



Advanced Electromagnetics:  
21<sup>st</sup> Century Electromagnetics

## Course Overview, Rules & Procedures

### Lecture Outline

- Course Overview
  - Mission
  - Course Objectives
  - Course Outline
- Policies and Procedures
  - MATLAB Codes



# Course Overview

3

## Mission

To teach students the theory, and equip them with the skills, to design electromagnetic devices in the 21<sup>st</sup> century where digital manufacturing and exploiting the third dimension becomes dominant.

4

# Course Objectives

- Present the most advanced topics in electromagnetics.
- Predict and describe 21<sup>st</sup> century electromagnetic device concepts.
- Train students to independently analyze and design 21<sup>st</sup> century electromagnetic devices.
- Present a potpourri of electromagnetic concepts that the student can draw upon in their career.
- Strong emphasis on metamaterials and 3D printed electromagnetics.

# Course Outline

- Lecture 1 -- Preliminary topics in EM
- Lecture 2 -- Lorentz and Drude models
- Lecture 3 -- Nonlinear and anisotropic materials
- Lecture 4 -- Transmission lines in anisotropic media
- Lecture 5 -- Coupled-mode theory
- Lecture 6 -- Coupled-mode devices
- Lecture 7 -- Theory of periodic structures
- Lecture 8 -- Calculation examples of periodic structures
- Lecture 9 -- Diffraction gratings
- Lecture 10 -- Subwavelength gratings
- Lecture 11 -- Guided mode resonance
- Lecture 12 -- Introduction to engineered materials
- Lecture 13 -- Metamaterials
- Lecture 14 -- Photonic crystals
- Lecture 15 -- Homogenization and parameter retrieval
- Lecture 16 -- Transformation Electromagnetics
- Lecture 17 -- Holographic lithography
- Lecture 18 -- Spatially variant lattices
- Lecture 19 -- Interfacing MATLAB with CAD
- Lecture 20 -- Frequency selective surfaces
- Lecture 21 -- Surface waves
- Lecture 22 -- Slow waves

# Policies and Procedures

7

## Structure of the Ideal Code

