

Prefix, Number and Name of Course:

ACM 610 Continuous Foundations of Applied Mathematics From a Problem Solving Perspective

Credit Hours: 1

In Class Instructional Hours: 1

Labs: 0

Field Work: 0

Catalog Description:

Prerequisite: Instructor permission.

Problem solving and applications of Continuous Mathematics, including Real Analysis, single and multi-variable Calculus, Differential Equations, Optimization and Fourier Analysis. Emphasis on team building and group management through problem solving activities.

Reasons for Addition:

To create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will be actively engaged in problem solving in Continuous Mathematics.

Student Learning Outcomes: Students will:	Course Content References:	Assessment:
1. integrate and synthesize principles and methods of applied calculus and real analysis to solve real life problems.	I	Group work in class, individual homework assignments, examinations, and projects.
2. integrate and synthesize principles and methods of differential equations to solve real life problems.	I,II	Group work in class, individual homework assignments, examinations, and projects.
3. integrate and synthesize fundamentals of the Fourier Transform and apply the properties of the Fourier Transform to solve real life problems.	I,II,III	Group work in class, individual homework assignments, examinations, and projects.
4. analyze problems involving optimization.	IV	Group work in class, individual homework assignments, examinations, and projects.
5. communicate, both orally and in writing solutions to complex problems drawn from continuous mathematics.	I,II,III,IV	Group work in class, individual homework assignments, examinations, and projects.
6. demonstrate ability to manage and communicate with team members when solving problems.	I,II,III,IV	Group work in class, individual homework assignments, examinations, and projects.

Course Content:

I. Applied calculus and real analysis

- A. Problems in single and multi-variable calculus
- B. Problems in vector calculus: planes, surfaces.
- C. Problems in curvature, Green's and Stokes' Theorem.
- D. Problems in different coordinate systems (Cartesian, cylindrical, polar, spherical)

II. Differential equations

- A. Problems in dynamical systems
- B. Problems in partial differential equations (heat, wave, transport equations).

III. Fourier analysis

- A. Problems in Fourier and inverse Fourier transformations
- B. Problems in fast Fourier transformations
- C. Problems in Fourier series

IV. Optimization models

- A. Problems in one variable optimization
- B. Problems in multivariable optimization
- C. Computational methods for optimization

Resources:Scholarships in the Field:

Blanchard, P., Devaney, R., and Hall, R.H., *Differential Equations*, Brooks/Cole, 2002.

Brigham, E. O., *The Fast Fourier Transform And Its Applications*, New Jersey: Prentice-Hall, Inc., 1988.

Edwards, C. H. and Penney, D. E., *Differential Equations and Boundary Value Problems: Computing and Modeling*, 2nd ed., New Jersey: Prentice-Hall Inc., 2000.

Fogiel, M., *The Advanced Calculus Problem Solver*, New York: Research and Education Association, 1981.

Lebedev, N.N., Skalskaya, I.P. And Uflyand, Y.S., *Worked Problems In Applied Mathematics*, New York: Dover Publications, 1979.

Meerschaert, M.M., *Mathematical Modeling*, Elsevier Academic Press, 2007.

Morton, K.W., Mayers, D.F., *Numerical Solution of Partial Differential Equations: An Introduction*, Cambridge University Press, 2005.

Strikwerda, J. F., *Difference Schemes and Partial Differential Equations*, Society for Industrial and Applied Mathematics (SIAM), 2004.

Periodicals:

College Mathematics Journal

Differential Equations and Applications

Differential Equations and Dynamical Systems

Mathematics Magazine

Notices of the American Mathematical Society

SIAM Journal of Optimization

The American Mathematical Monthly

Electronic and/or Audiovisual Resources:

Interdisciplinary Lively Applications Projects. Consortium for Mathematics and Its Applications, Inc., COMAP (800-772-6627, www.comap.com).

Numerical Recipes: The Art of Scientific Computing (third edition) (www.nr.com).

Undergraduate Applications in Mathematics Modules, COMAP.

Scientific computing FAQ (<http://mathcom.com/corpdir/techinfo.mdir/index.html>).

The Scientist and Engineer's Guide to Digital Signal Processing (by Steven W. Smith, Ph.D. <http://www.dspguide.com/pdfbook.html>).