14761

M. Tech 2nd Semester Examination

Industrial Tribology

PEE-12

Time : 3 Hours   **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions. All questions carry equal marks.

1. (a) Classify various types of motions. Explain the mechanism of surface interaction in each case. (10)

   (b) Define the various elements of the surface texture. Also explain surface integrity. (10)

2. (a) What is adhesion theory of friction? Elaborate with the help of well labelled diagram and example. (10)

   (b) Explain laws of sliding friction. How do we measure rolling friction? (10)

3. (a) What are various methods of monitoring wear? (5)

   (b) What are the various types of wear mechanism found in machine components like gear and bearing? Explain in detail any two wear mechanism found in these components with the help of neat sketch. (15)

4. (a) Explain the phenomenon of lubrication by describing various lubrication regimes. (5)

   (b) Derive Reynolds Equation from Navier-stokes equation for incompressible flow and also mention the various basic assumptions used for the theory of lubrication. What is the physical significance of terms used in Reynolds Equation? (15)

14761/100   **[P.T.O.]**

5. (a) What is hydrostatic bearing and for what condition it is preferred for different application? Deduce the Reynolds equation to obtain the variation in pressure, radial flow velocity, power and torque for hydrostatic bearing (10)

    (b) Design an externally-pressurized bearing for the end of a shaft to carry 4536 N thrust at 1740 r.p.m., with a minimum film thickness of 0.05 mm using SAE20 oil at 60°C, pumped against a pressure of 3.5 MPa. The overall dimensions should be kept low because of space restrictions. Assume that the mechanical efficiency of the pump is 90%. (Take viscosity of SAE20 oil at 60°C is 0.023 Pa-s).   (10)

6. (a) What are solid lubricants? What are their application areas and advantages over liquid lubricants?   (10)

    (b) Write short note on analysis of friction in rolling contact bearings.   (10)

7. (a) What are the various modes of bearing failures? Explain.
                                                        (10)

    (b) A full journal bearing has a journal of 50 mm diameter and runs concentrically inside a 75 mm long bearing with a radial clearance of 0.025 mm. If the journal speed is 1500 rpm and the viscosity of the lubricant is 40 mPa.sec at 35°C, calculate the following at this temperature: (a) The value of the tangential drag force on the journal, (b) The value of the viscous shear stress, and (c) Power loss in viscous friction.   (10)

8. Write short notes on:

    (a) Flash Temperature theory

    (b) Friction Instabilities

    (c) Wear resistant materials

    (d) Turbulence in oil bearing   (5×4=20)