Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – SUMMER 2013

Subject Code: 130604 **Date: 04-06-2013**

Subject Name: Structural Analysis-I

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.**

Q.1	**(a)**	(1) State and Explain Principle of Superposition.	**03**
		(2) Find static indeterminacy and kinematic indeterminacy of structures given in **Fig.1** and **Fig.2**	**04**
	(b)	Analyze the rigid jointed portal frame shown in the **Fig.3**. Draw shear force diagram, bending moment diagram and axial force diagram.	**07**
Q.2	**(a)**	(1) Define: Strain energy, modulus of resilience, Influence line	**03**
		(2) Derive an expression of slope at supports for the simply supported beam subjected to point load at the centre of the beam.	**04**
	(b)	A cantilever 2m long is loaded as shown in **Fig. 4**. Find slope and deflection at free end using Macaulayôs method. Take E = 200GPa and I = 160 $\times 10^6$ mm^4.	**07**
		OR	
	(b)	A solid cylindrical shaft is to transmit 300kW power at 100r.p.m. If the shear stress not to exceed 80N/mm^2, find its diameter. What percent saving in weight would be obtain if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same.	**07**
Q.3	**(a)**	Derive an expression for deflection of a closed coil helical spring subjected to an axial load.	**07**
	(b)	Determine the horizontal deflection and vertical deflection at D, of a truss shown in **Fig. 5** using unit load method. AE is same for all members.	**07**
		OR	
Q.3	**(a)**	Determine the tension in each segment of the cable shown in **Fig. 6**. Also, find the dimension ôhô.	**07**
	(b)	A masonry chimney 20m high is of circular section, the external diameter and internal diameter of the section being 6m and 4m respectively. The chimney is subjected to horizontal wind pressure of 1.2kN/m^2 of projected area. Find the maximum and minimum stresses at the base. Take unit weight of masonry as 20kN/m^3.	**07**
Q.4	**(a)**	Calculate the change in diamtere, change in length and change in volume of a thin cylindrical shell 1000mm diamter, 10mm thick and 5m long when subjected to internal pressure of 5N/mm^2. Take E = 2×10^5 N/mm^2 and Poissonôs ratio $\varepsilon = 0.3$.	**07**
	(b)	A circular arched rib of 20m span with central rise of 5m is hinged at the crown and springing. It carries a point load of 80kN at 5m from the left hand hinge. Find the horizontal thrust of the arch, the reactions at the supports and bending moment under the point load.	**07**
		OR	

Q.4 **(a)** A steel bar of 3m length and 1000mm^2 in cross section suddenly loaded with an axial pull of 20kN. Find maximum instantaneous stress, maximum instantaneous elongation and strain energy. Take E = 2×10^5 N/mm^2. **07**

(b) Derive an expression for crippling load when one end of column is fixed and the other end is free. **07**

Q.5 **(a)** A simply supported beam of span 6m carries uniformly distributed load of 10kN/m over its entire span. Find the strain energy stored due to bending in the beam. Take E = 2×10^5 N/mm^2, I = 1.5×10^6 mm^4. **07**

(b) A simply supported beam AB has a span of 10m. Draw influence lines for R_A, R_B, V_X and M_X for a section X at 4m from left hand support. **07**

OR

Q.5 **(a)** A hollow cylindrical cast iron column is 4m long with both ends fixed. Find the minimum diameter of the column if it has to carry a safe load of 250 kN with a factor of safety of 5. Take internal diameter as 0.8 times the external diameter. Take σ_c = 500MPa and Rankine's constant α = 1/1600. **07**

(b) A short column has a square section 300mm × 300mm with a square hole of 150 mm × 150 mm as shown in **Fig. 7**. It caarries an eccentric load of 1500kN, loacted as shown in figure. Determine the maximum and minimum stresses across the section. **07**

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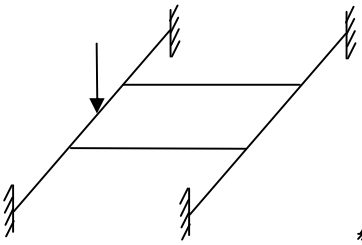

Fig. 1 [Q-1(a)(2)]

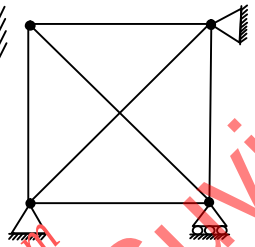

Fig. 2 [Q-1(a)(2)]

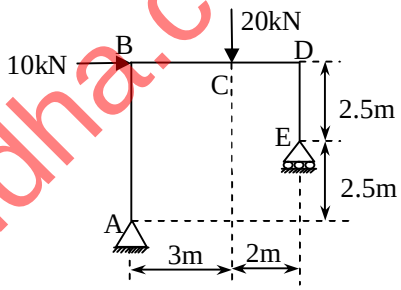

Fig. 3 [Q-1(b)]

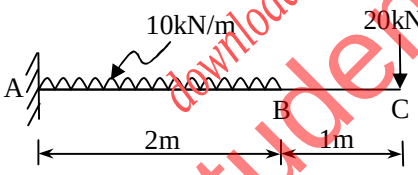

Fig. 4 [Q-2(b)]

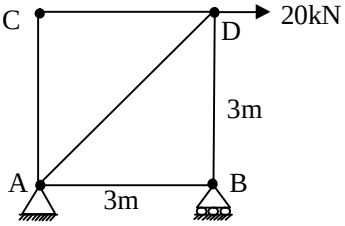

Fig. 5 [Q-3(b)]

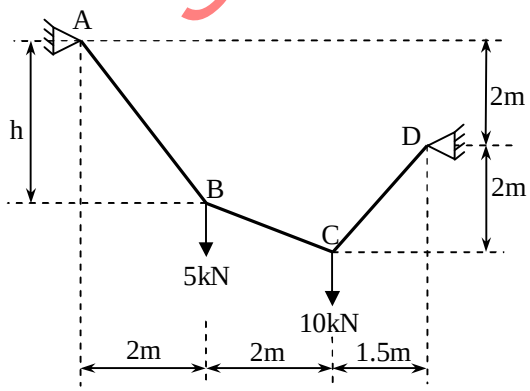

Fig. 6 [OR Q-3(a)]

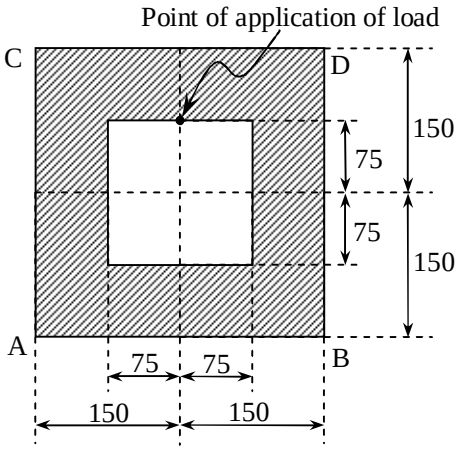

Fig. 7 [OR Q-5(b)]