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10ME831

Eighth Semester B.E. Degree Examination, Dec.2015/Jan.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 data handbook is permitted.***

PART – A

1 a. Define viscosity. Explain Newton's law of viscosity. **(06 Marks)**
   b. State Hagen-Poiseuille law. Show that the velocity distribution is parabolic for the fluid flow across the capillary tube. **(06 Marks)**
   c. An oil supply line of 3m long with internal diameter of 0.8 mm delivers 2 liters of oil per minute. The oil has viscosity of 0.065 pas-sec. Determine the pressure drop in the supply line and the maximum fluid flow velocity. **(08 Marks)**

2 Derive Reynolds equation in two dimensions. State the assumptions made. **(20 Marks)**

3 a. A machine tool bearing has a length of 50 mm and its journal diameter is also 50 mm. the diameteral clearance ratio is 0.001 and the operating viscosity of the lubricant is 0.05 pa-sec. If the journal speed is 950 rpm and the bearing sustains a load of 100 kN, calculate:
   i) Eccentricity ratio
   ii) Thickness of oil film
   (10 Marks)

   b. A Journal bearing operating under steady load condition has the following specifications:
   Diameter of journal = 62.5 mm
   Length of bearing = 50 mm
   Radial clearance = 0.03125 mm
   Speed of journal = 2000 rpm
   Load on bearing = 9090 N
   Lubricating oil used = SAE 20
   Expected oil temperature = 82°C
   Consider the influence of end flow in the performance of bearing. Determine:
   i) Minimum oil film thickness
   ii) Coefficient of friction
   iii) Power loss
   Assume β = 180°. **(10 Marks)**

4 a. Derive an expression for load carrying capacity of a plane slider bearing with pivoted shoe. **(10 Marks)**
   b. A pivoted shoe slider bearing has the following data:
   Length of shoe = 100 mm
   Width of shoe = 120 mm
   Velocity of moving member = 5 m/s
   Minimum oil film thickness = 0.002 mm
   Viscosity = 25 cp
   Determine: (i) maximum load carried; (ii) coefficient of friction. **(10 Marks)**

PART – B

5 a. Discuss thermal equilibrium of journal bearing. **(08 Marks)**

   b. A partial self contained 120° centrally loaded bearing has the following specifications journal diameter = 100 mm, length = 125 mm, diametral clearance = 0.125 mm, journal speed = 400 rpm. Expected approximate average oil temperature is 98°C. Lubricating oil SAE 60. Assuming steady load and average ventilation condition. Determine:

   i) Load carrying capacity of bearing if permissible minimum oil film thickness is 0.00625 mm.

   ii) Power loss in the bearing under given operating condition.

   iii) Maximum pressure in the oil film expected under operating conditions.

   iv) Average bearing operating temperature. **(12 Marks)**

6 a. Drive an equation for the rate of flow of oil through a hydrostatic step bearing. **(10 Marks)**

   b. A hydrostatic step bearing has the following particular:

   Inlet pressure = 4.5 MPa

   Viscosity of lubricant = 0.03 pas.sec

   Oil film thickness = 0.005 mm

   Vertical load on bearing = 18750 N

   Shaft speed = 900 rpm

   Ratio of $\dfrac{r_2}{r_1} = 2$.

   Determine: i) The diameter of shaft

   ii) The rate of oil flow through the bearing

   iii) Power loss due to viscous friction. **(10 Marks)**

7 a. Discuss the commonly used bearing alloys along with their advantage and disadvantages. **(10 Marks)**

   b. Write a note on properties of bearing material. **(10 Marks)**

8 a. Briefly explain the wear of ceramic materials. **(08 Marks)**

   b. Explain the technologies involved in surface engineering to improve tribological behaviour components. **(12 Marks)**

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