Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-3

Subject : Strength of Material - DETME13205

Type of course: Major (Core)

Prerequisite: Engineering Mechanics

Rationale: After learning Mechanics of rigid bodies in second semester in Engineering Mechanics, students will now learn the fundamentals of Mechanics of deformable bodies in this course as Strength of Materials. Choosing the proper material by keeping its strength and suitability in mind is a very important stage in production and design level in the field of Mechanical Engineering. The course is a prerequisite for understanding principles of machine design at various levels.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	-	2	5	60	30	10	20	30	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No	Course content	Hrs	% Weightage
1	**Direct Stress & Strain** • Direct Stress, Liner strain,Hook's Law calculate Numerical on Direct Stress & 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 Stresses & Strain with & without yielding • Shear Stress , Shear Strain & Shear Modulus • Bulk Modulus & Volumetric Strain • Differentiate Sudden , Gradual & Impact Load • Strain Energy & Proof Resilience for Sudden , Gradual & Impact Load with numerical problems **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 about C.G for I section , H section , Channel Section , Angle Section , T Section and Built up Section having flange plates to I & H Section and of Double Channels back to back & toe to toe	14	30%
2	**S.F. & B. M. in Beam** • Statically Determinate Beams Like Cantilever , Simply Supported & Over Hang Beam • Relation between Shear Force and Bending 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 like shaft , axle , spindle subjected to Point Load and/ or U.D.L **Bending & Shear Stress in Beam** • Concept and theory of pure bending, assumptions, bending equation (without derivation), Section Modulus, bending stresses and their nature, Bending stress distribution diagram.	14	35%

	• Concept of moment of resistance and simple numerical problems using bending equations. • Shear stress equation (without derivation), relation between maximum and average, Shear stress for rectangular and circular sections. • Shear stress distribution for square, rectangular, circle, hollow square, rectangular, circular, angle sections, channel section, I-section, T section. • Simple numerical problems based on Shear equation.		
3	**Slope and Deflection** • Concept of Slope & Deflection of beams. • Flexural rigidity and its significance. • Formulas (without derivation) of maximum slope & deflection for cantilever beams subjected to point load at free end and u.d.l. over the entire span. • Formulas (without derivation) of maximum slope & deflection for simply supported beams subjected to point load at center and u.d.l. over the entire span.	4	10%
4	**Torsion & Springs** • Torque or turning moment or twisting moment, Angle of twist, Shear stress in shaft, strength of shafts, Polar moment of inertia, Torsional rigidity, assumptions in the theory of torsion. • Equation of Torsion (without derivation) and related numerical. Relationship of H.P. , Torsion and RPM and related numerical. Springs: Stiffness of a spring(s)- Individual, in series and in parallel, Uses of springs, Types of springs. • Calculation of main dimensions of Closed Coiled Helical spring. **Mechanical Properties of Material** • Classification of engineering materials. Physical properties of material: - Elasticity, Plasticity, Ductility, Brittleness, Malleability, Fatigue, Creep, Toughness, Hardness etc. • Testing of materials for impact value (Izod impact and Charpy impact test) and hardness (Brinell and Rockwell hardness test) • Factors affecting selection of materials.	10	25%

Continuous Assessment (ALA):

Sr. No	Active Learning Activities	Marks
1	**Identify axial force, shear force & impact force** Collect different situations with photographs of machine components where axial force, shear force & impact force are predominant. and upload photographs on GMIU web portal.	10
2	**Identify I-section, angle section, channel section and built-up section.** Collect the photographs of machine components made of I-section, angle section, channel section and built-up section. and upload photographs on GMIU web portal.	10
3	**Identify bending moment & torsion.** Collect different situations with photographs of machine components where bending moment & torsion is predominant. and upload photographs on GMIU web portal.	10
Total		30

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	25%	55%	-	-	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Analyze structural behavior of various materials under axial loading.
CO2	Draw and Interpret shear force and bending moment diagrams and determine the bending and shear stresses in beams for various types and loading conditions.
CO3	Determine slope and deflection in cantilever and simply supported beams
CO4	Select suitable material(s) for given purposes in engineering.

List of Practical

Sr. No	Descriptions	Unit No	Hrs
1	Conduct tension tests on a given sample and draw a stress-strain curve.	1	04
2	Determine Young's Modulus of wire of given material.	1	02
3	Find out Compressive Strength of Cast Iron, Mild Steel, Wooden specimen.	1	04
4	Compute Polar Moment of Inertia of Flywheel.	1	02
5	Conduct shear test (Single and Double shear) on mild steel and cast-iron specimen	2	04
6	Find out deflection of cantilever beam for end point load.	3	02
7	Find out deflection of simply supported beam for central point load	3	02
8	Conduct Torsion test on cast iron, mild steel specimen.	4	04
9	Determine Izod impact value and Charpy impact value of given materials	4	04
10	Determine Brinell and Rockwell hardness of given materials.	4	02
		Total	30

Instructional Method:

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

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Strength of Materials (Mechanics of Solids) by R.S.Khurmi & N. Khurmi, S Chand Publishing.

[2] Strength of Materials by Dr. R.K.Bansal, Laxmi Publications (P) Ltd. New Delhi.

[3] Strength of Materials by S. Ramamrutham & R.Narayanan, Dhanpat Rai Publishing Company.

[4] Strength of Materials (Mechanics of Materials) by R.S. Laheri & A.S. Laheri, S.K. Karatia & Sons, Delhi.

[5] Strength of Materials by Dr. Sadhu Singh, Khanna Publishers , New Delhi.