BTS (C) – VI – (S) – 10 – 045 – M

B. Tech Degree VI Semester (Supplementary)Examination September 2010

ME 603 MACHINE DESIGN I

(2006 Scheme)

Time : 3 Hours

Maximum Marks : 100

(Use of approved Design data book is permitted, Data not given may be suitably assumed)

PART - A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) Define the following terms :
- (i) Design
- (ii) Mechanical Design
- (iii) Design consideration
- (iv) Factor of safety
- (v) Reliability.

(b) State and explain the following terms :
- (i) Maximum shear stress theory
- (ii) Determination of stress concentration factor for small elliptical hole.

(c) Derive an expression for efficiency of a square threaded screw.

(d) A bar of a boring machine having diameter of 60 mm is subjected to a shear stress of 40 MPa and has an angle of twist of 0.01 radian. Determine length of the bar. G = 84 Gpa.

(e) Explain the eccentric shear loads on riveted connections and determining their resultants.

(f) Derive an expression for total and maximum stresses produced in the helical spring sketch the different stresses on the spring subjected to torsion and shear.

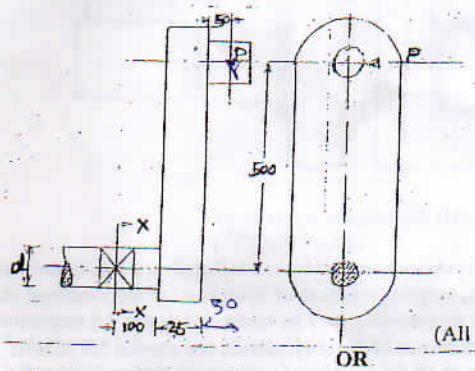
(g) Derive an expression for maximum shear stress in parallel fillet weld.

(h) Derive an expression to find the speed of rotating shafts.

PART – B

(4 x 15 = 60)

II. The dimensions of an overhanging crank as shown in the figure the force P acting at the crank pin is 1 KN. The crank is made of steel 30 C8 (Syt = 400 N/mm^2) and the factor of safety is 2. Using maximum shear stress theories of failure determine diameter d at section X-X.



(All dimensions are in mm)

OR

III. A circular machine member of ductile material is subject to a varying axial load from 250,000 N compressive, 750,000 N tensile, endurance stress for material is 250 MN/m^2, tensile yield stress = 350 MN/m^2 stress concentration factor 1.5 and factor of safety = 2.0. Determine the diameter of the member.

(P.T.O.)

IV. A double threaded power screw with ISO metric trapezoidal threads is used to raise a load of 300 kN. The nominal diameter is 10 mm and the pitch is 12 mm, coefficient of friction for thread is = 0.15 Neglecting collar friction. Calculate –

(i) Torque required to rise the load
(ii) Torque required to lower the load
(iii) Efficiency of the screw.

OR

V. Design a cotter joint (single cotter) to resist safely a load of 40 kN that acts along the coincident axes of the rods connected by cotter. The material of the cotter and rods will permit the following safe stresses. Ft = 50 MPa : Fc = 105 MPa & Fs = 40 MPa.

VI. The longitudinal joint of a cylindrical boiler shell 160 cm in diameter and subjected to an internal pressure 10 Kg/cm^2 is made of up of a lap joint with two rows of rivets if the plate thickness is 10 mm. Diameter of rivets 20 mm and the pitch of rivets 100 mm. Determine –

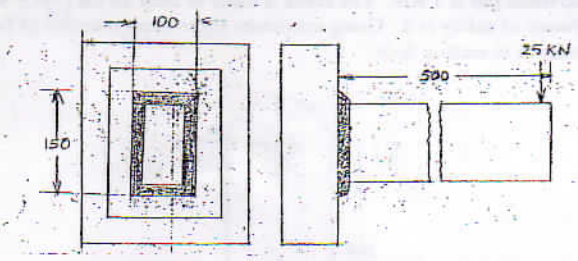
(i) the shear stress (ii) the tensile stress (iii) crushing stress induced in the joint. Determine also the three efficiencies if the permissible stresses are 700 Kg/cm^2 in shear, and 1000 Kg/cm^2 in both tension and compression.

OR

VII. A semi elliptical leaf spring used for automobiles suspension consists of three extra full length leaves and 15 graduated length leaves, including the master leaf. The centre to centre distance between two eyes of the spring is 1 m. The maximum force that can act on the spring is 75 kN. For each lead the ratio of width of thickness is 9:1. The modulus of elasticity of the material is 207000 N/mm^2. The leaves are pre stressed in such way that when the force is maximum the stresses induced in all leaves are same and equal to 450 N/mm^2. Determine –

(i) The width and thickness of leaves
(ii) The initial nip
(iii) The initial pressure load required to close the gap C between extra full length leaves and graduated leaves.

VIII. A shaft of rectangular cross section is welded to support by means of fillet weld as shown in the figure. Determine the size of the welds, if the permissible shear stress in the weld is limited to 75 N/mm^2.



(All dimensions are in mm)

OR

IX. The shaft of an axial flow rotary compressor is subjected to a maximum torque of 200 N-m and a maximum bending moment of 4000 N-m. The combined shear and fatigue factors in torsion and bending may be taken as 1.5 and 2.0 respectively.

(i) Determine the diameter of the shaft should not exceed 5.0 MN/m^2
(ii) Design a hollow shaft for the above compressor taking di/do = 0.5. What is the % of saving material also compare stiffness?
(iii) What will be the shear stress in solid shaft if axial load of 10000 N acts on the shaft. What do you conclude from this result?

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