

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-I Regular Examination January / February 2011****Subject code: 710905N****Subject Name: Tribology****Date: 03 /02 /2011****Time: 02.30 pm – 05.00 pm****Total Marks: 70****Instructions:**

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

Q.1 (a) The following data refers to a 360° hydrodynamic journal bearing: **10**

1. Radial load = 10kN
2. (l/d) ratio = 1
3. Journal radius = 800 X radial clearance
4. Permissible bearing pressure = 1000kPa
5. Journal Speed = 1440rpm
6. Minimum oil film thickness = 25μ
7. Specific heat of lubricant = $2.10\text{kJ/kg}^\circ\text{C}$
8. Density of lubricant = 860kg/m^3

Determine:

- (i) The total flow rate of lubricant in l/min
- (ii) The power lost in friction
- (iii) Absolute Viscosity of lubricant and effective temperature at which it is determined.
- (iv) The side leakage
- (v) The average temperature if make up oil is supplied at 35°C

l/d	h_o/c	ϵ	S	$(r/c)f$	$Q/(rcn_s l)$	Q_s/Q	P_{\max}/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	0.68	2.409
	0.6	0.4	0.264	5.79	3.99	0.497	2.066

(b) What do you mean by friction? What role is played by asperities in friction? Explain in detail **04****Q.2 (a)** Explain regimes of lubrication. **07****(b)** Derive petroff's equation for hydro journal bearings mentioning different assumptions made. **07****OR****(b)** Explain different methods of oil lubrication. **07****Q.3 (a)** Explain the analysis of pivoted shoe bearing **07**

(b) A self contained hydrodynamic journal bearing of (l/d) ratio 1.5 has a journal diameter of 50mm. The journal rotates at 900rpm and supports a radial load of 1kN. The average coefficient of friction in bearing is 0.002. The permissible average temperature of lubricating oil is 100°C . The temperature of surrounding air is 30°C . The surface area of bearing is approximated as $6d/\text{mm}^2$. If the combined heat transfer coefficient of conduction, convection and radiation for transfer of heat from lubricating oil through bearing housing to the surrounding air is $3\text{W/m}^2\text{C}$, comment on the performance of bearing based on the thermal considerations. **07**

OR

- Q.3 (a)** A hydrodynamic plane slider has the following particulars **07**
 Length of the slider = 140mm
 Width of the slider = 60mm
 Maximum oil film thickness = 200microns
 Minimum oil film thickness = 100 microns
 Viscosity of the lubricant = 60mPa.sec
 Sliding velocity = 15m/sec
 Calculate the maximum pressure and its locations and the average pressure. What is the load carrying capacity? Use the long bearing approximation.
- (b)** Explain working principle of Optical Profilometer with neat sketch. **07**
- Q.4 (a)** Explain the following in respect to surface characteristics: **07**
 (i) Waviness
 (ii) Surface roughness
 (iii) Sampling length
 (iv) Bearing area curve
 (v) Contact area
 (vi) Real area of contact
 (vii) CLA & RMS
- (b)** Explain the concept of Elasto hydrodynamic lubrication between two contacting bodies. **07**
- OR**
- Q.4 (a)** Explain working principle of Glossmeter with neat sketch. **07**
(b) Explain the phenomenon of wear and different types of wear in detail. **07**
- Q.5 (a)** Explain the concept of wear particle analysis ferrography. **07**
(b) Explain the bearing selection procedure of antifriction bearings with a flowchart. **07**
- OR**
- Q.5 (a)** What are the different applications of hydrodynamic sliders in machine tools? **07**
(b) Explain different physical properties of lubricants in detail. **07**
