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Question Paper Code: BSTB01



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## MODEL QUESTION PAPER

M.Tech I Semester End Examinations, January- 2020

**Regulations: R18**

### ADVANCED STRUCTURAL ANALYSIS

(STRUCTURAL ENGINEERING)

**Time: 3 hours**

**Max. Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

#### UNIT-I

1. a) Determine the degree of redundancy for the following structures: [7M]

Fig (i)

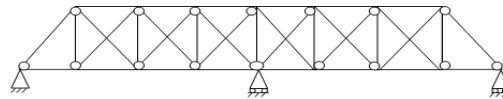
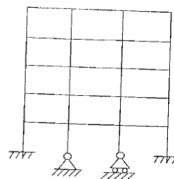
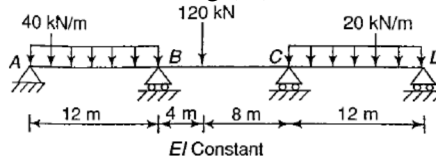


Fig (ii)



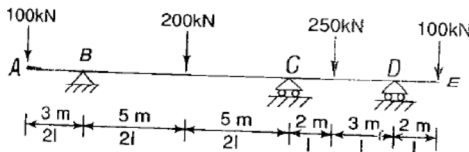
- b) Analyze the continuous beam shown in figure using stiffness method. [7M]

Fig (iii)



2. a) Formulate the stiffness matrices for a cantilever beam and fixed beam. [7M]  
 b) Analyze the continuous beam shown in figure using stiffness method. [7M]

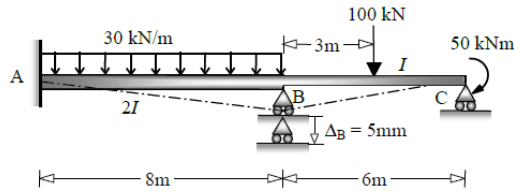
Fig (iv)



**UNIT- II**

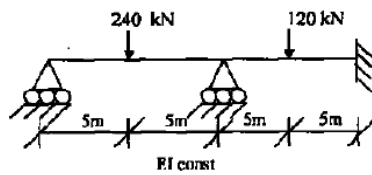
3. a) Explain the procedure of analysis using force and displacement method. [7M]  
 b) Analyse the two-span continuous beam shown in Figure by any matrix method (stiffness method) and draw the bending moment diagram. Assume  $EI = 27000 \text{ kNm}^2$ . [7M]

Fig (v)



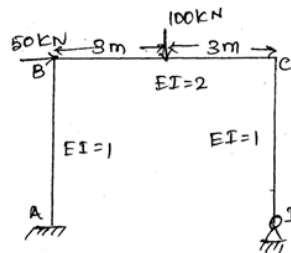
4. a) Write down the step by step procedure for the direct stiffness method of analysis for trusses. [7M]  
 b) Analyse the continuous beam by direct stiffness method. [7M]

Fig (vi)

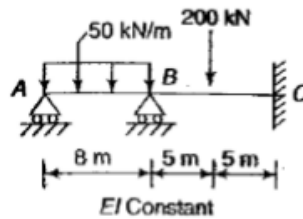


**UNIT- III**

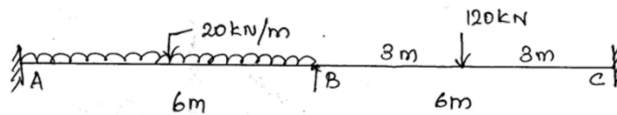
5. a) Analyse the portal frame using stiffness method (constant EI). [7M]  
 Fig (vii)



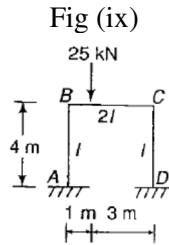
- b) Analyse the continuous beam using stiffness method. [7M]  
 Fig(viii)



6. a) Analysis the continuous beam in figure by stiffness method. [7M]  
 Fig (viii)



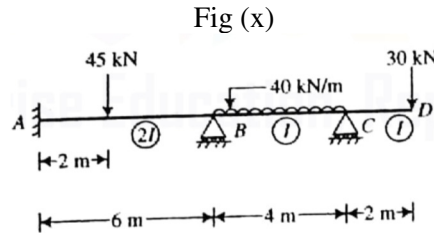
- b) Analyse the frame using displacement method. [7M]



#### UNIT- IV

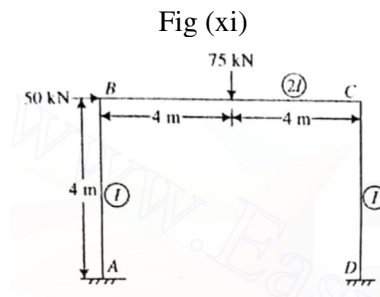
7. a) Derive the element stiffness matrix for a four noded isoparametric plan stress element. [7M]

- b) Analyse the continuous beam using stiffness method. [7M]



8. a) Derive the stress-strain relationship matrix (D) for the axisymmetric triangular element. [7M]

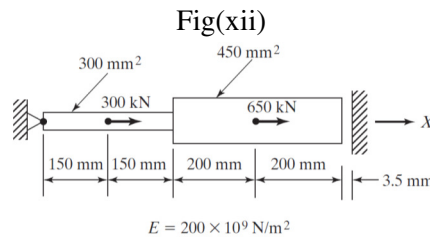
- b) Analyse the frame using stiffness method. [7M]



