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# P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Mechanical Engineering

Semester End Examination; Aug. / Sep. - 2020

**Tribology**

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Time: 3 hrs

Max. Marks: 100

- Note:* i) Answer **TWO** full questions, selecting **ONE** full question from **UNIT - I** and **UNIT - II**.  
 ii) Answer any **THREE** full questions, choosing from **UNIT - III**, **UNIT - IV** and **UNIT - V**.  
 iii) Use of Data hand book is permitted.

## UNIT - I

- 1 a. State clearly law of friction. Explain modified adhesion theory of friction. 10  
 b. With a neat sketch, explain the working of dry sand rubber wheel abrasion tester. 10

**OR**

- 2 a. Discuss any one of the following: 10  
 i) Abbott bearing area curve  
 ii) Probability distribution function  
 b. With a neat sketch, explain the optical profilo-meter technique used for the measurement of roughness of a surface. 10

## UNIT - II

- 3 a. Briefly explain the different types of lubricants used with examples. 10  
 b. With a neat sketch, explain different regimes of sliding lubrication. 10

**OR**

- 4 a. Discuss the effect of temperature and pressure on viscosity of lubricants. 10  
 b. Derive the expression for Hagen-Poiseuille law. 10

## UNIT - III

- 5 a. Explain the mechanism of pressure development in an oil film. 10  
 b. A lightly loaded journal bearing has the following specification :  
 Diameter of journal = 50 mm                      Bearing length = 80 mm  
 Diametral clearance ratio = 0.002              Radial load = 750 N  
 Viscosity = 10 cp                                      Speed = 4000 rpm  
 Determine; 10  
 i) Frictional torque  
 ii) Coefficient of friction  
 iii) Power loss  
 6. Derive Reynold's equation in two dimensions. State the assumptions made. 20

Contd...2

## UNIT - IV

7. Derive the expression for pressure distribution, load carrying capacity, coefficient of friction for idealized slider bearing with a pivoted shoe. 20
- 8 a. Derive the expression for pressure distribution in a fixed shoe slider bearing. 10
- b. A rectangular plain slider bearing with fixed shoe with no end leakage has the following data :
- |   |                                 |
|---|---------------------------------|
| Bearing length = 90 mm                  | Width of shoe = 90 mm           |
| Load on bearing = 7800 N                | Slider velocity = 250 cm/s      |
| Inclination $\alpha = -0.00035$ radians | Viscosity of oil $\eta = 40$ cp |
- Determine; 10
- Minimum film thickness
  - Power loss
  - Coefficient of friction

## UNIT - V

- 9 a. Write a note on; 8
- Oil film thickness
  - Sommerfeld substitution
- b. Determine the pressure in full journal bearing with following data : 12
- |   |  |
|---|--|
| Journal diameter = 38 cm                              | Length of bearing = 6.3 cm                           |
| Speed = 3000 rpm                                      | Radial clearance = $2.5 \times 10^{-3}$ cm           |
| Pressure of oil at inlet hole = $0.31 \text{ N/mm}^2$ | Location of inlet pole $315^\circ$                   |
| Attitude = 0.8  | Coefficient of viscosity of $0.0148 \text{ N-s/m}^2$ |
- 10 a. Derive the expression for load carrying capacity of a Hydrostatic bearing. 10
- b. A hydrostatic step bearing has the following data :
- |   |                                   |
|---|-----------------------------------|
| Diameter of shaft = 150 mm                              | Diameter of pocket = 100 mm       |
| Vertical thrust on bearing = $60 \times 10^3 \text{ N}$ | External pressure = atm. pressure |
| Shaft speed = 1500 rpm                                  | Viscosity of lubricant = 30 cp    |
| Desirable oil film thickness = 0.0125 cm                |                                   |
- Determine; 10
- Rate of flow of oil
  - Power loss due to friction
  - Coefficient of friction

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