Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2021

Subject Code:2140603 Date:04/01/2022

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.**

Q.1	**(a)**	Explain Maxwell's Theorem of reciprocal deflections.	**03**
	(b)	Derive the equation for Strain Energy stored in a bar due to Sudden Loading.	**04**
	(c)	Draw shear force, bending moment and axial force diagram for the rigid jointed frame as shown in figure-1.	**07**
Q.2	**(a)**	Find static indeterminacy for the structure shown in figure-2.	**03**
	(b)	Using Integrating method, Derive equation for Rotation and Deflection at free end for cantilever having span l meter, subjected to uniformly distributed load (UDL) of w kN/m.	**04**
	(c)	Using Moment Area Method, Calculate slope and deflection at mid point B and free end C for the cantilever beam as shown in figure-3. Consider EI=3000 $kN.m^{2.}$	**07**
		OR	
	(c)	A steel bar 120 cm long and rectangular in cross section 50 mm x 90 mm is subjected to an axial load of 1.2 kN. Find the maximum stress and strain energy stored if, (a) The load is applied gradually, (b) The load is applied suddenly, (c) The load is applied after falling through a height of 7 cm. Take E = 200 GPA.	**07**
Q.3	**(a)**	Discuss Stability Conditions for a retaining wall or a dam.	**03**
	(b)	Explain conjugate beam method for finding out slope and deflection of beams.	**04**
	(c)	A masonry dam 5 m high, 3.25 m wide at base and 1 m wide at top, retains water on vertical face for full height. Considering density of masonry as 18 kN/m^3 and density of water as 10 kN/m^3, calculate maximum and minimum pressure intensities at the base.	**07**
		OR	
Q.3	**(a)**	Define Core or Kernal of section. Derive and locate the same for a hollow rectangular cross section.	**03**
	(b)	Derive equation for Strain Energy stored in a bar due to impact loading.	**04**
	(c)	Analyze the beam shown in figure-4 by consistent deformation method. Draw shear force and bending moment diagram. Assume EI as constant.	**07**
Q.4	**(a)**	Define the followings: (a) Radius of Gyration, (b) Slenderness Ratio and (c) Critical Load.	**03**
	(b)	A hollow rectangular column having outside dimensions as 225 mm x 175 mm and inside dimensions as 200 mm x 150 mm. Length of column is 5 m and both ends are fixed. Calculate the Euler's Load if E = 2 x 10^5 N/mm^2.	**04**
	(c)	A fixed beam AB of span 7 m carries two point loads of 25 kN each at a distance of 2 m from both ends. Draw Shear force and Bending moment	**07**

diagrams.

OR

Q.4	**(a)**	State and explain Eddy's Theorem.	**03**
	(b)	A short column of rectangular section of 350 mm x 250 mm is subjected to a point load of 500 kN at a point 100 mm from longer side and 125 mm form shorter side. Calculate the maximum and minimum stresses in the column.	**04**
	(c)	A cast iron column of hollow cylindrical section 5.2 m long, with ends firmly built in, has to carry an axial load of 260 kN. Determine the section using a factor of safety of 8 and considering internal diameter to be 0.75 of the external diameter. Rankine constants for C.I. are f_c= 550 N/mm^2 and α = 1/1600.	**07**
Q.5	**(a)**	Explain stresses in thin cylindrical shells along with equations of hoop stress and longitudinal stress with neat sketch.	**03**
	(b)	A 2000 mm long wire of 30 mm2 cross sectional area is hanged vertically. It receives a sliding collar of 150 N weight and stopper at bottom end. The collar is allowed to fall on stopper through 210 mm height. Determine the instantaneous stress induced in the wire. Take E = 200 GPA.	**04**
	(c)	As shown in figure-5, A three hinged parabolic arch of span 20 m & having 4 m of central rise is loaded by uniformly distributed load of 3 kN/m over left 6m span. Calculate (a) direction and magnitude of reactions at hinges (b) Bending moment, Normal Thrust and radial shear at 3 m from left end.	**07**

OR

Q.5	**(a)**	Derive formulae for fixed end actions and Draw shear force & bending moment diagrams for a fixed beam having span l meter & carrying point load W kN at center of the span.	**03**
	(b)	Using integration method find out slope and deflection at fee end for a cantilever beam of span l meter loaded with a pint load W kN at tip of span i.e. at free end of the span.	**04**
	(c)	As shown in figure- 6, a suspension cable is supported at two points 50 m apart. The left support is 4.75 m above the right support. The cable is loaded with uniformly distributed load of 28 kN/m throughout the span. The maximum dip in the cable from the left support is 6.0 m. Calculate the maximum tension in the cable.	**07**

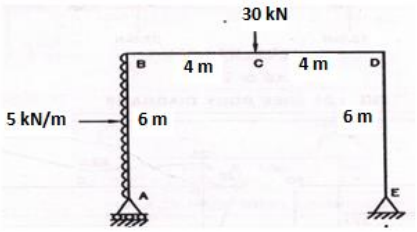

Figure-1

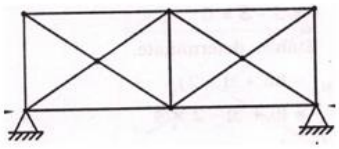

Figure-2

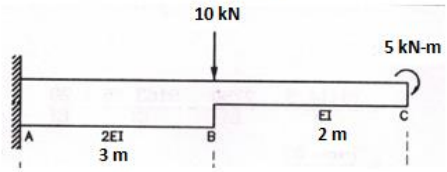

Figure-3

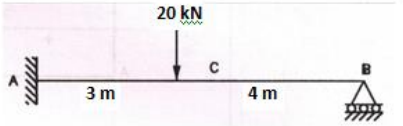

Figure-4

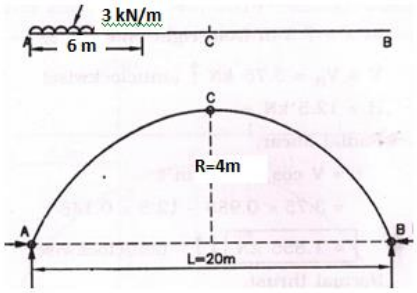

Figure-5

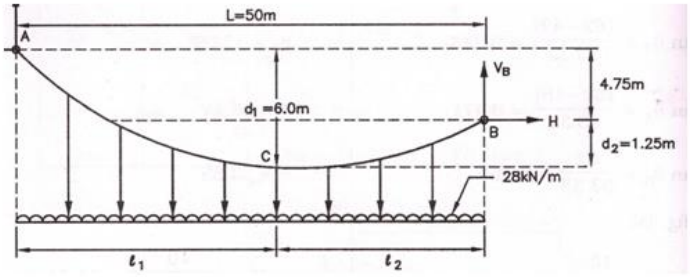

Figure-6

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