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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; May / June - 2019

Tribology

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

ii) Design Data Handbook is permitted.

UNIT - I

1 a. Explain following friction theories : 10

i) Mechanical interlocking ii) Molecular attraction

b. With a neat sketch, explain pin on disc wear tester. 10

2 a. Explain construction of Abbott bearing area curve. 6

b. Define M and E system used in surface roughness measurement. 4

c. With neat sketch, explain the working principle of optical profile meter. 10

UNIT - II

3 a. With neat sketches, explain the different regimes of lubrications. 8

b. Discuss the effect of temperature and pressure on viscosity of oils. 8

c. Explain Newton's law of viscosity. 4

4 a. Drive an expression for rate of flow between two parallel stationary plates. 10

b. Two reservoirs A and B are connected by a capillary of bore 1.25 mm and length 1.25 m. Pressure in reservoir A is 40 N/cm^2 and that of reservoir B is 20 N/cm^2. Calculate the rate of flow between the reservoirs, if the reservoirs are filled with an oil of viscosity 180 CP. 4

c. With neat sketches, explain the working of Redwood viscometer. 6

UNIT - III

5 a. Write short notes on Tower's experiment. 6

b. Differentiate between Converging and Diverging fluid film. 4

c. A full journal bearing have the following specification : 10

Shaft diameter = 4.5 cm Bearing length = 6.5 cm Radial clearance ratio = 0.0015

Speed = 2800 rpm Radial load = 800 N

Viscosity of lubricant at effective temperature of oil 8.274×10^{-3} Pa-s. Considering the bearing as lightly loaded, determine;

i) Frictional torque at the shaft ii) Coefficient of friction iii) Power losses

6 a. State the assumptions and derive Petroff's equation for friction force and power loss in lightly loaded journal bearing. 12

b. Briefly explain the mechanism of pressure development in the oil film. 8

Contd… 2

UNIT - IV

7. Derive an expression for pressure distribution, load carrying capacity, coefficient of friction for plane slider bearing with a fixed shoe. 20

8 a. Derive expressions for load carrying capacity, frictional force and coefficient of friction for idealized slider bearing with a pivoted shoe. 12

b. A pivoted shoe of the slider bearing has square shape. The load acting on the bearing is 13344 N, velocity of moving member is 5.08 m/sec, and lubricating oil is SAE40. The expected mean temperature of oil film 90°C, permissible minimum oil film thickness is 1.905×10^{-5} m. Find; 8

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 capacity. Neglect effect of end flow from the bearing.

UNIT - V

9 a. Write a note on : 10

i) Infinitely long –full journal bearing ii) Summer field substitution

b. A full journal bearing has following specifications : 10

Dia. 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 = SAE20, 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 is 312 mm^3/s in order to control the bearing temperature.

10 a. State the assumptions and derive the load carrying capacity of hydrostatic bearing. 12

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 kN, external pressure is atmospheric pressure, shaft speed 1500 rpm, viscosity of lubricant 30 CP and desirable oil film thickness 0.125 mm. Determine; 8

i) Rate of flow of oil

ii) Power loss due to friction

iii) Coefficient of friction

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