INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

M.Tech I Semester End Examinations (Regular) - January, 2019

Regulation: IARE–R18

ADVANCED STRUCTURAL ANALYSIS

Time: 3 Hours　　　　　　　　　　　**(STE)**　　　　　　　　　　　**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) Derive the stiffness influence coefficients of prismatic cantilever beam AB under UDL load subjected to unit displacement at free end B. **[7M]**

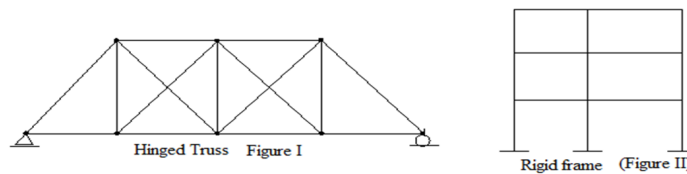   (b) Find the degree of redundancy of the Figure 1 **[7M]**

Figure 1

2. (a) If the member 2 of framed structure shown in Figure.2 is shorten by 0.01 m, Determine the force in members .Assume AE = 8×10^6 N. **[7M]**
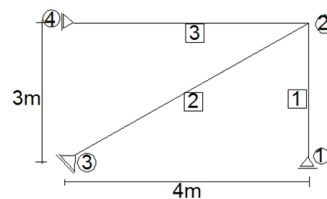

Figure 2

   (b) Write step by step procedure of stiffness matrix in the analysis of continuous prismatic beam ABC fixed at A and simply supported at B and C with UDL load (W) over the entire span. Assume support B is at mid span and C at end . **[7M]**

3. (a) Analyse the pin jointed truss frame shown in following Figure 3 by stiffness matrix Assume cross sectional area of each member $1000mm^2$, $E=2x10^5 N/mm^2$ **[7M]**
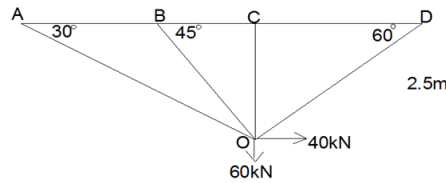

Figure 3

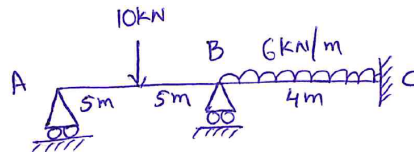(b) Analyze the continuous beam and find the support moments shown in Figure 4.   **[7M]**

Figure 4

4. (a) For the plane truss shown in below Figure 5 determine the element stiffness matrix and vertical displacement at nodes .Assume cross section area of members $250mm^2$ $E=2x10^5 MPa$.   **[7M]**
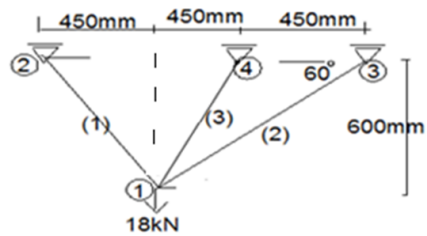

Figure 5

(b) Develop the stiffness matrix for the continuous beam shown in Figure 6.
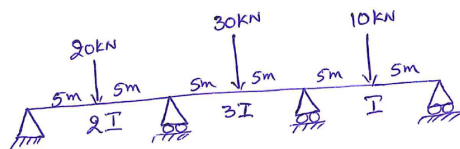

Figure 6

UNIT – III

5. (a) For the two bar truss element shown in Figure 7, determine the displacement at Node 2 and stresses in the elements .Assume cross sectional area of each member A=200mm^2 and E=70GPa.
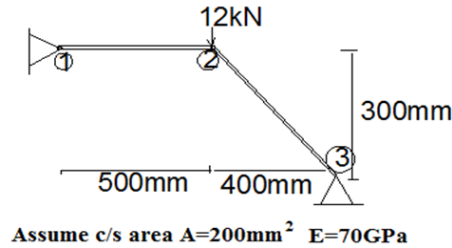
[7M]

Assume c/s area A=200mm^2 E=70GPa

Figure 7

(b) A beam fixed at one end supported by roller at other end has concentrated load 20kN at centre span. Calculate the deflection under the load by stiffness matrix method. Assume E=2x10^{5}N/mm^2 and I=2500cm^4. Assume length of beam 10m.

[7M]

6. (a) A stepped bar is subjected to axial load of 200kN at place of change in cross section as shown in the Figure 8. Find Reaction forces and induced stresses in element 1 and 2   [7M]
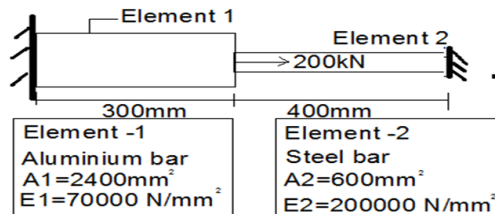

Figure 8

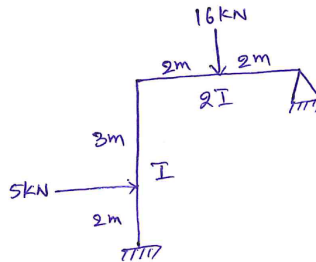(b) Analyze the frame shown in Figure 9 by using stiffness matrix method.   [7M]

Figure 9

UNIT – IV

7. (a) Analyse the continuous beam shown in Figure 10, if the support B sinks by 10mm. Use Displacement method. Assume EI=6000kN-m^2 **[7M]**
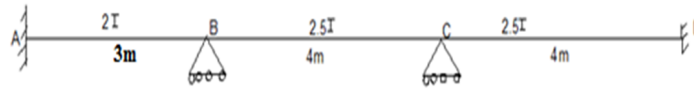

Figure 10

(b) Analyse the frame shown in Figure 11 by stiffness method. Assume EI constant. **[7M]**
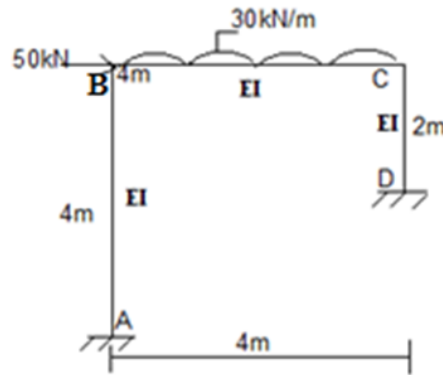

Figure 11

8. (a) Write the steps to develop stiffness matrix for indeterminate plane frames. **[7M]**

(b) For the beam loaded as shown in Figure 12, determine the slope at nodes 2, and 3 and vertical deflection at midpoint of the distributed load in span BC.(EI constant) **[7M]**
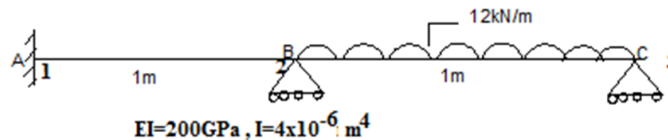

Figure 12

UNIT – V

9. (a) Briefly explain different types of coordinate systems with neat sketches in matrix analysis **[7M]**

(b) Briefly explain the following. (i) List of coordinate system used in FEM (ii) Types of boundary conditions **[7M]**

10. (a) Derive shape function of one dimensional linear element (Use Matrix method) **[7M]**

(b) What are the different types of element shapes used in finite element methods and explain with neat sketches. **[7M]**

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