

MAE 123  
Intro/Transport in Porous Media (4 units)  
formerly MAE 125B

**Class/Laboratory Schedule:** 4 hours lecture, 8 hours outside preparation. 12 hours/week total.

**Course Coordinator(s):** Jan Kleissl

**Textbooks/Materials:**

1. G. Pinder and M. Celia, Subsurface Hydrology

**Catalog Description:** Introduction to groundwater flow. Pollution transport through the water table. Fundamentals of flow. Single- and multiphase flow. Darcy law. Well hydraulics. Diffusion and dispersion. Gravity currents and plumes in porous media. Chemistry of fluid-solid interactions. Fundamentals of adsorption and surface reactions.

**Prerequisites:** Grades of C- or better in MAE MAE 101C or CENG 101B, 105, and 107.

Required Course

Technical Elective Course

Other: \_\_\_\_\_

**Performance Criteria:**

Objective 1

1.1 Students will demonstrate an understanding of optimum material selection for a variety of engineering applications.

Objective 2

2.1 Students will demonstrate the ability to identify the structure of common engineering materials, and calculate crystal lattice parameters.

2.2 Students will demonstrate an ability to qualitatively predict the physical properties of materials based on atomic bonding considerations.

2.3 Students will demonstrate an ability to qualitatively predict the mechanical properties of materials based on atomic bonding and crystal structure considerations.

Objective 3

3.1 Students will demonstrate an understanding of the role of processing route on microstructure evolution during material synthesis.

3.2 Students will demonstrate an ability to select a processing route for material synthesis to achieve specific material performance.

Objective 4

4.1 Students will demonstrate the ability to calculate the stress-strain behavior of a material from its load-displacement behavior.

4.2 Students will demonstrate the ability to design a thermo-mechanical processing route to produce a desired microstructure for structural and electrical performance.

**Course Objectives:**

(Numbers in parentheses refer to the specific MAE Program Outcomes)

Objective 1: To teach students the basic principles underlying the dynamics of linear electrical circuits (1a, 11k).

Objective 2: To train students to formulate and solve the equations describing electrical circuits (1a, 5e, 11k).

Objective 3: To introduce students to active circuits and to provide them with an understanding of their application to signal conditioning, acquisition and filtering. (1a, 3c, 5e, 11k).

**Course Topics:**

1. Circuit variables, units, symbols
2. Ideal elements - resistor, switch, voltage source, current source, capacitor, inductor
3. Kirchoff's laws
4. Elements in series and parallel, wye and delta
5. Nodal analysis; mesh analysis
6. Properties of linear circuits - proportionality, superposition
7. Thevenin and Norton equivalent circuits
8. RLC circuits
9. The operational amplifier (OP-AMP), analysis and design of circuits using OP-AMPS
10. Signal conditioning: offset removal, scaling, anti-aliasing
11. Signal acquisition by analog-to-digital converter
12. Using Laplace transform to solve constant-coefficient, ordinary differential equations of electrical circuits subject to known inputs and initial conditions
13. Filtering: low-pass, high-pass, band pass filters

**Prepared By:** K. Vecchio, March 2000

**Revised:** Prab bandaru & Joanna McKittrick, April 2008, via Teaching Work Group Meeting

**Reviewed and Revised:** TWG, June 2010; June 2011

**Reviewed:** TWG, October 2012

**Revised:** J. Kleissl, 2012