

**B.E Semester: 7 Automobile Engineering**  
**Subject Name: Industrial Tribology (MA704-N-D)**  
**[Dept. Elect.-4]**

**Course Objective:**

- To develop a solution oriented approach by in depth knowledge of Industrial Tribology.
- To address the underlying concepts, methods and application of Industrial Tribology.

**B. Teaching / Examination Scheme:**

| Teaching Scheme |     |     |       | Total Credit | Evaluation Scheme |       |              |       |        |       |
|-----------------|-----|-----|-------|--------------|-------------------|-------|--------------|-------|--------|-------|
| L               | T   | P   | Total |              | Theory            |       | Mid Sem Exam | CIA   | Pract. | Total |
| Hrs             | Hrs | Hrs | Hrs   |              | Hrs               | Marks | Marks        | Marks | Marks  | Marks |
| 3               | 0   | 0   | 3     | 3            | 3                 | 70    | 30           | 20    | 0      | 120   |

**C. Detailed Syllabus:**

| Unit No. | Details   |
|----------|---|
| 1        | <b>Introduction:</b><br>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. |
| 2        | <b>Friction and wear:</b><br>Role of friction and laws of static friction, causes of friction, theories of friction, Laws of rolling friction; Friction of metals and non-metals; Friction measurements. Definition of wear, mechanism of wear, types and measurement of wear, friction affecting wear, Theories of wear; Wear of metals and non-metals.  |
| 3        | <b>Hydrostatic lubrication:</b><br>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.   |
| 4        | <b>Hydrodynamic theory of lubrication:</b><br>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.  |
| 5        | <b>Air/gas lubricated bearing:</b><br>Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.  |
| 6        | <b>Lubrication and lubricants:</b><br>Introduction, dry friction; Boundary lubrication; classic hydrodynamics, hydrostatic and elasto 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,   |

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|   | general properties and selection.   |
| 7 | <b>Special Topics:</b><br>Selection of bearing and lubricant; bearing maintenance, diagnostic maintenance of Tribological components and considerations in IC engines and automobile parts, roller chains and wire rope, lubrication systems; Filters and filtration. |

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| <b>Total hours (Theory):48</b>    |
| <b>Total hours (Practical):00</b> |
| <b>Total hours:48</b>             |

#### D. Lesson Planning:

| Sr. No. | Date/Week   | Unit     | Weight age | Topic No |
|---------|---|----------|------------|----------|
| 1       | 1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup>                       | Unit 1,2 | 20%        | 1,2      |
| 2       | 4 <sup>th</sup> , 5 <sup>th</sup> , 6 <sup>th</sup>                       | Unit 3   | 20%        | 3        |
| 3       | 7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup>                       | Unit 4   | 20%        | 4        |
| 4       | 10 <sup>th</sup> , 11 <sup>th</sup> , 12 <sup>th</sup>                    | Unit 5   | 20%        | 5        |
| 5       | 13 <sup>th</sup> , 14 <sup>th</sup> , 15 <sup>th</sup> , 16 <sup>th</sup> | Unit 6,7 | 20%        | 6,7      |

#### E. Instructional Method & Pedagogy

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| 1 | At the start of course, the course delivery pattern , prerequisite of the subject will be discussed  |
| 2 | Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.                  |
| 3 | Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.   |
| 4 | One/Two internal exams may be conducted and total/average/best of the same may be converted toequivalent of 30 marks as a part of internal theory evaluation.  |
| 5 | Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation. |
| 6 | Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overallinternal evaluation.   |

#### G. Students Learning Outcomes:

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| 1 | The student can identify different areas of Industrial Tribology. |
| 2 | Can find the applications of all the areas in day to day life.    |

#### H. Text Books & Reference Books:

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| 1 | Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI                     |
| 2 | Tribology in Industry : Sushil Kumar Srivatsava, S. Chand &Co.              |
| 3 | Tribology H.G.Phakatkar and R.R.Ghorpade Nirali Publications                |
| 4 | Tribology – B.C. Majumdar, McGraw Hill Co Ltd.                              |
| 5 | Standard Hand Book of Lubrication Engg., O'Conner and Royle, McGraw Hills C |
| 6 | Introduction to Tribology, Halling , Wykeham Publications Ltd.              |

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| 7 | Lubrication, Raymono O. Gunther; Bailey Bros & Swinfan Ltd. |
| 8 | Bearing Systems, Principles and Practice, PT Barwll         |
| 9 | Tribology Hand Book, Michel Ncole                           |