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RN-6265

B. E. II (Sem. III) (Mechanical) Examination

May / June – 2010

Mechanics of Solids - I

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. 2 (Sem. 3) (Mechanical)**

Name of the Subject :

☛ **Mechanics of Solids - 1**

☛ Subject Code No. : **6 2 6 5** ☛ Section No. (1, 2,.....) : **1&2**

Seat No. :

Student's Signature

(2) Write **two** sections in **separate** answer book.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary and specifically mention them.
(5) All dimensions are in mm wherever required.

SECTION - I

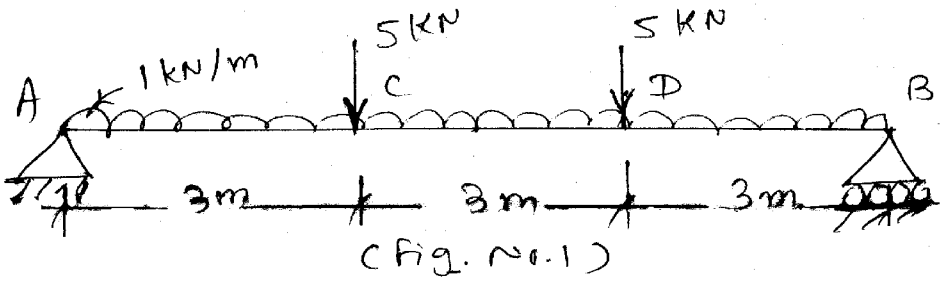
1 (a) Fill in the blanks : **5**

(i) Bending moment at the free end of cantilever beam subjected to any type of load is _____.
(ii) Resistance to impact is called_____.
(iii) Shear stress at the centre of the circular shaft under torsion is _____.
(iv) At the neutral axis of the value of tensile and compressive stress is _____.
(v) Modulus of rupture is determined is _____ test.

(b) Match the following : **5**

Name of Machine	Type of Text Perform
(i) U.T.M.	(a) Hardness
(ii) Torsion	(b) Endurance limit
(iii) B.H.N. V.H.N	(c) Modulus of rupture
(iv) Charpy Impact	(d) Rigidity
(v) Fatigue	(e) Toughness

2 Draw the S.F.D. and B.M.D. for the beam as shown in **Fig. 1**. Also locate the point of contraflexure if any. **10**



(Fig. No. 1)

3 Attempt any **three** : **30**

(i) A vertical circular bar 20 mm diameter 3m long carries a tensile load of 150 kN. Calculate

(a) Elongation

(b) Decrease in diameter

(c) Volumetric strain

Take Poisson's ratio as 0.3 and modulus of elasticity as 2×10^5 N/mm^2.

(ii) A C.I. beam of I-section is freely supported over a span of 6 m. The tensile stress in the beam should not exceed 60 N/mm^2, find the safe uniformly distributed load on the beam. Also find the maximum compressive stress.

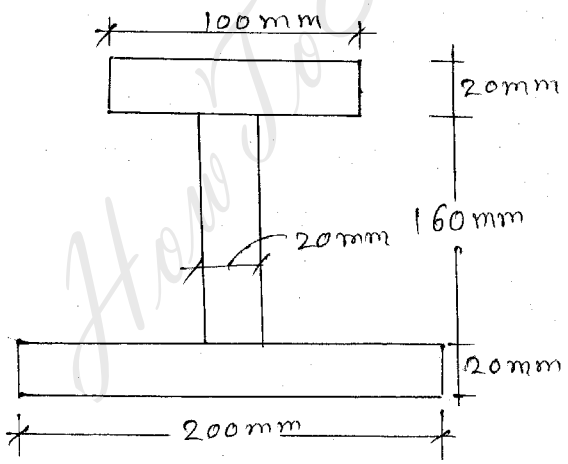


Fig. 2

(iii) A beam is loaded and having C.I. bracket subjected to shear force of 150 kN has cross section of I. section as shown in figure 3. Draw the shear stress distribution over the depth of the section.

