APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE (HONS) EXAM, DECEMBER 2019

Course code: 04 ME 6509

Course name: INDUSTRIAL TRIBOLOGY

Max. Marks: 60 Duration: 3 Hours

Use of approved design data handbooks are permitted

PART A

Answer All Questions
Each question carries 3 marks

1. Enumerate the quantification of surface roughness with THREE suitable examples.
2. Explain the different types of friction.
3. Explain viscosity and viscosity index of a lubricant.
4. Explain the mechanism of hydrodynamic pressure development in a plane slider bearing with neat sketches.
5. Write down the advantages and disadvantages of an externally pressurized oil bearings.
6. Explain the function of compensating element or restrictor in hydrostatic lubrication system.
7. Explain adhesive and abrasive wear mechanism.
8. Explain the geometrical construction of a ball bearing with a neat sketch.

PART B

Each question carries 6 marks

9. Write down the Navier-Stokes equation for compressible unsteady state viscous fluid flow. State the assumptions made, obtain Reynolds equation for incompressible viscous fluid flow.

OR

10. Derive Continuity equation in a column in Cartesian co-ordinates.

11. Explain the different lubrication regimes with the help of Stribeck curve and Lambda ratio.

OR

12. Discuss the different types and desirable properties of lubricants.

13. For an infinitely long journal bearing using half Sommerfeld conditions write down the equation for pressure distribution and from this equation derive the equations for load carrying capacity and attitude angle.

OR

14. A rectangular plane slider bearing with a fixed shoe is operating under the following conditions: Bearing width = 80 mm, Bearing length = 150 mm, Sliding speed = 2 m/s, Absolute viscosity of oil = 0.02 PaS, Minimum oil film thickness = 0.02 mm, Maximum oil film thickness = 0.05 mm. Calculate: (a.) Load carrying capacity, (b.) Maximum load (c.) Pressure at a distance 50 mm measured from maximum film thickness point, (d.) Friction force, (e.) Flow rate.

15. The following data is given for a 360° hydrodynamic bearing: Radial load = 10 kN, Journal speed = 1440 rpm, Unit bearing pressure = 1000 kPa, Clearance ratio (r/c) = 800, Viscosity of the lubricant = 30 mPa.s. Assuming that the total heat generated in the bearing is carried by the oil flow in the bearing, calculate (a.) Dimensions of the bearing, (b.) Coefficient of friction, (c.) Power lost in friction, (d.) Total flow of oil, (e.) Side leakage, (f.) Temperature rise.

OR

16. Design a journal bearing for the following specifications: Speed = 900 rpm, Load = 1200 N, L/D = 1, C/D = 0.001, Oil used is SAE 40 and the temperature of oil is 60 ℃, Bearing pressure = 15 N/mm^2. Check for thermal stability.

17. For a circular step hydrostatic bearing, derive an expression for pressure distribution and flow rate of lubricant using neat sketches.

OR

18. A hydrostatic square thrust bearing having a shoe dimensions of 250 mm and the square is subjected to a load of 120 kN. The ratio of the sides of the shoe and the recess is 2. SAE 30 oil is used at a temperature of 45 ℃. Film thickness is 60 μm. Determine the linear velocity of the runner, recess pressure, flow required and pumping power.

19. Derive Archad's wear equation for adhesive wear using a suitable model. State also, the assumptions made in formulating the model.

OR

20. A rolling contact bearing is subjected to the following work cycle:
    i. Radial load of 6000 N at 150 rpm for 25% of the time,
    ii. Radial load of 7500 N at 600 rpm for 20% of the time,
    iii. Radial load of 2000 N at 300 rpm for 55% of the time.

    The inner ring rotates and loads are steady. Select a bearing for an expected average life of 2500 hours.