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

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Mechanical Engineering

Semester End Examination; July - 2021

Tribology

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions.*
ii)Missing data, if any, may be assumed suitably.
iii) Use of data handbook allowed [with sign & seal of HOD].

1 a. Define wear. Explain Adhesive wear and Abrasive wear. 10

b. With neat sketch, explain wear measurement using pin-on-disk equipment. 10

2 a. Explain Interferometric method. 10

b. Write a short note on,

i) Center Line Average [CLA] 10

ii) Abbott bearing area curve

3 a. Define viscosity. Explain Newton's law of viscous flow. 10

b. With sketch, explain Regime of lubrication. 10

4 a. With graph, explain the effect of temperature and pressure on viscosity. 10

b. Derive an expression for discharge through capillary tube using Hagen-Poiseuille law. 10

5 a. Explain friction in bearing using Tower's experiment. 10

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

Diameter of journal 50 mm, bearing length 80 mm, diameter clearance ratio 0.002, Radial load 750 N, viscosity 10 cP, speed 4000 rpm, Determine; 10

i) Frictional torque ii) Coefficient of friction iii) Power loss

6. Derive Reynold's equation in two dimensions. State the assumptions made. 20

7. Derive an expression for pressure Distribution and load carrying capacity for a plane slider bearing with a fixed shoe. 20

8 a. A rectangular pivoted shoe bearing has following specifications:

Length of shoe 0.0762 m, width of shoe 0.1143 m, velocity of moving member 2.032 m/sec, expected mean temperature of the oil 80°C. Lubricating oil SAE 40 (η = 21 cP), h_2 = 1 mm. Determine load and power loss. The angle of inclination corresponds to minimum coefficient of friction. 10

b. Slider bearing with pivoted shoe has the following specifications:

B = 0.0508 m, L = 0.0625 m, U = 5.58 m/sec, W = 8006.4 N, η = *0.03* N-s/m. Determine; 10

i) Minimum film thickness

ii) Power loss, Angle of inclination corresponds to minimum co-efficient of friction.

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9 a. Explain significance of sommerfeld number in distinguishing bearings. 10

b. 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 0.005 mm, oil film thickness 7.9×10^{-3} mm lubricating oil SAE 20 [η = 7.5 cP], 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 mm^3/sec in order to control bearing temperature. 10

10 a. Derive an expression for load carrying capacity for a hydrostatic bearing. State the assumptions. 10

b. A hydrostatic step bearing has the following data,

Diameter of the shaft 150 mm, diameter of pocket 100 mm, vertical thrust on bearing 60×10^3N, external pressure = atmospheric pressure, shaft speed = 1500 rpm, viscosity of lubricant 30 cP, desirable oil film thickness 0.0125 cm, Determine; 10

i) Rate of flow of oil

ii) Power loss due to friction

iii) Coefficient of friction

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