



C. U. SHAH UNIVERSITY

Wadhwan City

FACULTY OF: - Technology and Engineering

DEPARTMENT OF: - Mechanical 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 | Introduction Tribology in design, tribology in industry Viscosity, flow of fluids, viscosity and 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, Geometrical properties of surfaces, methods of studying surfaces; Study of contact of smoothly and rough surfaces | 7 |
| 2 | Friction and wear 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 |

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|---|--|----|
| 3 | Lubrication and Lubricants 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, solid lubricants, general properties and selection, gas lubrication. | 6 |
| 4 | Hydrodynamic lubrication Principle of hydrodynamic lubrication, Various theories of lubrication, Petroff's equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl, anti – friction bearing, hydrodynamic thrust bearing | 10 |
| 5 | Hydrostatic lubrication Principle of hydrostatic lubrication, General requirements of bearing materials, types of bearing materials., Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, Hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing, optimum design of hydrostatic step bearing. | 8 |
| 6 | Tribological Aspects 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. | 6 |

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