An Introduction to Applied Mathematics for Students with Calculus

by
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Introduction to Applied Mathematics (MA 325)

- Surveys applications of mathematics
- Suitable for students who have taken multivariable calculus
- Student to formulate a *cohesive plan of study*
  for the third and fourth years
- Five three-week modules on variety of applications

Module Attributes

- Mathematics as is needed
- Each module taught by different faculty
- More motivational than in depth content

Examples modules include

- heat and mass transfer
- acoustics
- medical models
- mechanical vibration
- probability and finance
- cryptography
- population models
- mathematics of visualization

Faculty Module Contributors

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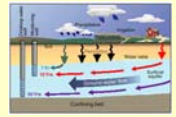
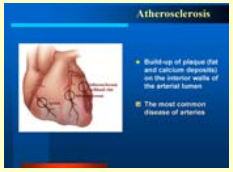
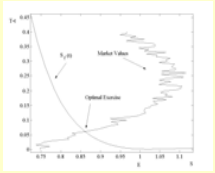
Introduces the Fourier heat law. Its discrete version is used to derive the explicit numerical method, which is implemented in Matlab. Advective models of mass transfer are described and implemented in one and two directions. Matrix model newu = A*u + d and stability analysis.





The wave equation is developed. Parameter identification and inverse problems are formulated. There is a physical laboratory component where real data is collected. Matlab is used to approximate the solutions of the resulting optimization problems.



The elements of probability are introduced including the Bernoulli model and random walks. This is then applied to financial models and value of option contracts.

Introduces algebraic cryptography including the Hill cryptosystem, the two-message problem and the RSA cryptosystem. Maple is used to do some symbolic calculations.

Images are represented by matrices, which can be manipulated to modify the image. Blurring, sharpening and filtering are introduced. The FFT is developed and used to do frequency filtering.

Course Administration

Course coordinator:

- selects faculty
- introduces new modules
- reads end of semester papers
- tabulates course grades

Module instructors:

- prepare course material at the *appropriate* level
- grades some traditional homework

Initial work load credit:

- one three-credit course
  equals
- a single new module spread over three semesters

Faculty and Student Opinions

Faculty:

- struggle to get the material at the correct level
- good advising tool
- an opportunity to advertise an upper level course

Students:

- are from applied math, math education and potential math majors
- may or may not like new instructor every three weeks
- exit interviews indicate this course was very useful in giving them information and guidance