Total No of Questions: [12] *SEAT NO. :* [ ]

[Total No. of Pages : 5]

S.E. 2008(Mech and Mech S/W) (Strength Of Machine Element)

SME (202051)

(Semester - II)

Time: 3 Hours *Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume Suitable data if necessary***

SECTION I

Q1) a) Draw the stress-strain diagram for aluminum and for M.S. mention all points on the diagram. [8]

b) Determine the force 'P' necessary for the equilibrium of a steel bar shown in **fig.1**.The diameter of the first, middle and last segments of the bar are 30 mm, 25 mm and 30 mm respectively. Also find the elongation of the bar. Take E=200Gpa. [8]

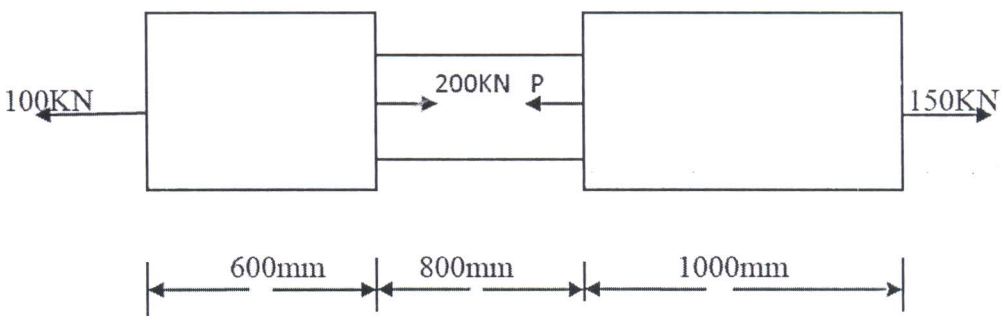


Fig.1

OR

Q2) a) Derive the expression for elongation of uniformly tapering circular bar. [8]

b) A composite bar of 20 mm x 20 mm cross section is made up of three bars are rigidly connected at the ends when the temperature is 20 ^{0} C as shown in **fig.2**.Determine; [8]

i)The stresses developed in each bar when the temperature of the composite bar is raised to 60 ^{0} C.

ii)The final stresses in each bar when a load of 17.6 KN is applied to the composite bar.

Ea=80 Gpa $\alpha a=11x10^{-6}/^0C$

Es=200Gpa $\alpha a=22x10^{-6}/^{0}C$

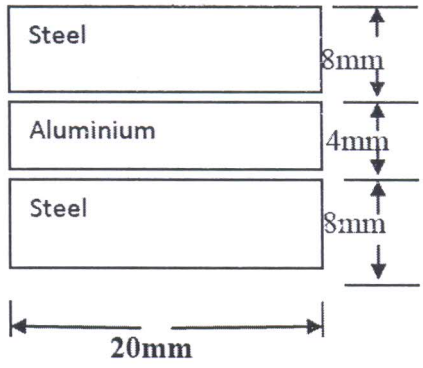


Fig.2

Q3) a) Indicate the shapes of shear force and bending moment diagram for triangular loaded simply supported and triangular loaded cantilever beam. [8]

b) The overhanging beam is loaded as shown in **fig 3.**Draw shear force and bending moment diagram. Indicate all important points on diagram and find point of contraflexture if any. [10]

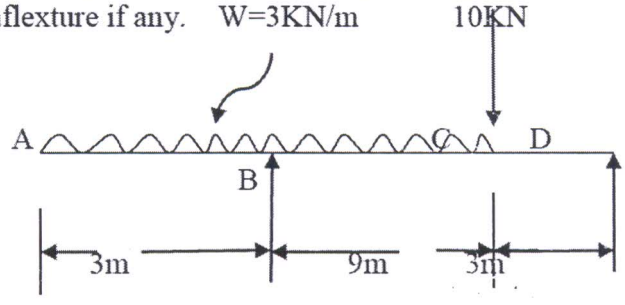
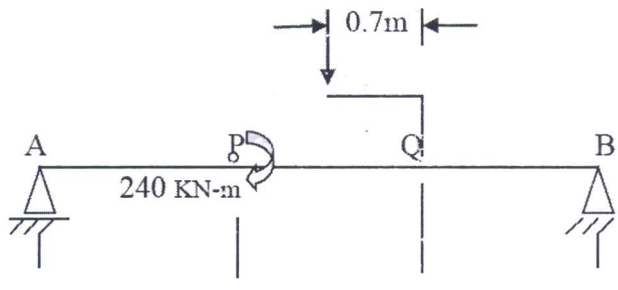


Fig.3

OR

Q4) a) Derive the expression for slope and deflection at free end of a cantilever beam of length 'L' carrying point load 'W' at its free end. [8]

b) A beam is loaded as shown in **fig.4**determine the deflection of the points 'P' and 'Q'.Take EI=70,000 KN-m^2. [10]



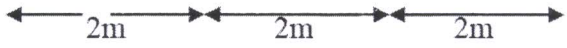


Fig.4

Q5) a) Deduce expression for stresses on an inclined plane in a body subjected to bi-axial stress condition. [6]

b) Two perpendicular stresses of 250 MPa and 100 MPa act at a point in a material. Draw the Mohr's stress circle and find the normal and shear stress components on a plane the normal of which makes an angle of 40 ^{0} with the 250 Mpa stress. Also, find the resultant. [10]

OR

Q6) a) What are the main theories of failure for a material? Explain their relative use. [6]

b) At a point in a strained material, stress pattern is as shown in **fig 5**.Determine [10]

i)Normal and shear stresses on plane 'AC' as shown for $\theta=30^0$

ii) Magnitude and nature of principal stresses.

iii)Orientation of principal planes.

iv)Maximum shear stress and orientation of planes having Maximum shear stress.

