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SAINTGITS COLLEGE OF ENGINEERING
KOTTAYAM, KERALA

(AN AUTONOMOUS COLLEGE AFFILIATED TO
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH. DEGREE EXAMINATION(R), MARCH 2021

(MACHINE DESIGN)

Course Code: 20MEMDT111

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. State and explain the laws of friction.
3. State the importance of viscosity and viscosity index of the lubricant and explain any TWO methods for measuring viscosity.
4. Explain the mechanism of hydrodynamic pressure development in a plane slider bearing with neat sketches.
5. Explain the working principle of a simple hydrostatic thrust bearing with a neat sketch.
6. Write down the advantages and disadvantages of an externally pressurized oil bearings.
7. Explain the classification of wear processes.
8. Write short notes on selection of rolling contact bearings.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. Derive Continuity equation in a column in Cartesian co-ordinates. (6)

OR

10. 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. (6)

MODULE II

11. Explain the different lubrication regimes with the help of Stribeck curve and Lambda ratio. (6)

OR

12. Discuss the different types and desirable properties of lubricants. (6)

MODULE III

13. For an infinitely long plane slider bearing, obtain the expression for pressure distribution if inlet and outlet film thicknesses are h1 and h2 respectively. Draw the pressure distribution curve also. (6)

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. (6)

MODULE IV

15. Derive an expression for pressure distribution and load carrying capacity for an infinitely short journal bearing using half Sommerfeld boundary conditions. (6)

OR

16. Design a journal bearing for the following specifications: Speed = 1200 rpm, Load = 900 N, Bearing pressure = 1 N/mm2, L/D = 1, C/D = 0.001. Oil used is SAE 30 at 55 ℃ and ambient temperature is 25 ℃. Find equilibrium oil temperature for thermal stability. (6)

MODULE V

17. For a circular step hydrostatic bearing, derive an expression for pressure distribution and flow rate of lubricant using neat sketches. (6)

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. (6)

MODULE VI

19. A rolling contact bearing is subjected to the following work cycle: (6)
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.

OR

20. Derive Archad's wear equation for adhesive wear using a suitable model. State also, the assumptions made in formulating the model. (6)

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