2002 SCHEME

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ME834

Eighth Semester B.E. Degree Examination, June-July 2009
Tribology

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions.***
2. Use of Design data hand book permitted.
3. Missing data, if any may be suitably assumed.

1 a. Stating the assumptions derive Hagen-Poiseuille relation. **(12 Marks)**

b. Two reservoirs P and Q are connected by a capillary tube of diameter 1.5mm and length 1.5m. Reservoir P is at a pressure higher than the reservoir Q. The reservoirs are filled with a liquid having an absolute viscosity of 27 CP. Assuming laminar flow, determine the pressure difference between two reservoirs, if the rate of flow through the capillary tube is 0.09×10^{-3} m^3/s. Also determine the pressure in reservoir P if the pressure in reservoir Q is 0.01 MPa. **(08 Marks)**

2 a. Derive the expressions for frictional force, torque and coefficient of friction for a lightly loaded Journal bearing. **(10 Marks)**

b. A lightly loaded full Journal bearing has the following specifications.

Bearing diameter	= 80mm
Bearing Length	= 60mm
Diametral clearance	= 0.12mm
Journal speed	= 24000rpm
Viscosity of the Lubricating oil	= 4CP
Radial load	= 900N

Determine
i) Frictional force; ii) Torque; iii) Power loss; iv) Coefficient of friction. **(10 Marks)**

3 Derive the Reynold's equation in 2.D and state the assumptions made. **(20 Marks)**

4 a. Derive an expression for the load carrying capacity of a plane slider bearing with a fixed shoe. **(10 Marks)**

b. A rectangular plane slider bearing with fixed shoe has the following details

Bearing length in direction of motion	= 80mm
Width of Bearing	= 101mm
Slider velocity	= 1.27 m/sec
Mean viscosity of Lubricant	= 17.24 CP
Minimum fluid film thickness	= 0.02mm
Maximum fluid film thickness	= 0.05mm

Draw the pressure distribution curve for the slider bearing. **(10 Marks)**

5 a. A slider bearing with a rectangular shoe has the following specifications.

Length of the shoe in direction of motion	= 75mm
Width of the shoe	= 115mm
Velocity of the moving member	= 2m/s
Expected mean temperature of oil	= 80°C
Permissible film thickness	= 0.023mm
Viscosity of oil	= 34.5CP

Determine i) Load carrying capacity; ii) Power loss in the bearing
Assume that the inclination of the bearing surface corresponds to the maximum load carrying capacity. Neglect the effects of end flow on the bearing. **(12 Marks)**

b. Write a note on self contained bearings. (08 Mar

6 a. Derive the expressions for rate of flow of oil and load carrying capacity for an hydrosta step bearing. (12 Mar

b. The following are the particulars of a Hydrostatic step bearing

Thrust load	= 500kN
Shaft dia	= 500mm
Recess dia	= 250mm
Film thickness	= 0.015mm
Viscosity of oil	= 48CP

Determine the inlet pressure and oil flow. (08 Mar

7 a. Discuss any six desirable properties of a bearing material. (10 Mar

b. Explain the following types of wear

i) Adhesive wear
ii) Abrasive wear
iii) Erosive wear
iv) Corrosive wear (10 Mar

8 Write short notes on any FOUR

a. Wear on ceramic materials
b. Wear on polymers
c. Wear measurement
d. Surface engineering
e. Partial bearings. (20 Mark

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06ME831

Eighth Semester B.E. Degree Examination, May/June 2010
Tribology

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Use of design data hand book is permitted.
3. Missing data, if any may be suitably assumed.

PART – A

1 a. Stating the assumptions, derive Hagen – Poiseuille law. **(08 Marks)**

b. State Newton's law of viscous flow and deduce the relation for fluidity of a Newtonian fluid. **(04 Marks)**

c. Tanks A and B are connected by a capillary tube and the system filled with a liquid of viscosity 2 cp. The pressures in tanks A and B are 0.01 and 0.04 MPa respectively. The outer diameter of the tube is 0.000835 mm with a wall thickness of 0.0001 mm. The length of the capillary is 2m. Assuming laminar flow, determine the rate of flow-through the capillary tube. **(08 Marks)**

2 a. Indicating the assumptions, derive the Petroff's equation and the expression for coefficient of friction for a lightly loaded journal bearing. **(10 Marks)**

b. A lightly loaded journal bearing is to support a radial load of 1 kN. The diameter of the shaft is 50 mm and length of the bearing is 60 mm. The oil used as the lubricant is SAE 30 at 70°C. Determine the coefficient of friction and power loss in the bearing if the speed is 750 rpm and the diametral clearance ratio is 0.001. **(10 Marks)**

3 State the assumptions made in derivation of Reynold's equation. Hence derive the Reynold's equation in two dimensions. **(20 Marks)**

4 a. Derive an expression for the load carrying capacity of a plane slider bearing with a fixed shoe. **(10 Marks)**

b. A pivoted shoe of a slider bearing has a square shape. The load acting on the bearing is 15 kN. Velocity of the moving member is 5 m/sec. Lubricating oil is SAE 30 and mean temperature of the oil is 70°C. The minimum oil film thickness is 0.02 mm. Take q = 1.4. Determine :

i) The dimensions of the shoe
ii) Coefficient of friction
iii) Power loss due to friction.

Assume that the inclination of bearing surface corresponds to the maximum load carrying capacity of the bearing. **(10 Marks)**

PART – B

5 a. A full journal bearing with a circumferential oil groove is lubricated under pressure and has the following specifications.

Journal diameter	= 0.0635 m
Total length of the bearing	= 0.127 m
Width of circumferential groove	= 6.35 mm
Radial clearance	= 0.04445 mm
Oil film temperature	= 112.7°C
Minimum oil film thickness	= 4.445×10^{-3} mm
Lubricating oil	= SAE 20

Determine the inlet pressure required in order to control the bearing temperature, if the rate of oil flow through the bearing is 5×10^{-6} m^3/s. **(12 Marks)**

b. Write a note on thermal equilibrium of journal bearings. **(08 Marks)**

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

b. A hydrostatic step bearing has the following characteristics.

Shaft diameter	= 130 mm
Diameter of pocket	= 55 mm
Shaft speed	= 1800 rpm
Inlet oil pressure	= 3.75 MPa
External pressure	= 0 (atmospheric)
Expected mean oil film temperature	= 60°C
Lubricating oil	= SAE 60
Desirable oil film thickness	= 0.0875 mm

Determine :

i) Load the bearing can support
ii) Rate of oil flow through the bearing
iii) Power loss due to viscous friction. **(10 Marks)**

7 a. Discuss briefly any ten desirable properties of a good bearing material. **(10 Marks)**

b. Discuss briefly the different types of wear, with simple sketches. **(10 Marks)**

8 Write short notes on :

a. Wear of ceramic materials
b. Improved design
c. Material selection
d. Surface engineering. **(20 Marks)**

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