

Total No. of Questions :10]

SEAT No. :

[Total No. of Pages :4

**P3673**

**[4959] - 1035**

**B.E. (Mechanical)**

**TRIBOLOGY**

**(End Semester) (Semester - I) (2012 Course) (402044 B)**

*Time : 2½ Hours]*

*[Max. Marks :70*

*Instructions to the candidates:*

- 1) Write Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) Assume suitable data, if necessary.*

**Q1) a)** Compare sliding and rolling contact bearing in terms of the following:[6]

- i) Magnitude of load
- ii) Starting friction
- iii) Nature of the load
- iv) Positional accuracy
- v) Speed
- vi) Noise

**b)** Define friction and wear. Explain different laws of friction. **[4]**

**OR**

**Q2) a)** Define Tribology. Mention minimum five tribological adverse effects generally arises in Industry. **[6]**

**b)** List the different theories of wear and also list the different friction measuring methods. **[4]**

**P.T.O.**

**Q3) a)** Explain four important causes of friction. [2]

b) A short hydrodynamic journal bearing refers the following data: [8]

Journal speed = 35 revolutions per seconds (rps)

Length of bearing ( $l$ ) =  $0.5 \times$  Journal diameter ( $d$ )

Radial clearance ( $c$ ) =  $0.001 \times$  Journal diameter ( $d$ )

Eccentricity ratio ( $\epsilon$ ) = 0.65

Flow rate of Lubricant ( $Q_s$ ) = 3.45 litre per hour

Radial Load ( $W$ ) = 1000 N

Calculate:

i) Journal Diameter

ii) Radial clearance

iii) Dimensions of the bearing

iv) Minimum oil film Thickness

v) Absolute viscosity of the lubricant

OR

**Q4) a)** What do you mean by abrasive wear and fatigue wear? [2]

b) Derive from basic principles two dimensional Reynolds equation taking usual notations. [8]

**Q5) a)** The following data is given for a hydrostatic step bearing. **[8]**

Thrust load = 450 kN

Shaft speed = 750 rpm

Shaft diameter = 400 mm

Recess diameter = 250 mm

Viscosity of lubricant = 30 cP

Specific heat of lubricant = 2 kJ/kg °C

Specific gravity of lubricant = 0.86

Calculate:

- i) The optimum oil-film thickness for minimum power loss
  - ii) The fractional power loss
  - iii) The pumping power loss and
  - iv) The temperature rise, assuming the total power loss in bearing is converted into the frictional heat.
- b) Explain the phenomenon of squeeze film lubrication. State and Explain any SIX practical examples of squeeze film action. **[8]**

OR

**Q6) a)** A circular plate of 250 mm diameter is approaching towards a fixed plane surface. Plate and fixed surfaces are separated by an oil film thickness with a viscosity of oil as 150 cP. A load of 15 kN is supported by a film. Calculate the time required for reducing the film thickness from 0.25 to 0.0125 mm. Also approximate square plate of dimensions [D×D] based on the parameters in this problem Where D is side of square plate and is equal to diameter of circular plate. **[8]**

- b) Explain in brief the working principle of hydrostatic bearing. State the advantages and limitations of hydrostatic bearing. **[8]**

- Q7)** a) Explain the phenomenon of Elastohydrodynamic lubrication and state its applications. [8]
- b) State the Merits, demerits and four applications of gas lubricated bearings. [8]

OR

- Q8)** a) What do you understand by gas lubricated bearings? Compare gas lubricated bearings with oil lubricated bearings based on the following parameters: [8]
- i) Viscosity of lubricant
  - ii) Viscous resistance
  - iii) Frictional power loss
  - iv) Operating speed
  - v) Load carrying capacity
  - vi) Film thickness and surface finish
- b) How Elastohydrodynamic lubrication differs from hydrodynamic lubrication? Also Explain the Ertel-Grubin equation with its limitation in brief. [8]

**Q9)** Write a short note on the following: (Any Three) [18]

- a) Mechanics of tyre road interaction
- b) Selection of coatings
- c) Porous bearing
- d) Foil bearing

OR

- Q10)** a) Explain the properties and parameters of coatings. [6]
- b) Explain with neat sketch the Electroplating process. [6]
- c) Classify the surface engineering processes in detail. [6]

