DEPARTMENT OF CIVIL ENGINEERING

SCHEME OF COURSE WORK

Course Details:

Course Title	**STRUCTURAL ANALYSIS**
Course Code	**20CE1112**
L T P C	**3 0 0 3**
Program	**B.Tech.**
Specialization	**CIVIL ENGINEERING**
Semester	**IV**
Prerequisites	**Mathematics, Applied Mechanics, Strength of Materials.**
Courses to which it is a prerequisite	**Advanced Structural Analysis**

COURSE OUTCOMES (COs):

After completion of this course the student would be able to

CO	Course Outcomes	Learning Outcomes
1	Analyze Propped Cantilever, Fixed Beams and Continuous Beams under different loading and support conditions.	1. categorize fixed and continuous beams and their performance (L2) 2. classify different loads on beams with different boundary conditions (L2) 3. analyze the beams subjected to loads (L4) 4. study the effect of sinking of supports on performance (L4)
2	Analyze beams subjected to moving loads using Influence line diagrams.	1. construct ILD for reactions, SF and BM (L3) 2. calculate position and magnitude of maximum BM and SF due to train of concentrated load and UDL at a given section (L3) 3. analyse the absolute SF and BM of a beam (L4)
3	Analyze two hinged and three hinged arches.	1. calculate horizontal thrust, bending moment, normal thrust and radial shear for arches (L3) 2. analyse three hinged arches (L4) 3. analyse two hinged arches (L4)
4	Apply slope deflection method and Moment Distribution Method to analyze continuous beams and portal frames.	1. develop slope deflection and moment distribution expressions (L3) 2. analyze beams with and without support sinking (L4) 3. analyze portal frames using slope-deflection and moment-distribution method (L4)
5	Analyze continuous beams using flexibility and stiffness matrix methods.	1. develop flexibility matrix for beams (L3) 2. develop stiffness matrix for beams (L3) 3. analyze structures with and without support sinking (L4)

PROGRAMME OUTCOMES

1. Graduates will be able to apply the knowledge of mathematics, science, engineering fundamentals to solve complex civil engineering problems.

2. Graduates will attain the capability to identify, formulate and analyse problems related to civil engineering and substantiate the conclusions
3. Graduates will be in a position to design solutions for civil engineering problems and design system components and processes that meet the specified needs with appropriate consideration to public health and safety.
4. Graduates will be able to perform analysis and interpretation of data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions.
5. Graduates will be able to select and apply appropriate techniques from the available resources and modern civil engineering and software tools, and will be able to predict and model complex engineering activities with an understanding of the practical limitations.
6. Graduates will be able to carry out their professional practice in civil engineering by appropriately considering and weighing the issues related to society and culture and the consequent responsibilities.
7. Graduates will be able to understand the impact of the professional engineering solutions on environmental safety and legal issues.
8. Graduates will transform into responsible citizens by resorting to professional ethics and norms of the engineering practice.
9. Graduates will be able to function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams.
10. Graduates will be able to communicate fluently on complex engineering activities with the engineering community and society, and will be able to prepare reports and make presentations effectively.
11. Graduates will be able to demonstrate knowledge and understanding of the engineering and management principles and apply the same while managing projects in multidisciplinary environments.
12. Graduates will engage themselves in independent and life-long learning in the broadest context of technological change while continuing professional practice in their specialized areas of civil engineering.

PROGRAMME SPECIFIC OUTCOMES(PSOs):

1. Collect, process and analyse the data from topographic surveys, remote sensing, hydrogeological investigations, geotechnical explorations, and integrate the data for planning of civil engineering infrastructure.

2. Analyse and design of substructures and superstructure for buildings, bridges, irrigation structures and pavements.

3. Estimate, cost evaluation, execution and management of civil engineering projects.

Course Outcome Vs Program Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3							2
CO2	3	3	3	2	3							2
CO3	3	3	2	3	3	2			2			2
CO4	3	3	2	3	3	2			2			2
CO5	3	3	2	3	3	2			2			2

Course Outcome Vs Programme Specific Outcomes:

CO	PSO1	PSO2	PSO3
CO1	-	3	-
CO2	-	3	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-

Mapping Levels:
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), put -: No Correlation

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

Teaching-Learning and Evaluation:

