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SE-6147

B. E. - II (Civil) (Sem. - III) Examination

April / May – 2011

Mechanics of Solids

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 (CIVIL) (SEM. - 3)**

Name of the Subject :

☛ **MECHANICS OF SOLIDS**

☛ Subject Code No. : **6 1 4 7** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Assume suitable data if necessary.
(3) Figures to the **right** indicate full marks.
(4) Use of non-programmable calculator is permitted.

1 Answer the following : **10**

(i) Point of contraflexure occur where Bending moment is_____.

(a) Zero

(b) Maximum

(c) Minimum

(ii) Relation between Modulus of elasticity (E) and Modulus of rigidity (C) is given by_____.

(a) $E = 2G/(1+\mu)$

(b) $E = 2G(1+\mu)$

(c) $E = 3G(1+\mu)$

(iii) The extension of tapered circular bar is given by_____.

(iv) When change in a volume take place, the corresponding strain is known as _____.

(a) Linear strain

(b) Lateral strain

(c) Volumetric strain

(v) The maximum shear stress developed in a beam of rectangular section is _____ average shear stress.
(a) twice
(b) equal to
(c) 1.5 times

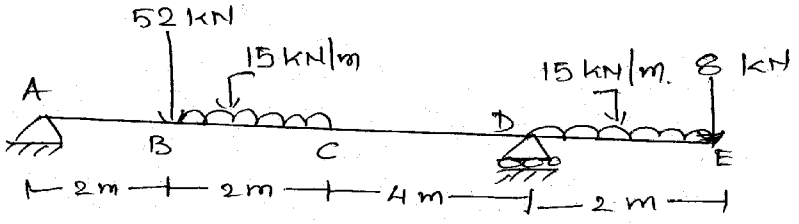
(vi) The Poisson's ratio is the ratio of linear strain to lateral strain.
(a) True
(b) False

(vii) The Maximum shear stress developed in a beam of circular section is _____ the average shear stress.
(a) $3/2$
(b) $4/3$
(c) equal

(viii) Define modular ratio. (2 marks)

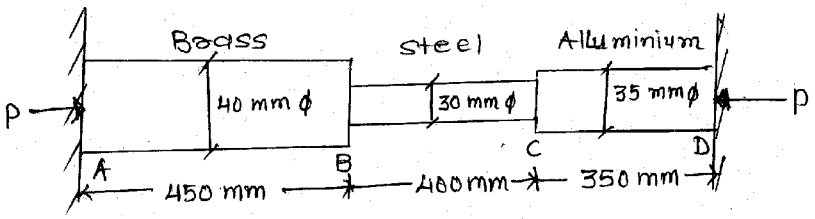
(ix) Polar modulus for solid circular section of diameter d is given by _____.

2 Draw shear force and bending moment diagrams for a beam shown in figure. Calculate both the values at important points and point of contraflexure if any. **10**

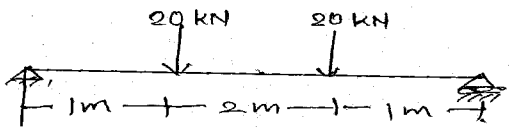


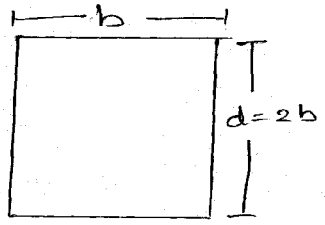
3 Attempt the following (any **three**) **30**

(i) A bar ABCD is made from three material and supported at A and D as shown in figure. Calculate the stress in all the parts when subjected to rise in temperature by 50°C. if (a) supports are rigid (b) supports yield by 0.7 mm. Take $E_b = 110\ GPa$, $\alpha_b = 17 \times 10^{-6}$ per °C $E_s = 200\ GPa$, $\alpha_s = 12 \times 10^{-6}$ per °C. $E_{al} = 70\ GPa$, $\alpha_{al} = 20 \times 10^{-6}$ per °C.



(ii) A simply supported beam is subjected to load as shown in figure and having rectangular cross section, the depth of which is twice the width. If permissible bending stress in the cross section of beam is 75 N/mm^2. Find the size of c/s of beam.





(iii) Derive the equation to show the shear stress distribution across the rectangular cross section.

(iv) A Hollow circular shaft of 145 mm external diameter and 90 mm internal diameter is subjected to torque of 2 kN.m. Find the maximum shear stress and shear stress at the internal surface of the shaft calculate also the angle of twist for 2 m long shaft. Take modulus of rigidity is 80 Gpa.

4 (a) Define Resilience, proof Resilience and Modulus of Resilience. **3**

(b) Derive the expression for instantaneous stress due to impact load. **7**

5 Attempt any **two** :

(a) A semi elliptical leaf spring is required to satisfy the following specification, L=0.75 m, W=5 kN, b=75 mm, maximum stress 210 MN/m^2, maximum deflection 25 mm, E=200 GN/m^2. Find the number of leaves and their thicknesses. **10**

(b) (i) State assumption made in the Euler's theory of column. **4**

(ii) Find the crushing load by Rankine's formula for a hollow cast iron column of 200 mm external diameter and 25 mm thickness of metal. If length of column is 8 m and its both ends are fixed. Assume f_c = 550 MPa and a = (1/1600). **6**

(c) A rectangular column 200 mm X 150 mm is carrying a compressive load of 50 kN at an eccentricity of 50 mm in a plane bisecting 150 mm side. Neglecting self weight determine maximum and minimum stresses across the cross section and maximum permissible eccentricity so as to develop no tension across the cross section. **10**

6 Attempt any **two** :

(a) Distinguish between thin shell and thick shell. **10**

(b) A pipe of 400 mm internal diameter and 100 mm thickness contains a fluid at a pressure of 8 N/mm^2. Find the maximum and minimum hoop stress across the section. Sketch the radial pressure distribution and hoop stress distribution across the section. **10**

(c) Derive the expression for deflection of closed coil helical spring. **10**
