



THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Polymer Smart Materials and Material Systems - Advanced Modeling and Characterization

MECHENG 7374

Credit Hours:

3.00 - 3.00

Course Levels:

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Polymer smart materials and material systems with specific emphasis on mathematical modeling and characterization of ionic electroactive materials. Introduction of ionic electroactive materials as engineering materials and motivate students through various contemporary applications. Fabrication, characterization, electrochemical modeling for actuation, sensing, energy conversion and storage.

Prerequisites and Co-requisites:

Prereq: 5374, and Grad standing in Mechanical Engineering; or permission of instructor.

Course Goals / Objectives:

- Knowledge and proficiency in fundamentals of polymeric smart materials (dielectric elastomers, conducting polymers, piezoelectric polymer composites) and their relevant fabrication methods
 - Knowledge and proficiency in mathematical modeling of polymer smart materials
 - Knowledge and proficiency in analysis of material systems with polymeric smart materials and their specific application as compliant actuators, high fidelity sensors and energy harvesting and storage systems (theory)
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Course Topics:

- Fabrication methods for piezoelectric polymers, ionic polymer metal composites, conducting polymers, dielectric elastomers.
 - Review of background information – modeling approaches for smart materials (Generalized constitutive modeling, deduction of property relations, approaches to dynamic models, selection criteria for modeling methods) (1 week)
 - Lumped parameter models (Impedance modeling for linear and non-linear response) (1 week)
 - Static and dynamic modeling of electronic smart polymers (2 weeks)
 - Mechano-electro-chemistry of ionic polymers (2 weeks)
 - Case study in actuation and energy storage (Lab 1) (2 weeks)
 - Modeling approaches for smart material system in actuation, energy storage(1 1/2 weeks)
 - Case study and project (Lab 2) (1 1/2 weeks)
 - Final project review and presentation (1 week)
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Designation:

Elective