Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. VIIth Semester–Examination – Nov- 2011

Subject code: 171905

Subject Name: Industrial Tribology

Date:29/11/2011 **Time: 10:30 am – 01:00 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)** Explain the following terms of lubrication: **07**

(i) SUS

(ii) Viscosity Index

(iii) Fluidity

(b) Discuss the various lubricating oils which are classified according to their functions. **07**

Q.2 **(a)** Derive the equation to evaluate the load carrying capacity of hydrostatic step bearing in following form. **07**

$$W = \frac{\pi P_i \left(R_O^2 - R_i^2\right)}{2 \ln \frac{R_o}{R_i}}$$

(b) The following data is given for hydrostatic step bearing: **07**

- Shaft diameter = 500 mm
- Recess diameter = 250 mm
- Shaft speed = 720 r.p.m
- Thrust load = 450 N
- Oil film thickness = 0.16 mm
- Absolute viscosity = 31.2534 x 10^{-9} N-s/mm^2

Calculate supply pressure, oil flow requirement in litre/min and frictional power. Assume that the total power loss is converted into frictional heat.

OR

(b) Describe practical situations where hydrostatic squeeze-film lubrication can be observed. **07**

Q.3 **(a)** Derive the Reynold's equation in two dimensional form using direct method for hydrodynamic lubrication. **07**

(b) Following data refers to full journal bearing. **07**

- Length of bearing =75 mm
- Diameter of bearing = 75 mm
- Load on bearing = 12 kN
- Speed of journal = 1800 rpm
- d/C ratio = 2000
- Viscosity of the oil = 10 cP, at operating temperature.

Determine the coefficient of friction using Raimondi and Boyd chart. 'd' is journal diameter and 'C' is the radial clearance. Use following property table.

S	$\left(r/C\right)f$
0.264	5.79
0.121	3.22
0.0446	1.7

OR

Q.3 **(a)** Explain the need of Reynold's equation and various assumptions required to derive it. **07**

(b) A hydrostatic thrust bearing consists of four pads as shown in Fig. 1. Each pad can be approximated as a circular area of outer and inner diameters of 200 mm and 50 mm respectively as shown in Fig.1. The total thrust load on bearing is 300 kN and film thickness is 0.1 mm. The absolute viscosity of the lubricating oil is 47.76 x 10^{-9} N-s/mm^2. Calculate supply pressure and flow rate. **07**

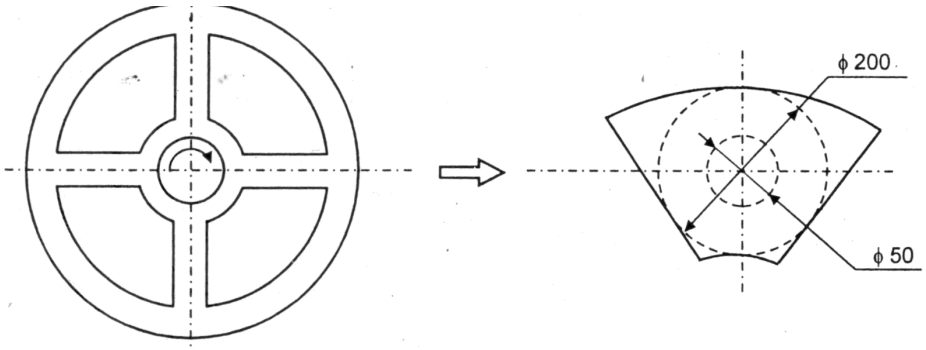

Fig.1.

Q.4 **(a)** State laws of friction. Explain how Coulomb's vision of friction explains these laws of friction. **07**

(b) List the methods of studying surface and describe a profilometer and a typical profilometer trace with neat sketch. **07**

OR

Q.4 **(a)** Explain the following term related to used motor oil: (i) Re-refining (ii) Reconditioning (iii) Reprocessing. Also, draw used oil management diagram. **07**

(b) In an experiment in which both adhesive and deformation actions contributed to the force of friction between metals, the measured coefficient of friction was 0.25. Estimate the slope of the surface asperities on harder solid. **07**

Q.5 **(a)** Discuss various types of hydrodynamic thrust bearing with the help of neat sketch. **07**

(b) Explain the term wear. Explain in detail different types of wear experienced in mechanical systems. **07**

OR

Q.5 **(a)** Enumerate the requirements to apply the gas lubrication. Discuss the merits and demerits of gas bearing. **07**

(b) Explain the importance of tribological considerations in IC engine. **07**

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