Model Question

Sixth Semester B. Tech. Degree Examination

(2013 Scheme)

13.805.7 TRIBOLOGY (MPU) (Elective IV)

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

Answer all questions in part A

PART –A

(Each question carries 2 marks)

1. Explain the importance of Tribology in the design of different machine elements
2. Discuss Archard's theory of wear
3. Explain modified adhesion (junction growth) theory of friction
4. Discuss different regimes of lubrication with the help of of Stribeck's curve
5. What are the desirable properties of bearing materials?
6. Distinguish between hydrostatic and hydrodynamic bearings
7. What is viscosity index? How it can be determined?
8. Give examples of squeeze film action.
9. Explain stick-slip phenomenon in friction
10. Explain Saybolt universal seconds (SUS)

(2 x 10 =20Marks)

PART –A

Answer any one full question from each module in part B

(4 x 20 =80Marks)

MODULE- I

11. a) Explain the following theories of friction in detail
    a. Mechanical interlocking theory b. Modified adhesion theory

    b) Write short notes on

    a. Abrasive wear b. Surface fatigue wear c. stages of cohesive wear

12. a) Derive a quantitative relationship for abrasive wear

    b) Explain the merits and demerits of various theories of friction

    c) Discuss the four basic types of wear mechanisms

MODULE- II

13 a) Explain in detail the desirable properties of a lubricant. Classify lubricants and give examples.

b) Derive Petroff's equation to find the frictional torque in a concentric journal bearing

c) A circular plate of 50mm radius is approaching the base plane at velocity of 150mm/s at the instant when oil film thickness is 0.2mm. If the viscosity of the oil is 0.025×10^{-6} Ns/m^2, Calculate

a. Load carrying capacity b. Maximum pressure c. average pressure

14. a) Derive the volumetric flow rate and temperature rise of oil flowing between two parallel plates with usual notations

b) What are the important additives used in improving various properties of lubricants. Explain in detail

c) Derive Hagen- Poiseuille relationship for flow through a capillary tube. Also state the assumptions

MODULE- III

15 a) With the help of a neat sketch explain the working of Starsor and Saybolt universal viscometer.

b) The following data refers to a hydrostatic bearing.

Thrust = 850KN, Shaft speed = 900 Rpm, Shaft diameter = 450mm, Recess diameter = 250 mm, Viscosity of the lubricant = 30cP, Calculate

1. Supply pressure 2. Frictional power loss in terms of oil film thickness

16. A circular hydrostatic pad has a constant flow rate Q. The circular pad is supporting a load W= 5000N. The outside disk diameter is 200 mm and the diameter of circular recess is 100mm. Oil viscosity is $\mu = 0.005$Ns/m^2. The pad is operating with a clearance of 120 μm.

a) Find the recess pressure, P_r

b) Calculate the constant flow rate Q of the oil through the bearing to maintain the clearance

c) Find the effective area of the pad

d) Find the stiffness of the circular pad operating under this conditions

MODULE- IV

17. a) Explain the following terms with respect to journal bearings

a. Design variables b. Performance variables c. Sommerfield number d. Eccentricity ratio

b) A journal bearing of width 1m operates with a shaft of 200mm diameter which rotates at 1200rpm. The diametrical clearance is 200 μm and absolute viscosity of the lubricating oil at an inlet temperature of 20^0C is 40 cP. For an eccentricity ratio of 0.7, calculate

1. Minimum film thickness, 2. Attitude angle 3. Maximum film pressure 4. Location of maximum film pressure 5. Load carrying capacity 5. Coefficient of friction

18. a) Compare long and short journal bearings

b) Derive two dimensional Reynolds equations for hydrodynamic lubrication

c) Explain the working principle of hydrodynamic bearing

d) Explain the significance of Sommerfield number in the analysis of hydrodynamic lubrication.