

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-III EXAMINATION – SUMMER 2016

Subject Code:130604

Date:02/06/2016

Subject Name:Structural Analysis-1

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.

- Q.1 (a)** Differentiate between Static and Kinematic indeterminacy. Also explain these terms with respect to a fixed beam. **07**
- (b)** State and prove Maxwell's reciprocal theorem. **07**
- Q.2 (a) (i)** "Indeterminate structures are better than determinate structures." Comment on the statement. **03**
- (ii)** Write the equations for Euler's crippling load for different end conditions of a long column. **04**
- (b)** Prove that bending moment at any section will be equal to zero for a parabolic three hinged arch subjected to a UDL over its entire span. **07**
- OR**
- (b)** A solid steel shaft has to transmit 75 kW at 200 rpm. Taking allowable shear stress as 70 MPa, find suitable diameter for the shaft, if the maximum torque transmitted at each revolution exceeds the mean by 30%. **07**
- Q.3 (a)** Find the slope and deflection at the free end B of a cantilever beam AB as shown in Fig. 1 by moment area method. Take $I = 2 \times 10^8 \text{ mm}^4$ and $E = 2 \times 10^5 \text{ N/mm}^2$. **07**
- (b)** A hollow cast iron column has outside diameter 200 mm and thickness of 20 mm. It is 4.5 m long and fixed at both ends. Calculate the safe load and ratio of Euler's and Rankine's critical load. For cast iron $F_c = 550 \text{ N/mm}^2$, $\alpha = 1/1600$ and $E = 0.8 \times 10^5 \text{ N/mm}^2$. **07**
- OR**
- Q.3 (a)** Find the slope and deflection at the center C of a simply supported beam AB as shown in Fig. 2 by Conjugate Beam Method. Take $I = 2 \times 10^8 \text{ mm}^4$ and $E = 2 \times 10^5 \text{ N/mm}^2$. **07**
- (b)** A cable carrying a load of 10 kN/m run of horizontal span is stretched between supports 100 m apart. The supports are at same level and central dip is 8 m. Find maximum and minimum tension in the cable. **07**
- Q.4 (a)** A three hinged parabolic arch has a span of 30 m and a rise to the central hinge of 5 m. The arch is loaded with two vertical loads of 200 kN symmetrically situated on either side of the central hinge at 3.75 m horizontally from the hinge. Calculate the maximum positive and negative bending moments in the arch stating where they occur. **07**
- (b)** A cylindrical vessel closed with plane ends is made of a 4 mm thick steel plate. Its external diameter is 250 mm and length is 750 mm. It is subjected to an internal fluid pressure of 3 N/mm², calculate the longitudinal and hoop stresses in the shell plate. Also calculate change in diameter, length and volume of the cylinder. Take $E = 2.1 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio = 0.3. **07**

OR

- Q.4 (a)** A masonry wall 6 m high, is of solid rectangular section, 4 m wide and 2 m thick. A horizontal wind pressure of 1.3 kN/m² acts on 4 m side. Find the maximum and minimum stresses induced on the base, if the unit weight of masonry is 22.4 kN/m³. **07**
- (b)** It is found that a bar 36 mm in diameter stretches 1.9 mm under a gradually applied load of 150 kN. If a weight of 1500 N is dropped on to a collar at the lower end of this bar, through a height of 50 mm before commencing to stretch the bar, calculate the maximum instantaneous stress and elongation produced in the bar. Take $E=215\text{kN/mm}^2$. **07**
- Q.5 (a)** Two wheel loads of 16 kN and 8 kN, at a fixed distance apart of 2 m, crosses a simply supported beam of span 10 m. Find maximum shear force and maximum bending moment at a point 4 m from left support. **07**
- (b)** Find the slope and deflection at point C and B for the beam shown in the Fig. 3 using Macaulay's Method. Take $EI=3000\text{ kN.m}^2$. **07**
- OR**
- Q.5 (a)** What is an influence line diagram? Explain its importance in structural analysis. **07**
- (b)** Draw Influence Line diagram for R_A , M_A & M_x for cantilever beam having span 6 m and section X is at 2 m from support A. **07**

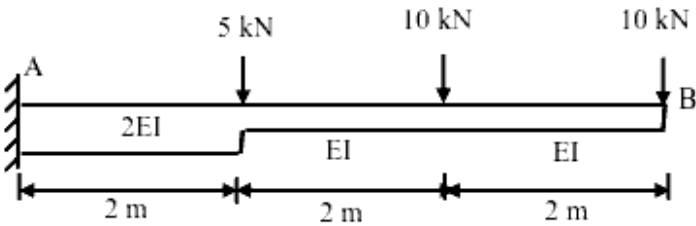


Fig 1 Q-3 (a)

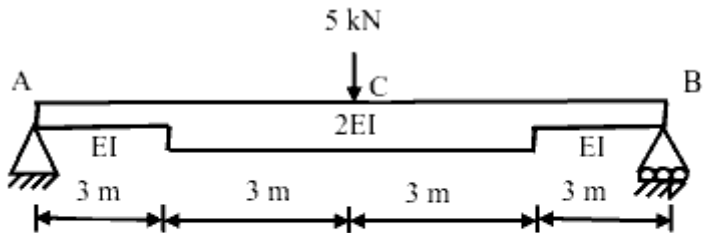


Fig. 2 Q-3 (a) (OR)

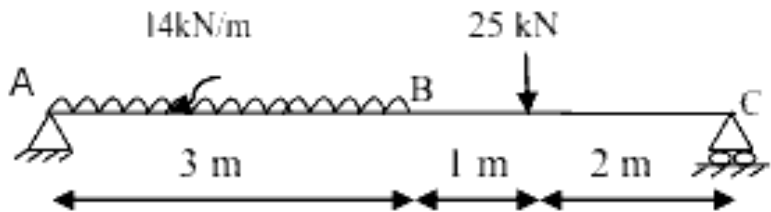


Fig. 3 Q-5 (b)
