Course Syllabus
Gyanmanjari Institute of Technology
Semester-2 (B.Tech)

Subject : Structural Mechanics I–BETCV12303
Type of Course: Professional Core
Prerequisite: Physics

Rationale: Structural mechanics is a branch of engineering that deals with the behavior and analysis of structures, including buildings, bridges, dams, and other load-bearing structures. It provides the fundamental principles and concepts necessary for understanding how structures respond to loads and forces.

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	
04	00	02	05	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:

Sr. No	Course content	Hrs	% Weightage
1	**Introduction and Fundamentals of Statics** Definition of force, Resultant, Equilibrant, Free body diagrams and resolution of Forces-Types, characteristics and system of forces. **Coplanar Concurrent and Non-Concurrent Force System**: - Resultant, Equilibrant- Free body diagrams **Coplanar Concurrent Forces**: - Law of polygon of forces- Lami's theorem- Law of parallelogram **Coplanar Non-Concurrent Forces**: Moments & couples	05	14

2	**Simple Stresses and Strains** Stress - Strain- Types of stresses and strain - Hooke's law - tension - Compression and shear - Strain diagrams - Relation between elastic constants - Composite bars in tension and compression - Principle of superposition - Bars of varying sections and of different materials.	08	15
3	**Shear Force and Bending Moment** Beams and Bending - Types of loads, Supports - Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load - Uniformly distributed load - Point of Contra flexure	10	25
4	**Centroid** Centroid of lines- plane areas and volumes **Moment of Inertia** Moment of inertia-Radius of gyration-Section modulus-Parallel axis theorem-Perpendicular axis theorem	05	14
5	**Stresses in Beams:** **Flexural Stresses** – Theory of simple bending-Assumptions, derivation of equation of bending equation **Shear Stresses:** - Introduction- Shear stress distribution for beam of rectangular- Circular- Triangle and I- section	06	12
6	**Theory of Columns and Struts** Theory of columns - Long column and short column – Short column subjected axial forces and bending moments, engineering problems, long columns, stability and equilibrium, ranking formula - End Condition of Column and effective Length of Column & Modes of Failure in column- Euler's formula - Rankin's load / Buckling Load of Column	08	20

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
01	**Prepare a model making of beam and apply load on different positions:** In this hands-on activity, students will individually construct a model using ice cream sticks to simulate a beam. They will systematically apply loads (weights) at different positions on the beam and observe its deformation. The objective is to demonstrate the impact of load placement on structural behavior. Students are required to record a video of their model and upload it to the GMIU web portal.	10

02	**Prepare a model and balance law of forces:** In this activity where each student will create a 100 cm x 100 cm model using candy sticks, highlighting the concept of force balance. Demonstrate the forces acting on each joint to uphold equilibrium conditions. Students are required to record a video showcasing their model and upload it onto the GMIU web portal	10
03	**Presentation on centroid.** In this activity, each student will make 3 different objects from plastic material and apply this concept by designing and crafting a plastic model, ensuring the material distribution aligns with centroid principles. Student upload the video of model upload 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	10%	30%	30%	30%	-	-

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	Apply fundamental principles of mechanics, equilibrium and statics to practical problems of engineering.
CO2	Analyze and determine the various types of stresses and strains that develop in structural members subjected to axial, bending, and shear forces.
CO3	Determine centroid and moment of inertia of a different geometrical shape and its use in engineering problem.
CO4	Apply principles of mechanics and equilibrium to get responses of rigid and deformable bodies
CO5	Proficient in determining the load-carrying capacity of columns in structural design.

List of Practical:-

Sr. No	Descriptions	Unit No	Hrs
01	To determine the compressive strength of various materials.	01	04
02	To find resultant force for a set of non-concurrent forces	01	04
03	Bending test on a wooden beam	03	06
04	Give the practice to students base on force system	01	04
05	Moment of inertia of the flywheel.	04	04
06	Give the practice to students base on stresses in beam	05	04
07	Give the practice to students base on column and beam	06	04
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.

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 laboratory.

Reference Books:

[1] Engineering Mechanics statics by R. C. Hibbeler, McMillan Publication.
[2] Engineering Mechanics by R S Khurmi
[3] Engineering Mechanics by S S Bhavikatti
[4] Strength of Materials by G. H. Ryder
[5] Introduction to Mechanics by M K Verma
[6] Theory of Structures by R S Khurmi
[7] Strength of Materials by Dr. R. K. Bansal