Total No. of Questions : 10]

SEAT No. :

P2140

[Total No. of Pages : 4

[5254]-535
B. E. (Mechanical)
TRIBOLOGY
(2012 Pattern) (Elective - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Write Q.1 OR Q.2, Q.3 OR Q.4, Q.5 OR Q.6, Q.7 OR Q.8, Q.9 OR Q.10.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data whenever necessary.***

Q1) a) Explain different regimes of hydrodynamic lubrication with the help of Sribeck curve. **[6]**

b) Explain the factors affecting wear. **[4]**

OR

Q2) a) Define Tribology. Explain its importance in the design of machine elements. **[6]**

b) What is friction? Explain the laws of dry friction. **[4]**

Q3) a) What is fatigue wear? Where does it occur? **[2]**

b) Following data refers to the full journal bearing. **[8]**

i) Diameter of bearing = 75 mm

ii) Length of bearing = 75 mm

iii) Load on bearing = 12 KN

iv) Speed of journal =1800 rpm

v) $\frac{d}{c}$ Ratio = 2000

vi) Viscosity of oil = 10 cP at operating temperature.

Determine the coefficient of friction by using Raimondi and Boyd chart. 'd' is journal diameter and 'c' is the radial clearance in the bearing.

P.T.O.

Given is table for Dimensionless parameter for 360° Hydrodynamic journal bearing.

S	$\left(\frac{r}{c}\right)$ f
0.264	5.79
0.121	3.22
0.0446	1.70

OR

Q4) a) What is adhesive wear? Where does it occur? **[2]**

b) Derive from basic principle, two dimensional Reynolds equations taking usual notation. Also state assumptions made. **[8]**

Q5) a) Following data is given for the hydrostatic step bearing : **[8]**

- Thrust load = 450 KN
- Shaft speed = 750 rpm
- Shaft diameter = 400 mm
- Recess diameter = 250 mm
- Viscosity of the lubricant = 30 cP
- Specific gravity of the lubricant = 0.86
- Specific heat of the lubricant = 2 KJ/Kg °C

Calculate:

i) The optimum oil-film thickness for minimum power loss

ii) The frictional power loss

iii) The pumping power loss

iv) Total power loss

v) The temperature rise

Assuming the total power loss in the bearing is converted into the frictional heat.

b) Derive an expression for viscous flow through a rectangular slot [slit] for a constant viscosity. What are the assumptions made while deriving the equation? **[8]**

OR

Q6) a) Derive the expression for the pressure distribution , load carrying capacity and time of approach for a circular plate near a plane under hydrostatic squeeze film lubrication. **[8]**

b) Explain the 'Hydrostatic squeeze film lubrication phenomenon with at least four examples. A rectangular plate having 50 mm length and an infinite width is approaching a fixed plane surface. Initially oil-film thickness is 0.035 mm and viscosity of oil is 75 cP. Load supported per unit width of plate is 30 KN/m. **[8]**

Calculate :

i) The time required to squeeze the film to 0.008 mm.

ii) The maximum and average pressure.

Q7) a) Explain the phenomenon of Elastohydrodynamic lubrication [EHL] and how it differs from hydrodynamic lubrication. State the applications of EHL. **[8]**

b) Explain gas lubricated bearings and state advantages and disadvantages or limitations of gas bearings. **[8]**

OR

Q8) a) Explain the significance of the Hertz theory in Elastohydrodynamic Lubrication. Write Ertel-grubin equation with all specific terms and also write the limitations of this equation. **[8]**

b) Explain the working principle of active and passive magnetic bearing. Also mention its types. **[8]**

Q9) a) Explain the lubrication requirements in case of **[8]**

i) Rolling operation

ii) Forging operation

iii) Drawing operation

iv) Extrusion

b) How surface engineering processes are specified? Classify in detail the surface engineering processes and Explain any one process in short.**[10]**

OR

Q10) Write a note on following. (Any Three) : **[18]**

a) Foil bearing

b) Mechanics of tyre-road interactions.

c) Properties and parameters of coatings

d) Hybrid bearing