

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Winter 2022 - 23 Examination

Semester: 7
Subject Code: 203109435
Subject Name: Tribology

Date: 08/10/2022
Time: 10:30 am to 01:00 pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (All are compulsory) (Each of one mark)**(15)**

1. Define Newton's law of viscosity.
2. Define Tribology.
3. Mention the application of Lubricant.
4. Define fire point of lubricants.
5. Define kinematic viscosity.
6. $10000\text{cP} = \underline{\hspace{2cm}} \text{Mpa}$
7. $100000\text{cSt} = \underline{\hspace{2cm}} \text{m}^2/\text{s}$
8. Define Friction.
9. Dynamic Friction of the surface is higher than kinetic friction. True or False?
10. Mention The Reynolds equation for 1-D flow
11. For Hydrodynamic Journal bearing, for infinitely long Journal The (l/d) ratio is less than 2. True or False?
12. For Hydrodynamic Tapered Pad bearing, for infinitely width, The (B/L) ratio is less than 4. True or False?
13. The following is not a type of sliding contact bearing
 (a) Ball Bearing (b) Journal Bearing
 (c) Bush Bearing (d) Thrust Bearing
14. The flash point of lubricant must be _____ the working temperature.
 (a) Well Below (b) Well Above
 (c) Equal to (d) None of the above
15. As per laws of dry friction, the frictional force
 (a) Depends upon the nature of sliding surface
 (b) is independent of the sliding velocity
 (c) is directly proportional to the load
 (d) All of the above

Q.2 Answer the following questions. (Attempt any three)**(15)**

- A) The following data refer to hydrodynamic full journal hydrodynamic narrow journal bearing
 Journal diameter $(d) = 75 \text{ mm}$
 Bearing Length $(l) = 25 \text{ mm}$
 Journal Speed = 1550 rpm
 Eccentricity = 30 microns
 Radial clearance = 40 microns
 Viscosity of lubricant = 0.025 Pa-Sec
 Calculate: Load carrying capacity (W) , Flow rate of lubricant (Q_s)
- B) Write Comparison between sliding and rolling contact bearings.
- C) Derive Petroff's equation which contain two dimensionless parameters

D) A hydrodynamic, 360 degree short journal bearing l/d ratio is 0.3 to support a radial load of 5 KN. The journal rotates at 5000 RPM. The eccentric ratio is 0.6. if the central lubrication system supplies lubricating oil of viscosity 46.7 cP at flow rate of 0.5 liter per minute to the bearing. Calculate diameter of Journal.

Q.3 A) The following data refer to the hydrodynamic tapered pad bearing.

Length of pad = 200 mm

Width of pad = 900 mm

Maximum oil film thickness (h_i) = 0.15 mm

Minimum oil film thickness (h_o) = 0.075 mm

Viscosity of lubricant = 5×10^{-8} MPa-s

Sliding velocity = 5 m/s

(07)

Calculate: (a) Load carrying capacity of bearing (b) the pressure at a distance of 100 mm from leading edge.

B) The following data refer to hydrodynamic narrow tapered pad bearing of machine tool Length of the bearing (L) = 800 mm

Width of the bearing (B) = 175 mm

Inclination of pad = 1.75×10^{-3} Degree

Sliding Velocity (U) = 2.5 m/s

Minimum oil film thickness (h_o) = 0.015 mm

Viscosity of lubricant = 25×10^{-9} MPa-s

Assume (n) = 2

(08)

Calculate: (1) Load carrying capacity (W) (2) Coefficient of friction (3) Power lost in friction (4)

The pressure @ 500 mm from leading edge

OR

B) Derive the equation of pressure for Hydrostatic step bearing.

(08)

Q. 4 A) The following data given for hydrostatic thrust bearing:

Shaft speed = 720 r.p.m

Supply pressure = 5 Mpa

Shaft diameter = 400 mm

Recess diameter = 250 mm

Film thickness = 0.15 mm

Viscosity of lubricant = 30cP

Sp. Heat of lubricant = 1.76 KJ/kg °C

Sp. Gravity of lubricant = 0.86

(07)

Calculate: (1) Load carrying capacity (2) Flow rate of lubricant (in lit. /min) (3) The friction power loss (4) The pumping power loss (5) Temperature rise.

OR

A) Two reservoirs are connected by slit: 200 mm wide, 300 mm long, and 0.3 mm thick. The reservoirs are filled with an oil of viscosity 105cP. The pressure in the reservoir are 10 bar and 2 bar respectively. If the relative density of the oil is 0.8, determine

(1) The average velocity of the oil flow through the slit

(2) The flow rate of fluid through the slit in lit/min

(07)

B) Derive the equation of pressure for infinite width tapered pad bearing with neat sketch.

(08)