Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Remedial Examination January/ February 2011

Subject code: 711501

Subject Name: Matrix Analysis of Framed Structures

Date: 31/01 /2011 **Time: 02.30 pm – 05.00 pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Take E=200 GPa, EI = 20 × 10^3 kN m^2 & EA=40 MN, unless given.**
3. **Make suitable assumptions wherever necessary & state clearly.**
4. **Use of member approach is essential, except Q.4 2nd alternative.**
5. **Figures to the right indicate full marks.**

Q.1 **(a)** Represent rotational transformation matrices for beam, plane truss, plane frame and plane grid. **06**

(b) Compute displacement/s for a beam shown in *fig. 1*, using appropriate method. **06**

OR

(b) Calculate the member end actions of the beam shown in *fig.1*, if 'B' sinks by 6 mm. Neglect given loading. **06**

Q.2 **(a)** Explain any ***six*** terms from the following in details with the illustration and specify whether it pertains to *stiffness method* or *flexibility method* or both the methods. **06**
$[S_{RF}]$, $\{A_Q\}$, $[B_{RJ}]$, $\{A_J\}$, $[S_J]$, $\{D_F\}$ & $\{A_{RC}\}$.

(b) For a beam shown *fig. 1*, if end 'A' is replaced by a hinged instead of fixed, construct equilibrium matrix,$[B_{MS}]$, selecting M_B and M_C as redundants. What will be the effect on $[B_{MS}]$, if the couple is doubled? **06**

Q.3 **(a)** A R.C.C. frame, shown in *fig. 2*, is to be used for a stadium, where ABC has M.I. of 1.575 × 10^{-3} m^4 and c/s. area of 0.1 m^2, while column BD has M.I. of 0.8 × 10^{-3} m^4. Considering E=20 GPa and neglecting axial displacement of BD, prove that the displacements at 'B' are u_B = 0.043 mm rightward and θ_B= 0.0008 radian clockwise. **07**

(b) Knowing the displacements at 'B', for the frame in *fig.2*, compute **either** the member end actions **or** the reaction components. **05**

OR

Q.3 Using **either** *stiffness method* **or** *flexibility method*, compute member end actions for the plane truss shown in *fig.3*. **12**

Q.4 Analyse a space truss, shown in *fig.4* to find displacements, the reactions and member end actions. **12**

OR

Q.4 Compute displacement/s for a composite beam shown in *fig.5*, neglecting axial deformation in the beam and find member end actions. **12**
Consider I_{ABC} = 30 × 10^6 mm^4 and A_{BD} = A_{BE}= 500 mm^2.

Q.5 **(a)** Show that displacements at 'B' for plane grid, shown in *fig.6*, is w_B= 2.756 mm downward and θ_{BX}= 0.001 radian clockwise. Consider GJ= 0.8 EI. **06**

(b) Knowing the displacements of the grid (in *fig.6*), compute required secondary unknowns and draw bending moment diagram and torsion moment diagram. **06**

OR

Q.5 **(a)** Explain with illustration, how the effect of semi-rigid connections can be incorporated for the plane frame, using stiffness method. **06**

(b) Explain any ***two*** of the following secondary effects without any detailed calculations, using any method. **06**

(i) For *fig.1*, roller 'B' is replaced by linear spring.
(ii) For the truss shown in *fig 3*, vertical member is short.
(iii) The temperature of member 5 of the truss in *fig. 3* is raised.