Teaching-Learning and Evaluation

Week	Topics	CO	Sample questions	Teaching-learning strategy	Assessment Method & Schedule
1	Analysis of Propped Cantilever – Shear force and Bending moment diagrams Effect of sinking and rotation of supports.	1	1. Analyse a propped cantilever beam. 2. Draw shear force and bending moment diagram	Lecture Problem solving	Assignment/ Quiz
2	Analysis of fixed beams – Shear force and Bending moment diagrams.	1	1. Analyse a fixed beam. 2. Draw shear force and bending moment diagram	Lecture Problem solving	
3	Effect of sinking and rotation of supports for fixed beams. Introduction –Clapeyron's theorem of three moments – Analysis of continuous beams with constant moment inertia.	1	1. Causes of support sinking and effects. 2. What is Clapeyron's theorem of three moments? 3. Analyse a continuous beam for a given moment.	Lecture Problem solving	
4	Analysis of continuous beams with different moment inertia. Draw SFD, BMD diagrams. Effect of sinking of supports.	1	1. Analyse a continuous beam for a given moment. 2. Draw SFD, BMD and deflection diagrams for a	Lecture Problem solving	

			given beam. 3. Causes of support sinking and effects.		
5	Definition of Influence line for reactions, SF and BM	2	1.Definition of Influence line for reactions, SF and BM.	Lecture Problem solving	
6	Find SF and BM at a given position of loading, number of point loads, UDL.	2	1.Find SF and BM for a given of point load 2. Find SF and BM at a given UDL.	Lecture Problem solving	
7	Introduction, maximum SF and BM at a given section and absolute maximum SF and BM due to single concentrated load, UDL longer than the span. UDL shorter than the span.	2	1.Determine maximum SF and BM at a given section and absolute maximum 2. SF and BM due to single concentrated load, UDL longer than the span. 3. UDL shorter than the span.	Lecture Problem solving	
8	UDL shorter than the span, two point loads with fixed distance between them and several point loads – Load position for maximum BM at a given section, load position for maximum SF at a given section.	2	1.Determine load position for maximum BM and SF at a given section.	Lecture Problem solving	
Internal Exam-I					
9	Introduction to three hinged arches – Eddy's theorem, determination of horizontal thrust, bending moment, normal thrust and radial shear	3	1. Determine why the arch is effective over the beam? 2. Determine the horizontal thrust of a three hinged arch carrying UDL. 3. Determine the horizontal thrust of three hinged arches carrying two concentric loads.	Lecture Problem solving	Assignment/ Quiz
10	Introduction to two hinged arches, determination of horizontal thrust, bending moment, normal thrust and radial shear	3	1. Determine the horizontal thrust of two hinged arches carrying two concentric loads. 2. Determine the horizontal thrust of a three hinged arch carrying UDL.	Lecture Problem solving	
11	Analyse the forces induced into the arches for various loadings taking the effect of temperature and rib-shortening.	3	1. Derive the expression for rib shortening and temperature stress in two hinged arches.	Lecture Problem solving	

12	Introduction - Derivation of slope deflection equation – application to continuous beams including settlement of supports with complex loading conditions. Analysis of single bay single storey portal frames with and without sway draw shear force and bending moment diagram.	4	1. Derive the equation of slope deflection method. 2. Analyse the continuous beam with a given loading condition using slope deflection equation.. 3. Analyse the portal frame ABCD with given loading condition whose supporting ends are fixed using slope deflection method.	Lecture Problem solving	
13	Introduction - stiffness and carry over factors – Distribution factors– Analysis of continuous beams with and without sinking of supports. Analysis of single bay single storey portal frame without sway draw shear force and bending moment diagram	4	1. Analyse the continuous beam with a given loading condition using the moment distribution method. 2. Analyse the portal frame ABCD with given loading conditions whose supporting ends are fixed using the moment distribution method.	Lecture Problem solving	
14	Analysis of single bay single storey portal frames with sway draw shear force and bending moment diagram Introduction to the structural analysis by flexibility concept using Matrix approach. Step by step procedure to solve the indeterminate beams by flexibility method.	4,5	1. Analyse the portal frame ABCD with given loading conditions whose supporting ends are fixed using the moment distribution method. 2. What is the procedure involved in a flexible method of analyzing a continuous beam. 3. Analyse the continuous beam with a given loading condition using the flexibility matrix method.	Lecture Problem solving	
15	Introduction to the structural analysis by stiffness concept using Matrix approach. Introduction to the structural analysis by stiffness concept using Matrix approach.	5	1. Difference between flexibility and stiffness method? 2. What is the procedure involved in a stiffness method of analyzing a continuous beam.	Lecture Problem solving	
16	Step by step procedure to solve the indeterminate beams by stiffness method.	5	1. Analyse the continuous beam with a given loading condition using the stiffness matrix method.	Lecture Problem solving	
17	**Internal Exam-II**				
18	**END EXAM**				