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

Section A: 30 Marks

1. **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

(xi)   Lubricants should have _____ shear strength at the interface for lower coefficient of friction
        a. Low
        b. High
        c. No role of shear strength
        d. None of these

(xii)   To find out coefficient of lubrication in mixed lubrication_____ can be used.
        a. Junction growth theory
        b. Holm's equation
        c. Burwell & Strang equation
        d. None of these

(xiii)   _____ occurs in temperature distress gap.
        a. Chemisorption
        b. Physisorption
        c. Both
        d. Neither chemisorption nor physisorption

(xiv)   _____ is an example of EP additive

a. Sulfur
b. Chlorine
c. Boron
d. All of these

(xv) _____ are used as organic binders.

a. Ceramics
b. Metals
c. Grease
d. None of these

Section B: 50 marks

2. Analyze the data for hydrodynamic journal bearings, and answer the questions:
Bearing 1: P_{max} = 15 bar, μ= 0.0127, W= 700 N
Bearing 2: P_{max} = 6.24 bar, μ= 0.0026, W= 700 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**

3. Describe boundary lubrication and hydrodynamic lubrication.   **CO3**

4. List out the desirable properties from a boundary lubricant.   **CO3**

5. Write advantages and disadvantages of greases.   **CO3**

6. 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**

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

Section C: 20 marks (CO4)

7. 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)**