#### UNIT- V

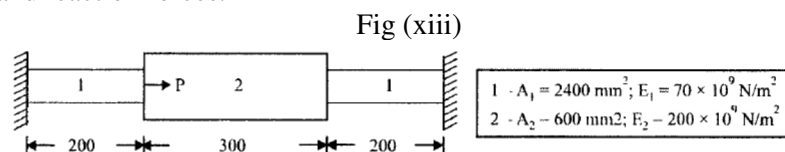
9. a) Explain briefly about the local coordinates, global coordinates, natural coordinates and area coordinates. [7M]

- b) Consider the bar shown in figure (xii). Determine the nodal displacements, element stresses and support reactions. [7M]



10. a) Explain the nodes, primary nodes, secondary nodes and internal nodes. [7M]

- b) An axial load  $P=200 \times 10^3$  N is applied on a bar as shown. Using the penalty approach for handling boundary conditions, determine nodal displacements, stress in each material and reaction forces. [7M]





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## COURSE OBJECTIVES:

The course should enable the students to:

I	Analyse the skeleton structures using stiffness analysis code.
II	Use direct stiffness method understanding its limitations.

## COURSE OUTCOMES (COs):

CO 1	Know the physical significance, effects of settlements, temperature change and lack of fit, member approach and structure approach.
CO 2	Understand the force method and displacement method, degree of freedom, local coordinates and global coordinates.
CO 3	Understand the stiffness matrix in global coordinates, boundary conditions, solution of stiffness matrix equations, calculation of reactions and member forces for beams, plane trusses, plane rigid jointed frames and grids by structure approach and member approach.
CO 4	Know the boundary value problems: approximate solution of boundary value problems, modified galerkin method for one-dimensional BVP, matrix formulation of the modified galerkin method.
CO 5	Understand the shape functions linear element, solution for poisson's equation, general one dimensional equilibrium problem.

## COURSE LEARNING OUTCOMES (CLOs):

BSTB01.01	Understand the physical significance of stiffness influence coefficients.
BSTB01.02	Understand the effects of settlements of stiffness influence coefficients.
BSTB01.03	Solve the problems on temperature change and lack of fit.
BSTB01.04	Know the member approach and structure approach.
BSTB01.05	Understand the force method.
BSTB01.06	Understand the displacement method.
BSTB01.07	Know concept of degree of freedom.
BSTB01.08	Understand the concept of local coordinates.
BSTB01.09	Understand the concept of global coordinates.
BSTB01.10	Develop the stiffness matrix for global coordinates and know the boundary conditions.
BSTB01.11	Concepts on solution of stiffness matrix equations.
BSTB01.12	Know the calculation of reactions and member forces.
BSTB01.13	Understand the stiffness method for beams, plane trusses and plane rigid jointed frames.
BSTB01.14	Understand the formulation of grid structures.
BSTB01.15	Concept of structure and member approach.
BSTB01.16	Understand the solutions for boundary value problems.
BSTB01.17	Know the modified galerkin method.
BSTB01.18	Understand the modified galerkin method for one-dimensional BVP.
BSTB01.19	Understand the matrix formulation of the modified galerkin method.
BSTB01.20	Know the shape functions for linear elements.
BSTB01.21	Understand the solution for poisson's equation.
BSTB01.22	Formulation of general one dimensional equilibrium problem.
BSTB01.23	Solution of general one dimensional equilibrium problem.

**MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES**

SEE Question No		Course Learning Outcomes	Course Outcomes	Blooms Taxonomy Level	
1	a	BSTB01.02	Understand the effects of settlements of stiffness influence coefficients.	CO 1	Understand
	b	BSTB01.03	Solve the problems on temperature change and lack of fit.	CO 1	Analyze
2	a	BSTB01.02	Understand the effects of settlements of stiffness influence coefficients.	CO 1	Understand
	b	BSTB01.04	Know the member approach and structure approach.	CO 1	Analyze
3	a	BSTB01.05	Understand the force method.	CO 2	Understand
	b	BSTB01.06	Understand the displacement method.	CO 2	Analyze
4	a	BSTB01.07	Know concept of degree of freedom.	CO 2	Understand
	b	BSTB01.05	Understand the force method.	CO 2	Analyze
5	a	BSTB01.11	Concepts on solution of stiffness matrix equations.	CO 3	Understand
	b	BSTB01.15	Concept of structure and member approach.	CO 3	Analyze
6	a	BSTB01.15	Concept of structure and member approach.	CO 3	Understand
	b	BSTB01.15	Concept of structure and member approach.	CO 3	Analyze
7	a	BSTB01.16	Understand the solutions for boundary value problems.	CO 4	Understand
	b	BSTB01.18	Understand the modified galerkin method for one-dimensional BVP.	CO 4	Remember
8	a	BSTB01.16	Understand the solutions for boundary value problems.	CO 4	Understand
	b	BSTB01.19	Understand the matrix formulation of the modified galerkin method.	CO 4	Analyze
9	a	BSTB01.20	Know the shape functions for linear elements.	CO 5	Understand
	b	BSTB01.23	Solution of general one dimensional equilibrium problem.	CO 5	Analyze
10	a	BSTB01.22	Formulation of general one dimensional equilibrium problem.	CO 5	Understand
	b	BSTB01.23	Solution of general one dimensional equilibrium problem.	CO 5	Analyze

**Signature of Course Coordinator**

**HOD, CE**