Total No. of Questions : 12 **[Total No. of Printed Pages :5]**

[4362]-119

S. E.(Mechanical) (Mechanical S/W)(Automobile) Examination -2012

STRENGTH OF MACHINE ELEMENT (2008 Pattern

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions:

1. *Answers to the **two sections** should be written in **separate answer-books**.*
2. *Neat diagrams must be drawn wherever necessary.*
3. *Assume suitable data, if necessary.*
4. *Use of logarithmic tables, slide rule, Mollier charts, electronics pocket calculator is allowed*
5. *Black figures to the right indicate full marks.*

Section I

1. a. Draw stress stains diagram for aluminium and for mild steel, clearly mention all point on the diagram (8)

   b. A bar ABCD is fixed at point A and D as shown Figure 1b. it is subjected to axial forces of 60 KN and 120 KN at point B and C respectively. The cross-sectional areas of AB, BC and CD are 1000mm^2 and 1500mm^2 and 2000 mm^2 respectively. Take E=200 GPa. Determine: (8)

   (i) Forces in the member AB, BC and CD

   (ii) Displacement of points B and C.

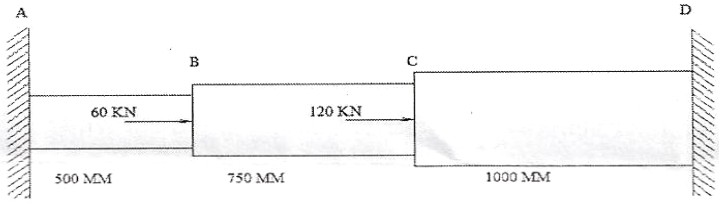


Figure 1b

OR

2 a. Two copper road and one steel rod(center) together support load be shown in figure 2a. Cross sectional area of each rod is 900 mm^2. If the stresses in copper steel are not to exceed 50 MPa and 100 MPa respectively find safe load can be supported Young's modules of the steel is twice that of copper. (8)

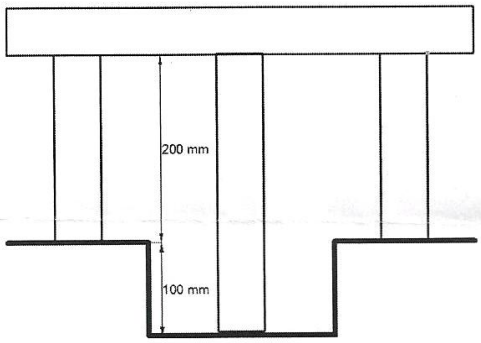


Figure 2a

b. a compound bar made of aluminium and steel subjected to a load of 200 kN is shown in figure 2b . The cross-sectional area of aluminium section is twice the steel section . If the elongation of the two section is equal, determine the length of each section (8)

Take E= 210 GPa for steel and E= 70 Gpa for aluminium .

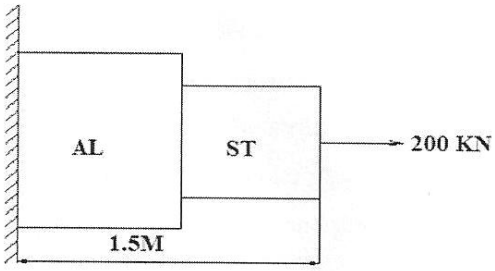


Fig. 2b

UNIT- II

3 .a A simply supported bean subjected to a uniformly distributed load and a clock wise couple is shown in figure 3a. Draw the shear force and bending moment Diagram. (8)

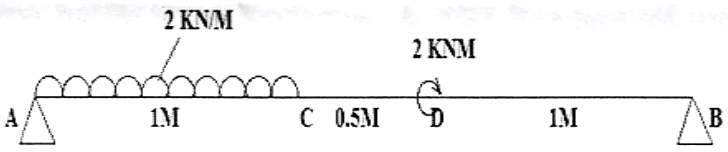


Figure 3a

b. The Share force diagram for a simple beam is shown in figure 3b. Determine the loading on the beam and draw the bending- movement diagram, assuming that no couple act as loads on the beam (8)

