Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination April 2010

Subject code: 712001 Subject Name: Advanced Structural Analysis

Date: 06 / 04 / 2010 Time: 12.00 noon – 02.30 pm

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain SI and KI giving suitable examples. Also discuss advantages of Indeterminate structures. **06**

(b) Write 12×12 stiffness matrix with respect to member oriented axis for space frame member. Also explain the terms with illustration:$[S_J]$, $[D_Q]$, $[S_{FR}]$ **06**

Q.2 **(a)** Calculate displacements for the truss shown in **fig.1** by Flexibility Method Member approach. EA is constant for all members. **06**

(b) Analyze the beam shown in **fig.2** if the downward settlements of supports B & C in kN-m units are 200/EI & 100/EI respectively and draw bending moment diagram. Use stiffness method. EI is constant for all members. **06**

OR

(b) Explain the method to solve simultaneous equations giving computer program. **06**

Q.3 For a plane frame shown in **fig.3** Find member end actions OR reactions by flexibility method member approach. Only flexural effects are considered. EI is constant for all members. **12**

OR

Q.3 Determine the elements of stiffness matrix for the frame shown in **fig.4**.Number of unknown joint displacements are in the following order: (i)Horizontal translation of beam AB(ii) Horizontal translation of beam CD(iii)rotation of joint A(iv) rotation of joint B(v) rotation of joint C(vi) rotation of joint D. **12**

Q.4 Obtain the joint stiffness matrix S_J for the plane truss shown in **fig.5**.Assume all the members have same axial rigidity EA_X. Use given Numbering system for joints and members. **12**

OR

Q.4 **(a)** Explain rotation matrix R & rotation transformation matrix R_T. Write rotation transformation matrix for grid structure. **06**

(b) Explain substructure technique of analysis giving example of plane truss. **06**

Q.5 For the plane frame shown in **fig.6** calculate reactions at supports by stiffness method member approach assuming $E=70\times10^6$ kN/ m^2.The moment of inertia and cross section area of members 1 & 2 are $0.5\times10^{-3}m^4$ and 0.02 m^2 respectively. Use given Numbering system for joints and members. **12**

OR

Q.5 Obtain joint stiffness matrix and calculate displacements for the frame shown in **fig.7** assuming $E=70\times10^6$ kN/ m^2. The moment of inertia and cross section area of members 1 & 3 are $0.5\times10^{-3}m^4$ and 0.02 m^2 respectively & for member 2 are $1\times10^{-3}m^4$ and 0.03 m^2 respectively. **12**

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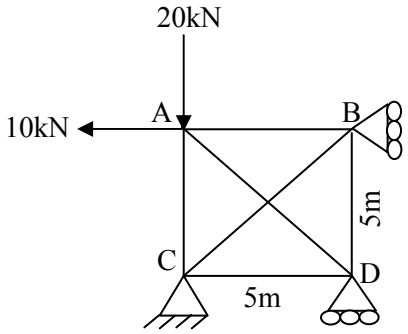

Fig.1,Q.2(A)

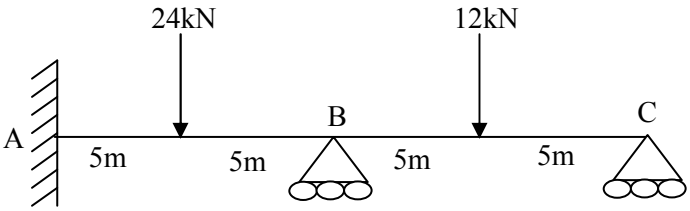

Fig.2,Q.2(B)