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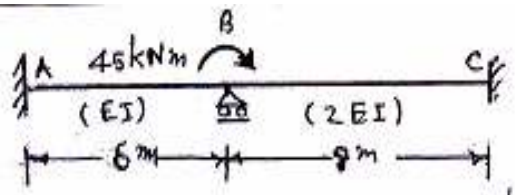

fig. 1, Q 1(b) both alt, Q 2(b) and Q 5(b) 2nd alt(i)

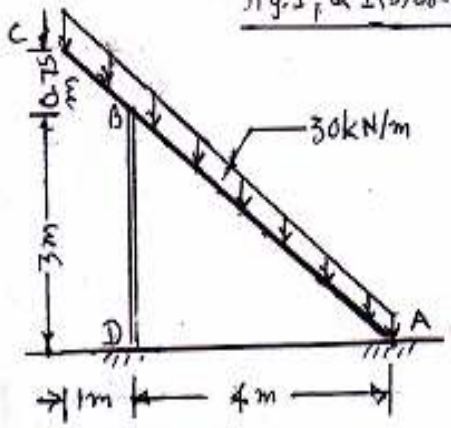

fig. 2, Q. 2 (a) and (b) 1st alt.

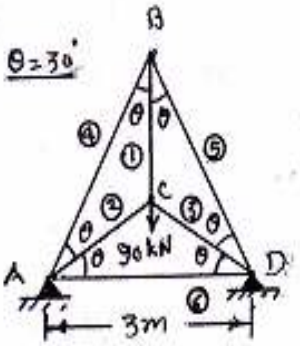

fig. 3, Q. 3 and Q. 5 2nd alt (ii) & (iii)

(F.T.O.)

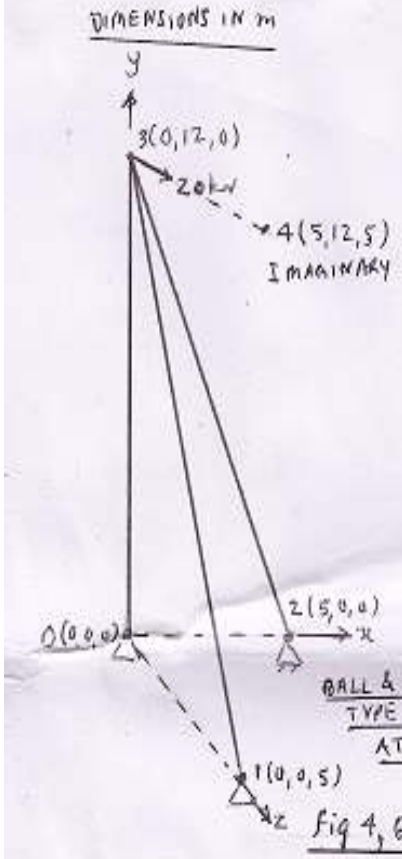

fig 4, Q 4 1st alt

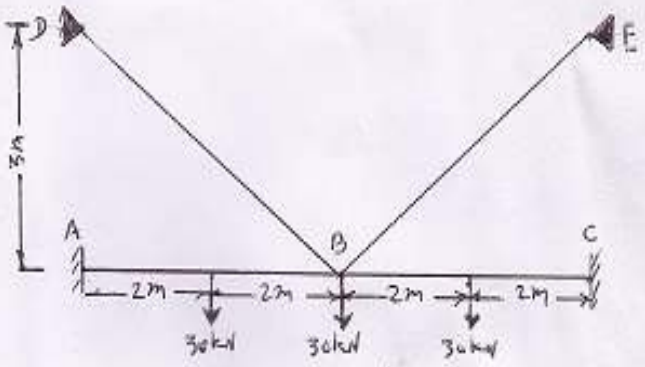

fig. 5, Q. 4 2nd alt.

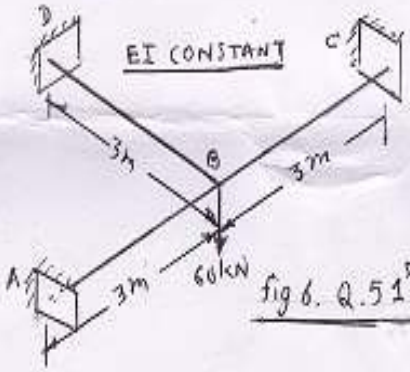

fig 6. Q. 5 1st alt (a) & (b)

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