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

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. - Mechanical Engineering

Semester End Examination; Dec. - 2014

Tribology

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.*
ii)Use of design data book is permitted.

PART - A

1. a. Explain with sketches, the regimes of Lubrication. 9

   b. Derive Hagen Poiseville law, for the flow of fluid between two parallel stationary plates. State the assumptions made in the derivation. 11

2. a. Derive Petroff's equation for the coefficient of friction in a lightly loaded bearing with usual notations. State the assumptions made in the derivation. 10

   b. A full journal bearing has the following of specifications. Shaft diameter = 46 mm, Bearing length = 66 mm, Radial clearance ratio = 0.0015; Speed = 2800 rpm, Radial load = 800 N; Viscosity of lubricant = 8.27×10^{-3} Pa-s. Considering the bearing as lightly loaded determine the following; 10

   i) Friction torque

   ii) Coefficient of friction

   iii) Power Loss.

3 a. State the assumptions made in the derivation of Reynolds Equation in two dimensions. 5

   b. With usual notations, derive Reynolds equation in two dimensions. 15

4 a. Derive an expression for the pressure distribution in an idealized plane sider bearing with fixed shoes. State the assumptions. 10

   b. A shoe of a slider bearing has a square shape, so that L = B. The load acting on the bearing is W = 13344 N. The velocity of the moving member is U = 7.6 m/s. The lubricating oil is SAE 40. The expected average temperature of oil film is 74ºC. The permissible minimum film thickness is h_2 = 0.13 mm. Determine; 10

   i) Required dimensions for L and B

   ii) The resistance force

   iii) The coefficient of friction.

PART – B

5 a. Derive an expression for rate of oil flow through bearings. 10

   b. Write a note on self contained bearings and bearings lubricated under pressure. 5

   c. Write the procedure to determine the thermal equilibrium of a self contained bearings. 5

6 a. Derive an expression for load capacity of an externally pressurized thrust bearing. 10

b. A hydrostatic step bearing has the following specifications.

Diameters of shaft d_2 = 153 mm ; diameter of pocket d_1 = 102 mm

Vertical thrust of hearing, W = 45 kN External pressure (atmospheric) P_1 = 0, shaft speed = 900 rpm, viscosity of the lubricant η = 24 cp, oil film thickness h = 0.13 mm 10
determine;

i) Rate of flow

ii) Power loss.

7 a. Explain the following standard parameters of roughness with expressions:

i) Average Roughness (R_a) 6

ii) Root mean square roughness (R_q)

b. With a neat sketch explain stylus profilometry. 8

c. Write a note on M and E system of standardisation. 6

8 Write note on the following:

a) Adhesion Theory of friction. 6

b) Adhesive wear and abrasive wear 8

c) Wear resistant materials 6

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