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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, M. Tech. - Mechanical Engineering (MMDN)
Semester End Examination; Dec - 16/Jan - 2017
Tribology and Bearing Design

Time: 3 hrs   *Max. Marks: 100*

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.
ii) Use of Design Data Hand is permitted.

UNIT - I

1 a. Explain the following parameters of surface roughness with expressions;

   i) Average Roughness   ii) Root mean square roughness   8

   iii) Skewness   iv) Kurtosis.

  b. What is friction? Explain adhesion, abrasion and junction growth theory related to friction.   12

2 a. Demonstrate with diagrams the regimes of Lubrication.   6

  b. Sketch and explain the influence of temperature and pressure on viscosity.   6

  c. Explain the abrasive and adhesive wear mechanism.   8

UNIT - II

3 a. Derive an expression for flow through parallel stationary plates.   10

  b. A lightly loaded full journal bearing has the following specifications:

Bearing diameter = 80 mm;   Bearing Length = 60 mm;   Diametrical clearance = 0.12 mm;

Journal speed = 2400 rpm;   Viscosity of Lubricant = 4 cp; Radial load = 900 N   10

Determine:

i) Friction Force   ii) Coefficient of friction

iii) Torque   iv) Power loss.

4 a. Write brief note on pressure development mechanism in the oil film.   5

  b. Establish 2-D Reynolds expression for the flow between two surfaces with relative velocity.   15

UNIT - III

5. Derive an expression for film thickness and pressure for an idealized full journal bearing.   20

6 a. Illustrate with a graph the importance of Sommerfeld number.   5

  b. A full journal bearing has following specifications:

Journal Diameter = 60 mm;   Bearing Length = 60 mm;   Radial clearance = 0.05 mm;

Speed = 2000 rpm;   Mean viscosity = 10 cp;   Eccentricity ratio = 0.8;   15

Location of inlet hole = 220º;   Inlet pressure = 0.3 MPa

Determine the location and magnitude of maximum and minimum pressure.

UNIT - IV

7 a. Derive an expression for load carrying capacity of a hydrostatic circular thrust bearing.   10

b. A hydro static step bearing for turbine rotor has the following specifications:

Diameter of shaft = 150 mm

Diameter of pocket = 100 mm

Vertical thrust on bearing = 70 kN

Shaft speed = 100 rpm

Viscosity of lubricant = 0.025 Pa-sec

Oil film thickness = 0.125 mm

Supply pressure = 5.78 MPa

Determine;

i) Rate of flow through bearing

ii) Power loss due to viscous friction

iii) Coefficient of friction.   10

8 a. State and explain the causes of elasto-hydrodynamic lubrication.   10

b. Derive Grubin's equation for elasto-hydrodynamic lubrication.   10

UNIT - V

9 a. Elaborate on the following:

i) Application of gas bearings

ii) Advantages and disadvantages of gas bearings.   10

b. State Reynolds equation for porous bearings and explain the working of porous bearings.   10

10 a. Sketch and explain the working of an active and passive magnetic bearing.   10

b. State and explain the applications of Magnetic bearings.   10

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