

Programme : B.Tech Mechanical, Mechanical- all specializations
Semester : VIII
Name of the Course : Tribology
Course Code : ADEG 353

Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention “NOT APPLICABLE”:

Section A: 30 Marks

1. Write true or false: 1 mark each

- (i) Seals do not provide very good grease retainability.
- (ii) In journal bearings, increase in length increases load bearing capacity of the bearing.
- (iii) Physisorption is attachment and detachment of lubricant layers due to molecular attraction.
- (iv) Sulfide group lubricants can not be used for chemisorption process.
- (v) In case of elastohydrodynamic lubrication, surface of seal may get deformed.
- (vi) Gas lubricants have very high viscosity.
- (vii) Solid lubricants can not sustain very high loads.
- (viii) Liquid lubricants have bad self-healing properties.
- (ix) Organic binders can not be used at temperatures above 350 °C.
- (x) Grease restricts contaminants to enter between the surfaces.

2. Multiple choice questions: 2 marks each

- (i) As per laws of dry friction, the frictional force
 - a. Depends on nature of sliding force
 - b. Is independent of sliding velocity
 - c. Is directly proportional to load
 - d. All of the above
- (ii) The following is not a sliding contact bearing
 - a. Ball bearing
 - b. Journal bearing
 - c. Roller bearing
 - d. All of the above
- (iii) Boundary friction conditions may develop in journal bearings, when shaft passes through zero speed during
 - a. Starting
 - b. Stopping
 - c. Reversing
 - d. All of the above
- (iv) The following lubricants are obtained from petroleum
 - a. Mineral Oils

- b. Grease
 - c. Solid lubricants
 - d. All of the above
- (v) For low pressure and low speed condition, we use
- a. Mineral Oils
 - b. Semi Solid lubricants
 - c. Solid lubricants
 - d. None of these
- (vi) A base oil
- a. Is the minor component of an oil based lubricant
 - b. Is an oil additive that counteracts oil acidity arising from oil degradation
 - c. Can be mineral, synthetic or biological in origin and constitutes the major component of lubricant
 - d. Is a reference oil used for base line comparisons
- (vii) For a hydrodynamic journal bearing, an eccentricity ratio of about 0.7
- a. Gives maximum bearing load capacity
 - b. Gives minimum bearing friction
 - c. Gives minimum bearing vibration
 - d. Gives minimum bearing temperature rise
- (viii) Out of the following disciplines, which one is not considered for an interdisciplinary approach in tribology?
- a. Solid and Fluid Mechanics
 - b. Chemistry
 - c. Material Science
 - d. Industrial Engineering
- (ix) Which one of the following is NOT the purpose of Tribology?
- a. Improve service life
 - b. Increase safety and reliability
 - c. Reduce fatigue
 - d. Increase heat generation
- (x) The function of bearing is to
- a. support load
 - b. transmit power
 - c. convert rotary to reciprocating movement
 - d. All of the above

Section B: 50 marks

3. Analyze the data for hydrodynamic journal bearings, and answer the questions:
 Bearing 1: $P_{\max} = 13 \text{ bar}$, $\mu = 0.0117$, $W = 700 \text{ N}$
 Bearing 2: $P_{\max} = 7.24 \text{ bar}$, $\mu = 0.0046$, $W = 700 \text{ N}$
 P_{\max} is maximum pressure that bearing can bear, W is load bearing capacity, μ is coefficient of friction.

Out of the two bearings, which would be better from tribological point of view? Explain Why.

CO2

4. Describe Chemisorption and Physisorption processes. **CO3**
5. List out the desirable properties from a boundary lubricant. **CO3**
6. Write advantages and disadvantages of solid lubricants. **CO3**
7. A. Describe average surface roughness (R_a) method and root mean square surface (R_q) method. **(6)**
B. Analyzing the equations below and explain which method would give lesser error and why? **(4)** **CO2**

$$R_a = \frac{1}{N} \sum_{i=1}^N Z_i \quad R_q = \sqrt{\frac{1}{N} \sum_{i=1}^N Z_i^2}$$

Section C: 20 marks (CO4)

8. A. Write the three necessary parameters that are considered while designing journal bearing. **(5)**
B. Describe how these parameters may affect load bearing capacity and coefficient of friction. **(10)**
C. Write all the steps for designing a hydrodynamic journal bearing. **(5)**