

R09

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year II Semester Examinations, May – 2013

Design of Machine Members-II
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

1. The following data is given for a full hydrodynamic bearing used for electric motor:
Radial load = 1200 N; Journal Speed = 1440 rpm; Journal diameter = 50 mm;
Static load on the bearing = 350 N; Operating temperature = 65 °C;
The values of surface roughness of the journal and the bearing are 2 and 1 micron respectively. The minimum film thickness is five times the surface roughness. Determine
a) length of the bearing,
b) select a suitable lubricant based on viscosity of the lubricant,
c) flow of the lubricant. [15]
- 2.a) Compare the variation of coefficient of friction versus speed for rolling contact bearing and sliding contact bearing.
b) A ball bearing is operating on a work cycle consisting of three parts – a radial load of 3000 N at 1440 rpm for one quarter cycle, a radial load of 5000 N at 720 rpm for one half cycles and radial load of 2500 N at 1440 rpm for the remaining cycle. The expected life of the bearing is 10000 Hrs. Calculate the dynamic load carrying capacity of the bearing. [5+10]
- 3.a) Derive the conditions for the maximum power transmission in the flat belt drives.
b) Design an open type flat belt drive for a compressor running at 720 rpm which is driven by a 25 kW, 1440 rpm motor. Centre distance is 3 m. [3+12]
4. Design a side crankshaft for 500 mm × 600 mm gas engine. The weight of the flywheel is 80 kN and the explosion pressure is 2.5 MPa. The gas pressure at the maximum torque is 0.9 MPa, when the crank is 30° from the Inner Dead Centre. The connecting rod is 4.5 times the crank radius. [15]
5. Design a pair of spur pinion and gear made of cast steel and cast iron respectively. The diameter of pinion is 140 mm and transmits 30 kW at 1250 rpm. The gear ratio is 3:1 and teeth are 20° full depth involute system. Check the design for wear strength and dynamic load assuming BHN 250 for pinion material. [15]
6. Two parallel shafts are connected by helical gears with 20° full depth teeth and helix angle of 15°. The material for both gears is forged steel with safe static stress of 140 MPa. The power to be transmitted is 40 kW at 1400 rpm of the pinion. Design the gears with Lewis equation and check for the wear strength. Use BHN = 250, gear ratio = 4.5. [15]

7. A pair of worm gear is designated by as 1/40/10/4. The input speed of the worm shaft is 1000 rpm. The worm wheel is made of phosphor bronze while the worm is made of hardened steel. Determine the power transmitting capacity based on beam strength and on wear strength. [15]

8. A screw press is required to exert a force of 50 kN when applied torque is 560 Nm. The unsupported length of the screw is 450 mm and a thrust bearing of hardened steel on cast iron is provided at the power end. Determine the dimensions of screw and nut, and efficiency using the data given below.

The permissible stresses in steel screw:

Tension and compression – 85 MPa, Shear – 55 MPa,

The permissible bearing pressure is 13.5 MPa for steel screw and C.I nut

The permissible shearing stress in the CI is 20 MPa

The yield strength of steel of screw = 260 MPa

The coefficient of friction in screw and nut is 0.15. [15]

