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Eighth Semester B.E. Degree Examination, June/July 2014
Tribology

Time: 3 hrs.
Max. Marks:100

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

PART – A

1 a. Distinguish between:
   i) Dynamic and kinematic viscosity
   ii) Fluidity and viscosity
   iii) Newtonian and non-Newtonian fluid
   iv) Mineral oil and vegetable oil (for lubrication)
   v) Full and partial journal bearing.   **(10 Marks)**
   b. Sketch and explain working of any two viscosity measuring apparatus types. Add a note on
   the effect of temperature and pressure on viscosity of a fluid.   **(10 Marks)**

2 a. State Petroft's law and explain its significance.   **(05 Marks)**
   b. Describe Tower's experiments and conclusions drawn.   **(05 Marks)**
   c. A lightly loaded journal bearing has the following specifications:
   Diameter of journal = 50 mm   Bearing length = 80 mm
   Diametral clearance ratio = 0.002   Radial load = 750 N
   Viscosity = 10 cP   Speed = 4000 rpm
   Determine: i) Frictional torque, ii) Coefficient of friction, iii) Power loss. **(10 Marks)**

3 a. Explain the significance of Sommer field number in distinguishing bearings. **(05 Marks)**
   b. Draw a typical pressure distribution curve for an idealized full journal bearing and explain
   the significance of zones.   **(05 Marks)**
   c. A full journal bearing has the following specifications:
   Diameter of journal = 75 mm   Length of bearing = 60 mm
   Oil film temperature = 96°C   Radial clearance = 0.05 mm
   Oil film thickness = 7.9×10^{-3} mm   Lubricating oil is SAE 20.
   Lubricant is delivered to the bearing under a pressure through a single inlet pressure hole in
   an unloaded bearing region. Determine inlet pressure required if the rate of oil flow through
   the bearing must be 312 mm³/sec in order to control bearing temperature.   **(10 Marks)**

4 a. Distinguish a pivoted shoe slider bearing from a fixed shoe slider bearing. **(05 Marks)**
   b. Discuss locating centre of pressure in fixed show slider bearing.   **(05 Marks)**
   c. A pivoted shoe of the slider bearing has square shape. The load acting on the bearing is
   13.34 kN velocity of the 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
   1.905×10^{-5} m. Find:
   i) Required dimensions of the shoe
   ii) Coefficient of friction in the bearing under given operating condition
   iii) Power loss.
   Assume that inclination of surface corresponds to maximum load carrying capacity. Neglect
   effect of end flow of oil.   **(10 Marks)**

PART – B

5 a. How do you distinguish between bearings from the standpoint of cooling conditions? Explain the categories with equations that are applicable under each. **(05 Marks)**
  b. Write a note on flow of lubricant through a journal bearing having a single hole. **(05 Marks)**
  c. The main bearing for a stationary slow speed steam engine has the following data:
    Journal dia = 20 cms   Maximum load on the piston = 80 kN,
    Engine speed = 200 rpm   Diamteral clearance ratio = 0.0009.
    Determine the heat generated and heat dissipated given the operating temperature is 65°C and ambient temperature is 25°C. Take absolute viscosity as 60×10^{-3} PaS, heat capacity = 11.36×10^{-3} KW/m^{2}K, length of the bearing = πx diameter of journal (L = πd). **(10 Marks)**

6 a. State the principles, advantages, disadvantages and applications of hydrostatic lubrication. **(05 Marks)**
  b. Explain the two main systems of hydrostatic lubrication. **(05 Marks)**
  c. A hydrostatic circular thrust bearing has the following data:
    Shaft dia = 300 mm   Dia of pocket = 200 mm
    Shaft speed = 100 rpm   Pressure at the pocket = 500 kN/m^2
    Film thickness = 0.07 mm   Viscosity of lubricant = 0.05 PaS.
    Determine: i) Load carrying capacity, ii) Oil flow rate, iii) Power loss due to friction. **(10 Marks)**

7 a. What properties are expected of bearing materials? List them. **(05 Marks)**
  b. What are conformability and embedability with respect to bearing materials? Explain. **(05 Marks)**
  c. List the commonly used bearing materials. Explain any five of them with respect to their typical properties and advantages. **(10 Marks)**

8   Write explanatory notes on:
  a. Wear of ceramic materials
  b. Surface engineering
  c. Wear measurements
  d. Improved design of a tribological component
  e. Advanced material's use in tribology application. **(20 Marks)**

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