

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), Nov.-Dec. 2015

B. Tech, Civil Engineering, Semester III

Roll No.....

CE-305: Structure Analysis - I

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. Modulus of rigidity is defined as the ratio of -
A) Longitudinal stress to longitudinal strain B) shear stress to shear strain
C) stress to strain D) stress to volumetric strain
- ii. If the young's modulus of elasticity of a material is twice its modulus of rigidity, then the Poisson's ratio of the material is
A) -1 B) -0.5 C) 0.5 D) 0
- iii. The relationship between Young's modulus of elasticity E , bulk modulus K and Poisson's ratio ' μ ' is given by
A) $E = 2K(1-2\mu)$ B) $E = 3K(1 + \mu)$ C) $E = 3K(1-2\mu)$ D) $E = 2K(1 + \mu)$
- iv. Shear stress on principal planes is
A) Zero B) Maximum C) minimum D) none of above
- v. Maximum bending moment in a beam occurs where
A) deflection is zero B) shear force is maximum
C) shear force is minimum D) shear force changes sign
- vi. The variation of the bending moment in the portion of a beam carrying linearly varying load is
A) Linear B) Parabolic C) Cubic D) Constant
- vii. A beam of rectangular cross-section is 100 mm wide and 200 mm deep. If the section is subjected to a shear force of 20 kN, then the maximum shear stress in the section is
A) 1 N/mm² B) 1.125 N/mm² C) 1.33 N/mm² D) 1.5 N/mm²
- viii. A beam of triangular cross section is placed with its base horizontal. The maximum shear stress intensity in the section will be
A) at the neutral axis B) at the base
C) above the neutral axis D) below the neutral axis
- ix. If the length of a simply supported beam carrying a concentrated load at the center is doubled, the deflection at the center will become
A) two times B) four times C) Eight times D) sixteen times
- x. A shaft turns at 150 rpm under a torque of 1500 N-m. Power transmitted is
A) 15π kW B) 10π kW C) 7.5π kW D) 5π kW

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- The deflection at the free end of a uniformly loaded cantilever beam is 15mm and the slope of the deflection curve at the free end is 0.02 radian. Calculate the length of the cantilever beam.
- A solid shaft has diameter 80 mm. It is subjected to a torque of 4 kN-m. Calculate the maximum shear stress induced in the shaft.
- The principal tensile stresses at a point across two mutually perpendicular planes are 120 N/mm² and 60 N/mm². Determine the normal and tangential stresses on a plain inclined at 40° to the axis of minor principle stress.
- Determine the maximum permissible load on a steel bar of 20 mm diameter when the factor of safety is 1.8 and the ultimate stress is 495 MPa.

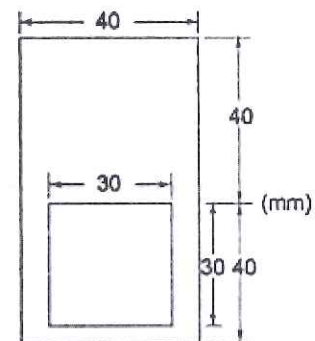
Q.3A Explain the stress strain diagram for the mild steel. 05

Q.3B A bar of uniform thickness and length L has its depth increasing from 'd' at one end to 'D' at the other. Determine the elongation of the member subjected to a tensile force P. 05

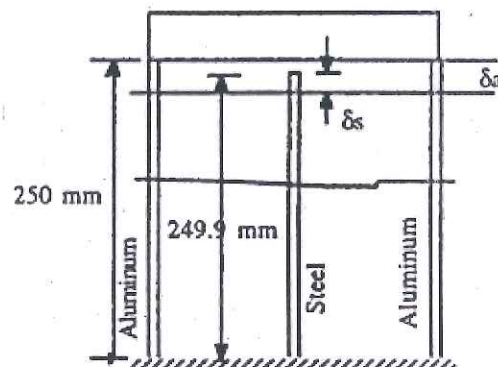
Q.4A Drive the expression of the direct stress and shear stress at a plain inclined at an angle θ from vertical axis in an element under pure shear stress condition. 05

