

Course code	Course Name	L-T-P-Credits	Year of Introduction
ME369	Tribology	3-0-0-3	2016
<b>Prerequisite : Nil</b>			
<p><b>Course Objectives</b></p> <ul style="list-style-type: none"> <li>• To provide broad based understanding of the subject ‘Tribology’ and its technological significance</li> <li>• To understand the genesis of friction, the theories/laws of sliding and rolling friction and the effect of viscosity</li> <li>• To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems</li> <li>• To learn about the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques and the application of lubrications in metal working.</li> <li>• To understand the importance of adhesion property in different applications and to get knowledge about different bearing materials.</li> <li>• To understand the nature of engineering surfaces, their topography and learn about surface characterization techniques</li> </ul>			
<p><b>Syllabus</b></p> <p>Introduction to Tribology- Tribology in Design, Tribology in Industry, Tribological Parameters Like Friction, Wear and Lubrication, different types of lubrication techniques and applications, measurement of friction and wear -The Topography of Engineering Surface, Contact Between Surfaces, surface modification techniques- Adhesion properties, Adhesion in Magnetic Recording Systems, Types of Bearings, Comparison of Sliding and Rolling Contact Bearings.</p>			
<p><b>Expected Outcome</b></p> <p><b>The students will be able to</b></p> <ol style="list-style-type: none"> <li>i. Understand the subject ‘tribology’ and its technological significance.</li> <li>ii. Understanding the theories/laws of sliding and rolling friction and the effect of viscosity.</li> <li>iii. Get basic idea on consequences of wear, wear mechanisms, wear theories and analysis of wear problems</li> <li>iv. Get an exposure to theories of hydrodynamic and the advanced lubrication techniques and the application of lubrications in metal working.</li> <li>v. Gain overview of adhesion property in different applications and to get knowledge about different bearing materials</li> <li>vi. Get basic idea about the nature of engineering surfaces, their topography and learn about surface characterization techniques.</li> </ol>			
<p><b>Text books</b></p> <ol style="list-style-type: none"> <li>1. Ernest Rabinowicz, Friction and Wear of Materials, John Wiley &amp; sons,1995</li> <li>2. I.M. Hutchings, Tribology: Friction and Wear of Engineering Materials, Butterworth-Heinemann,1992</li> <li>3. Prasanta Sahoo, Engineering Tribology, PHI Learning Private Ltd, New Delhi, 2011.</li> </ol>			

<b>Reference books</b>			
1. B. Bhushan, Introduction to Tribology, John Wiley & Sons, Inc, New York, 2002			
2. B.Bhushan, B.K. Gupta, Handbook of tribology: materials, coatings and surface treatments”, McGraw-Hill,1997			
3. Halling J ,“Principles of Tribology“, McMillan Press Ltd.,1978			
<b>Course Plan</b>			
<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>End Sem. Exam. Marks</b>
<b>I</b>	Introduction to Tribology- Tribology in Design, Tribology in Industry, Economic Aspects of Tribology	1	<b>15%</b>
	Tribological Parameters Like Friction, Wear and Lubrication	1	
	The Topography of Engineering Surface, Contact Between Surfaces.	2	
	Types of Bearings, Comparison of Sliding and Rolling Contact Bearings.	2	
<b>II</b>	Introduction, Empirical Laws of Friction, Kinds of Friction	1	<b>15%</b>
	Causes of Friction, Theories of Friction	1	
	Measurement of Friction	1	
	Friction of Metals, Ceramic Materials, Polymers.	2	
	Rolling Friction- Laws of Rolling Friction, Relation Between Temperature and Friction	1	
	Stick-Slip, Prevention of Stick-Slip, Consequences of Friction.	1	
<b>FIRST INTERNAL EXAMINATION</b>			
<b>III</b>	Types of Wear, Various Factors Affecting Wear	1	<b>15%</b>
	Theories of Wear, Wear Mechanisms	2	
	Measurement of Wear.	1	
	Wear Regime Maps, Alternative Form of Wear Equations	1	
	Lubricated and Unlubricated Wear of Metals, Materials Used in Different Wear Situations.	2	
<b>IV</b>	Fundamentals of Viscosity And Viscous Flow	1	<b>15%</b>
	Principle and Application of; Hydrodynamic Lubrication, Elastodynamic Lubrication, Boundary and Solid Lubrication	2	
	Types of Lubricants, Properties of Lubricants	1	
	Effect of Speed and Load on Lubrication, Frictional Polymers.	1	
	<b>Lubrication in Metal Working:</b> Rolling, Forging, Drawing and Extrusion.	2	
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	<b>Adhesion:</b> Introduction, Adhesion Effect by Surface Tension, Purely Normal Contact and Compression Plus Shear	2	<b>20%</b>

	Adhesion in Magnetic Recording Systems	1	
	Dependence of Adhesion on Material and Geometric Properties.	1	
	<b>Bearing Materials:</b> Introduction, Rolling Bearing, Fluid Film Lubricated Bearing, Dry Bearing, Bearing Constructions.	3	
<b>V1</b>	Introduction To Surface Engineering, Concept and Scope of Surface Engineering.	1	<b>20%</b>
	Surface Modification – Transformation Hardening, Surface Melting, Thermo chemical Processes	3	
	Surface Coating – Plating and Anodizing Processes, Fusion Processes, Vapor Phase Processes.	3	
	Selection of Coating For Wear And Corrosion Resistance, Potential Properties and Parameters of Coating.	1	
<b>END SEMESTER EXAMINATION</b>			

### Question Paper Pattern

**Maximum marks: 100**

**Time: 3 hrs**

The question paper should consist of three parts

**Part A**

There should be 2 questions each from module I and II

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**

There should be 2 questions each from module III and IV

Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**

There should be 3 questions each from module V and VI

Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: Each question can have a maximum of four sub questions, if needed.