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10ME831

Eighth Semester B.E. Degree Examination, July/August 2021
Tribology

Time: 3 hrs. Max. Marks:100

Note : 1. ***Answer any FIVE full questions.***
2. ***Use of Machine Design data handbook is permitted.***

1 a. State the assumptions and derive Hagen – Poisulle's equation for flow through capillary tube. **(10 Marks)**

b. Explain with sketches :
i) The effect of temperature on viscosity ii) Coulte – Hatscheck viscometer. **(10 Marks)**

2 a. Derive the Petroff's equation for coefficient of friction for a lightly loaded journal bearing. **(08 Marks)**

b. A full journal bearing has the following specifications :
i) Shaft diameter = 0.045m ii) Bearing length = 0.066m
iii) Radial clearance / radium ratio = 0.0015 iv) RPM = 2800
v) Load carrying capacity = 800N vi) Viscosity of the oil = 8.27 CP.
Considering the bearing as a lightly loaded journal bearing , determine Frictional torque, Coefficient of friction and Power loss. **(06 Marks)**

c. Write a short note on "Tower's experiment". **(06 Marks)**

3 Derive Reynold's equation in 2D. Also state the assumptions made. **(20 Marks)**

4 a. Derive an expression for the load carrying capacity of an idealized Plane – Slider bearing with fixed shoe. **(10 Marks)**

b. The following data refers to a slider bearing with pivoted shoe :
Length of the bearing = 500mm , Width of the bearing = 500 , Viscosity of lubricant = 0.054 Pa-S , Velocity of runner = 8 m/s , Maximum and Minimum oil film thickness = 0.15mm and 0.075mm respectively. Determine i) Load carrying capacity ii) Co-efficient of friction iii) Power loss. **(10 Marks)**

5 a. Discuss Thermal Equilibrium of Journal bearing. **(08 Marks)**

b. A full journal bearing with a circumferential oil groove is lubricated under pressure and has the following specifications : Journal diameter = 0.0635m ;
Total length of bearing = 0.127m ; Width of circumferential groove = 0.35mm ;
Radial clearance = 0.04445mm ; Oil film temp. = 112.7^{0}C ; Minimum oil film thickness = 4.445×10^{-3}mm ; Lubricating oil = SAE 20.
Determine the inlet pressure required in order to control the bearing temperature if the minimum rate of flow through the bearing of 5×10^{-6} m^3/s. **(12 Marks)**

6 a. Derive an equation for the load carrying capacity of a hydrostatic step bearing. **(10 Marks)**

b. A hydrostatic step bearing has the following specifications. Diameter of shaft = 153mm , Diameter of pocket = 102mm , Vertical thrust on bearing = 45kN , External pressure = 0 , Shaft speed = 900 rpm , Viscosity of lubricant = 24 cP , Oil film thickness = 0.13mm. Determine i) Rate of flow ii) Power loss. **(10 Marks)**

7 a. List the commonly used bearing materials. Describe any five materials characteristics and advantages. **(10 Marks)**

b. List any ten desirable properties of a Typical bearing material. Explain any five. **(10 Marks)**

8 Write explanatory notes on :

a. Wear measurements.
b. Wear of Ceramic materials.
c. Surface Engineering.
d. Improved design of a Tribological component.
e. Advanced Materials use in Tribology. **(20 Marks)**

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