

Surface Engineering in Manufacturing

MECH ENG 727

Winter 2027

Instructor: Dr. Maryam Aramesh

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Textbooks:

1. COATINGS TRIBOLOGY Properties, Techniques and Applications in Surface Engineering, Holmberg and Matthews
2. Materials and surface engineering in Tribology; J. Takadoum
3. Tribology in manufacturing technology; Paulo Davim

Course Description:

This course is designed to provide a fundamental understanding of tribology and surface engineering in manufacturing. Topics include an introduction to surface engineering and surface properties; surface evaluations including investigation instruments and material characterization techniques; surface engineering techniques (surface treatments and coatings); surface engineering considerations in manufacturing applications including machining operations; selection, development, and identification of mechanical properties and material characteristics of thin coatings used in cutting tools.

Upon completion of the course, students will understand the general concepts related to tribology and surface engineering as well as the instrumentation commonly used. Students will also be exposed to applications in manufacturing including coatings used in cutting tools.

Course Outline

1. Introduction Surface Engineering - Surface Properties & Characterization; Jan. 13th- Jan. 27th

An introduction to surface engineering including:

- Importance and applications of surface engineering in manufacturing
- Surface engineering basics
- Coating properties-characteristics
- Coating evaluation/characterization techniques

2. Surface Characterization Lab; Jan. 27th - Feb. 10th

Surface characterization and evaluation techniques including:

- Nano-indentation
- Scratch testing
- Tribometry/Heavy load tribometer
- Alicona
- Optical Microscopy

Reading week: Feb.15th

3. Surface Engineering Methods II - Deposition Techniques; Feb.23rd - March 9th

- Thin coatings deposition methods:
- Physical Vapour Deposition (PVD)
- Coating Parameters
- Coating Defects

4. Surface Engineering in Manufacturing-Tribology of cutting tools; March 9th – March 23rd

- Tribology of cutting tools
- Classical friction and seizure phenomenon
- Friction measurements
- Tool wear and process performance
- Lubrication in machining

5. Surface Engineering in Manufacturing-Cutting Tool Selection (Geometry, Material & Coating); March 23rd – April 6^h

- Cutting tool geometry
- Effect of tool geometry on tool wear
- Typical cutting tool substrate materials
- Typical cutting tool coatings

Grading:

15%	Quizzes
20%	Lab Assignments
40%	Project
25%	Final exam

Important dates

Lab Assignments: Feb. 23rd, 2026

Quiz # 1: Jan. 27th, 2026

Quiz # 2: March 9th, 2026

Quiz # 3: March 23rd, 2026

Quiz # 4: April 6th, 2026

Lab Project Presentations: April 6th, 2024

Final Exam: April 14th