P1938

[5254]-37
B.E. (Mechanical)
TRIBOLOGY
(2008 Pattern) (Elective - I)

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

Instructions to the candidates:
1) *Answer any 3 questions from each section.*
2) *Answers to the two sections should be written in separate books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of Logarithmic Tables, Slide Rule, Mollier Charts, Electronic Pocket Calculator & Steam tables is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) An oil of viscosity of 70 cp and relative density of 0.7 is used for lubrication. Convert the viscosity into centi-stoke. SUS. **[4]**

    b) Explain the following properties of lubricant in brief. **[6]**

        i) Viscosity

        ii) Flash point & fire point

        iii) Viscosity Index

    c) Using stribeck curve explain the range and types of lubrication modes.**[6]**

OR

Q2) a) Explain the process and methods of recycling of the used oil. **[5]**

    b) What do you mean by tribology? Explain the importance of tribology in industry. **[6]**

    c) Write a short note on the solid lubricants. **[5]**

Q3) a) Explain (1) Archard's wear theory (3)Factors affecting wear. **[8]**

    b) What do you mean by stiction ? Give examples. What are the methods toreduce stiction? **[6]**

    c) State different techniques used for wear debris analysis. **[2]**

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Q4) a) Write notes on : **[8]**

      i) Adhesive wear

      ii) Abrasive wear

      iii) Fretting wear

      iv) Corrosive wear

  b) Wite a note on friction measurement by pin-on-disk apparatus.Also explain the causes of friction. **[8]**

Q5) a) Explain mechanism of pressure development in hydrodynamic lubrication with the help of two non-parallel surfaces separated by convergent film.**[6]**

  b) Derive the relation $\dfrac{h0}{c} = 1$ - for hydrodynamic journal bearings. **[4]**

  c) Compare long and short journal bearings with the help of following points:
[8]

      i) Fluid film pressure

      ii) Pressure gradient

      iii) Fluid flow

      iv) Load carrying capacity

OR

Q6) a) The following data refers to a 360° hydrodynamic journal bearing. **[12]**

    Radial load = 10 kN   Journal Speed = 1450 rpm

    L/D ratio =1   Bearing Length =50 mm

    Radial Clearance = 20 microns   Eccentricity = 15 microns

    Specific gravity of the oil = 0.86   Specific heat of the lubricant
                                               = 2.09KJ/kg°C

    Calculate :

      i) The minimum oil film thickness

      ii) The coefficient of friction

      iii) The power lost in friction

      iv) The viscosity of the lubricant

      v) The total flow rate of lubricant in lpm

      vi) The side leakage

$\left(\dfrac{l}{d}\right)$	ε	$\left(\dfrac{h_0}{c}\right)$	S	Φ	$\left(\dfrac{r}{c}\right)f$	$\left(\dfrac{Q}{rcn_{c}l}\right)$	$\left(\dfrac{Q_s}{Q}\right)$	$\left(\dfrac{P}{p_{max}}\right)$
1	0	1.0	∞	(85)	∞	π	0	—
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	—

Note : Assume linear interpolation for intermediate values.

b) Name the types of Hydrodynamic thrust bearing. Dervie the equations for pressure distribution for flat plate thrust bearing. **[6]**

SECTION - II

Q7) a) Derive an expression for load carrying capacity and oil flow rate for hydrostatic bearing. State the assumptions made. **[8]**

b) Explain thermal considerations in hydrostatic step bearings. **[8]**

OR

Q8) a) Explain the mechanism of piston-pin lubrication in IC engines. **[8]**

b) Two circular plates of 400 mm diameter are seperated by an oil flim havig viscosity of 105cp. A load of 20 kN is transferred through the film. Calculate the time taken for reducing the flim thickness from 0.2 mm to 0.01mm.

Also estimate the time of approach, if plates were square in shape of side 400 mm, all other parameters are same. **[8]**

Q9) a) Explain the principle of Elastohydrodynamic Lubrication with applications. **[8]**

b) Write short note on Ertel - Grubin Theory and Hertz theory. **[8]**

*Q10)*a) Compare gas Lubricated bearings with oil-lubricated bearings for following parameters **[8]**

      i)   Operating speed

      ii)   Load Carrying capacity

      iii)   Viscosity of Lubricant

      iv)   Film thickness

    b) Explain desirable properties of bearing materials. **[8]**

*Q11)*a) Why Lubrication is required in metal working? Explain the types of Lubrication in metal working. **[8]**

    b) Discuss the development of concept and structure of superficial layers. **[10]**

Q12) Write short note on any three of the following : **[18]**

    a)   Lubrication is wire drawing

    b)   Lubrication in rolling

    c)   Metal spraying

    d)   Cladded coatings

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