



Course Syllabus
MA5629 – Numerical PDEs
College of Science and Arts
Fall 2016

Instructor Information

Instructor: Benjamin Ong
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Course Identification

Course Number: MA5629
Course Name: Numerical PDEs
Course Location: Fisher 327B
Class Times: TR 8:05 am – 9:20 am

Course Description/Overview

Analysis and design of algorithms for the numerical solution of partial differential equations.

Course Learning Objectives

1. Exposure to a broad range of numerical techniques for solving PDEs
2. Mathematical theory behind finite element methods

Course Topics

The course topics will cover a subset of the “PDEs/Numerical PDEs” qualifying exam.

1. Finite Difference/Finite Volume Methods
 - a. Common FD/FV methods for: Poisson, heat, wave and advection equations
 - b. Incorporation of boundary and initial data
 - c. Stability, consistency and convergence
 - d. Fourier stability analysis of one-step schemes
2. Finite Element Methods
 - a. Weak formulation of a second order elliptic BVP. (Existence and uniqueness of solutions, Riesz representation theorem, Lax-Milgram Theorem)
 - b. Galerkin and related methods for approximation (Cea’s Lemma)
 - c. Various types of elements (Lagrange, tetrahedral, tensor product rectangles, isoparametric)
 - d. Convergence of Galerkin FEM

Course Resources

Course Website(s)

<http://mathgeek.us/teaching/ma5629-2016-3/index.html>

Required Course Text

The Mathematical Theory of Finite Element Methods, Brenner & Scott

ISBN: 978-1-4419-2611-1. Ebook available for free:

<https://services.lib.mtu.edu/login?url=http://link.springer.com/book/10.1007%2F978-0-387-75934-0>

Grading Scheme

Grading

Homework	60%
Project	20%
Final	20%
Total Points	100%

Course Policies

Working together on HW is encouraged. You need to make sure that you understand your individual submissions. Exams dates and schedule to be determined.

Collaboration/Plagiarism Rules

Exams are individual exercises you need to complete without external assistance. Exams dates and schedule to be determined.

University Policies

Student work products (exams, essays, projects, etc.) may be used for purposes of university, program, or course assessment. All work used for assessment purposes will not include any individual student identification.

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