

Syllabus: MA 4411 Numerical Analysis Of Differential Equations, D-term, Spring 2017

(CRN 23144 for registration on bannerweb)

Professor: Zhongqiang Zhang

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Office hours: Tuesday 3:00-3:50pm, Thursday 3:00-3:50pm and by appointment

Class meetings: MTRF 2:00-2:50pm SH304

Required textbook No

Recommended reference A First Course in the Numerical Analysis of Differential Equations by Iserles, Cambridge university press.

Solving Ordinary Differential Equations I: Nonstiff Problems by Hairer, Nørsett, and Wanner, Springer.

Grading

Homework = 30% (weekly)

Midterm = 30% (on April 07, Friday in class)

Final project = 40% (Due on May 02 in class)

Grades are given as follows: A (90 – 100), B (80 – 89), C (65 – 79), and NR otherwise.

Course description

This course is concerned with the development and analysis of numerical methods for differential equations. Topics covered include: well-posedness of initial value problems, analysis of Euler's method, local and global truncation error, Runge-Kutta methods, higher order equations and systems of equations, convergence and stability analysis of one-step methods, multistep methods, methods for stiff differential equations and absolute stability, introduction to methods for partial differential equations.

Recommended background: MA 2071 and MA 3457/CS 4033. An ability to write computer programs in MATLAB is assumed.

Course outline:

Week 1 Introduction to ODEs and numerical ODEs

Week 2 One-step schemes: Explicit schemes and implicit schemes; linear stability

Week 3 Multi-steps schemes: Explicit schemes and implicit schemes; zero-stability

Week 4 Finite difference methods for wave equations, stability and dispersion analysis

Week 5 Finite difference/element methods for two-point boundary values problems

Week 6 Finite difference/element methods for boundary value problems in 2D

Week 7 Finite difference/element methods for heat equation

Homework

Problems will be posted on myWPI (canvas). Make sure that you turn in your homework on

time as late homework will not be accepted and will be graded as zero. If you have to miss the class on Thursday, turn in your homework to me either on Monday or on Tuesday.

There will be coding assignments in the homework. You are expected to email me your code and your solutions to the assigned problems.

You are encouraged to discuss homework problems. But you are expected to write your own homework in your own words.

Homework will be due in class on Thursdays.

Final project

You are expected to hand in your report no later than May 02 in class. There will be four or five groups and thus four/five oral presentations. Each team will present their study to the rest of class and spend some time to answer questions.

Some statements

You are encouraged to attend all the lectures. Though lecture attendance will not be monitored, you will be responsible for knowing everything delivered in class.

Cell phones and all electric devices should be turned off or muted.

Disability services

If you are eligible for course adaptations or accommodations because of a disability or if you have medical information to share with me about, please make an appointment with me as soon as possible. If you are not sure about the eligibility for course adaptations or accommodations, please contact the Disability Services Office (DSO), which is located in the Student Development and Counseling Center, 124 Daniels Hall and the phone number is 508-831-4908, e-mail is DisabilityServices@wpi.edu. See also <https://www.wpi.edu/offices/office-disability-services> for resources.

Academic honesty

Each student is expected to familiarize him/herself with WPI's Academic Honesty policies which can be found at <https://www.wpi.edu/about/policies/academic-integrity>. All acts of fabrication, plagiarism, cheating, and facilitation will be prosecuted according to the university's policy. If you are ever unsure as to whether your intended actions are considered academically honest or not, please contact me.