C.U.SHAH UNIVERSITY
Summer Examination-2019

Subject Name : Tribology in Design and Surface Engineering
Subject Code : 5TE01TDS1   **Branch: M.Tech Mechanical (CAD/CAM)**
Semester : 1   **Date : 26/03/2019**   **Time : 02:30 To 05:30**   **Marks : 70**

Instructions:
   (1) Use of Programmable calculator and any other electronic instrument is prohibited.
   (2) Instructions written on main answer book are strictly to be obeyed.
   (3) Draw neat diagrams and figures (if necessary) at right places.
   (4) Assume suitable data if needed.

SECTION – I

Q-1	**Attempt the Following questions**	
a.	Define 'Tribology'.	**(1)**
b.	Explain 'Flaw' with diagram.	**(1)**
c.	Draw the diagram for Absolute Viscosity Vs. Pressure	**(1)**
d.	What is square bearing?	**(1)**
e.	Draw the internal load distribution diagram for cylindrical roller bearing.	**(1)**
f.	'Stiffness is high in case of hydrostatic bearing' – Give your comments.	**(1)**
g.	Write down the Hertz equation to determine contact radius when two spheres of different diameters are in contact.	**(1)**
Q-2	**Attempt all questions**	
a.	Explain the following theories of friction. (1) Junction growth theory (2) Deformation theory	**(7)**
b.	Derive Archard's equation to determine volume of adhesive wear.	**(7)**

OR

Q-2	**Attempt all questions**	
a.	Write different standards used to designate the viscosity of lubricant with example.	**(7)**
b.	Explain the effect of C/d ratio and L/d ratio on the performance of hydrodynamic journal bearing.	**(7)**
Q-3	**Attempt all questions**	
a.	Prove that the co-efficient of friction during sliding is $$\mu_{sld} = \frac{\tau}{H} + \frac{2}{\pi}\tan\theta,$$ where τ = shear strength, H = hardness and θ = asperity angle.	**(7)**
b.	Explain and draw the topography of solid surface and indicate typical layers with thickness.	**(7)**

OR

Q-3	**Attempt all questions**	
a.	Explain with neat sketch 'Redwood Viscometer'. Also write the equation	**(7)**

which is used to calculate the viscosity through it.

b. Derive the equation to evaluate the pressure distribution on annular area of hydrostatic step bearing in following term, **(7)**

$$P = \frac{P_i \ln\left(\dfrac{R_o}{r}\right)}{\ln\left(\dfrac{R_o}{R_i}\right)}$$

Where,

R_o = Outer radius of shaft,

R_i = Radius of recess

P_i = Supply of inlet pressure

SECTION – II

Q-4   **Attempt the Following questions**

a. Draw the pressure distribution diagram in case of Hydrodynamic journal bearing. **(1)**

b. What are the limitations of Hydrostatic bearing? **(1)**

c. Define attitude of the bearing. **(1)**

d. Define Waviness. **(1)**

e. Define Surface roughness. **(1)**

f. What is the term 'SUS' **(1)**

g. Define Real area of contact. **(1)**

Q-5   **Attempt all questions**

a. Explain the different configurations of hydrodynamic journal bearings with neat sketches (at least four). **(7)**

b. Explain the concept of Elasto hydrodynamic lubrication between two contacting bodies. **(7)**

OR

Q-5   **Attempt all questions**

a. What do you mean by lubricants? State the properties of a liquid lubricants. **(4)**

b. Define: Viscosity index, Efflux viscometer, profilometry. **(3)**

c. Discuss factors affecting the wear rate between the rubbing surfaces **(7)**

Q-6   **Attempt all questions**

a. Suggest the various tribological solutions for overcoming friction and wear. **(7)**

b. Discuss the different bearing materials. **(7)**

OR

Q-6   **Attempt all Questions**

a. Explain fiber optic transducer with neat sketch. **(7)**

b. Write different standards used to designate the viscosity of lubricant with example. **(7)**