Roll No. ....

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36130

BT-6/M-19

MACHINE DESIGN-II

ME-310N (Opt. I)

Time : Four Hours] [Maximum Marks : 75

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks. Use of machine design data book is allowed.

Unit I

1. (a) Explain (i) Interference (ii) Undercutting (iii) Backlash (iv) Crowning of gears. **8**

   (b) A double start worm gear set has pitch diameter 50 mm, axial pitch 10 mm and transmission ratio 27:1. Input speed is 1800 rpm. Determine the worm gear diameter, lead, lead angles, and centre distance. State if the gear set is self-locking ? **7**

2. A pair of helical gears consists of 24 teeth pinion meshing with 72 teeth gear. Normal pressure angle is 20 deg. and the helix angle is 24 deg. The pinion rotates at 720 rpm. Normal module of gear is 5 mm and face width is 50 mm. Both pinion and gear are made of steel with S_{ut} = 600 MPa. Gears are heat treated to a surface hardness of 360 BHN. What power can be transmitted by the gears if the service factor is 1.4 and factor of safety is 2 ? Assume that velocity factor accounts for the dynamic load. **15**

Unit II

3. A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100 kW at 2400 rpm and maximum torque 500 N-m. The outer radius of the friction plate is 25% more than the inner radius. The intensity of pressure between the plate is not to exceed 0.07 N/mm^2. The coefficient of friction may be assumed equal to 0.3. the helical springs required by this clutch to provide axial force necessary to engage the clutch are eight. If each springs has stiffness equal to 40 N/mm, determine the dimensions of the friction plate and initial compression in the springs. **15**

4. A rope drum of an elevator having 650 mm diameter is fitted with a brak drum of 1 m diameter. The brake drum is provided with four cast iron brake shoes each subtending an angle of 45°. The mass of the elevator when loaded is 2000 kg and moves with a speed of 2.5 m/s. The brake

has a sufficient capacity to stop the elevator in 2.75 metres. Assuming the coefficient of friction between the brake drum and shoes as 0.2, find : 1. width of the shoe, if the allowable pressure on the brake shoe is limited to 0.3 N/mm^2; and 2, heat generated in stopping the elevator. 15

Unit III

5. A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa. Find :.(i) Size of the spring wire (ii) Diameters of the spring (iii) Number of turns of the spring (iv) Free length of the spring. The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as 80 kN/mm^2. 15

6. Design a journal bearing for a centrifugal pump running at 1440 rpm. The diameter of the journal is 100 mm and load on each bearing is 20 kN. The factor ZN/p may be taken as 28 for centrifugal pump bearings. The bearing is running at 75°C temperature and the atmosphere temperature is 30°C. The energy dissipation coefficient is 875 W/m^2/°C. Take diametral clearance as 0.1 mm. 15

Unit IV

7. Design a plain carbon steel centre crankshaft for a single acting four stroke single cylinder engine for the following data : 15

Bore = 400 mm; Stroke = 600 mm; Engine speed = 200 rpm; Mean effective pressure = 0.5 N/mm^2; Maximum combustion pressure = 2.5 N/mm^2; Weight of flywheel used as a pulley = 50 kN; Total belt pull = 6.5 kN. When the crank has turned through 35° from the top dead centre, the pressure on the piston is 1 N/mm^2 and the torque on the crank is maximum. The ratio of the connecting rod length to the crank radius is 5. Assume any other data required for the design. 15

8. Design and draw a cast iron flywheel used for a four stroke I.C. engine developing 180 W at 240 r.p.m. The hoop or centrifugal stress developed in the flywheel is 5.2 MPa, the total fluctuation of speed is to be limited to 3% of the mean speed. The work done during the power stroke is 1/3 more than the average work done during the whole cycle. The maximum torque on the shaft is twice the mean torque. The density of cast iron is 7220 kg/m^3.