based on column and strut.** Problems based on column and strut	2
9	**Problems based on combined direct and bending stress.** Problems based on combined direct and bending stress	2
10	**Analytical method to determine principal stress.** Analytical method to determine principal stress.	2
11	**Mohr's circle method to determine principal stress.** Mohr's circle method to determine principal stress.	2
12	**Problems based on torsion.** Problems based on torsion.	2
Total Hours		**28**

Textbook :

1 STRENGTH OF MATERIALS, R.P. Rethaliya, Atul Prakashan, 2016

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References:

1 STRENGTH OF MATERIALS, STRENGTH OF MATERIALS, R.S. Khurmi, S. Chand Publication, 2008

2 STRENGTH OF MATERIALS, STRENGTH OF MATERIALS, S RAMAMURTHAN, Dhanpat Rai Publishing Company (P) Ltd., 2020

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking
20.00	30.00	50.00			

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, Quiz, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Students will use supplementary resources such as online videos, NPTEL videos, e-courses.

Supplementary Resources:

1 https://skyciv.com/docs/tutorials/

2 https://sm-nitk.vlabs.ac.in/exp/tensile-test-mild-steel/

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