Course No: ITM - 101 FUNDAMENTALS OF TRIBOLOGY C L P(4 3 2)

UNIT I

Introduction to Tribology and its historical background, Factors influencing Tribological phenomena, Engineering surfaces – Surface characterization, Computation of surface parameters, surface measurement techniques, Apparent and real area of contact, Contact of engineering surfaces – Hertzian and non-hertzian contact, contact pressure and deformation in non-conformal contacts.

UNIT II

Genesis of friction, friction in contacting rough surfaces, sliding and rolling friction, various laws and theory of friction, Stick slip friction behaviour, frictional heating and temperature rise, Friction measurement techniques, Friction in tribo-systems, Frictional Devices in mechanical systems.

UNIT III

Wear and wear types, Mechanism of wear-adhesive, abrasive, corrosive, erosion, fatigue, fretting, etc., Wear of metals and non- metals, Wear models- asperity contact, constant and variable wear rate, geometrical influence in wear models, wear damage, Wear in various mechanical components, wear controlling techniques, Introduction to lubrication, Lubrication regimes, Introduction to micro and nano Tribology.

Text Books :

1. Czichos, H., "A system approach to science and Technology of Friction, Lubrication and Wear" Volume I, Tribology series, *Elsevier Publications, 1978*.
2. Ludema, K.C., "Friction, wera , Lubrication", CRC Press, NY., 1996.

Reference Books:

1. Peterson M.B.,Winner W.O, "Wear control Handbook" *sponsored by The Research Committee on Lubrication, 1980.*
2. Cameron A., "The principles of Lubrication", *Longman, London, 2000*.

Course: FRICTION WEAR AND LUBRICATION (ITM-101)

Tutorial No. 1

Q. No. 1 What is Tribological Surface?

Q. No. 2 Give brief summary of Historic development of friction.

Q. No. 3 What do you understand by Tribology and its influence on:

a) Material Conservation

b) Environment preservation

C) Energy conservation

Tutorial No. 2

Q. No. 1: What is surface Roughness? How it is measured?

Q. No. 2 what do you understand by R_a, R_m and R_z?

Q. No. 3 Explain the following briefly:

a) Apparent and real area of contact

b) Hertzian and non-hertzian contact

Tutorial No. 3

Q. No. 1: Explain Coulombs model of friction. What are the major defects in it?

Q. No. 2: Develop a model for influence of contamination on friction.

Q. No. 3: Explain the following briefly:

a) Stick-Slip friction behaviour

b) Frictional Heating and Surface Temperature

Q. No. 4: Develop a model for surface temperature.

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Tutorial No. 4

Q. No. 1 What is Wear and what are the different types of wear? Explain all types in brief.

Q. No. 2 Develop a model for Adhesive Wear, Abrasive wear, Oxidational wear , Erosive wear and Cavitations wear ?

Q. No.3 Explain the difference between two body abrasive wear and three body abrasive wear.

Q. No.4 Explain the effect of erosive wear on brittle and ductile materials drawing a plot between impact of droplet and impingement angle.

Q. No.5 Name material, operational, geometrical and environmental variables for designing of wear.

Tutorial No. 5

Q. No. 1 Draw Stribeck Curve and explain the various regimes of lubrication.

Q. No. 2 Explain: a) EP additive b) Anti-wear additive c) Friction Modifier.

Q. No. 3 Draw a graphical model to show the effect of temperature on EP additives.

Q. No. 4 What are the design requirements for solid lubricants?

Q. No. 5 Explain the structure and tribological properties of Graphite and MoS_2 as solid lubricants and lubricant additives.

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Assignment No. 1

- **Study of tribological surface and its physical significance in tribology.**
- **Study of Surface roughness and surface roughness measurement.**
- **Methods and tool used for surface morphological studies and surface elemental analysis.**
- **Study of friction**

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Assignment No. 2

- **Historic development of friction**
- **Types of wear and wear modeling**
- **Surafce temperature and flash temperature**

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Assignment No. 3

- **Lubrication and types of lubrication**
- **Solid lubricants and self lubricating materials**
- **Study of HDL, EHDL etc.**
- **Nanolubrication and Nanotribology**

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