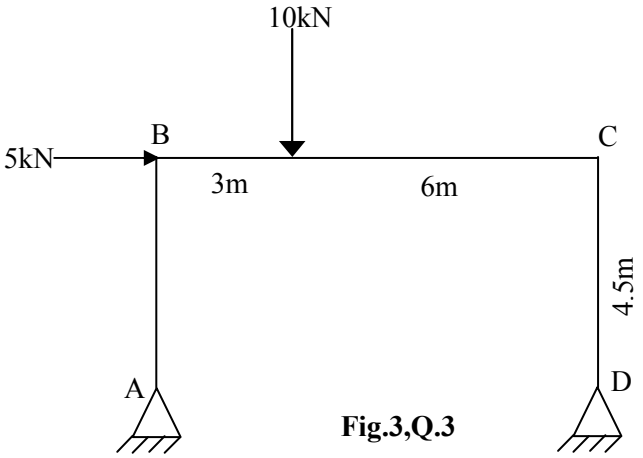

Fig.3,Q.3

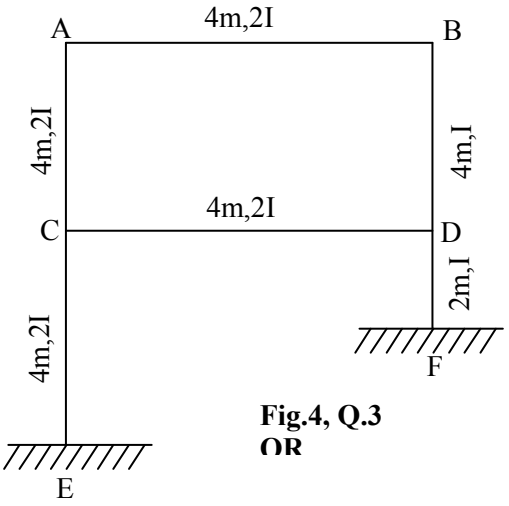

Fig.4, Q.3
OR

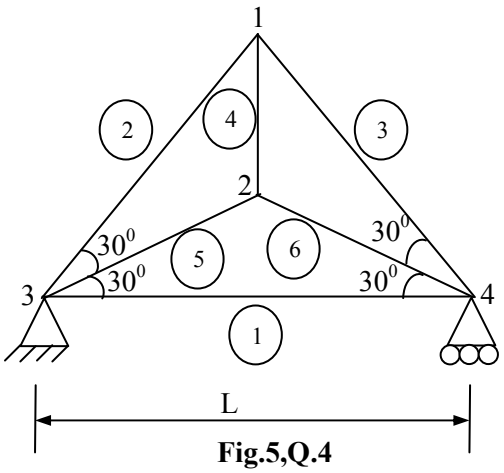

Fig.5,Q.4

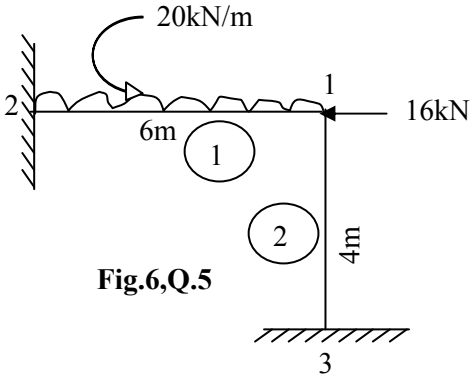

Fig.6,Q.5

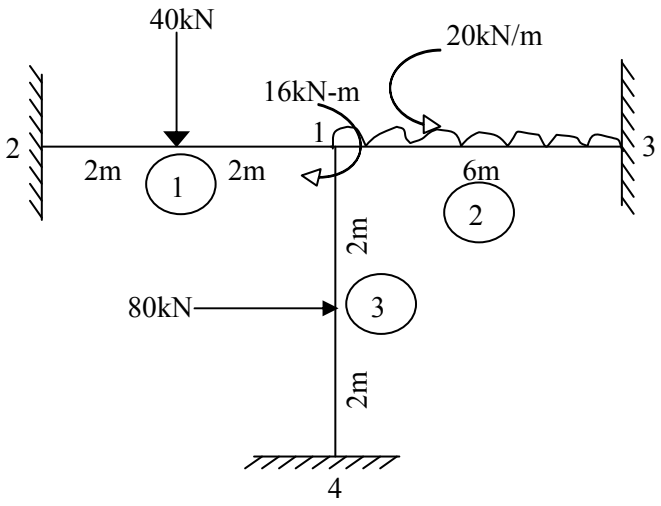

Fig.7,Q.5 OR