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BT-5/D-13

MACHINE DESIGN-I

Paper-ME-309-E

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions in all, selecting at least **one** from each unit. All questions carry equal marks. Any missing data may be assumed suitably.*

Unit-I

1. (a) Explain in detail the factors to be considered for the selection of materials for design of machine elements. 10

(b) Explain Mechanical properties of an Engineering Material in detail. 10

2. (a) Write Soderberg's equation and state its application to different type of loading. 10

(b) Explain the following terms with design of Machine members subjected to variable loads :

(i) Endurance limit

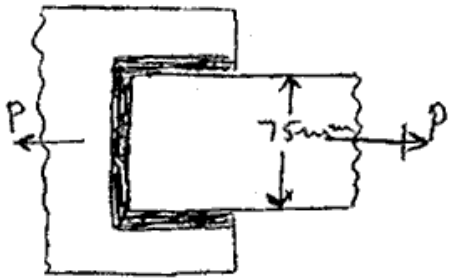
(ii) Size factor

(iii) Notch sensitivity. 10

[Turn over

Unit-II

3. 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 fig. The maximum tensile and shear stresses are 70 MPa and 56 MPa. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading. 20



4. Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6. 20

Unit-III

5. Two 400 mm diameter pulley are keyed to a simply supported shaft 500 mm apart. Each pulley is 100 mm from its support and has horizontal belts, tension ratio being 2.5. If the shear stress is to be limited to 80 MPa while transmitting 45 kW at 900 rpm. Find the shaft diameter if it is to be used for the input-output belts being on the same or opposite sides. 20

6. Design a right angled bell crank lever. The horizontal arm is 500 mm long and a load of 4.5 kN acts vertically downward through a pin in the forked end of this arm. At the end of the 150mm long arm which is perpendicular to the 500 mm long arm, a force P act at right angle to the axis of 150 mm arm through a pin into forked end. The lever consists of forged steel material and a pin at the fulcrum. Take the following data for both the pins and lever material.

Safe stress in tension = 75 MPa.

Safe stress in shear = 60 MPa

Safe bearing pressure on pins = $10N/mm^2$ 20

Unit-IV

7. The cutter of a broaching machine is pulled by square threaded screw of 55 mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400 N on a flat surface of 60 mm and 90 mm internal and external diameters respectively. If the coefficient of friction is 0.15 for all contact surfaces on the nut. determine the power required to rotate the operating nut when the cutting speed is 6 m/min. Also find the efficiency of the screw. 20

8. Describe with the help of neat sketches :

   (a) the types of various shaft coupling mentioning the uses of each type. 12

   (b) Explain the procedure for design of a circular flanged pipe joint. 08