

Roll No.

Total Pages : 04

BT-5/D-18

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MACHINE DESIGN-I

ME-309-E

Opt. I

Time : Three Hours]

[Maximum Marks : 100

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

Unit I

1. (a) Explain the difference between malleable cast iron and grey cast iron. 5
- (b) A cold drawn steel bar is to withstand a tensile preload of 36.3 kN and a fluctuating tensile load varying from 0 to 72.60 kN. The bar has a geometric stress concentration factor of 2.02 corresponding to a fillet whose radius is 4.75 mm. Determine the size of the bar for an infinite life and factor of safety of 2. The material properties are $S_{yt} = 588$ MPa, $S_{ut} = 700$ MPa.

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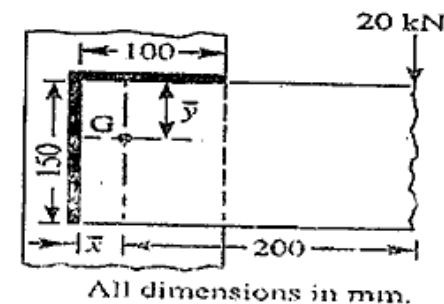
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P.T.O.

2. Define endurance limit. How the endurance limit is determined from the S-N plot ? Also classify the low cycle and high cycle fatigue region. 20

Unit II

3. Fig. 1 shows a welded joint subjected to an eccentric load of 20 kN. The welding is only on one side. Determine the uniform size of the weld on the entire length of two legs. Take permissible shear stress for the weld material as 80 MPa. 20



4. Two mild steel rods 40 mm diameter are to be connected by a cotter joint. The thickness of the cotter is 12 mm. Calculate the dimensions of the joint, if the maximum permissible stresses are : 46 MPa in tension; 35 MPa in shear and 70 MPa in crushing. 20

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Unit III

5. A hollow shaft of 0.5 m outside diameter and 0.3 m inside diameter is used to drive a propeller of a marine vessel. The shaft is mounted on bearing 6 metre apart and it transmits 5600 kW at 150 r.p.m. The maximum axial propeller thrust is 500 kN and the shaft weights 70 kN. Determine : (i) The maximum shear stress developed in the shaft, and (ii) The angular twist between the bearings. <http://www.kuonline.in> 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 150 mm long arm which is perpendicular to the 500 mm long arm, a force P act at right angles to the axis of 150 mm arm through a pin into a 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 = 10 N/mm². 20

Unit IV

7. Design a bushed-pin type flexible coupling for connecting motor shaft to a pump shaft for the following service conditions : Power to be transmitted = 400 kW; speed of the motor shaft = 1000 r.p.m.; diameter of the motor shaft = 50 mm; diameter of the pump shaft = 45 mm. The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 N/mm² and 25 MPa respectively. 20
8. Design an oval flanged pipe joint for pipes of internal diameter 50 mm subjected to a fluid pressure of 7 N/mm². The maximum tensile stress in the pipe material is not to exceed 21 MPa and in the bolts 28 MPa. 20

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