Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-3

Subject: Structural Mechanics II – BETCV13305

Type of course: Professional Core

Prerequisite: Mechanics of solids

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	**Fundamentals of Statically Determinate Structures** **Basics:** Types of statically determinate & indeterminate structures - static and kinematic indeterminacy - Stability of structures - principle of superposition - Maxwell's reciprocal theorems. **Framed structure:** Computation of internal forces in statically determinate structures such as plane truss - plane frame – grids.	10	15

2	**Arches, Cables and Suspension Bridges** Calculation internal forces in three hinge arches with circular and parabolic shapes subjected to various types of loading - Forces and end actions in cables due to various types of loading - Unstiffened three hinged parabolic and Catenary type suspension bridge	08	10
3	**Thin cylinder:** Analysis of thin cylinder and spherical vessels under pressure. **Strain Energy** Resilience - strain energy due to axial loads & flexure - proof resilience - modulus of resilience - impact loads - sudden loads	15	25
4	**Displacement of statically determinate structures:** Differential equation of elastic curve - relation between moment - slope and deflection - Macaulay's method - Moment Area Method - Conjugate Beam Method applied to beams - Joint displacement of determinate plane truss using unit load method. **Direct and Bending stresses:** Members subjected to eccentric loads - middle third rule - kernel of section - chimney subjected to wind pressure - retaining walls - dams subjected to hydraulic pressure.	16	30
5	**Fixed Beams & Consistent Deformation Method:** Computation of fixed- end actions for various types of loads and secondary - Effects using basic principles - beams of varying moment of inertia - Analysis of propped cantilever beams & beams of varying moment of inertia using Consistent Deformation Method. **Moment distribution method** Important terms- sign conventions- fixed end moments (FEM) – steps of moments distribution method – examples.	11	20

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Prepare a model of Arch bridge by sticks** In this hands-on activity, students will individually construct a model of arch truss bridge using ice cream sticks. They will apply loads (weights) and observe its deformation. Students are required to record a video of their model and upload into the GMIU web portal.	10
2	**Industrial Visit to a Cable stayed Bridge** Faculty will arrange industrial visit to cable-stayed bridge, Understand the forces and design of cable stayed bridges through direct observation. Student have to Upload report on GMIU web Portal	10

3	**Analysis of Local Infrastructure** Faculty will Assign student local existing building, so student can analysis the building by using basics manual method and Student have to Upload report 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	Identify and classify statically determinate and indeterminate structures, calculate indeterminacy, and assess stability using principles like superposition and Maxwell's theorems.
CO2	Calculate internal forces in statically determinate plane trusses, frames, and grids under various loads..
CO3	Determine forces and end actions in three-hinged arches, cables, and suspension bridges under different loading conditions.
CO4	Use methods like Macaulay's, Moment Area, and Conjugate Beam to determine slope, deflection, and strain energy in structures.
CO5	Evaluate direct and bending stresses in members subjected to eccentric loads, wind, and hydraulic pressure, and compute fixed-end actions and moments.

List of Practical:-

Sr. No	Descriptions	Unit No	Hrs
01	To computation of internal forces in statically determinate structures such as plane truss, plane frame, grids.	01	06
02	Determine plane truss using unit load method.	02	06
03	The students will have to solve at least five examples.	03	05
04	Give the practice to Students base on cantilever beams.	03	05

05	Give the practice to students base on understand behavior of plane truss, plane frame and grids	04	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] Junarkar S.B. & Shah H.J.; Mechanics of Structures Vol-I; Charotar publishing house, Anand
[5] Hibbler R C; Structural Analysis; Pearson Education
[6] Theory of Structures by R S Khurmi
[7] Strength of Materials by Dr. R. K. Bansal