TRIBOLOGY
(Elective-I)

Subject Code: 13ME2205

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Course Outcomes:

At the end of the course, the student will be able to

CO1: Assess the properties of lubricants experimentally

CO2: Examine the wear in metals;identify the wear testing and wear reduction methods

CO3: Explain lubrication process and its importance in bearings; appraise the application of lubrication

CO4: Summarize various theories of lubrication;solve the Grubin type solutions and film thickness equations

CO5: Explain the nano tribology and describe the working of various microscopes

UNIT-I

Properties and testing of lubricants: Viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers.

Friction: Introduction, Laws of friction, kinds of friction, causes of friction, friction measurement, theory of friction. Friction characteristics of metals, friction of Non metals, ceramics and polymers. Study of current concepts of boundary friction and dry friction.

UNIT-II

Wear of metals: Introduction, definition, scope, classification of wear, adhesive, delamination, fretting, abrasive, erosive and corrosive wear. Mechanism of wear, wear resistant materials, wear testing methods, wear reduction by surface improvement. Introduction to wear of polymers and ceramics.

UNIT-III

Hydrostatic lubrication: Hydrostatic step bearing, application to fixed and pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing. Hydrostatic thrust bearings, Hydrostatic bearing analysis including compressibility effects.

UNIT-IV

Hydrodynamic lubrication: Various theories of lubrication, Petroff's equation, Reynolds equation in two dimensions. Effects of side leakage - Reynolds equation in three dimensions, Somerfield number. Friction in slider bearing, hydro dynamic theory applied to journal bearing

Elastohydrodynamic lubrication: Theoretical considerations, Grubin type solutions, film thickness equations. Different regimes in EHL contact.

UNIT-V

Nano tribology: Introduction, measurement tools, Surface force operators, scanning tunneling microscope, friction force microscope, atomic force microscope, fabrication techniques for MEMS/NEMS.

TEXT BOOK:

1. B.C Majumdar, "*Tribology and Bearings*", C Publications, 2e, 2007

REFERENCES:

1. Basu Sen Gupta and Ahuja, "*Fundamentals of Tribology*", Prentice Hall, 1e, 2006.

2. Prasanth Sahoo, "*Engineering Tribology*", PHI Learning Publishing, 1e, 2005.

3. Kenneth C Ludema, "*Friction, Wear, Lubrication*", CRC Press, 1996.

4. Bharath Bhushan, "*Introduction to Tribology*", Wiley, 2002