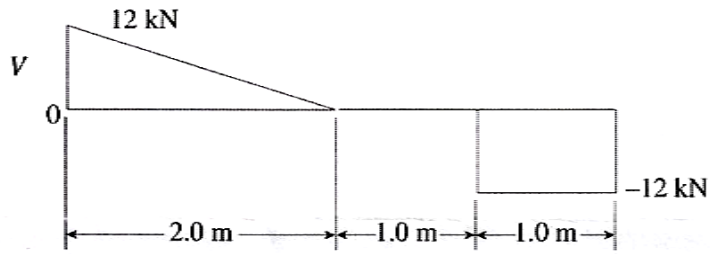


Figure 3b

OR

4 a. A simply supported beam with a span of 4.5 m carries a point load 30 kN at 3 meters from the left support. If for the section, Ixx = 5 x 10^{-6} m^4 and E =200 GPa , find (8)

(i) The defection under the load

(ii) The position and amount of maximum deflection

b. A beam of length 6 m is simply supported at it's ends and carries two point laods of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support find: 1. Deflection under each load 2. Maximum deflection 3. The point at which maximum deflection occurs.
(E= 2 x 10^5 N/mm^2 and I = 85 x $10^6 mm^4$) (8)

UNIT- III

5. a Derive the formula for normal stress and shear stress on an oblique plane which is inclined at an angle θ with the axis of minor stress. (8)

b. an element in a stressed material has tensile stress of 500 MPa and compressive stress of 350 MPa acting on two mutually perpendicular planes and equal shear stresses of 100 MPa on these planes(ccw). Find principal stresses and position of principal planes. Also find maximum shearing stress. (10)

OR

6. a. List theories of failure and explain their significance also explain the application of each theory of failure (8)

b. A blot is under an axial pull of 24 kN together with a transverse shear force of 5 kN. Calculate the diameter if bolt using (10)

(i) Maximum principle stress theory

(ii) Maximum shear stress theory

(iii) Strain energy theory

Take , elastic limit of bolt material as 250Mpa and μ= 0.3 Factor of safety is 2.5

SECTION – II

UNIT - IV

7.a. State the assumption in theory of simple bending and derive the flexure formula. (8)

b. A beam having a cross section in the from of channel (see figure 7b) is subjected to a bending moment acting about the axis . calculate the thinkness of the channel in order that the bending stresses at the top and bottom of the beam will be in the ratio 7:3, respectively. (8)

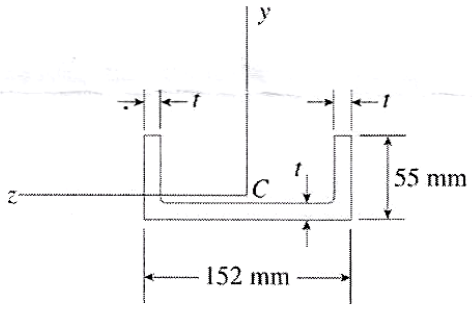


Figure 7b

OR

8. a. A Rectangular beam is simply supported at the end and carries a point load at the center . Establish the relation between maximum bending stress and maximum shear stress (8)

b. The T-beam shown in the figure 8b has cross- sectional dimentions : b= 220 mm, *l*= 15 mm, h = 300mm, and h_1 = 275mm. the beam is subjected to a shear force V = 60 kN. Determine the maximum shear stress in the web of the beam. (8)

