Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 171905 **Date: 28/12/2012**

Subject Name: Industrial Tribology (Departmental Elective-I)

Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** (i) Define viscosity and discuss effect of pressure and temperature on viscosity of the lubricating oil. **04**

(ii) Write short note on Viscosity Index **03**

(b) (i) State any two examples of wear and two examples of friction can be beneficial in day to day application. **02**

(ii) What is the Tribology? Explain the various Tribological solutions for overcoming friction and wear. **05**

Q.2 **(a)** Do as directed:

(i) Define roughness. **01**

(ii) State the specification of surface texture. **02**

(iii) Explain the CLA method and RMS method used to analyze surface traces. **04**

(b) Determine the roughness value (Ra) for the information given below **07**

Sum of area above center line = $480mm^2$

Sum of area below center line = $480mm^2$

Vertical magnification of graph = 15000

Horizontal magnification of graph = 100

Suitable sampling length = 0.8 mm

Also (i) Find RMS value (ii) Find out roughness grade of Ra value computed above (iii) Draw the roughness symbol for roughness value computed above.

OR

(b) Give detail comparison hydrodynamic bearing with hydrostatic bearing. **07**

Q.3 **(a)** Prove that co-efficient of friction during sliding is $\mu_{sld} = \frac{\tau}{H} + \frac{2}{\Pi}\tan\theta$ **07**

Where, H = hardness, τ = shear strength, θ = asperity angle.

(b) A steel disc having 200 mm diameter and 10 mm width is required to roll freely on a rigid plane. Find co-efficient of rolling friction if the density of steel = $8000kg/m^3$, poission 's ratio = 0.3, modulus of elasticity = 2.1×10^{11} N/m^2, and hysteresis loss 25%. **07**

OR

Q.3 **(a)** In a cross cylinder wear measuring experiment the stationary is brass in contact with a rotating cylinder made all of hardened cylinder having radius 50mm and thickness 25 mm, is rotating at 500RPM. The rate of radial wear was observed to be constant is found 2mm in 6 hours of a constant operation under a 50N load. Determine the wear constant if hardness of material is 120 N/mm^2. **06**

(b) Show that Volume of wear due to adhesion and abrasion is given by **08**

$(K_{abr} + K_{adh}/3) \bullet \frac{Wx}{H}$; where K is wear constant, x is the sliding distance, W is load and H is the hardness.

Q.4 **(a)** Derive the equation of load carrying capacity of hydrostatic step bearing. **06**

(b) The following data is given for a hydrostatic thrust bearing: **08**
Thrust load = 500 kN, Shaft speed = 720 rpm, Shaft diameter = 500 mm, recess diameter = 300 mm, film thickness = 0.15 mm, Viscosity of lubricant = 29.3 cP, Specific gravity = 0.86.
Determine: (i) Supply pressure (ii) Flow requirement (iii) Power loss in pumping (iv) Frictional power loss.

OR

Q.4 **(a)** Derive the Petroff's equation for hydrodynamic journal bearings. State the assumptions made in derivation of Reynold's equation for hydrodynamic journal bearings. **06**

(b) The following data is given for a short hydrodynamic journal bearing: **08**
Radial load = 1 kN, Shaft speed = 2100 rpm, (l/d) ratio = 0.5, Eccentricity ratio = 0.65, Radial clearance = 0.002 x journal radius, Flow rate of lubricant = 3.45 liter per hour.
Determine: (i) Diameter of journal (ii) Dimensions of bearing (iii) Minimum oil film thickness (iv) Average pressure in bearing.

Q.5 **(a)** State the desirable properties of lubricants. Also explain briefly the process of recycling of Used Oil **06**

(b) Do as directed:
(i) State the operating conditions of Gas lubricated bearings. **02**
(ii) State the application of Gas lubricated bearings. **02**
(iii) Write down merits and limitations of Gas lubricated bearings. **04**

OR

Q.5 **(a)** Which are the main regimes of lubrication? **02**
Explain the elastohydrodynamic lubrication in detail. **04**

(b) Explain the tribological considerations in design of different systems (at least four) of Automobiles. **08**

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