

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 distribution. 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 $f_c = 320 \text{ N/mm}^2$, $E = 2.1 \times 10^5 \text{ N/mm}^2$, $\alpha = 1/6400$. 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 $\mu = 0.5$ 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 20 kN/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 neat 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

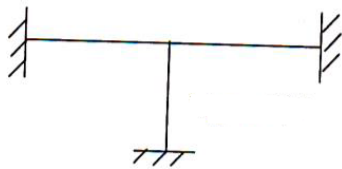


Fig. 1(a)
30 kN

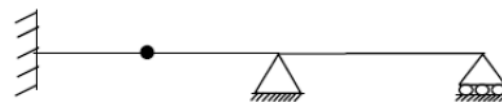


Fig. 1(b)

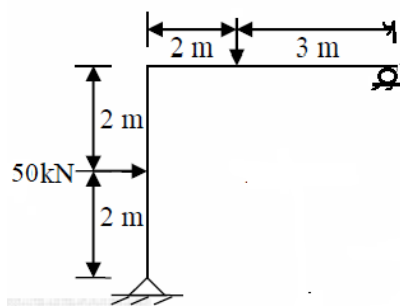


Fig. 2

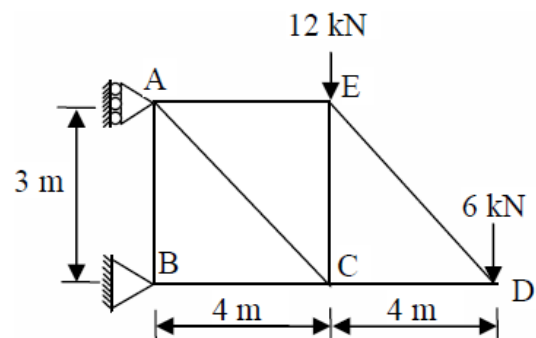
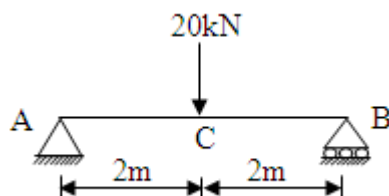


Fig. 3



$2I_{AC} = I_{CB}$
Fig. 4

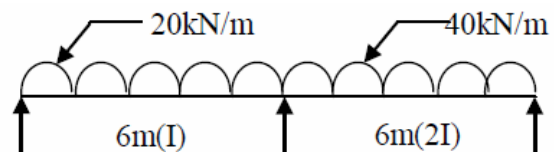


Fig.5
