

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4071

Roll No.

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B.Tech.

THIRD SEMESTER EXAMINATION, 2005-2006

STRENGTH OF MATERIALS

Time : 3 Hours

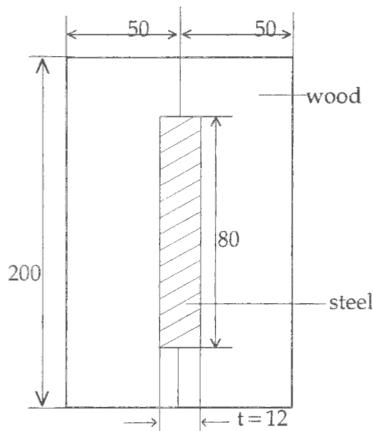
Total Marks : 100

- Note :** (i) Answer *ALL* questions.
(ii) All questions carry equal marks.
(iii) Be precise in your answer.

1. Attempt *any two* of the following questions : (10x2=20)
- (a) What are the factors that have to be considered while designing members for dynamic loads. Discuss the effect of shape, stress distribution and elastic constants.
 - (b) What do you understand by strain energy absorbed by a system, complimentary strain energy, and elastic strain energy? Explain these with the help of a diagram.
 - (c) Draw Mohr's circle for :
 - (i) Pure shear
 - (ii) Pure biaxial tension
 - (iii) Pure uniaxial compression
 - (iv) Pure uniaxial tensionin a two-dimensional stress-field.

2. Attempt *any two* of the following questions : (10x2=20)

- (a) A flitched beam consists of two 50mm × 200mm wooden beam and a 12mm × 80mm steel plate. The plate is placed centrally between the wooden beams and recused into each so that, when rigidly joined, the three units form a 100mm × 200mm section as shown in fig. 1. Determine the moment of resistance of the flitched beam when the maximum bending stress in the timber is 12MN/m². What will then be the maximum bending stress in the steel ? For steel E = 200 GPa, for wood E = 10GPa.

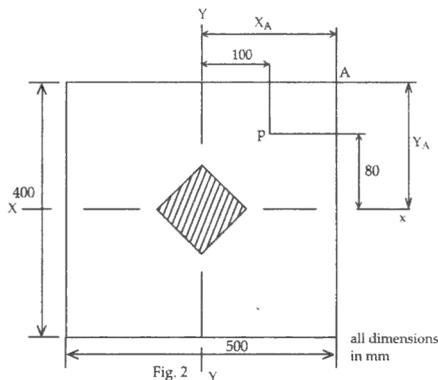


- (b) Derive the deflection equation for cantilever beam subjected to non-uniform distributed load. What assumptions are made in simple theory of bending?
- (c) A circular bar ABC, 3m long, is rigidly fixed at its ends A and C. The portion AB is 1.8m long and 50mm diameter and BC is 1.2m long and 25mm diameter. If a twisting moment of 680Nm is applied at-B, determine the values of the resisting moments at- A and C and the maximum stress in each section of shaft. What will be the angle of twist of each portion ? For the material of the shaft G = 80GPa.

3.

Attempt *any two* of the following questions : (10x2=20)

- (a) Deduce an expression for the extension of an open-coiled helical spring carrying an axial load W . Take ' α ' as the inclination of the coils, d as the diameter of the wire and R as the mean radius of the coils. Find by what percentage the axial extension is underestimated if the inclination of the coil is neglected for a spring in which $\alpha = 25^\circ$. Assume n and R remain constant.
- (b) A rectangular masonry column has a cross-section $500\text{mm} \times 400\text{mm}$ and is subjected to a vertical compressive load of 100kN applied at point- 'P' shown in Fig. 2. Determine the value of the maximum stress produced in the section. Is the section at any point subjected to tensile stresses ?



- (c) Determine the maximum compressive stress set up in a $200\text{mm} \times 60\text{mm}$ I-section girder carrying load of 100kN with an eccentricity of 6mm from the critical axis of the section. The ends of the struct are pin-jointed and overall length is 4m .
 Take $T_{yy} = 3 \times 10^{-6} \text{m}^4$
 $A = 6 \times 10^{-3} \text{m}^2$
 $E = 207\text{GPa}$.

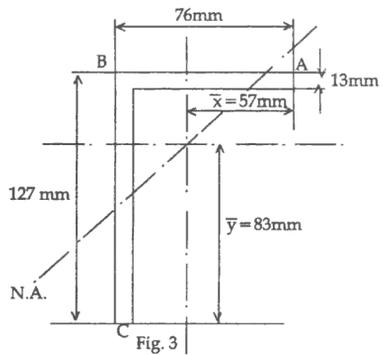
4. Attempt *any two* of the following questions : (10x2=20)

- (a) Derive the equations for circumferential stress and volumetric strain in a thin spherical shell under internal pressure.
- (b) A thick cylinder with closed ends has 100mm internal radius and 150mm external radius. It is subjected to an internal pressure of 60MN/m² and external pressure of 30MN/m² Determine the hoop and radial stresses at the inside and outside of the cylinder together with longitudinal stress.
- (c) How thick and thin cylinder are classified ? Derive the equation for Hoop stress and radial stress in thick cylinder ?

5. Attempt *any two* of the following questions : (10x2=20)

- (a) A cantilever of length 1.2m is of the cross-section as shown in Fig. 3. It carries a vertical load of 10kN at its outer end, the line of action being parallel with the longer leg and arranged to pass through the shear centre of the section (i.e. there is no twisting of the section). Working from first principles, find the stress setup in the section at points A, B and C given that the centroid is located as shown. Determine the angle of inclination of the N.A.

$I_{xx} = 4 \times 10^{-6} \text{m}^4$; $I_{yy} = 1.08 \times 10^{-6} \text{m}^6$



(b) A chain link (fig. 4) is made of round steel rod of 15mm diameter. If $R = 45\text{mm}$, $l = 75\text{mm}$ and load applied is 1.5kN . Determine the maximum compressive stress in the link and tensile stresses at the same section.

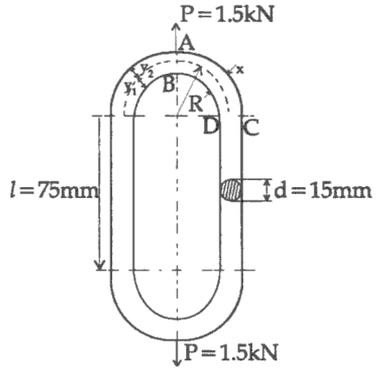


Fig. 4

(c) A steel ring has a rectangular cross-section, 75mm in the radial direction and 45mm perpendicular to the radial direction. If the mean radius of the ring is 150mm and maximum tensile stress is limited to 180MN/m^2 calculate the tensile load the ring can carry.

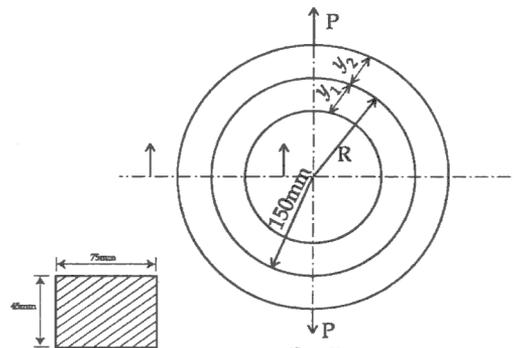


Fig. 5

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