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10ME831

**Eighth Semester B.E. Degree Examination, June/July 2018**  
**Tribology**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer FIVE full questions, selecting at least TWO questions from each part.  
2. Use of Design data handbook permitted.

**PART – A**

- 1 a. Explain the principle of working of a falling sphere viscometer. (06 Marks)  
b. Explain briefly the factors affecting viscosity. (04 Marks)  
c. Derive an expression for the flow of oil between parallel stationary plates. (10 Marks)
- 2 a. Derive the expressions for frictional force, torque and coefficient of friction for a lightly loaded journal bearing. (08 Marks)  
b. Explain the formation of continuous oil film in a full journal bearing. (06 Marks)  
c. 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. (06 Marks)
- 3 Derive the Reynold's equation in two dimensions, Also state the assumptions. (20 Marks)
- 4 a. A rectangular plain slider bearing with fixed shoe with no end leakage has the following data Bearing length = 90mm, Width of shoe = 90mm, Load on bearing = 7800N, Slider velocity = 250 cm/sec, Inclination  $\alpha = -0.00035$  radians, Viscosity of oil  $\eta = 40\text{CP}$ . Determine:  
i) Minimum film thickness  
ii) Power loss  
iii) Coefficient 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 moving member is 5.08 m/sec, lubricating oil is SAE 40. The expected mean temperature of oil film is 90°C permissible minimum oil film thickness is  $1.905 \times 10^{-5}\text{m}$ .  
i) Required dimensions of the shoe  
ii) Coefficient of friction in the bearing under given operating condition  
iii) Power loss

Assume inclination of surface corresponds to maximum load carrying capacity. Neglect effect of end flow from the bearing. (10 Marks)



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**PART - B**

- 5 a. Discuss thermal equilibrium of Journal bearing. (08 Marks)  
b. A full journal bearing with circumferential oil groove is lubricated under pressure and has the following specifications. Journal diameter = 62.5mm, Total length of bearing = 125mm, Width of circumferential groove = 6.25mm, Radial clearance = 0.04375mm, Effective oil temperature = 100°C, Lubricating oil = SAE 20, Minimum oil film thickness = 0.004375mm. Determine the inlet pressure required in order to control the bearing temperature. The rate of oil flow through the bearing is to be 4925 mm<sup>3</sup>/s. (12 Marks)
- 6 a. Derive the expression for rate of flow of oil and load carrying capacity for an hydrostatic step bearing. (12 Marks)  
b. A hydrostatic step bearing has the following specifications. Diameter of shaft = 150mm, Pocket diameter = 102mm, Vertical thrust of bearing = 40kN, shaft speed 900rpm, Viscosity of lubricant = 25×10<sup>-3</sup> Pa.s, Oil film thickness = 0.15mm, External pressure = Zero. Find:  
i) Required inlet pressure  
ii) Rate of flow through the bearing  
iii) Power loss due to viscous friction. (08 Marks)
- 7 a. Enlist the properties of good bearing materials (05 Marks)  
b. List out commonly used bearing materials (05 Marks)  
c. Define wear. Explain types of wear with simple sketches. (10 Marks)
- 8 Write short notes on any Four  
a. Wear of ceramic materials  
b. Wear of polymers  
c. Wear measurement  
d. Surface engineering  
e. Improved design. (20 Marks)

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