Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:3140603 Date:11-07-2023

Subject Name:Structural Analysis-I

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	State and explain principle of superposition with its application in this subject.	**03**
	(b)	Differentiate between (i) Plane frame and Grid (ii)Conjugate beam and real beam	**04**
	(c)	Define: Impact factor. A weight of 10kN falls by 30 mm on a collar rigidly attached to lower end of a vertical bar 4 m long and 1000 mm^2 in section. The upper end of the vertical bar is fixed. Find the instantaneous expansion, stress and energy absorbed by the bar. Find also impact factor. Take E = 210GPa.	**07**
Q.2	**(a)**	Derive equation of circumferential and longitudinal stresses in cylindrical shell due to internal pressure.	**03**
	(b)	Find SI and KI of structures shown in fig. 1 (a), 1(b).	**04**
	(c)	Draw shear force, bending moment and axial force diagrams for the frame shown in fig. 2	**07**
		OR	
	(c)	Analyse the truss shown in fig. 3	**07**
Q.3	**(a)**	Define: (i) Strain energy (ii) Resilience (iii) Modulus of resilience	**03**
	(b)	A beam simply supported over a span of 6m is carrying a point load 50kN at mid span. Find slope at supports using Macaulay's method. EI= 20000kNm^2	**04**
	(c)	A three hinged parabolic arch has a span of 20m and central rise 5 m. It carries two point loads of 20 kN of each at 3m and 6m from the left hinge. Calculate normal thrust, shear and bending moment at a section 5m from left end hinge.	**07**
		OR	
Q.3	**(a)**	Define: (i) Crippling load (ii) Statically indeterminate structure (iii) Strut	**03**
	(b)	Draw S.F. and B.M. diagram for fixed beam carrying central point load 'W' using basic principle.	**04**
	(c)	Find out slope at 'A' and deflection at 'C' for the beams shown in fig.4 using Conjugate beam method. $2I_{AC} = I_{CB}$ .EI = 12000kNm^2.	**07**
Q.4	**(a)**	What is middle third rule? What is importance of this rule in stability check for dam section?	**03**
	(b)	A strut 2 m long is 50mm in diameter. One end of the strut is fixed while its other end is hinged. Find the compressive load for the member using Euler's formula, allowing a factor of safety of 3.5. Take E=2.1 x $10^5 N/mm^2$.	**04**

(c) A rectangular pier of 1.5 m X 1 m is subjected to a compressive load of 500 kN with 0.25m eccentricities in both directions. Find the stress on all four corners of the pier and draw stress disribution. **07**

OR

Q.4 **(a)** Draw a neat sketch for Kernel of section for rectangular 400 mm X 300mm **03**

(b) A column of size 250mm (b) x 350mm (d), 4.2 m in length with its both ends are fixed. Find load carrying capacity of the column by Rankine's formula. Take fc=320 N/mm^2, E = 2.1 x 10^5 N/mm^2, α= 1/6400. **04**

(c) A masonry retaining wall of trapezoidal section is 12 m high and retains earth which is level up to the top. The width at the top and bottom are 3 m and 6 m respectively. Exposed face is vertical. Determine the stresses at base and check the section for its stability. Take density of earth = 16 kN/m^3 and density of masonry =24 kN/m^3 and angle of repose of earth= 30◦ and μ =0.5 **07**

Q.5 **(a)** Define & explain the following terms **03**
Relative stiffness, Carry-over factor, Distribution factor

(b) Find the deflection at the free end of cantilever of span '*l*' subjected to point load 'P' at free end by equating strain energy to work done. **04**

(c) Analyse the propped cantilever beam AB, fixed at 'A' and simply supported at 'B' subjected to UDL of 20kN/m^2 throughout span using consistent deformation method. Draws shear force and bending moment diagrams. **07**

OR

Q.5 **(a)** State moment area theorems with net sketches. **03**

(b) Find fixed end moments due to rotation of support B by Θ in clockwise direction for fixed beam AB. **04**

(c) Determine end moments for the beam ABC loaded as shown in fig.5 using moment distribution method. **07**

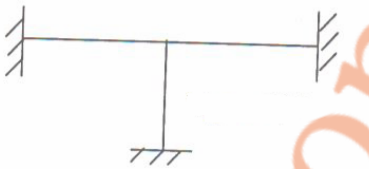


Fig. 1(a)

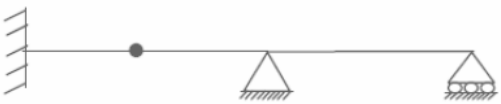


Fig. 1(b)

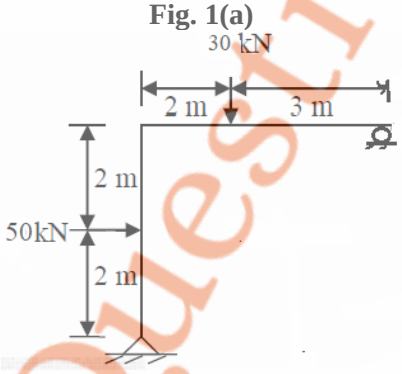


Fig. 2

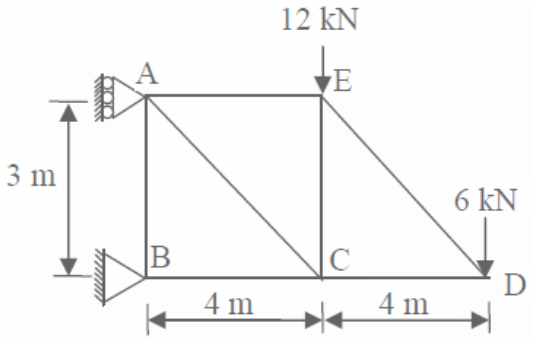
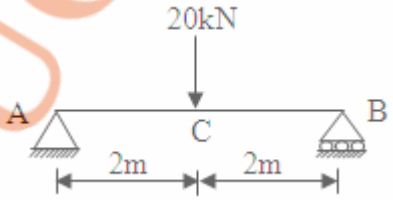


Fig. 3



$2I_{AC} = I_{CB}$

Fig. 4

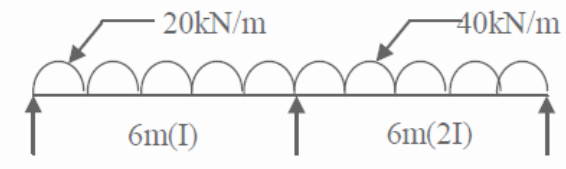


Fig.5

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