Proposed Syllabus
MA 325
Introduction to Applied Mathematics

Instructor:

R. E. White
Professor of Mathematics
HA 308
515-7478
white@math.ncsu.edu
http://www4.ncsu.edu/eos/users/w/white/www/white/bob.html
Office Hours: MW 12:15 to 1:15

Course Objectives:

Students completing this course will be able to: (1) describe a number of applications of mathematics and how they relate to calculus and algebra and to subsequent advanced mathematics courses; (2) to understand the synergistic relationship between mathematics and applications; (3) to develop and write a plan of study for the last two years of undergraduate study of mathematics and applications.

Course Description:

Introduces students with multivariable calculus to five different areas of applied mathematics. These areas will be five three-week modules, which lead to higher level courses in the application areas. Topics will vary, and examples of modules are heat and mass transfer, biology and population, probability and finance, acoustic models, cryptography as well as others.

Prerequisites:

MA 231 or MA 242

Required Text:

Lecture notes as provided on the www at

http://www4.ncsu.edu/eos/users/w/white/www/white/MA325.htm
Course Organization and Scope:

I. Module on Heat and Mass Transfer
   - Newton cooling and stability
   - Discrete versus continuous models
   - Analysis of discretization error
   - Diffusion in a wire
   - Analysis of stability
   - Diffusion in a cooling fin
   - Pollutant transfer in a stream
   - Pollutant transfer in a lake
   - Analysis of von Neumann series

R. E. White
Room 308, Harrelson Hall
Phone 515-7478
email: white@math.ncsu.edu

II. Module on Acoustic Waves and Boundary Conditions
   - Development of the wave equation from first principles
   - Development continued
   - Development of several types of boundary conditions
   - Discuss experimental procedures and data collection
   - Formulate the least square problem for parameter estimation
   - Visit to the CRSC/Math laboratory for data collection
   - Analysis of data
   - Analysis continued

H. T. Tran
Room 329, Harrelson Hall
Phone 515-8782
email: tran@math.ncsu.edu
III. Module on Cryptography
- Some elementary cryptosystems.
- The Hill cryptosystems.
- The Hill cryptosystem with Maple.
- Generalizations of the Hill cryptosystem.
- The two-message problem.
- Mathematical prerequisites for the RSA encryption
- The RSA encryption and decryption.
- The RSA cryptosystem and Maple.

E. L. Stitzinger
Room 220, Harrelson Hall
Phone 515-3258
email: stitz@math.ncsu.edu

IV. Module on Modeling of Random Phenomena
- Basic concepts in Probability: random experiments, events, probability, frequencies, conditional probabilities, independence. Bayes formula and decision examples.
- Law of Large Numbers: applications to averaging and homogenization. Example of a particle moving in a random medium.
- Central Limit Theorem: examples of approximations. Estimation from large samples.
- Financial Mathematics: an introduction to the problem of pricing and hedging financial derivatives. The one-period model.
- Black-Scholes formula: from discrete to continuous time models. Brownian motion.

Jean-Pierre Fouque
Room 315, Harrelson Hall
Phone 515-8588
email: fouque@math.ncsu.edu
http://www.math.ncsu.edu/~fouque
V. Module on Biological Modeling

- Compartmental models. How is alcohol different from Prozac?
- Disease transmission. How does an epidemic happen? What happens when you vaccinate some of the population?
- Human population growth. When will Raleigh have 1 million people? How many people will the world have in the long run?

S. R. Lubkin
Biomathematics Graduate Program, Box 8203
North Carolina State University
919-515-1904
email: lubkin@eos.ncsu.edu

Assignments and Grading:

- Five Modules: 17% each
  - traditional math homework (15%)
  - two page summary of each module (2%)
- Written Plan of Study: 15%

  100>A+ >= 97, 97>A >= 93, 93>A- >= 90
  90>B+ >= 87, 87>B >= 83, 83>B- >= 80
  80>C+ >= 77, 77>C >= 73, 73>C- >= 70
  70>D+ >= 67, 67>D >= 63, 63>D- >= 60
  60>F

The written Plan of Study serves as the final examination.

Deadlines:

All deadlines for homework and written papers will be announced one week in advance. Students are expected to make a very good effort to comply with these. The instructors will accommodate any student who has been unable to complete the assigned work due to events beyond his/her control.

Academic Integrity:

The University polices on academic integrity can be found in the Code of Student Conduct at

http://www.fis.ncsu.edu/ncsulegal/41.03-codeof.htm

On the homework assignments the students may consult with each other, but each student should do the written homework reports.
Students with Disabilities:

You must contact the NCSU Disability Services for Students DSS is located in Suite 1900 of the Student Health Center. To get there, enter campus from Western Boulevard onto Dan Allen Drive. At the bottom of the hill on the right, there is a sign that reads Central Campus Pay Lot, Student Health Services, Patient Parking. Please park in this pay lot. Accessible parking is available and parking tickets can be validated at the end of your visit. Enter the back door of the Student Health Center from the parking lot. Suite 1900 is on the left after the second set of automatic doors.

http://www.ncsu.edu/equal_op/dss/

Laboratory Safety:  No Lab.

Pass-through Charges:  None.