Eighth Semester B.E. Degree Examination, June/July 2016
Tribology

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer FIVE full questions, selecting*
**   *at least TWO questions from each part.***
**   2. *Use of machine design data hand book is permitted.***

PART – A

1 a. Derive an expression for the rate of flow through capillary tube based on Hagen-Poiseuille law. State the assumption made in deriving the equation.   **(10 Marks)**
   b. With the help of neat sketches explain the working of i) Ostwald viscometer   ii) Saybolt Viscometer.   **(10 Marks)**

2 a. What is lightly loaded bearing? Derive petroffs equation for frictional force and co-efficient of friction in lightly loaded bearing.   **(10 Marks)**
   b. A lightly loaded bearing has the following specifications: Journal diameter = 25mm, bearing length = 57mm, Radial clearance = 5×10^{-2} mm, Journal speed = 25,000rpm, Radial Load = 910N, Viscosity of the lubricant = 24cp.
   Calculate: i) Coefficient of friction ii) Frictional Torque and   iii) Power loss due to viscous friction.   **(10 Marks)**

3 a. Determine i) Load carrying capacity   ii) Frictional force   iii) Coefficient of friction and iv) Power loss due to friction for an idealized full Journal bearing having the following specifications :
   Diameter of the Jourani = 50mm, length of bearing = 65mm, Speed of the Journal = 1200rpm, Radial clearance = 0.025mm, Average viscosity = 0.01125PaS, Attitude = 0.8.
                                                                                   (10 Marks)
   b. A partial self contained 120°, centrally loaded bearing has the following specifications :
   Journal diameter = 100mm, Bearing length = 125mm, Journal speed = 400rpm, Radial clearance = 0.0625mm, Minimum film thickness = 6.25×10^{-3} mm, Viscosity of lubricating oil = 0.018Pa.S. Determine i) Load carrying capacity of the bearing   ii) Power loss in the bearing   iii) Maximum pressure in oil film.   **(10 Marks)**

4 a. A rectangular plain slider bearing with fixed shoe with no end leakage has the following specifications Bearing length = 90mm, width of shoe = 90mm, Load on the bearing = 7800N, Slider velocity = 250 cm/sec, Indination α = -0.00035 radians, visocity of oil at operating temperature = 40cp. Determine: i) Minimum Film thickness ii) Power loss iii) Co – efficient of friction.   **(10 Marks)**
   b. A pivoted shoe of the slider bearing has square shape. The load acting on the bearing is 13344N, velocity of the moving member is 5.08m/sec, and Lubricating oil is SAE 40. The expected mean temperature of oil is 90°C. Permissible minimum oil film thickness is 1.905×10^{-5} m. Find i) Required dimensions of the shoe ii) Coefficient of friction under given operating conditions iii) Power loss.
   Assume inclination of surface corresponds to maximum load carrying capacity, Neglect the effect of end flow from the bearing.   **(10 Marks)**

PART – B

5 a. Write notes an oil flow through Journal Bearings with i) Central groove and ii) having a single hole. **(05 Marks)**

   b. Write notes on thermal equilibrium of journal bearings. **(05 Marks)**

   c. An oil ring full Journal bearing is to operate in still air. The bearing diameter is 75mm and the length is 75mm. Bearing is subjected to a load of 5kN and is rotating at 500rpm. Radial clearance is 0.0625mm. The oil is SAE 30. The ambient air temperature is 20°C. Determine the equilibrium temperature and viscosity of oil. **(10 Marks)**

6 a. Derive the expression for rate of flow of oil and load carrying capacity for a hydrostatic step bearing. **(10 Marks)**

   b. A Hydrostatic step bearing has following specifications shaft diameter = 0.150m, Recess diameter = 0.100m, Vertical thrust load = 60kN, Speed of the shaft = 1500 rev/min, Viscosity of the lubricant is 30cp, Minimum oil film thickness = 1.25×10^{-4}m.
   Determine: i) Discharge ii) Power loss due to viscous friction iii) coefficient of frication. **(10 Marks)**

7 a. List the commonly used bearing material and describe any of the five commonly with respect to their characteristics and advantages. **(10 Marks)**

   b. List any ten desirable properties of typical bearing material and explain any of the five in portent properties in detail. **(10 Marks)**

8 a. Write notes on i) Wear of ceramic materials ii) Wear measurements and iii) Effect of speed, temperature and pressure on wear. **(10 Marks)**

   b. Briefly explain: i) Improved design and ii) Surface Engineering. **(10 Marks)**

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