Reg. No. : .....

Name : .....

(Pages : 3)

C – 2368

Eighth Semester B.Tech. Degree Examination, May 2017
(2013 Scheme)
13.805.7 : TRIBOLOGY (MPU)

Time : 3 Hours Max. Marks : 100

Instructions : 1) *Answer* ***all*** *questions from Part – **A**. **Each** question carries **2** marks.*
2) *Answer* ***one full*** *question from* ***each*** *Module in Part – **B**. **Each full** question carries **20** marks.*
3) ***Use*** *of Design Data Handbook is* ***permitted**.*

PART – A

1. Explain stick-slip phenomenon in friction.
2. Explain how the physico-chemical characteristics of surface layers affect the tribological properties.
3. Mention the various stages of wear.
4. Discuss different regimes of lubrication with the help of Stribeck's curve.
5. What are the applications of Elastohydrodynamic lubrication ?
6. Explain the following terms of lubrication with units :
   i) SUS
   ii) Kinematic and absolute viscosity
   iii) Viscosity index.
7. Suggest an application where there is justification for using synthetic oil of higher cost and list the advantages of synthetic oils.
8. Derive Petroff's equation to find the frictional torque in a concentric journal bearing.
9. What are the desirable properties of bearing materials ?
10. Explain the significance of Sommerfield number in the analysis of hydrodynamic lubrication.

(10×2=20 Marks)

P.T.O.

PART – B

Module – I

11. a) Write short notes on : **10**
    i) Adhesive wear
    ii) Fretting wear.

    b) Explain in detail : **10**
    i) Modified adhesion theory of friction.
    ii) Merits and demerits of various theories of friction.

OR

12. a) Explain the four basic types of wear mechanisms. **12**

    b) Discuss Archard's hypothesis of wear. **8**

Module – II

13. a) Explain in detail the desirable properties of lubricants. **8**

    b) An oil having an absolute viscosity of 120cP flows through a gap of 190 mm wide and 1.8 m long with a pressure difference of 0.95 MPa. Find out the average and maximum velocities, the temperature rise and volumetric flow rate. Mass density of oil is 820 Kg/m^3 and specific heat of the oil is 1.80 kJ/kgK. **12**

OR

14. a) What are the important additives used in improving various properties of lubricants ? Explain in detail. **8**

    b) Derive Hagen-Poiseuille relationship for flow through a capillary tube. State the assumptions also. **12**

Module – III

15. a) With the help of a neat sketch explain the working of Saybolt universal viscometer. **8**

    b) The following data refers to a hydrostatic step bearing.
    Thrust load = 450 kN, Shaft speed = 750 Rpm, Shaft diameter = 400 mm, Recess diameter = 250 mm, Viscosity of the lubricant = 30cP, specific gravity of lubricant = 0.86, Specific heat of lubricant = 2kJ/kg°C. Calculate
    i) Supply pressure
    ii) Frictional power loss

iii) Pumping power loss

iv) Total power loss

v) Temperature rise, assuming that the total power loss in the bearing is converted into frictional heat. **12**

OR

16. a) Explain the ASTM test procedure to find the viscosity index of a lubricant. **5**

b) A circular hydrostatic pad has a constant flow rate Q. The circular pad is supporting a load W = 6000 N. The outside disk diameter is 220 mm and the diameter of circular recess is 110 mm. Oil viscosity is $\mu = 0.005$ Ns/m^2. The pad is operating with a clearance of 150 μ m.

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. **15**

Module – IV

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

i) Minimum film thickness

ii) Attitude angle

iii) Maximum film pressure

iv) Load carrying capacity

v) Viscous power loss

vi) Coefficient of friction. **20**

OR

18. a) Derive three dimensional Reynolds' equation for hydrodynamic lubrication. **15**

b) Explain the significance of Sommerfield number in the analysis of hydrodynamic lubrication. **5**