Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-III Examination May 2012

Subject code: 130604

Subject Name: Structural Analysis-I

Date: 15/05/2012 **Time: 02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Consider E = 2 x 10^5 MPa, G = 80 GPa, Poisson's ratio = 0.3 unless specified otherwise.**

Q.1	**(a)**	Find SI and KI for the structures shown in Fig.1.	**04**
	(b)	Differentiate between stable and unstable structure.	**03**
	(c)	Analyse the grid shown in the Fig.2 and draw shear force, bending moment and twisting moment diagrams.	**07**
Q.2	**(a)**	A solid rod AB is attached to a rigid lever BC as shown in Fig. 3. Support A is fixed. Twisting is possible at B but vertical displacement is restrained. Determine the diameter of the rod AB so that the deflection at C does not exceed 25 mm and maximum shear stress does not exceed 100 MPa.	**07**
	(b)	Calculate diameter of shaft to transmit 10 kW at a speed of 15 Hz. The maximum shear stress should not exceed 60 MPa.	**07**
		OR	
	(b)	A 40 mm diameter steel shaft of length 1200 mm is used to transmit 50 kW between a motor and a pump. Determine the lowest speed of rotation at which shear stress does not exceed 60 MPa and angle of twist does not exceed 2°.	**07**
Q.3	**(a)**	Concentrated loads of magnitude 40 kN, 80 kN, 80 kN and 100 kN at 2 m gap between each other crosses a 12 m span simply supported beam from right to left. Calculate the maximum shear force and bending moment at a section 4 m from left support.	**07**
	(b)	For the beam shown in Fig. 4 determine the deflection and slope at C using Macaulay's method.	**07**
		OR	
Q.3	**(a)**	Draw influence lines diagrams for the axial forces in the members BC, CF and FG in the truss shown in Fig. 5.	**07**
	(b)	For the truss shown in Fig. 6 calculate horizontal deflection at C by unit load method. Area of member AB is 400 mm^2. Area of AC and BC is 600 mm^2.	**07**
Q.4	**(a)**	A masonry retaining wall is 6 m high, 0.75 m wide at top and 2 m wide at bottom. The wall is retaining soil up to top. The face of the wall on soil side is vertical. The lateral pressure due to soil varies from zero at top to 3.2 kN / m^2at bottom. Specific weight of masonry is 24 kN / m^3. Draw stress distribution at base of wall due to self weight of wall alone and due to self weight of wall and soil pressure.	**07**
	(b)	A three hinged parabolic arch of 20 m span and 4 m central rise carries a point load of 150 kN at 4 m from left side support. Calculate normal thrust	**07**

and shear force at section under load. Draw BMD.

OR

Q.4 **(a)** A tie rod of circular cross section is subjected to a tensile force of 20 kN. The force is acting with eccentricity of 4 mm. Calculate the diameter of the rod if maximum tensile stress in the rod is not to exceed 150 MPa. **07**

Q.4 **(b)** A three hinged parabolic arch has a span of 30 m and central rise of 5 m. It carries two vertical loads of 250 kN at 4 m on either side of the central hinge. Calculate the maximum and the minimum bending moments and their position. Also draw BMD. **07**

Q.5 **(a)** A cylindrical shell has 3.5 m length, 1.2 m diameter and 10 mm thickness. The shell is subjected to internal pressure of 2 N / mm^2. Calculate the maximum shear stress and change in dimension of the shell. **07**

(b) A 35 kg collar is released from height h to drop on a disk at bottom end C of the bar ABC. End A of the bar is fixed. Part AB is 2 m long and 40 mm in diameter. Part BC is 1.5 m long and 30 mm in diameter. Calculate the height h for which the maximum stress in the rod is 250 MPa. **07**

OR

Q.5 **(a)** A 2.5 m long pin ended column of square cross section is made up of timber. Using Euler's formula, find out size of the column with a factor of safety 2 for 250 kN axial load. **07**
Consider E = 12.5 GPa, Allowable stress in axial compression = 12 MPa.

