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Tribology
(New) (1300)

P. Pages : 3

Time : Three Hours **Max. Marks : 100**

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **all five** questions.
5. Attempt **any two** sub questions out of a, b & c.
6. Figures to the right indicate full marks.
7. Draw neat figures wherever necessary.
8. Use of design data hand book is allowed.

1. a) What is 'tribology' ? Discuss the role and importance of tribology in industries. **10**

b) State and explain laws of friction . What are different method uses to measure friction ? Explain any two methods. **10**

c) Write short notes on : **10**
i) Sticks slip oscillations and its elimination.

ii) Cavitation errosion.

2. a) Derive an expression for viscous flow through a rectangular slot. **10**

b) The following data is given for a hydrostatic step bearing. **10**

Thrust load	= 400 kN
Shaft speed	= 700 rpm
Shaft diameter	= 480 mm
Recess diameter	= 240 mm
Oil film thickness	= 0.15 mm
Viscosity of lubricant	= 160 SUS
Sp. heat of lubricant	= 1.76 kJ/kg°C
Sp. gravity of lubricant	= 0.86

Calculate :
i) The supply pressure.
ii) The flow requirement in ℓ/min.
iii) The frictional power loss.
iv) The pumping power loss.
v) The temperature rise, assuming the total loss in bearing is converted into the frictional heat.

c) Explain basic modes of lubrication in detail. **10**

3. a) Explain practical design considerations in hydrodynamic bearing. **10**

b) The following data is given for a 360º hydrodynamic bearing. **10**
Radial load = 3.2 kN
Journal diameter = 50 mm
Bearing length = 50 mm
Journal speed = 1490 r.p.m.
Radial clearance = 50 microns
Viscosity of lubricant = 25 cp
Density of lubricant = 860 kg/m^3
Sp. heat of lubricant = 1.76 kJ/kg ºC.

Assuming that the total heat generated in the bearing is carried by the total oil flow in the bearing, calculate :
i) The minimum oil film thickness.
ii) The coefficient of friction.
iii) The power lost in friction.
iv) The total flow rate of lubricant in ℓ/min.
v) The side leakage.
vi) The temperature rise.

c) Explain the mechanism of pressure development in oil film. **10**

4. a) Derive equation for pressure and load carrying capacity for flat plate thrust bearing. **10**

b) The following data refers to the hydrodynamic tapered pad bearing. **10**
length of pad = 200 mm
width of pad = 850 mm
max^m oil – film thickness = 150 μm
minimum oil film thickness = 75 μm
viscosity of lubricant = 0.05 Pa-s
sliding velocity = 5 m/s

Calculate :
i) The load carrying capacity of bearing.
ii) The pressure at a distance of 100 mm from leading edge.
iii) The coefficient of friction.
iv) The power lost in bearing.

c) Write short notes on : **10**
   i) Rayleigh step bearing.
   ii) Tilting pad bearing.

5. a) Explain merits and demerits of gas bearings. Also give the application with suitable example. **10**

b) Derive an expression for squeeze load capacity of circular plate. **10**

c) Compare gas lubricated bearings with oil lubricated bearings based on the following parameters : **10**
   i) Viscosity of lubricant.
   ii) Viscous resistance.
   iii) Frictional power loss.
   iv) Operating speed.
   v) Load carrying capacity.

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