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SE-6265

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

April / May – 2011

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) (Mech.)**

Name of the Subject :

☛ **Mechanics of Solids - 1**

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

Seat No. :

Student's Signature

(2) Make suitable assumptions wherever necessary.

(3) Figures to the right indicate full marks.

(4) All dimensions are in mm wherever required.

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

(i) Lateral strains are _____ longitudinal strains. (Always less than, sometimes less than, never less than).

(ii) Bending moment is _____ at a hinged support. (Always maximum, always zero)

(iii) Poisson's ratio is ratio of _____ (longitudinal to lateral strain, lateral to longitudinal strain, shear stress to shear strain).

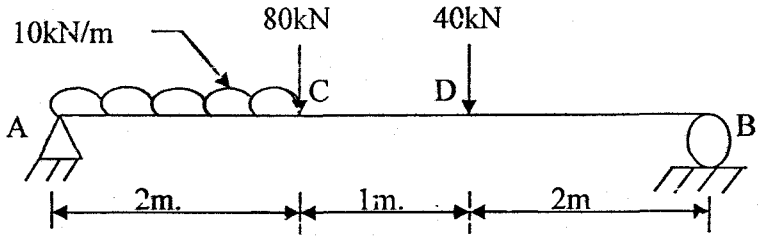
(iv) At the point of contraflexure _____ changes its sign. (shear force, bending moment, axial force)

(v) Shear stress on principal plane is _____. (maximum, zero, minimum)

(b) Match list A with B. **5**

A	B
1. Toughness	(a) Impact
2. Rigidity	(b) Fatigue
3. Resistance to penetration	(c) Hardness
4. Endurance limit	(d) Torsion
5. Ductility	(e) Tension

2 Draw Shear Force and Bending Moment Diagram and locate the point of contraflexure, if any. **10**



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

(i) An M.S. bar of 20mm diameter is acted upon by a tensile force of 60kN. If the length of bar is 1.2m and modulus of elasticity is $2.0\times10^5 N/mm^2$, find stress, strain and elongation of the bar.

(ii) A cantilever beam 1.2m long has rectangular section 150mm × 300mm, if permissible bending stress is 15 N/mm^2, find point load at free end of cantilever. Which beam can support ?

(iii) A circular beam of 100mm diameter is subjected to a shear force of 12kN. Calculate the value of maximum shear stress and draw the variation of shear stress along the depth of the beam.

(iv) An elastic material is subject to two direct stresses $200N/mm^2$ Compressive and $80N/mm^2$ tensile at right angles to each other. If major principal stress is limited to 210 N/mm^2 compressive, find the value of shear stress that can be applied to the material. Also find minor principal stress.

4 (a) Explain the following : (any **five**) **10**

(1) Resilience

(2) Modulus of resilience.

(3) Circumference stress and longitudinal stress in thin cylinder.

(4) Shows load extension diagram of body under gradually applied tensile load.

(5) Write eq. of crippling load when. Both ends of the column are hinged.

(6) What is column and strut ?

(7) Torsion.

(b) Determine the diameters of solid steel shaft which will transmit 90kw at 180 r.p.m. also determine the length of the shaft if the twist must not exceed 1^{o} over the entire length the maximum shear stress is limited to 70 N/mm^2.

Take the value of modulus of rigidity = 8×10^4 N/mm^2.

OR

(b) Determine the angle of twist and maxmum shear stress. Developed in shaft which trapers uniformly from diameter 160 mm and 240 mm. The length of shaft is 2 m and transmit torque of 48 kN.m. Take the value of modulus of rigidity for shaft material as = 80 GN/m^2.

5 (a) Expression for maximum bending stress devloped in the plate. **6**

(b) A laminated spring 1m long is made up of plates each 5 cm wide and 1 cm thick if the bending stress in the plate is limited 120 N/mm^2 how plates would be required to be enable the spring to carry a central point load of 2 kN ? If $E = 2.1\times10^5$ N/mm^2. What is a deflection under the load ? **6**

(c) Obtain an expression for maximum instaneous stress when load 'p' is dropped from height 'H'. **6**

OR

(c) A 1500 mm long steel rod of 25 mm^2 cross sectional area is hanged vertically. It recives a sliding collar of 100 N. Weight and stopper at bottom end the coller is allowed to full on stopper through 200mm height. Determine instaneous stress induced in the rod and corrosponding elongation. Also determine the strain energy stored in the wire take modulus of elasticity of wire as 200 GPa. **6**

6 Write the answer of following : (any **two**) **14**

(a) Derive Renkine's empirical formula for critical load of any column.

(b) Obtain Lame's equation for thick cylinders.

(c) A solid round bar 3m long and 6 cm in diameter is used as a strut with both ends hinged. Determine the cripling load. Take $E = 2.0 \times 10^5 \text{ N/mm}^2$.