**Course number and name: MTSE 4900: Introduction to Tribology and Lubrication**

**Credits and contact hours:** 3 Credits. Office Hours: Walk in or by appointment.

**Instructor’s or course coordinator’s name**: Dr. Diana Berman

T/Th 11:30-12:50, B 158

**Text book, title, author, and year**

K.C. Ludema, A textbook in Tribology: Friction, Wear, Lubrication, CRC Press 1996. electronic or paper.

G.W. Stachowiak, Engineering Tribology, Butterworth Heinemann.

1. *Other supplemental materials*

Electronic copies of lectures on Canvas.

**Specific Course Information**

1. *Brief description of the content of the course (catalog description)*

Friction, wear, and lubrication; surface properties and surface topography; friction of surfaces in contact; wear and surface failures; biotribology; boundary lubrication; fluid properties; hydrodynamic lubrication; bearing selection; introductory micro- and nanotribology.

1. *Prerequisites or co-requisites*

PHYS 1710. CHEM 1410/CHEM 1430 (for MTSE Undergraduates) or CHEM 1415/CHEM 1435.

1. *Indicate whether a required, elective, or selected elective course in the program*

Elective

**Specific goals for the course**

*a. Specific outcomes of instruction*

|  |
| --- |
|  |
| **Specific Course Learning Outcome** |
| 1. Understand the basic principles of contact mechanics |
| 2. Understand and recognize the origins of friction and wear in materials |
| 3. Recognize how material bonding and structure determine material properties in response to applied stresses. |
| 4. Understand how materials processing impact its tribological performance. |
| 5. Apply the concepts tribology to analytically evaluate current challenges in the field as part of a team |

1. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes that are addressed by the course.*

This course addresses ABET Student Outcomes 1, 3, 5, 7

**Brief list of topics to be covered**

I. Introduction & Engineering Surfaces

II. Contact Mechanics

Real Area of Contact & Hertzian Elastic Contacts

Elastic-Plastic Contacts & Sliding of Elastic Contacts

Sliding of Elastic-Plastic Contacts & Contact of Rough Surfaces

III. Mechanisms of Friction and Wear

Origin of Friction

Frictional Heating

Wear of Solids: Metals, Ceramics & Polymers

Measuring Friction & Uncertainty

IV. Fundamental of Lubrication

Lubricant Properties

Hydrodynamic Lubrication

Elastohydrodynamic Lubrication

Lubricant Types/Additives & Friction and Wear Testing

V. Tribology in Real Life Applications

Coatings & Surface Engineering

Biotribology: Minimizing Friction and Wear in Biosystems

Nanotribology