

**P 7131**

M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

Computer Aided Design

Elective

ED 031 — TRIBOLOGY IN DESIGN

(Common to ME Engineering Design and ME CAD/CAM)

Time : Three hours

Maximum : 100 marks

Reference to approved design data book and data sheet is permitted

Missing data if any may suitably be assumed.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the different types of wear.
2. Mention the advantages of surface coatings.
3. List any four distinct forms of lubrication.
4. Quote a few practical applications of hydrostatic lubrication.
5. How will you assess the performance of a journal bearing?
6. Discuss the effect of temperature on the performance of a journal bearing.
7. What is meant by basic load rating of a rolling element bearing?
8. Profuse spherical wear particles found in lubricant is an indication of \_\_\_\_\_ wear in rolling elements.
9. How adhesive wear and abrasive wear can be differentiated using surface topography?
10. Name a few friction measuring techniques.

PART B — (5 × 16 = 80 marks)

11. (i) Explain the importance of surface properties in tribological applications. (8)
- (ii) Explain with examples, the advantages of multiple coatings in sliding bearings. (8)

12. (a) (i) Derive Reynolds equation clearly stating the assumptions made. (8)
- (ii) Sero 40 oil at 60 C is flowing through a channel of uniform thickness 0.2 mm, width 20 mm and length 200 mm under a pressure drop of 10 N/sq.mm. If the dynamic viscosity of the oil is 30 centipoise, calculate the flow rate. (8)

Or

- (b) (i) Discuss the factors to be considered in selection of lubricants. (8)
- (ii) Explain the regimes of lubrication. Show how the coefficient of friction depends on the bearing characteristic number in these regimes. (8)
13. (a) (i) Derive an expression for the film thickness in a journal bearing. (8)
- (ii) A journal bearing is to be designed for supporting a journal of 30 mm diameter carrying a load of 10 kN at 2000 rpm. Select a suitable lubricant minimum film thickness, flow, temperature rise of oil and power lost in friction. (8)

Or

- (b) (i) Compare hydrodynamic and hydrostatic lubrication. (8)
- (ii) A hydrostatic step thrust bearing is to be operated under the following conditions
- Load = 1 kN
- Clearance = 60 microns
- Operating temp = 50 C
- Speed = 150 rpm
- Shaft radius = 50 mm
- Lubricant = SAE 30
- Pressure at ends = atmospheric
- Pump efficiency = 90%
- Design the bearing for minimum power loss and obtain the power lost in the bearing. (8)
14. (a) (i) List out the factors considered in the selection of rolling bearings. (8)
- (ii) Discuss the common types of failures encountered in rolling bearings. (8)

Or

- (b) (i) Suggest a few materials suitable for rolling elements. (6)
- (ii) Derive the Hertzian stress equation for a sphere in contact with a flat surface. (10)

- (i) Explain the use of Scanning Electron Microscope in the measurement of wear. (8)
- (ii) Explain how bearing vibration measurement could be used to monitor the bearing performance. (8)

Or

(b) Write short notes on the following :

- (i) Friction of Lamellar solids. (4)
- (ii) Elastohydrodynamic lubrication (4)
- (iii) Materials for sliding bearings (4)
- (iv) Air and gas bearings. (4)
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