ME 311 (R-20)

Total No. of Questions : 10] [Total No.of Pages : 03

III/IV B. Tech. DEGREE EXAMINATIONS, DECEMBER - 2022

First Semester

MECHANICAL ENGINEERING

DESIGN OF MACHINE ELEMENTS

(Data Books may be allowed)

Time : **Three Hours** Maximum : **60** Marks

Answer ONE question from each Unit.

All questions carry equal marks. 5x12=60 M

UNIT - I

1. a) What is the general procedure followed when designing a machine element.

   b) A steel shaft transmits 100 kW at 120 rpm. The maximum twisting moment during each revolution exceeds the mean by 30%. Suggest the suitable diameter for the solid shaft if the torsional shear stress is not to exceed 65 MPa.

(OR)

2. a) A bolt is subjected to an axial pull of 10kN and a transverse shear force of 5kN. The yield strength of the bolt material is 300 MPa. Considering a factor of safety of 2.5. Determine the diameter of the bolt using (i) maximum normal stress theory (ii) maximum shear stress theory (iii) maximum principal strain theory. Take Poisson's ratio as 0.25.

   b) Explain any two theories of failure briefly ?

UNIT - II

3. a) A machine component is subjected to a flexural stress which fluctuates between + 300MN/m^2 and -150 MN/m^2. Determine the value of minimum ultimate strength according to : (i)Modified Goodman relation and (ii) Soderberg relation. Take yield strength = 0.55 Ultimate strength; Endurance strength = 0.5 Ultimate strength; and factor of safety = 2.

   b) A steel link having a rectangular section is subjected to a repeated axial load of 50,000N with a medium shock. Determine the section if the endurance limit be 250 MPa with a design factor 1.5. Take side ratio as 2:1. Size factor may be taken as 0.85 and surface finish factor as 0.88.

(OR)

P.T.O.

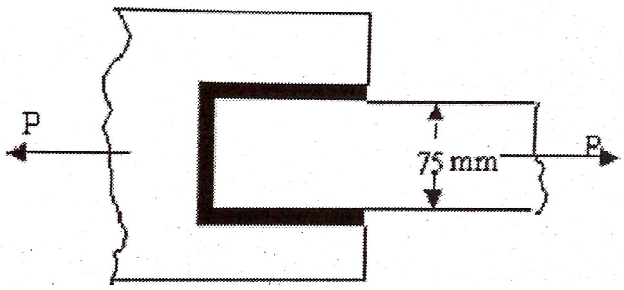
4. a) Discuss the concepts fatigue, endurance limit and notch sensitivity.

   b) Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete reversal), σe = 265 MPa and tensile yield strength of 350 MPa. The member is subjected to a varying axial load from Wmin = -300 kN to Wmax = 700 kN and has a stress concentration factor = 1.8. Use factor of safety as 2.

UNIT - III

5. a) What do you understand by the term welded joint ? How it differs from the riveted joint ?

   b) A plate 75 mm wide and 12.5 mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld as shown in figure below. The maximum tensile and shear stresses are 70 MPa and 56 MPa respectively. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading. Assume a length of 12.5 mm for starting and stopping of weld run. Take stress concentration factor for transverse weld as 1.5 and for parallel fillet welds as 2.5.



(OR)

6. a) What do you understand by the term riveted joint ? Show the various rivet configurations during the formation riveted joint ?

   b) A triple riveted lap joint with zig-zag riveting is to be designed to connect two plates of 6 mm thickness. Determine the diameter of the rivet, pitch of rivets and distance between the rows of the rivets. Indicate how the joint will fail. Also, find the efficiency of the joint. The permissible stresses are 120 MPa in tension, 100 MPa in shear and 150 MPa in crushing.

UNIT - IV

7. a) A shaft transmits 120 kW at 260 r.p.m to another shaft through a flange coupling. The bolts in the flange are arranged on a pitch circle of 200mm. Determine the number and size of bolts, if the permissible shear stress in the bolt material is 50 MPa.

b) Derive an expression for the maximum load in a bolt when a bracket with circular base is bolted to a wall by means of four bolts.

(OR)

8. a) What is a bolt of uniform strap in.

b) What design parameters are calculated when bolt is under tension.

UNIT - V

9. a) Differentiate between a cotter and knuckle joint.

b) Design and draw a socket and spigot cotter joint two connect two mild steel rods for a pull of 30 KN. The maximum permissible stresses are 55 MPa in tension, 40 MPa in shear and 70 MPa in crushing.

(OR)

10. a) Differentiate between differential screw and compound screw.

b) The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine (a) the power required to drive the screw; and (b) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar.