Course Syllabus
Gyanmanjari Institute of Technology
Semester-4

Subject: Solid Mechanics- BETME14305

Type of course: Major

Prerequisite: Basic understanding of Physics and Mathematics

Rationale: Engineers are keen to use mechanics laws to solve actual field problems. The application of laws of mechanics to field problems is termed engineering mechanics. Here the students will learn the laws and principles of mechanics and their applications to engineering problems. Knowledge of solids' mechanics is essential for an engineer in planning, designing, and constructing various types of structures and machines so that the design is safe and economical.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P	C	Theory Marks		Practical Marks		CA	
				ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom 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:

Unit No	Course content	Hrs	% Weightage
1	**Fundamental of Mechanics and Statics:** Introduction to engineering mechanics, laws of mechanics, forces on particles, concurrent forces in a plane, coplanar forces, resolution of forces, resultant of several concurrent forces, Lami's Theorem, free body diagram, moment of a force, varignon's theorem, equivalent system of forces, reduction of system of forces into single force and couple, types of loads, types of supports and their reactions.	10	20
2	**Simple Stresses and Strains:** Introduction, stress, strain, tensile, compressive and shear stresses, elastic limit, Hooke's law, Poisson'sratio, modulus of elasticity, modulus of rigidity, bulk modulus, bars of varying sections, extension of tapering rods, bars of uniform strength, temperature stresses, relation between elastic constants, stress, strain diagram.	15	25
3	**Center of Gravity and Moment of Inertia:** Centre of gravity, definition, lamina, moment of an area, centroid of a uniform lamina, centroids of laminate of various shapes, triangle, circle, semicircle, trapezium, built in sections, analytical and graphical methods, concept of moment of inertia, moment of inertia of plane areas, polar moment of inertia, radius of gyration of an area, parallel and perpendicular axis theorem, moment of inertia of composite areas, product of inertia, principal axes and principal moments of inertia.	15	30
4	**Stresses in Beams:** Theory of simple bending, bending stresses, moment of resistance, modulus of section, built up and composite beam section, Beams of uniform strength, Distribution of shear stress in different sections. **Friction:** Coefficient of friction, laws of friction, angle of friction, angle of repose and cone of friction, Friction on blocks resting on horizontal and inclined planes, belt Friction.	20	25

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Simulation:** Use any software or tools to simulate any one mechanical system and upload results on GMIU web portal.	10
2	**Presentation:** Make a presentation on center of gravity and moment of inertia and upload it on GMIU web portal	10
3	**Case Study:** Case study to analyze real world engineering failures or successes and upload it 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	15%	30%	20%	15%	20%	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Learn Fundamentals of Mechanics, Statics, Forces, Theorems, and Load Reactions.
CO2	Understand Simple Stresses, Strains, Elastic Constants, and Stress-Strain Diagrams.
CO3	Explore Center of Gravity, Moment of Inertia, and Related Theorems.
CO4	Comprehend Stresses in Beams, Bending Theory, Shear Stress Distribution, and Friction Concepts.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	**Equilibrium of Coplanar Concurrent Forces:** Perform equilibrium analysis of coplanar concurrent forces.	1	2
2	**Equilibrium of Coplanar Non-Concurrent Forces:** Perform equilibrium analysis of coplanar non-concurrent forces.	1	2
3	**Stress-Strain Curve:** Express the stress-strain curve and its characteristics through a tensile test on a ductile material.	2	4
4	**Compressive Strength Test:** Perform the compressive strength test on various materials.	2	2
5	**Impact Behavior of Materials:** Observe the behavior of materials under impact loading.	2	2
6	**Shear Strength Test:** Determine the shear strength of a mild steel bar in single shear and double shear stress conditions.	2	4
7	**Centroid Determination:** Find the centroid of different objects.	3	2
8	**Moment of Inertia:** Determine the moment of inertia of a wheel.	3	4
9	**Equilibrium of Simply Supported Beam:** Find the condition of equilibrium for a simply supported beam.	4	4
10	**Friction in Belt Drive:** Demonstrate the effect of friction on a belt drive system.	4	4
		Total	30

Instructional Method:

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, role play, Quiz, brainstorming, MOOCs etc.

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 laboratory.

Reference Books:

[1] Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria& Sons.

[2] Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan.

[3] Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand& Co.

[4] Theory and Applications of Fluid Mechanics by K. Subramanya, McGraw Education.

[5] Fluid Mechanics by Frank.M. White, McGraw Hill Education.

[6] Mechanics of Fluids by Shames, McGraw Hill Education.