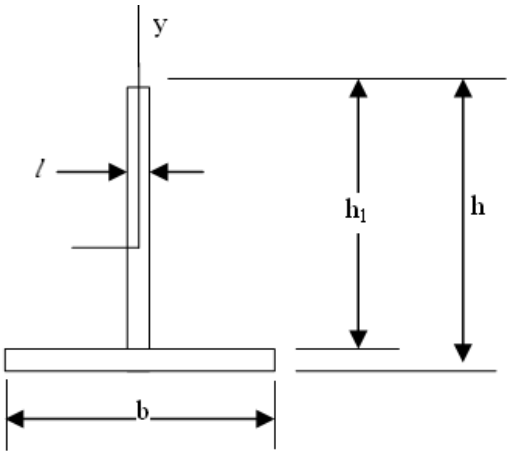


Figure 8b

UNIT – V

9. a. a composite shaft consist if copper rod of 20 mm diameter enclosed in a steel tube of 60 mm external diameter and 20 mm thick thee shaft is require to transmit to torque if 1200 N-m Determine the shear stresses developed in the copper and steel . if both the shaft have equal length and welded to a plate at each end so that their twists are equal take modulus of rigidity for steel as twice that of copper. (8)

b. A composite shaft made of 40 mm solid steel.The shaft is covered by tightly fitting alloy tube of 60 mm external diameter and 40 mm internal diameter. The shafts are tightened together so as to prevent any relative motion between two maximum permissible shear stress in steel and alloy are 60 and 38 MPa respectively find maximum power transmitted by composite shaft at 600 rpm Take G_{steel} = 80 GPa and G_{alloy} = 44 GPa (8)

OR

10. a . determine the crippling load for a T section of dimensions 10 cm X 10 cm X 2 as shown in figure 10 a and having length of 5 m. it's hinged at both ends.E = 200 GPa. (8)

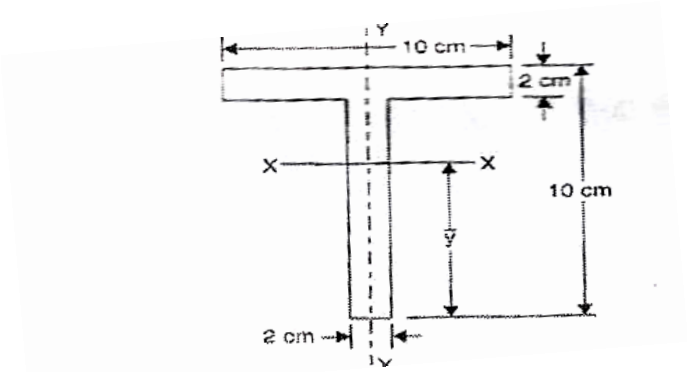
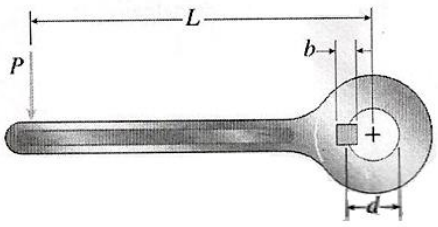


Figure 10a

b. Derive Euler's formula for buckling load for aluminium with hinged ends Also state the limitation if Euler's formula (8)

UNIT – VI

11. a. A specially designed wrench is used to twist a circular shaft by means of a square key that fits into slots (or Keyways) in the shaft and wrench as shown in the figure 11a. shaft has diameter d, the key has a square cross section of diameters b X b , and the length of the key is c the key fits half into the wrench and half into the shaft (i.e. the keyways have a depth equal to b/2). Derive a formula for the average shear stress in the key when a load p is applied at distance L from the center of shaft. Disregard the effects of friction, assume that the bearing pressure between the key and the wrench is uniformly distributed and draw free –body diagrams of the wench and key. (12)



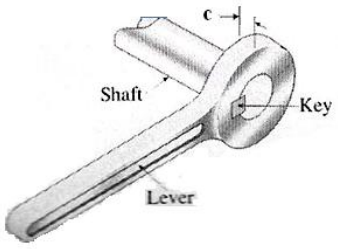


Figure 11a

b. Explain product life cycle (6)

OR

12. a Design a knuckle joint for a tie rod of circular section for a maximum pull of 15 kN . The yield strength of material is 315 N/$m\,m^2$ .Allowable stress in shear is 100N/mm^2 Permissible stresses are same in tension and compression . take factor of safety as 2.

(12)

b. Write a short note on design synthesis [6]