



# C. U. SHAH UNIVERSITY

## Wadhwan City

**FACULTY OF:** - Technology and Engineering  
**DEPARTMENT OF:** -Automobile Engineering  
**SEMESTER:** -VII  
**CODE:** - 4TE07ITR1  
**NAME:** –Industrial Tribology

### Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE07ITR1	Industrial Tribology	3	0	2	5	4	30	1.5	70	3	---	20	30	150

### Objectives:

- To impart knowledge in the friction , wear and lubrication aspects of machine components
- To understand the material properties which influence the tribological characteristics of surfaces.
- To understand the analytical behaviour of different types bearings and design of bearings based on analytical /theoretical approach

### Prerequisite:

- Basic and analytical knowledge of Theory of Machine and Machine design

### Course Outline:

Sr. No.	Course Content	Hours
1	<b>Introduction:</b> Tribology in design, tribology in industry Viscosity, flow of fluids, viscosityand its variation -absolute and kinematic viscosity, temperature variation,viscosity index determination of viscosity, different viscometers,Tribological considerations Nature of surfaces and their contact;Physic-mechanical properties of surface layer, Geometricalproperties of surfaces, methods of studying surfaces; Study ofcontact of smoothly and rough surfaces	7
2	<b>Friction and wear:</b> Introduction, laws of friction, Friction classification, causes of friction. Theories of dry friction, Friction measurement,Stick-slip motion and friction instabilities. Wear-classification, wear between solids, wear between solid and liquids, factors affecting wear, Theories of wear, Wear measurement,Approaches to friction control and wear prevention.	8

3	<b>Lubrication and Lubricants:</b> Types and properties of Lubricants - Testing methods, Boundary lubrication; classic hydrodynamics, hydrostatic and elasto and plasto hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses; SAE classification, recycling , disposal of oils, properties of liquid and grease lubricants; lubricant additives , general properties and selection, gas lubrication.	<b>6</b>
4	<b>Hydrodynamic lubrication:</b> Principle of hydrodynamic lubrication, Various theories of lubrication, Petroff 's equation, Reynold's equation in two dimensions - Effects of sideleakage - Reynolds equation in three dimensions,Friction in sliding bearing, hydro dynamic theory applied to journalbearing, minimum oil film thickness, oil whip and whirl, anti –frictionbearing, hydrodynamic thrust bearing	<b>10</b>
5	<b>Hydrostatic lubrication:</b> Principle of hydrostatic lubrication, General requirements of bearingmaterials, types of bearing materials., Hydrostatic step bearing, applicationto pivoted pad thrust bearing and other applications,Hydrostatic lifts, hydrostatic squeeze films and its application tojournal bearing, optimum design of hydrostatic step bearing	<b>8</b>
6	<b>Tribological Aspects:</b> Lubrication in rolling, forging, drawing and extrusion,Mechanics of tyre road interaction, road grip, wheel on rail road,Surface engineering for wear and corrosion resistance-diffusion, plating and coating methods, selection of coatings, properties and parameters of coatings, Other bearings-porous bearing, foil bearing, Lobe, hybrid bearing.	<b>6</b>

### Learning Outcomes:

- Ability to select material / surface properties based on the tribological requirements
- Methodology for deciding lubricants and lubrication regimes for different operating conditions
- Analysis ability of different types of bearings for given load/ speed conditions.

### Books Recommended:

- 1 Basic Lubrication Theory **Cameron, A.** , Ellis Herward Ltd., UK, 1981.
- 2 Principles of Tribology **Hulling, J. (Editor)** , MacMillan, 1984.
- 3 Tribology in Industry by **Sushil Kumar** Srivatsava, S. Chand &Co.
- 4 Engineering Tribology **Williams, J.A.** Oxford University Press, 1994.
- 5 Tribology Handbook **Neale, M.J.** , Butterworth Heinemann, 1995.
- 6 Modern Tribology Handbook Vol. – I & II. **Bharat Bhushan**
- 7 Friction and Wear of materials Rabinowicz.E, John Willey &Sons, UK, 1995.
- 8 Fundamentals of Tribology **S.K.Basu, S.N.Sengupta & B.B.Ahuja**, Prentice – Hall of India Pvt Ltd, New Delhi, 2005

### Research Reference:-

1. ASME 'Journal of Tribology'
2. Proceeding of the Institution of Mechanical Engineers, Part J : Journal of Engineering Tribology
3. Indian Journal of Tribology - Tribology Society of India