Mth 622: Advanced Differential Equations - II

Instructor: Dacian N. Daescu
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Office Hours: 12:30 - 13:30 TR. Also by appointment.

Class Time and Location: TR 14:00 - 15:15; SRTC, room 139B

Textbook: No textbook is required. Lectures will cover topics selected from the list of references.

References:

Functional Analysis, Sobolev Spaces and Partial Differential Equations
Haim Brezis, Springer 2010.

Partial Differential Equations
Lawrence C. Evans, Graduate Studies in Mathematics vol. 19, American Mathematical Society 1998.

Partial Differential Equations: Methods and Applications
Robert McOwen, 2nd Ed., Prentice Hall 2003.

Elliptic Partial Differential Equations of Second Order
D. Gilbarg and N.S. Trudinger, Springer-Verlag 1983.

Final Examination: Monday, March 14, 10:15–12:05, in class

Course web site: Lecture notes, homework assignments, and other information about the course will be available on the web site: http://www.web.pdx.edu/∼daescu/mth622.html
Students are responsible for checking this site on a regular basis.

Course Description: The course will cover modern theory and applications of partial differential equations. Topics will be selected from:

Sobolev compact embeddings, weak convergence, reflexive spaces, Poincaré inequality in $H^1(\Omega)$, applications.

Spectral theory of elliptic operators: self-adjoint and compact operators on Hilbert spaces, Hilbert-Schmidt theorem, applications.

Optimization approach to spectral analysis, max-min characterization of eigenvalues; Ritz-Galerkin approximation to weak solutions.

Linear evolution equations: parabolic and hyperbolic equations, weak solutions, energy estimates, existence and uniqueness of solution. Contraction semigroups, Hille-Yosida theorem.

Maximum principles for elliptic and parabolic problems (if time allows).

Additional topics may be covered to accommodate students'interests

Student Learning Objectives: To become familiar with fundamental topics in the modern theory and solution techniques for PDEs; to build the skills and understanding necessary to pursue research in PDEs.

Prerequisites: Mth 621.

Grading Policy: The final grade will be based on homework and a final project, as follows:

1. **Homework, 75% of the course grade**. Three sets of problems will be assigned as homework.
2. **Project, 25% of the course grade**. Each student is required to complete a project assignment divided into two parts: written report and in-class presentation.

In assigning final course grades, plus/minus grading will be used.

Main criteria for evaluating your work will be: correctness, completeness, and *clarity* of the presentation.

Working in team for your homework and project is encouraged *only if each student in the team is contributing to the problem solving.*

Special requests: If you require special arrangements for seating, testing or other class requirements, please contact me after class or during my office hours.