Total No. of Questions :12]

SEAT No. :

P3317

[Total No. of Pages :5

[4959]-38
B.E. (Mechanical)
TRIBOLOGY
(2008 Pattern) (402044D) (Elective - I) (Semester - I)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Solve in Section I: Q1 or Q2, Q3 or Q4, Q5 or Q6; Section II: Q7 or Q8, Q9 or Q10, Q11 or Q12.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn whenever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data wherever necessary.***

SECTION -I

Q1) a) Write short note on- **[6]**

i) Tribology in design.

ii) Tribology in industry.

b) Explain different lubricating regime using stribeck curve. **[6]**

c) Explain the term 'Viscosity Index' and how V.I can be improved? **[4]**

OR

Q2) a) Explain following- **[4]**

i) Classification of Greases.

ii) Uses of Greases.

b) Discuss the effect of pressure on lubricating oil and also explain why excessive amount of E.P. additives is harmful for material. **[6]**

c) Explain the importance of recycling of used oils. Explain different ways of disposal of used oil. **[6]**

P.T.O.

Q3) a) Using the Bowden and tabor's theory of simple adhesion prove that coefficient friction due to adhesion is-. **[8]**

$$f_a = \frac{kS_{sy}}{S_{yc}}$$

b) Discuss the effect of following on coefficient of friction between two surfaces- **[4]**

i) Surface finish.

ii) Sliding velocity.

c) Write a short note on 'Pitting.' **[4]**

OR

Q4) a) Show that the volume of abrasive wear per unit sliding distance with conical abrasive particles is given by- **[8]**

$$Q = \left[\frac{2k_w \cot\alpha}{\pi}\right]\frac{W}{P}$$

b) Write short note on Delamination Wear. **[4]**

c) Classify different friction measurement tests with their application. **[4]**

Q5) a) Derive the two dimensional Reynolds equation for hydrodynamic lubrication. Also state the assumptions in derivation. **[12]**

b) Using diagram show the pressure distribution along the axis and circumference in infinitely long and narrow hydrodynamic journal bearing. **[6]**

OR

Q6) Following data is given for 360°C hydrodynamic bearing. (refer Table 1).**[18]**

Radial load: 10kN

Journal speed:1450rpm

l/d=1

Bearing length=50mm

Radial clearance=20 microns

Eccentricity= 15 microns

Specific gravity of lubricant=0.86

Specific heat of lubricant=2.09kJ/kg°K

Calculate:

i) Minimum oil film thickness;

ii) Coefficient of friction;

iii) Power lost in friction;

iv) Viscosity of lubricant in cp;

v) Total flow rate of lubricant in 1/min;

vi) Side leakage;

vii) Average temperature, if make up oil is supplied at 30°C.

Table: I

l/d	h_0/C	ϵ	S	*(r/c)f*	*Q/ rcnsl*	*Qs/Q*	P_{max}/P
1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.000	0.000
	0.0300	0.9700	0.00474	0.5140	4.8200	0.973	6.579
	0.1000	0.9000	0.0188	1.0500	4.7400	0.919	4.048
	0.2000	0.8000	0.0466	1.7000	4.6200	0.842	3.195
	0.4000	0.6000	0.1210	3.2200	4.3300	0.680	2.409
	0.6000	0.4000	0.2640	5.7900	3.9900	0.497	2.066
	0.8000	0.2000	0.6310	12.8000	3.5900	0.280	1.890
	0.9000	0.1000	1.3300	26.4000	3.3700	0.150	1.852
	1.0000	0.0000	∞	∞	3.1420	0.000	0.000

SECTION- II

Q7) a) What is stiffness of hydrostatic step bearing? Obtain an expression for stiffness of hydrostatic step bearing in terms of thrust load. **[8]**

b) A vertical shaft rotating at exceptionally low speed is supported by the hydrostatic step bearing. The thrust load acting on shaft is 900 kN. The diameter of shaft is 450mm. The minimum oil film thickness required for avoiding the metal to metal contact is 95 microns. The fluid pump has efficiency of 90%. The pumping power loss should be minimum as possible, if frictional power loss in bearing is negligible. Calculate,

i) Recess Diameter.

ii) Supply pressure of fluid.

iii) Flow rate of fluid in 1pm.

iv) Pumping power required.

v) Temperature rise. **[10]**

OR

Q8) a) Derive an equation for load carrying capacity for given velocity of approach and film thickness in case of rectangular plate approaching a plane. **[8]**

b) A plate of 27.5 mm length and infinite width is separated from a plane by an oil film of 26 micron thickness and having viscosity of 0.05 Pa - sec. If the normal load per unit width of 22 kN/m is applied on plate. Determine, **[10]**

i) Time required to reduce the film thickness to 2.6 microns.

ii) Maximum pressure.

iii) Avg. Pressure.

Q9) a) Explain Elastro-hydrodynamic lubrication between two long cylinders and hence derive equation of pressure distribution. **[8]**

b) Explain the principle and application of elasto-hydrodynamic lubrication. **[8]**

OR

Q10)a) Derive an expression for volume flow rate of air in case of aerostatic step bearing. **[8]**

b) Write short notes on. **[8]**

i) Lubrication in wire drawing and extrusion.

ii) Self lubricated bush bearings.

Q11)a) What is surface engineering? Explain its concept and scope. **[8]**

b) Explain the mechanism of electro and electro less plating with industrial application. **[8]**

OR

Q12)a) Explain different geometrical properties of surface and state various parameters used for measurement of surface properties. **[8]**

b) What is the concept of PVD, CVD and PECVD. Explain with the help of schematic illustration by suitable industrial example. **[8]**