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

Architectured 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