

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 171905

Date: 29/04/2017

Subject Name: Industrial Tribology (Department Elective - I)

Time: 02:30 PM to 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)** Derive Reynold's equation for 3-D hydrodynamic lubrication. Also state the assumptions made in this derivation. **07**

**(b)** A 360° hydrodynamic bearing has the following data for centrifugal pump application: **07**

Journal diameter = 100 mm

Bearing material - Babbit

Radial load = 20 kN

Journal speed = 900 r.p.m.

Operating temp of oil = 55° C

Ambient temp of oil = 15.5° C

Type of oil SAE10 ,has the absolute viscosity at 55° C = 0.017 kg/m-sec

Rise in temperature of oil is limited to 10° C

Permissible bearing pressure = 1.5 MPa

Heat dissipation coefficient of oil = 1232 W/ m<sup>2</sup>/ ° C

Value of ( ZN / p )<sub>min</sub> = 28

Correction factor for end leakage = 0.002

Ratio c / d = 0.0013

Find the length of the bearing and mass of the lubricating oil to be circulated for artificial cooling.

**Q.2 (a)** Explain the different methods used for friction /wear measurement. **07**

**(b)** Define and explain: viscosity, viscosity index, absolute viscosity, kinematic viscosity and bearing modulus. **07**

**OR**

**(b)** Classify the lubricants. Explain the parameters to be considered while selecting suitable lubricant. **07**

**Q.3 (a)** How does hydro-dynamic lubrication differ from hydro-static lubrication? Explain this in detail. **07**

**(b)** Discuss the geometrical properties of the surface. Also discuss parameters of measurements of roughness of the surface. **07**

**OR**

**Q.3 (a)** Explain the optimum design of hydrostatic step bearing in detail. **07**

**(b)** The hydrostatic thrust bearing ( circular type ) of a generator consists of six pads has the following data(refer given fig): **07**

Total thrust load = 600 kN

Shaft diameter = 500 mm

Viscosity of the lubricant = 30 cP

Recess diameter =200 mm

Shaft speed =720 r.p.m.

Density of the lubricant = 900 kg/m<sup>3</sup>

Specific heat of lubricant = 2.09 kJ/kg °C

Oil film thickness = 0.15 mm

Neglecting the flow over corners and each pad can be approximated as circular area of outer and inner diameters, Find (i) supply pressure (ii) total power loss.

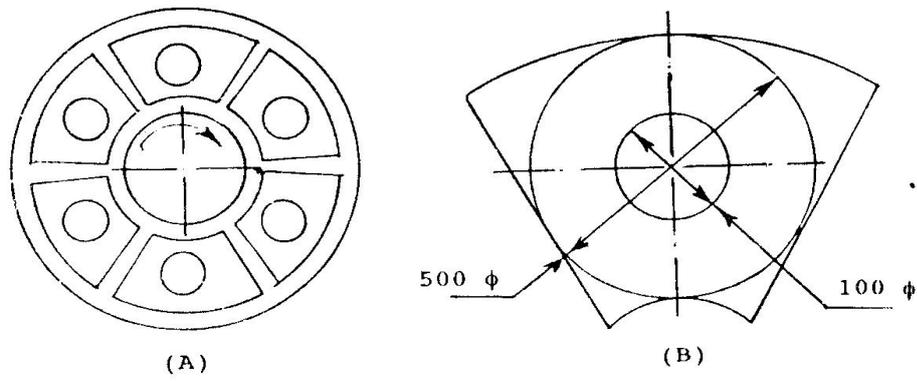


Fig. (a) Six-pad bearing, (b) Dimensions of each pad

- Q.4** (a) Explain the recycling of used oils in detail. **07**  
 (b) Explain the air/gas bearing in detail with neat sketch. **07**
- OR**
- Q.4** (a) Explain the different regimes of hydrodynamic lubrication with the help of plot of coefficient of friction v/s bearing characteristic number. **07**  
 (b) Explain the diagnostic maintenance of tribological components and considerations in IC engines and automobile parts. **07**
- Q.5** (a) Write a detailed note on: EHD (elasto hydrodynamic) lubrication and its different examples. **07**  
 (b) State and explain the factors to be considered while selecting suitable rolling contact bearing. **07**
- OR**
- Q.5** (a) State the different theories of friction. Explain the junction growth theory with the neat sketch. **07**  
 (b) Explain the bearing materials and its properties in detail. **07**

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