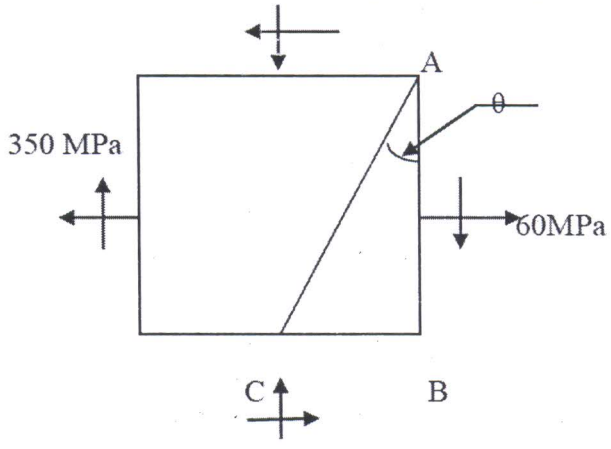


Fig.5

SECTION II

Q7) a) A 'T' section shown in fig.6 for material of section of the permissible stresses in compression and tension are 60 N/mm^2 and 100 N/mm^2 respectively. Decide whether T section should be placed with flange in tension at bottom and in compression at top to obtain maximum moment of resistance. Calculate maximum moment of resistance and comparison of the moment of resistance in these two positions. [10]

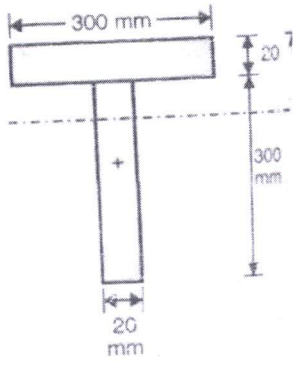


Fig.6

b) Derive the expression for shear stress induced at a distance 'y' from neutral axis in the cross section of a beam subjected to shear force. [6]

OR

Q8) a) Explain the following terms: [4]
(i) Neutral axis (ii) Moment of resistance

b) Show that neutral axis of section always passes through centroid of section in simple bending. [4]

c) A steel section is a square plate (300 mm x 300 mm) with circular hole (200 mm diameter) at its center as shown in fig.7 is subjected to a shear force of 200 kN. Draw shear stress distribution diagram. Also find the range of maximum shear stress to avg. shear stress. [8]

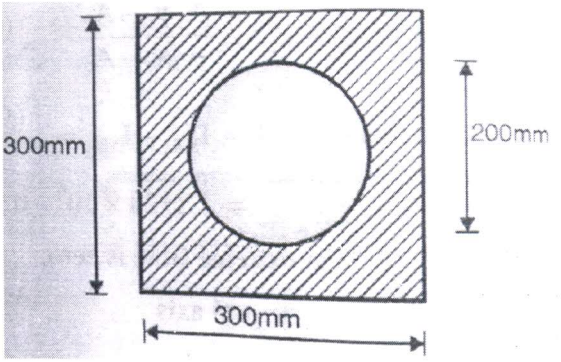


Fig.7

Q9) a) A hollow shaft whose internal diameter is half the external diameter is subjected to a torque of 60 kN-m and bending moment of 45 kN-m. If maximum shear stress is not to exceed 75 N/mm^2, Find the external and internal diamter of shafts. [4]

b) State the assumptions made in theory of torsion. [4]

c) State the limitations of Eulers formula. Hence obtain Rankines formula for long as well as short columns to overcome the limitations. [8]

OR

Q10) a) A hollow shaft of diameter ratio 3/8 (internal diameter to outer diameter) is to transmit 375 kW power at 100 rpm. The maximum torque being 20 % greater than the mean torque. The shear is not to exceed than the 60 N/mm^2 and twist in length of 4m is not to exceed 2^0. Calculate its external and internal diameter which would satisfy both the above conditions. Assume G = 0.85 x 10^5 N/mm^2. [8]

b) A cross section of column is hollow rectangular section, having external dimensions 120 mm x 80 mm, internal dimensions 100 mm x 60 mm, with uniform thickness of 10 mm. It is 5 m long having one end fixed, other end hinged. Find the safe load it can carry by (i) Euler's formula (ii) Rankin's formula. Assume, E = 200 GPa. σ_c = 320 N/mm^2, α = 1/7500, FOS = 3. [8]

Q11) a) Explain various steps in the process of design of machine elements. [6]

b) Write a short note on (i) Preferred Series (ii) Product life cycle. [6]

c) A 'C' frame subjected to load of 10 kN is shown in figure 8. It is made up of gray cast iron with allowable stress of 120 N/mm^2. Determine the dimensions of cross section of frame. [6]

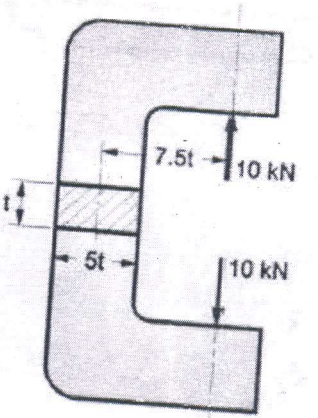


Fig. 8

OR

Q12) a) Design a cotter joint to transmit a load of 100 kN in tension or compression. [12]
Assume the following stresses for socket, spigot and cotter.
Allowable tensile stress = 90 N/mm^2
Allowable crushing stress = 170 N/mm^2
Allowable shear stress = 60 N/mm^2

b) Explain in short any three of the following terms: [6]
(i) Service factor (ii) Selection of Factor of safety (iii) Creativity in design
(iv)Design synthesis