

20MD011 APPLIED TRIBOLOGY

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Course Description and Objectives: Tribology deals with the study of friction, lubrication and wear in all contacting pairs. The Tribological knowledge helps: To provide fundamental knowledge in lubrication, rubbing of surfaces & wear. To design efficient mechanical systems using good bearings to provide high quality machines. To improve service life, safety and reliability of interacting machine components; and yields substantial economic benefits.

Course Outcomes:

Upon successful completion of this course student should be able to:

- Understand the concepts of the tribological phenomenon of Engineering systems.
- Design any type of Engineering system incorporating lubrication.
- Propose suitable lubrication and types of bearing for a given operational parameters.
- Suggest suitable measurement technique for fractal analysis and nano tribology treatments

UNIT – I

L12

Introduction: Nature of surfaces and contact-Surface topography-friction theories and wear mechanisms, Lubrication Regimes.

Surface Engineering: Surface Treatments – Micro-structural and thermochemical, Surface Coatings – Hard Facing, vapor deposition process.

UNIT – II

L12

Hydrodynamic bearings: Fundamentals of fluid formation –Reynold’s equation; Hydrodynamic journal bearings–Sommerfield number–performance parameters– Optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings–fixed tilting pads, single and multiple pad bearings–optimum condition with largest minimum film thickness.

UNIT – III

L12

Hydrostatic Bearings: Thrust bearings –pad coefficients –restriction –optimum Film thickness-journal bearings–design procedure; Thrust bearings and Journal bearings– design procedure. Dry rubbing Bearings: Porous metal bearings and oscillatory journal bearings – qualitative approach only.

UNIT – IV

L12

Nano tribology: Introduction, measurement tools – Surface force Apparatus, Scanning Tunneling Microscope, Atomic Force Microscope, Measurement techniques, Fabrication of MEMS/NEMS, Atomic Scale Simulations

UNIT – V

L12

Fractal Analysis in Tribology: Introduction, Fractal Geometry, Fractal Characterization of Rough Surfaces, Evaluation of Fractal Dimension, Fractal Contact Model, Fractal Analysis of Adhesive Contact

TEXT BOOKS:

1. Prasanta Sahoo,"Engineering Tribology", 6th Reprint PHI Learning Pvt. Ltd., 2015
2. Gwidon W. Stachowiak and Andrew W. Batchelor, ,"Engineering Tribology",4th Edition, Butterworth – Heinemann 2014.
3. R. D. Arnell, P. B. Davies, J. Halling, T. L. Whomes, "Tribology:Principles and Design Applications", 1st Edition, Springer– Verlag, London,1991.

REFERENCE BOOKS:

1. B.C. Majumdar,"Introduction to tribology of Bearings",2nd Edition, S Chand,2008.