Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (OLD) EXAMINATION – WINTER 2021

Subject Code:130604 Date:23-02-2022

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)**	Define Influence Line Diagram and give it's uses.	**03**
	(b)	Find out SI and KI of the structures shown in the fig.1 and fig.2.	**04**
	(c)	Calculate the deflection at C in terms of EI for the beam as shown in fig.-1 by Macaulay's method..	**07**
Q.2	**(a)**	Find the Euler's crippling load for a hollow cylindrical steel column of 40 mm external diameter and 3.0 mm thick. Take length of the column as 2.5 m and hinged at its both ends. Take E = 200 GPa. Also determine the crippling load by Rankine's formula using constants as 335 MPa and 1/7500.	**07**
	(b)	A three hinged arch of 30m span and 6m rise carries a UDL of 25kN per horizontal meter run over the left hand half of the span and three point loads of 80kN each at 15,20 and 25m from the left hand hinge. Calculate the horizontal thrust.	**07**
		OR	
	(b)	A light cable, 16 m long is supported at two ends at the same level. The supports are 16 m apart. The cable supports three loads of 8, 10 and 12 N dividing the 16 m distance in four equal parts. Find the shape of the string and the tension in various portions	**07**
Q.3	**(a)**	Draw the S.F and B.M diagram for the beam loaded as shown in the fig.-3.	**07**
	(b)	For torsion of a circular shaft, derive the equation $T/I_P = \tau/R = C\theta/L$ with usual notations	**07**
		OR	
Q.3	**(a)**	Draw the S.F and B.M diagram for the portal loaded as shown in the fig.-2.	**05**
	(b)	A hollow circular shaft transmits 750 kW at 160 RPM. Its maximum torque is 25% more than the average torque. The ratio of internal to external radius is 0.8. If the maximum shear stress and angle of twist in 3 m length are not to exceed 80 MPa and 3^o then find the required sectional dimension of the shaft. Take modulus of rigidity: C = 85 GPa.	**09**
Q.4	**(a)**	Write the equation for instantaneous stress for impact loading. Using the same show that the stress induced due to sudden loading is twice that of the stress due to gradual loading.	**07**
	(b)	A cylindrical pressure vessel 1.90 m in dia. And 3.80 m in length is made up of 12.5 mm thick plates. It is subjected to an internal pressure of 0.07 N/mm^2. Calculate the longitudinal and circumferential stresses developed in the vessel.	**07**
		OR	
Q.4	**(a)**	A spherical shell of 1.8 m diameter is made up of 18 mm thick plates. Calculate the increase in volume of the shell when it is subjected to an internal pressure of 1.50 N/mm^2. Take E = $2x10^5$ N/mm^2 and $\mu = 0.3$.	**07**

Q.4 **(b)** A steel bar 3.5 m long and 2000 mm^2 in area hangs vertically, which is securely fixed on its lower end. If a weight of 15 kN falls on the collar from a height of 15 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E = 200 GPa. **07**

Q.5 **(a)** Find out the value of stresses at every corner for a rectangular column of size 300X500 mm subjected to an axial load of 1200 kN at an eccentricity of 60 mm along X-X axis and 40mm along Y-Y axis. **07**

(b) Draw ILD for R_A, R_B, Shear at C and BM at D for beam shown in fig.-4 **07**

OR

Q.5 **(a)** A masonry dam 5 m high, 1 m wide at its top and 3 m wide at its bottom retains water on its vertical face. Determine maximum and minimum stresses at the base when the reservoir is full and when the reservoir is empty. Take weight of water and masonry as 10 kN/m^3 and 20 kN/m^3 respectively. **07**

(b) Obtain the differential equation given below for the deflection curve of a beam stating clearly assumptions made in deriving it. $\frac{d^2y}{dx^2} = \pm \frac{M}{EI}$ **07**

Explain how a particular sign (+ve or –ve) can be chosen in the above equation.

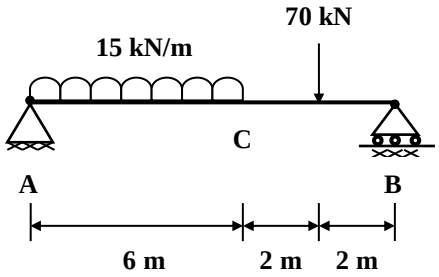


Fig. 1

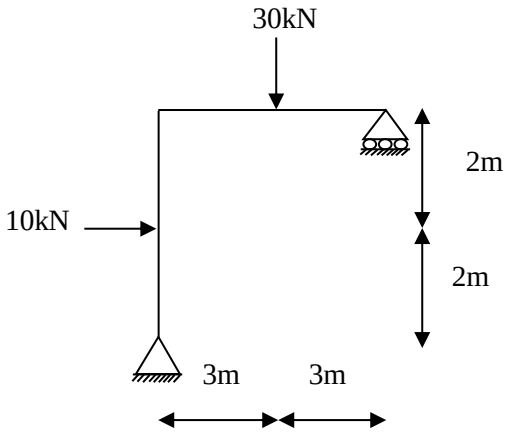


Fig.2

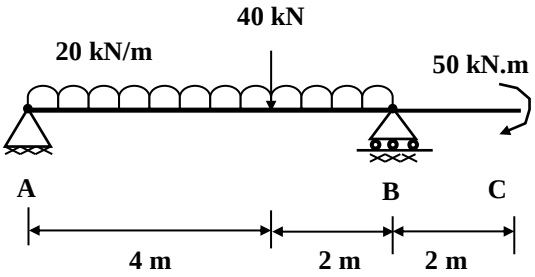
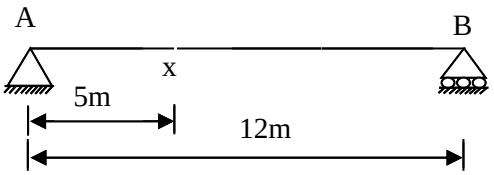


Fig. 3



R_A, R_B, V_x, M_x

Fig.4

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