BMEE312L	Engineering Tribology	L	T	P	C
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Pre-requisite	**BMEE201L, BMEE204L, BMEE204P**	**Syllabus version**			
		1.0			

Course Objectives

1. To introduce tribology as an important design consideration that affects the performance of various machine components in relative motion and in contact.
2. To understand the importance of friction and wear while designing components for functional applications.
3. To recognize the importance of lubrication in machine components and in the design of various types of bearings.
4. To provide exposure latest developments and applications in the field of Tribology.

Course Outcomes

At the end of the course, the student will be able to

1. Apply the principles of tribology in design of machine components.
2. Estimate the friction and wear characteristics in interacting surfaces.
3. Use the principles of lubrication in designing various types of bearings.
4. Analyze the pressure and estimate the load carrying capacity of a journal bearing.
5. Examine components and characterize tribological failures.
6. Apply the knowledge on surface modification/treatment techniques in designing components for various applications.

Module:1	**Introduction to Tribology**	**6 hours**

Introduction – Tribology in design – Tribology in Industry – Economic aspects – Topography of engineering surfaces – Surface parameters – Geometric – Statistical parameters – Measurements – Surface contact – Types of contact – Hertz's theory of elastic contact

Module:2	**Friction and Wear**	**6 hours**

Laws of friction – Stick-slip phenomenon – Friction characteristics of metals and non-metals – Ploughing theory of friction – Measurement of friction. Wear – Wear mechanisms – Interfacial wear and Chemical wear – Wear measurements – Ferrography and oil analysis.

Module:3	**Lubrication and Bearings**	**7 hours**

Lubrication types – Regimes – Basic Modes of Lubrication – Properties of Lubricants – Lubricant Additives – Bearing Terminology – Sliding contact and Rolling contact bearings

Module:4	**Hydrodynamic Lubrication**	**11 hours**

Mechanism of pressure development – Reynolds equation – Plane slider bearing – Journal bearing – Long bearing and Short Bearing approximations – Load carrying capacity – Friction – Sommerfeld Number – Petroff's equation – Oil flow and Thermal equilibrium – Squeeze film lubrication

Module:5	**Tribological testing and Instrumentation**	**5 hours**

Diagnosing Tribological problems – Atomic Force Microscope (AFM) – Challenges of Tribological Testing at Small Scales – Methods and Instrumentation used for Tribological Testing – Influences of Test Parameters

Module:6	**Wear resistant coatings and surface treatments**	**4 hours**

Coating techniques dependent on vacuum or gas at very low pressure (Physical vapour, Chemical vapour and Physical-chemical vapour deposition techniques) – Coating processes requiring localized sources of intense heat (Surface welding, Thermal spraying and Laser surface hardening/alloying techniques)

Module:7	**Applications and case studies in Tribology**	**4 hours**

Tribology in Automotive, Aerospace, Marine, Manufacturing, Biomedical and other applications

Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**45 hours**

TextBooks	
1.	Gwidon Stachowiak and Andrew W Batchelor, Engineering Tribology, 2016, Fourth Edition, Butterworth Heinemann, Oxfordshire UK.
Reference Books	
1.	Harish Hirani, Fundamentals of Engineering Tribology with Applications, 2016, First Edition, Cambridge University Press, England.
2.	Bharat Bhusan, Modern Tribology Handbook Volume 1, 2000, First Edition, CRC Press, Florida US.
3.	Prasanta Sahoo, Engineering Tribology, 2005, Prentice Hall of India, New Delhi, India.
4.	Majumdar B.C., Introduction to Tribology of Bearings, 2018, Second Edition, S.Chand Publisher, India.
5.	Ian Hutchings and Philip Shipway, Tribology: Friction and Wear of Engineering Materials, 2017, Second Edition, Butterworth Heinemann, Oxfordshire UK.
6.	Kenneth C. Ludema and Layo Ajayi, Friction, Wear, Lubrication, A Textbook in Tribology, 2018, Second Edition, CRC Press, Florida US.
7.	Yukio Hori, 2006, Hydrodynamic Lubrication, Springer Japan.
8.	N.P. Suh, Tribophysics, 1986, Prentice-Hall, Englewood Cliffs, New Jersey.

Mode of Evaluation: CAT, Written assignment, Quiz, FAT			
Recommended by Board of Studies	09-03-2022		
Approved by Academic Council	No. 65	Date	17-03-2022