Q1) a) Why recycling of used oil is important? How recycling of motor oil is done? **[5]**

   b) What is friction? Classify it. Write four friction measuring methods. **[5]**

<div align="center">OR</div>

Q2) a) Define Tribology. Explain its importance in industry. **[5]**

   b) Define wear. Explain Adhesive and Abrasive wear. **[5]**

Q3) The following data is given for a 360° hydrodynamic bearing: **[10]**

   i)   Radial load = 10 KN

   ii)   Journal speed = 1450 rpm

   iii) $\dfrac{l}{d}$ Ratio = 1

   iv)   Bearing length = 50 mm

   v)   Radial clearance = 20 microns

   vi)   Eccentricity = 15 microns

   Calculate:

   i)   The minimum oil film thickness

   ii)   The coefficient of friction

iii) The power lost in friction

iv) The viscosity of lubricant in cP

v) The total flow rate of lubricant in *lit/min*.

$\dfrac{l}{d}$	$\dfrac{ho}{C}$	$\in$	S	$\left(\dfrac{r}{c}\right)f$	$\dfrac{Q}{r.C.n.l}$	$\dfrac{Qs}{Q}$	$\dfrac{Pmax}{p}$
1	0.2	0.8	0.0446	1.7	4.62	0.842	3.195
	0.4	0.6	0.121	3.22	4.33	0.680	2.409
	0.6	0.4	0.264	5.79	3.99	0.497	2.066

OR

Q4) a) Explain the mechanism of pressure development in hydrodynamic thrust bearing. **[6]**

b) Explain any TWO. **[4]**

   i) Surface fatigue wear

   ii) Rolling friction

   iii) EP Additive

Q5) a) Explain with neat sketch, working principal of hydrostatic step bearing. A hydrostatic step bearing has shaft diameter 120 mm and recess diameter 80 mm. It is working under supply pressure of lubricant of 8 bar which induces film thickness in the bearing of 0.08 mm. **[8]**

   Viscosity of oil lubricant is 30×10^{-9} N-S/mm^2.

b) Derive an expression for flow rate through rectangular slot. State the assumptions made. **[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 phenomenon of squeeze film lubrication **[8]**
   Two parellel plates 30 mm long and infinitely wide are separated by an oil film 25 µm thick having viscosity of 0.65 Ns/m^2. If the load per unit width of 15000 N/m is applied to the plates, find the time required to reduce the film thickness to 2.5 µm and the velocity of approach, maximum pressure.

Q7) a) Explain the phenomenon of Elastohydrodynamic lubrication [EHL] and state the applications where EHD lubrication is observed. **[8]**

b) Explain merits, demerits and applications of gas bearings. **[8]**

OR

Q8) a) What is 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 of active magnetic bearing with its advantages and applications. Also mention its types. **[8]**

Q9) Write a note (Any THREE): **[18]**

a) Lubrication in metal working

b) Foil bearing

c) Tribological aspects of wheel on rail road.

d) Lobe bearing.

OR

*Q10)*a) State desirable properties of bearing materials. List few suitable bearing materials **[6]**

b) Explain the mechanics of tyre road interactions. **[6]**

c) What is surface engineering? State its significance and applications. **[6]**

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