Q.4B A rectangular block that is 350 mm long, 100 mm wide and 80 mm thick is subjected to axial loads of 50 kN tensile force in the direction of length, 100 kN compressive force in the direction of its thickness and 60 kN tensile force in the direction of its width. Determine change in the volume, bulk modulus and modulus of rigidity. Take $E = 2 \times 10^5$ N/mm² and poisson's ratio = 0.25. 05

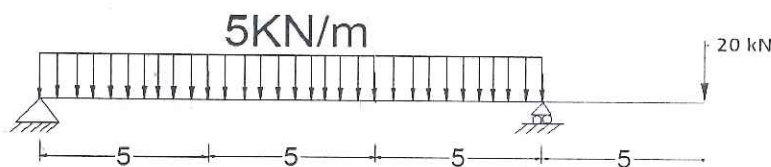
Q.5A Find the center of gravity (CG), in both X and Y direction, of the section shown below. Also calculate the moment of inertia (I_{xx} & I_{yy}) about axis passing through CG. 05



Q.5B The rigid platform, shown in figure, has negligible mass and rests on two aluminium bars each 250 mm long. The center bar is made of steel and 249.9 mm long. Find the stress in the steel bar after the center load of 400 kN is applied. Each aluminium bar has an area of 1200 mm² and $E = 70$ GPa. The steel has an area of 2400 mm² and $E = 200$ GPa. 05

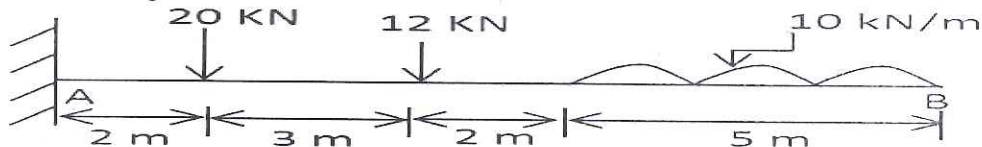


- Q.6 A overhang beam is loaded as shown in Fig. Write the Equations of Shear Force and Bending Moment for Beam. Also, Draw the Shear Force and Bending Moment Diagram. All the dimensions are in meter. 10



OR

- Q.6 A cantilever is loaded with the loading shown in Figure. Draw the Shear Force and Bending Moment Diagram for the cantilever beam. 10

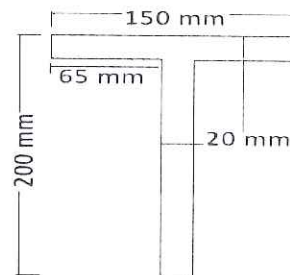


- Q.7 Power of 2250 kW has to be transmitted at 2 Hz. If the permissible stress is 80 N/mm^2 , determine the necessary diameter for a solid shaft of circular section. A hollow circular shaft is made with the same material having the same weight. Length of hollow shaft is same as the solid shaft. The internal diameter of shaft is 0.75 times the external diameter of the shaft. Calculate the percentage change in the power generation. 10

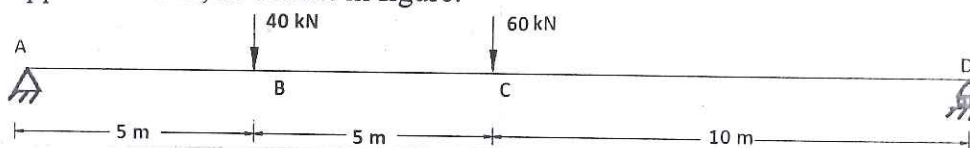
OR

- Q.7 Power of 2250 kW has to be transmitted at 1 Hz. If the permissible stress is 80 N/mm^2 , determine the necessary diameter for a solid shaft of circular section. If a hollow circular shaft of same cross sectional area and thickness of 40 mm is used. Calculate the new power transmitted. 10

- Q.8 Derive the expressions of shear stress and bending stress at any point in the given section. Also draw the bending stress and shear stress diagram. Modulus of Elasticity = E, Bending Moment = M, Shear Force = V. 10



- Q.9A Using Macaulay's Method, Determine the Deflection and slope at mid span of a simply supported beam, as shown in figure. 10



- Q.9B Using Conjugate Beam Method, Determine the Deflection and slope at mid span of a simply supported beam, as shown in figure. 10