(b) Find out slope and deflection at C for the beam shown in Fig. 7 by conjugate beam method. **07**

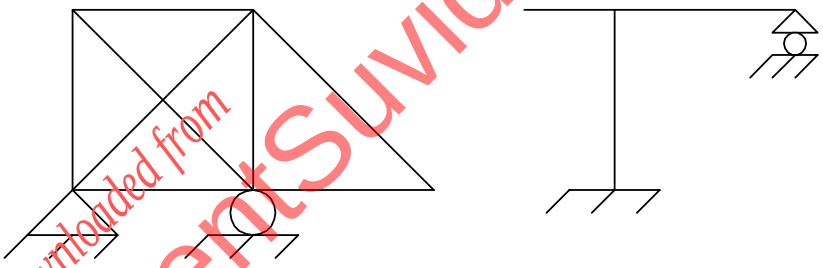

Fig. 1. Q. 1.(a)

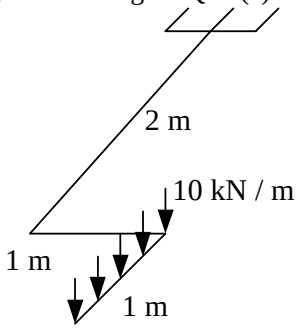

Fig. 2 Q.1. (b)

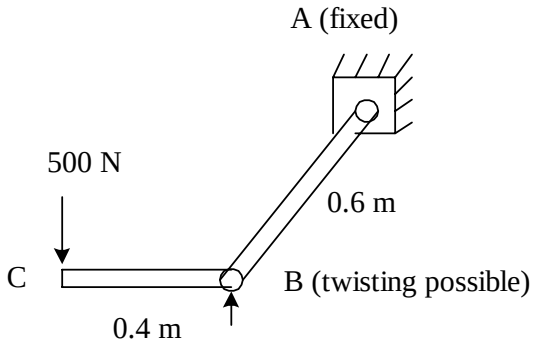

Fig. 3 Q.2 (a)

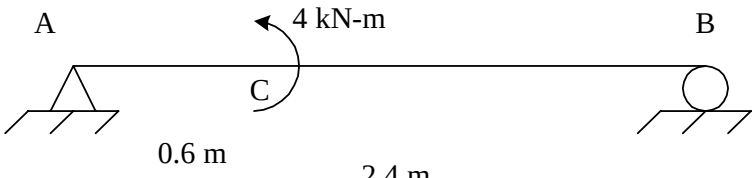

Fig.4 Q.3(b)

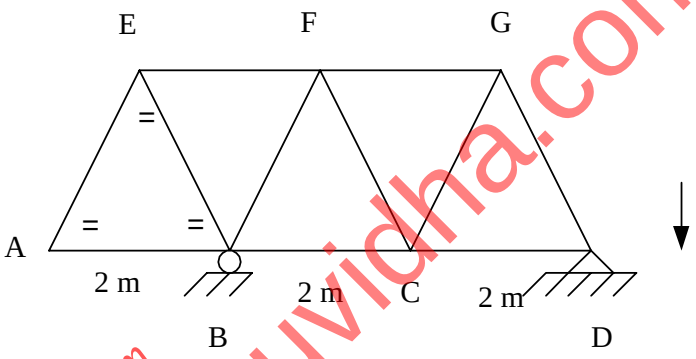

Fig. 5 Q.3 (a) OR

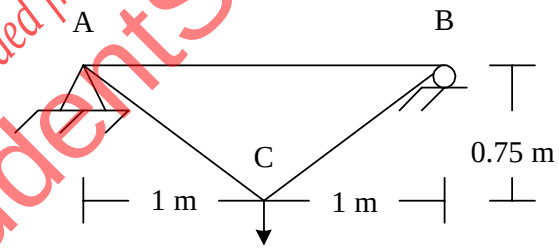

Fig. 6 Q.3 (b) OR

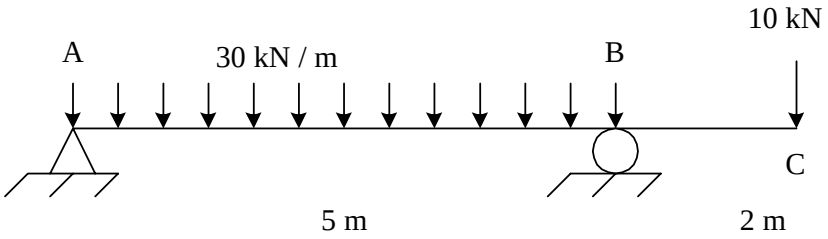

Fig.7 Q.5 (b) OR