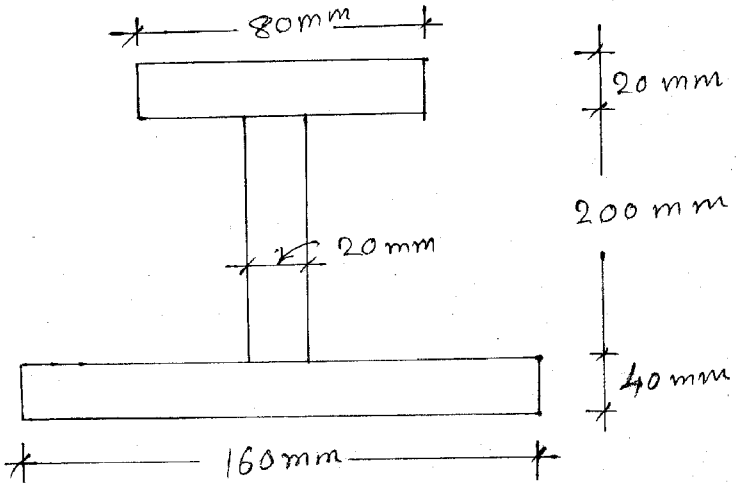


Fig. 3

(iv) A rectangular block is subjected to following system. Calculate :
- (a) Principal stresses
- (b) Max. shear stress and its position in the plane (Fig. No. 4)

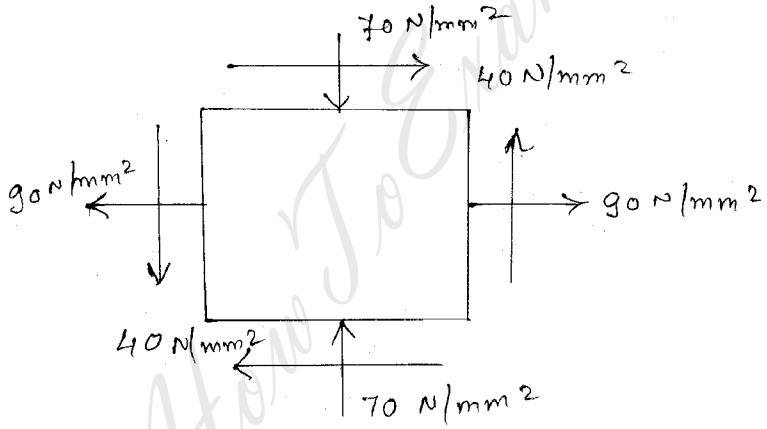


Fig. 4

SECTION - II

4 (a) Answer the following : (any five)
- (i) Proof Resilience
- (ii) Modulus of Resilience
- (iii) Strain energy
- (iv) Defined helical springs name the two important types of helical spring.
- (v) Defined polar modulus.
- (vi) Circumferential stress and longitudinal stress in thin cylinder.

(vii) When a thin cylinderical shell is subjected to internal fluid pressure p and torque, then the principal stress are given by Cp.

(b) Find and expression for the strain energy stored in body when the load is applied suddenly. **4**

(c) Assumption made in derivation of shear stress produced in a circular shaft subjected to tension. **6**

OR

(c) A hallow shaft of external diameter 120 mm transmits 300 kW power of 200 r.p.m. Determine the maximum internal diameter if max. stress of shaft is not exceed 80 N/mm^2. **6**

5 (a) Derive an expression for central deflection of the leaf spring and also expression for the bending stress. **7**

(b) A closely coiled helical spring of round steel wire 6 mm diameter having 12 complete coils of 50 mm mean diameter is subjected to an axial load of 150 N. Find deflection of spring and the maximum shearing stress in material. Take C = 80 GPa. **8**

OR

5 (a) Obtain an expression for maximum instantaneous stress when load 'p' is dropped from height 'n'. **7**

(b) A rod 13.5 mm in diameter is stretched 3.2 mm under a steady load of 10 kN. What stress would be produced in bar by a weight of 700 N. falling through 75 mm before commencing to stretch, the rod being initially unstress? The value of E may be taken as 2.1×10^5 N/mm^2. **8**

6 (a) Obtain Lame's equation for thick cylinder. **7**

OR

(a) Derive an expression for both ends of the column are hinged. **7**

(b) Find the thickness of metal necessary for a steel cylinderical shell of internal diameter 160 mm to withstand on internal pressure 60 N/mm^2. The maximum hoop stress in the section is not to exceed 180 N/mm^2. **8**

OR

(c) Calculate the safe compressive load on a hallow cast iron column (one end rigidly fixed and other hinged) of 18 cm. External diameter 12 cm internal diameter and 10 m in length. Use Euler's formula with a factor of safey of 5 and E = 95 N/mm^2. **8**
