GG/OCN 312: Geomathematics

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Prerequisites: MATH 242 or consent


OVERVIEW AND OBJECTIVES
This course will cover topics in ordinary differential equations, linear algebra and vector calculus with applications in fluid and solid mechanics. Emphasis will be placed on applications in the Earth and Ocean Sciences and Engineering.

CLASS FORMAT
The class meets 9:30 am – 10:20 pm, MWF, POST 703. In addition there will be up to 4 one-hour problem sessions each week to answer questions about lecture and/or problem sets (psets). You also are welcome to e-mail me to schedule individual office hours.

GRADING
50 % psets, 20 % midterm, 30 % final

READING AND HOMEWORK
You will have reading and homework assignments each week. Psets are due on Fridays at 3:00 p.m. at the instructor’s office. On Friday holidays, the pset due date will be specified on the assignment sheet. Only under extenuating circumstances may homework be turned in late and permission must be obtained from Prof. Becker prior to the due date.

COMPUTING
You will need to use Matlab on some of the problem sets. Please e-mail me if you need access to Matlab.

COURSE OUTLINE
*Chapters are from Greenberg

Unit 1: Introduction and Review
- Calculus: derivatives and integrals
- Elementary functions: logs exponentials, trigonometric functions
- Coordinate systems: Cartesian, polar, cylindrical, spherical
- Infinite series: Taylor Series, Binomial Expansion
- Functions of two or more variables: partial derivatives (Chapter 13)
- Complex numbers, complex exponentials (Chapter 21)

Unit 2: Ordinary Differential Equations (ODEs)
(Chapters 1-3,6)
- First order ODEs
- Second order and higher order ODEs
- Systems of coupled ODEs
- Applications
- Numerical methods

Unit 3: Matrices and Linear Algebra
(Chapters 8,10,11)
- Matrix algebra
- Systems of linear equations
- Matrix inversion and solutions of a linear system
- Eigenvalues and eigenvectors
- Applications

Unit 4: Vectors and Vector Calculus
(Chapters 9,14-16)
- Vectors and unit normals
- Scalar (dot) and vector (cross) products
- Coordinate transformations
- Gradient, Divergence, Curl
- Multidimensional integrals
- Integral Theorems
- Conservation laws: mass and momentum