Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NMED525	Bearing Design and Lubrication	3	0	0	3

Course Objective

- The objective of this course is to present the theory of bearing design in a simplified form with an emphasis on the basic physical concept and to encourage students to innovate design ideas and unique solution to bearing design problems.

Learning Outcomes

Upon successful completion of this course, students will:

- have a broad understanding of the theory of lubrication applied to fluid film-bearing
- be able to analyse and design hydrodynamic bearings, squeeze film bearings, Hydrostatic bearings
- be able to analyse and design gas-lubricated bearings.
- be able to understandthe practical aspects of bearing design such as bearing arrangement, high-temperature consideration, tolerances, and material selection.
- be able to solve bearing-related issues inmachinery.

Unit No.	Topics to be Covered	Lecture Hours	Learning outcome
1	Viscosity and the rheology of lubricants, Lubrication regimes, Surface texture and interaction of surfaces, Bearing Materials.	6	Understanding of general considerations in bearing design
2	Mechanics of Lubricant Film: Momentum equation, Navier-Stokes equation, Continuity equation, Energy equation, Reynolds equation, Lubricant flow, Shear forces, Thermal Reynolds Equation, Reynolds equation with non-Newtonian fluid.Performance Parameters of bearing. ILA, ISA, and Finite bearings	7	Understanding of mechanics of lubricant film and performance of fluid film bearings
3	Hydrodynamic Thrust Bearing: Tapered-land thrust bearing, Pivoted-pad thrust bearings, Step thrust bearings and Exponential bearing	6	Understanding of design and analyse hydrodynamic thrust bearing
4	Journal Bearing: Hydrodynamic journal bearing with infinitely long approximation(ILA), Boundary conditions, Infinitely short bearing approximation(ISA), Finite hydrodynamic journal bearing design and analysis, Bearing Stiffness, rotor vibration, oil whirl instability, Dry and Starved Bearings.	8	Learn to design and analyse hydrodynamic journal bearing and to analyse dry and Starved bearing
5	Squeeze film Bearing: Squeeze film of planer, non-planer, and finite surfaces.Partial and full journal bearing.	5	Students will learn to design and analyse squeeze film bearing
6	Hydrostatic Bearing: Circular step externally pressurized thrust bearing (capillary and orifice compensated), Externally pressurized multi-recess journal bearing with short and large sill dimensions.	5	Students will learn to design and analyse hydrostatic film bearing

7	Gas Lubricated Bearings: Thrust Bearing, Journal bearings, porous bearing	5	Students will learn to describe gas lubricated bearing system and ability to design such bearing
Total		42	

Text Book:

1. Applied Tribology- Bearing Design and Lubrication: M MKhonsari and E R Booser, John Wiley & Sons; 3rd edition, 2017
2. Theory of Lubrication : Ghosh , Mazumdar, and Sarangi, Tata McGraw Hill Education.; 1st edition , 2013

Reference Books:

1. Engineering Tribology by GwidonW. Stachowiak and Andrew W. Batchelor, 4th Edition, 2014.
2. Fundamental of Fluid Film Lubrication: B J Hamrock, S R Schimid, and B O Jacobson, Marcel Dekker Inc. 2004