

Sample Syllabus ME559 Micromechanics of Materials

Professor Thomas Siegmund

Specific dates for the units listed below will depend on the actual semester start/end date but will follow the sequence provided here.

Introduction

Unit 1: Introduction to Micromechanics of Materials

Basic Composite Mechanics

Unit 2: Unidirectional Composites, Elastic Properties

Unit 3: Unidirectional Composites, Elastic Properties

Unit 4: Unidirectional Composites, Shear Modulus, Poisson's Ratio, Yield

Unit 5: Unidirectional Composites, Failure

Unit 6: Unidirectional Composites, Thermomechanical Properties

Unit 7: Material Property Spaces

Unit 8: Shear Lag Model

Unit 9: Shear Lag Model

Unit 10. Size Effects in Composites: Smaller is Stronger

Micromechanics of Multiphase Materials

Unit 11: Homogenization I: Representative Volume Element Concept, Averaging

Unit 12: Homogenization II: Basic Equations

Unit 13: Eigenstrains

Unit 14: Eigenstrains Thermal Strains

Unit 15: Eigenstrains Mechanical Loading

Unit 16: Dilute Approximation

Unit 17: Dilute Approximation

Unit 18: Self Consistent Model

Unit 19: Mori Tanaka Method

Unit 20: Mori Tanaka Method

Architected Material Systems

Unit 22: Cellular Solids – Introduction

Unit 23: Honeycomb Structures Elastic Properties

Unit 24: Honeycomb Structures Nonlinear Properties

Unit 25: Honeycomb Structures Nonlinear Properties

Unit 26: Honeycomb Structures Failure

Unit 27: Properties of Foams

Unit 28: Foams, Thermal Shock Properties: Case Study

Unit 29: Foams, Energy Absorption: Case Study

Unit 30: Generalization to Lattice Materials

Unit 31: Mechanics of Lattice Materials

Unit 32: Segmentation and Assembly as a Material Design Concept

Unit 33: Mechanics of Segmented and Topologically Interlocked Material Systems

Unit 34: Mechanics of Segmented and Topologically Interlocked Material Systems

Unit 35: Mechanics of Segmented and Topologically Interlocked Material Systems

Damage Mechanics as an Example of Mechanics with Evolving Microstructure

Unit 35: Introduction to Damage Mechanics

Unit 36: Introduction to Damage Mechanics

Unit 37: Damage as Internal Variable

Unit 38: Methods for Determination of Damage

Unit 39: Thermodynamics of Damage

Unit 40: Damage Equivalent Stress

Unit 41: Kinetic of Damage Evolution

Unit 42: Ductile Fracture Models

Unifying Concepts

Unit 43: Material Design Combining Composition, Shape, Assembly

Unit 44: Material Design Combining Composition, Shape, Assembly