Objective: The course builds on the knowledge gained in classes on structural mechanics and solid mechanics, extending the concepts of those classes in two directions, (1) the inclusion of uncertainty in problems in mechanics and (2) consideration of mechanics phenomena which occur at small scales. Students completing the course should

1. have the necessary background in the theory of stochastic processes and fields for addressing problems in stochastic micromechanics
2. be able to calculate from material measurements the types of statistics which are useful in quantifying material microstructure
3. be able to develop probabilistic models for material microstructures of broad classes of engineering materials
4. evaluate the connection between uncertainty in microstructural material properties and response variability in engineering systems
5. Identify aspects of their own research in which material microstructure may play an important role and apply the techniques of the class to address such problems.

Instructor:
Sanjay Arwade
202 Latrobe Hall
srarwade@jhu.edu

Office Hours:
Monday 4-5
or by appointment

Lectures:
MW 1:30pm - 2:45pm Latrobe 107
Text:
Required: none
Optional: Stochastic Calculus: Applications in Science and Engineering. M. Grigoriu
Random Heterogeneous Materials. S. Torquato
Both optional texts will be placed on reserve at Eisenhower library.

Topics:

- **Probability and statistics:** pdfs and cdfs, joint distributions, random vectors, correlation, simulation.

- **Stochastic processes/fields:** stationarity, ergodicity, correlation, spectral density, Gaussian and non-Gaussian processes/fields, simulation.

- **Micromechanics:** Effective properties, averaging methods, localization, representative volume element.

- **Polycrystalline materials:** data types, crystallographic orientation, grain geometry, probabilistic models, simulation.

- **Composite materials:** data types, n-point correlation functions, reconstruction from statistics.

- **Biological materials:** viscoelastic materials.

- **Special topics:** at students’ request. probabilistic mechanics.

Grading:
Homework 15%
Midterm 25%
Participation 20%
Project 40%

Homework policies:
Occasional homework will be assigned. Late submissions will be awarded half credit. You may help each other out on the homework, but you should feel comfortable claiming your own submission as your own work. **Homeworks which do not meet minimum standards of neatness will be returned ungraded.**