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MMMD - 204

M.E./M.Tech. II Semester

Examination, June 2013

Industrial Tribology

Time : Three Hours

Maximum Marks : 70

Note : 1. *Attempt any five questions.*

1. a) Enumerate the various factors affecting wear.
   b) Derive the Archard's equation for volume of Adhesive wear with assumptions made. State laws of wear using above equation.

2. a) Explain in brief the following theories of friction:
      i) Coulomb's classical theory
      ii) Electrostatic theory of friction
      iii) Tomlinson's theory of molecular attraction
   b) Discuss in details the model for the effect of lubrication on friction behavior.

3. a) Derive a equation for minimum film thickness in hydrodynamic bearings.
   b) Explain the mechanism of load support in hydrodynamic lubrication using rough surfaces.

4. a) Derive the relation for load carrying capacity of hydrostatic step bearing. Also derive the relation for pressure and flow capacity of the pump used to circulate the lubricant.
   b) Discuss the optimum design of hydrostatic step bearing to achieve optimum design with minimum total power loss and maximum stiffness of bearing.

5. Following data is given for 360° hydrodynamic bearing:
   Journal Diameter = 60 mm, Bearing length = 30 mm, Radial Load = 14.2 kN
   Journal Speed = 1440 rpm, Radial Clearance = 0.005 mm, Oil Viscosity = 30 cP
   Specific heat of lubricant = 1.76 kJ/kg/°C
   Density of lubricant = 860 kg/m^3
   Assuming that the total heat generated in the bearing is carried away by the total oil flow in the bearing, calculate:
   i) Minimum oil film thickness ii) Coefficient of friction iii) Flow requirement in litre/min iv) Maximum film pressure v) Temperature Rise vi) Eccentricity vii) Power Loss in friction

6. Explain the EHD lubrication on the following lines:
   i) Basic equation giving significance of each term
   ii) Effect of pressure distortion of surfaces
   iii) Deformation outside the zone of contact
   iv) Comparison between the theoretical and experimental pressure profiles.

7. a) Write short notes on:
      i) Tribological aspects of wheel on rail contact
      ii) Tribo characteristics of various materials.
   b) Discuss the classification of wear measuring machine with sketches of any two types.

8. Write a short note on:
   i) Lubrication in drawing
   ii) Lubrication in Rolling
   iii) Air lubricated Bearings
   iv) Role of Tribology in industry