

Penn State University
Department of Mechanical and Nuclear Engineering

ME 497 J: Micro/Nanotechnology for Mechanical Engineers

Prerequisites: Senior standing in any engineering discipline. Contact instructor for further information

Text: None. Study materials will be posted on the Angel website.

Time & Place: M W F 03:35P - 04:25P in 101 Leonhard

Instructor: Dr. Aman Haque, 317A Leonhard Bldg., Tel: 865-4248, Email: ahaque@mne.psu.edu

Office Hours: Monday, 10:00 am – 1:00 p.m. or by appointment

Course Objectives:

This course will introduce the nanoscale science and technology relevant to mechanical engineering. The objectives are to:

- A. Develop an understanding of concepts and theories on nanofabrication, nanoscale devices (sensors and actuators) and nanoscale mechanics of solid, fluids and heat transfer and identify potentials for engineering applications.
- B. Develop awareness on the fundamentals of multi-domain (electrical, mechanical, thermal) coupling that is pronounced at nanoscale and its impact on mechanical device design.
- C. Familiarize with state of the art (atomic force and electron) microscopy in nanotechnology research.
- D. Identify the mainstreams of concurrent micro and nanotechnology research thrusts
- E. Communication Objective: Demonstrate professionalism in interactions with colleagues, faculty, and staff.

Course Outline

A brief outline of the course content is as follows:

1. Scaling theories of mechanical, fluidic and thermal phenomena
2. Transduction principles for mechanical engineers
3. Generic tools for micro/nanotechnology
4. Nanofabrication and Non-traditional materials for mechanical structures
5. Mechanics of nanoscale materials and interfaces
6. Design of micro/nanoscale mechanical systems
7. Micro/nanofluidics and applications in micro-mechanical devices
8. Micro/nano thermal transport and applications in micro-mechanical devices
9. Multi-physics (thermo-electro-mechanical coupling) at the nanoscale
10. Case studies in micro/nano mechanical systems: Engines, pumps, energy harvesting, flow control, cooling
11. Lab tours and guest lectures

Grading:

In class quizzes	25%
Midterm Exam	25%
Project	25%
Final Exam	25%
TOTAL	100%