



K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF MECHANICAL ENGINEERING

CO-PO Mapping

Course: Tribology			
Type: ELECTIVE		Course Code: 15ME742	
No of Hours			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total hours/Week	Total teaching hours
3	0	3	40
Marks			
Internal Assessment	Examination	Total	Credits
20	80	100	3
Aim/Objectives of the Course			
<ol style="list-style-type: none"> 1. To educate the students on the importance of friction, the related theories/laws of sliding and rolling friction and the effect of viscosity of lubricants 2. To make the students understand the principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques. 3. To make the students understand theories of hydrostatic lubrication and Plane slider bearings with fixed/pivoted shoe techniques. 4. To expose the students to the consequences of wear, wear mechanisms, wear theories and analysis of wear problems 5. To expose the students to the factors influencing the selection of bearing materials for different sliding applications and introduce the concepts of surface engineering and its importance in tribology. 			
Course Learning Outcomes			
After completing the course, the students will be able to			
CO1	Identify the types and properties oil used in the specific field.	Applying (K3)	
CO2	Utilize the knowledge of journal bearing, mechanism of pressure development and solving problems on journal bearings.	Applying (K3)	
CO3	Make use of theories of hydrostatic lubrication and Plane slider bearings with fixed/pivoted shoe techniques.	Applying (K3)	
CO4	Develop the concept of consequences of wear, wear mechanisms, wear theories and analysis of wear problems.	Applying (K3)	
CO5	Determine factors influencing the selection of bearing materials for different sliding applications and introduce the concepts of surface engineering and its importance in tribology.	Applying (K3)	
Syllabus Content			
Module 1: Introduction to tribology: Historical background, practical importance, and subsequent use in the field. Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of			CO1 10 hrs PO1-3

<p>lubricants, and selection of lubricants.</p> <p>LO: At the end of this session the student will be able to</p> <ol style="list-style-type: none"> 1. Explain properties of oils. 2. Derive equation for Viscosity, Newton's Law of viscosity. 3. Explain different viscosity measuring instruments. 4. Differentiate different types of lubricants and explain different lubrication principles. 	<p>PO2-3 PO12 -1 PSO1-3 PSO2-1</p>
<p>Module 2: Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D. Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and it's significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.</p> <p>LO: At the end of this session the student will be able to</p> <ol style="list-style-type: none"> 1. Derive an equation for frictional force and power loss in lightly loaded bearing, State and explain petroff's law and explain different mechanism of pressure development in an oil film. 2. Explain Reynold's investigation and Derive Reynolds equation in 2D. 3. State and explain idealized journal bearing and derive load carrying capacity and condition for equilibrium 4. Derive Sommerfeld's numbers and explain Partial bearings and end leakages in journal bearing 	<p>CO2</p> <p>10 hrs.</p> <p>PO1-3 PO2-3 PO12-1 PSO1-3 PSO2-1</p>
<p>Module 3 Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.</p> <p>Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.</p> <p>LO: At the end of this session the student will be able to</p> <ol style="list-style-type: none"> 1. Derive Pressure distribution, Load carrying capacity and coefficient of friction 2. Derive frictional resistance in a pivoted shoe bearing 3. State and explain hydrostatic lubrication 4. Explain hydrostatic step bearings and derive load carrying capacity 5. Explain oil flow through the hydrostatic step bearing 	<p>CO3</p> <p>10 hrs</p> <p>PO1-3 PO2-3 PO12-1 PSO1-3 PSO2-1</p>
<p>Module 4: Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.</p> <p>Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.</p>	<p>CO4</p> <p>10hrs</p> <p>PO1-3 PO2-3 PO12-1</p>

<p>LO: At the end of this session the student will be able to</p> <ol style="list-style-type: none"> 1. State how a bearing is selected. 2. Explain about Wear of ceramic materials and how wear is measured 3. Explain the influence of speed, temperature and pressure on bearing and 4. Define the measures to be taken according to tribology. 5. Define are the parameters to be considered for material selection and explain how the design has to be improved. <p>State and explain surface engineering</p>	<p>PSO1-3 PSO2-1</p>
<p>Module 5 Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials. Introduction to Surface engineering: Concept and scope of surface engineering. Surface modification – transformation hardening, surface melting, thermo chemical processes. Surface Coating – plating, fusion processes, vapor phase processes. Selection of coating for wear and corrosion resistance.</p> <p>LO: At the end of this session the student will be able to</p> <ol style="list-style-type: none"> 1. Explain Commonly used bearings materials 2. State and explain properties of typical bearing materials <p>List some Advantages and disadvantages of bearing materials.</p>	<p>CO5</p> <p>10hrs</p> <p>PO1-3 PO2-3 PO12-1 PSO1-3 PSO2-2</p>
<p>Text Books</p> <ol style="list-style-type: none"> 1. Fundamentals of Tribology , Basu S K., Sengupta A N., Ahuja B.B., , PHI 2006 2. Introduction to Tribology Bearings, Mujumdar B. C., S. Chand company pvt. Ltd 2008. 	
<p>Reference Books (specify minimum two foreign authors text books)</p> <ol style="list-style-type: none"> 1. Theory and Practice of Lubrication for Engineers, Fuller, D., New York company 1998 2. Principles and Applications of Tribology, Moore, Pergamaon press 1998 3. Tribology in Industries, Srivastava S., S Chand and Company limited, Delhi 2002 4. Lubrication of bearings – Theoretical Principles and Design, Redzimoskay E I., Oxford press company 2000 	
<p>Useful Websites</p> <ul style="list-style-type: none"> ● http://nptel.iitg.ernet.in ● http://elearning.vtu.ac.in ● http://freevideolectures.com/Subject/Mechanical ● http://video.mit.edu/channel/mechanical-engineering 	
<p>Useful Journals</p> <ul style="list-style-type: none"> ● Tribology International, Elsevier, http://www.journals.elsevier.com/tribology-international/ ● Journal of Tribology, The American Society of Mechanical Engineers, http://tribology.asmedigitalcollection.asme.org/journal.aspx 	
<p>Teaching and Learning Methods</p> <ol style="list-style-type: none"> 1. Lecture class: 40 hours 2. Practical classes: - hours 	

Assessment**Type of test/examination:** Written examination**Continuous Internal Evaluation(CIE) :** 20 marks (15 marks -Average of three tests + 05 marks Assignments)**Semester End Exam(SEE) :** 80 marks (students have to answer all main questions) .**Test duration:** 1 :30 hours**Examination duration:** 3 hours**CO to PO Mapping**

PO1: Science and engineering Knowledge
PO2: Problem Analysis
PO3: Design & Development
PO4: Investigations of Complex Problems
PO5: Modern Tool Usage
PO6: Engineer & Society


PO7:Environment and Society
PO8:Ethics
PO9:Individual & Team Work
PO10: Communication
PO11:Project Mngmt & Finance
PO12:Lifelong Learning

PSO1: Ability to apply concept of mechanical engineering to design a system, a component or a process/system to address a real world challenges

PSO2: Ability to develop effective communication, team work, entrepreneurial and computational skills

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
17 ME44	K-level														
CO1	K3	3	3	-	-	-	-	-	-	-	-	-	1	3	1
CO2	K3	3	3	-	-	-	-	-	-	-	-	-	1	3	1
CO3	K3	3	3	-	-	-	-	-	-	-	-	-	1	3	1
CO4	K3	3	3	-	-	-	-	-	-	-	-	-	1	3	1
CO5	K3	3	3	-	-	-	-	-	-	-	-	-	1	3	1


 Course In charge


 Head - Dept 18/9/19


 Principal