USN ☐☐☐☐☐☐☐☐☐☐ 14MDE/MMD41

Fourth Semester M.Tech. Degree Examination, June/July 2019
Tribology and Bearing Design

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer any FIVE full questions.*
2. *Use of Machine design data hand book is permitted.*

1 a. Discuss the effect of pressure and temperature on viscosity of lubricants. **(08 Marks)**
   b. Derive expression for rate of flow through stationary parallel plates. **(12 Marks)**

2 a. Derive Petroff's equation and hence explain the concept of lightly loaded bearings. **(10 Marks)**
   b. A lightly loaded bearing has a load of 500N, Diameter of Journal 60mm, Length of bearing 90mm and diametral clearance ratio 0.001. If the Journal operates at 15000 rpm and viscosity of lubricant used is 0.05 pa-s. Determine the frictional torque , power loss and coefficient of friction. **(10 Marks)**

3 a. Explain the mechanism of pressure development in Journal bearings. **(05 Marks)**
   b. Derive Reynold's equation in two dimensions. **(15 Marks)**

4 a. Explain the significance of Somerfield number on Journal bearings. **(05 Marks)**
   b. A Journal bearing operating under a steady load has the following specification :
   Diameter = 1.00mm , Radial clearance = 0.0625mm , Journal speed = 1800 rpm ,
   Load = 40kN , Expected mean oil film temperature = 80^0C , Length of diameter ratio of bearing must be equal to one. Minimum thickness must be equal to 0.0125mm considering the end leakage. Determine i) Length of bearing ii) Kind of lubricating oil that should be used iii) Expected maximum pressure in oil film iv) Power loss in the bearing. **(15 Marks)**

5 a. Derive an expression for load carrying capacity of an idealized plane slider bearing. **(12 Marks)**
   b. A pivoted bearing has the following data : Length of shoe = 100mm ;
   Width of shoe = 120mm ; Velocity of moving member = 5m/s ; Minimum film thickness = 0.002mm ; Viscosity = 25 Cp. Determine
   i) Maximum load carrying capacity ii) Coefficient of friction. **(08 Marks)**

6 a. Derive an expression for inlet pressure of hydrostatic step bearing. **(10 Marks)**
   b. A hydrostatic step bearing has the following data : Inlet pressure = 4.5 Mpa ;
   Viscosity of lubricant = 0.03 Pa – S ; External pressure = 0 ;
   Oil film thickness = 0.005mm ; Vertical load on bearing = 1 & 750 N ;
   Shaft speed = 900 rpm. Assume $\frac{r_2}{r_1} = 2$. Determine i) Diameter of shaft ii) Rate of flow through the bearing iii) Power loss due to viscous flow. **(10 Marks)**

7 a. Discuss Elasto – hydrodynamic lubricated bearings. **(10 Marks)**
   b. Write a brief note on Antifriction bearings. **(10 Marks)**

8 a. Give a brief account of porous and gas lubricated bearings. **(10 Marks)**
   b. Explain the working principle of magnetic bearing. **(10 Marks)**

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