Total No. of Questions : 12]

SEAT No. :

P1526

[Total No. of Pages : 4

[4759]-37

B.E. (Mechanical)

TRIBOLOGY

(2008 Pattern) (Semester - I) (Elective - I) (402044D)

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

Instructions to the candidates:

1) ***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 wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data wherever necessary.***

SECTION - I

Q1) a) What is tribology? What is the importance of Tribology in Machine Design? **[6]**

b) Explain Redwood viscometer used to measure viscosity of lubricating oil. **[6]**

c) A lubricating oil has a specific gravity of 0.86 and it gives 170 SUS for a viscosity measurement. Calculate the viscosity in CP. **[4]**

OR

Q2) a) What are the functions of additives for lubricating oil? Elaborate your answer by mentioning any three examples. **[6]**

b) State and explain Newton's law of viscous flow. What is absolute viscosity? **[6]**

c) Explain any four important desirable properties of bearing materials. **[4]**

Q3) a) Explain any eight factors affecting wear rate. **[8]**

b) Explain briefly any two friction measurement methods. **[8]**

OR

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Q4) a) Explain Archard's wear theory. What are the assumptions made for this? **[8]**

b) Using modified adhesion theory of friction, show that the coefficient of friction due to adhesion is $fa = \frac{k}{\left[\propto (1-k^2)\right]^{1/2}}$. **[8]**

Q5) a) Derive Reynold's one dimensional equation for flow of viscous fluid. **[12]**

b) What are tilting pad thrust bearings. Explain the hydrodynamic action in fixed pad thrust bearing. **[6]**

OR

Q6) The following data is given for 360° hydrodynamic bearing.(Refer Table 1) **[18]**

Radical Load = 9 KN

Journal speed = 2185 rpm

I/d ratio = 1

Permissible average bearing Pressure = 2.5 N/mm^2

Viscosity of lubricant = 155 SUS

Specific gravity of lubricant = 0.86

Specific heat of lubricant = 2.09 KJ/Kg°K

Calculate:

a) Length of bearing

b) Diameter of journal

c) Coefficient of friction

d) Power lost in friction

e) Total flow rate in 1/min

f) Side leakage in 1/min

g) Minimum oil film thickness

h) The temperature rise

Table:1

l/d	h_0|C	∈	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 are the advantages of hydrostatic step bearings? Draw a sketch indicating various elements of this bearing. **[6]**

b) Derive the equation for quantity of oil flow through a rectangular slot. **[10]**

OR

Q8) a) Derive following equation for oil flow rate Q for a hydrostatic conical thrust bearing for a shaft having outside diameter Do (radius Ro) and recess diameter Di (radius Ri): **[10]**

$$Q = \frac{\pi h^3 p_i \sin\alpha}{6\mu \log_e \left(\frac{R_o}{R_i}\right)}$$

b) Explain squeeze film lubrication with examples.. **[6]**

Q9) a) List down any three bearing materials, their composition, and special property possessed by each one of them and their typical applications. **[8]**

b) What are self lubricated bearings? Explain the process involved. **[5]**

c) Write short notes on gas lubricated bearings. **[5]**

OR

Q10)a) What is electro-hydrodynamic lubrication? Explain the phenomenon. What is the assumption made for solving the Reynold's equation for EHL application. **[8]**

b) What are Lined bearings? Explain the process involved and the advantages. **[6]**

c) What are the requirements of lubrication used for **[4]**

i) Deep drawing operation.

ii) Machine bed guide-ways.

Q11)a) Explain the importance of Surface Engineering in tribological design. **[6]**

b) Explain with sketches, any two methods used for corrosion resistance. **[10]**

OR

Q12)a) Explain the general characteristics of superficial layers obtained by Machining, strengthening and weakening of superficial layers. **[8]**

b) With suitable sketches, write short notes on: **[8]**

i) Electroplating.

ii) Crystallizing coating.

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