ACMS 40390: Syllabus

Instructor: Martina Bukač, e-mail: mbukac@nd.edu

Office hours: Th 9:30 -11:30 AM in Hurley Hall 158

TA: Adrian Navarro, e-mail: anavarr5@nd.edu

TA office hours: Wed 12:30-2:30 PM in Hayes Healy Center 215.

Class time and location: MWF 11:30 AM to 12:20 PM in Haggar Hall 117.


Prerequisites: ACMS 20750 OR MATH 20750 OR MATH 20860 OR MATH 30650. The course requires a certain amount of programming. You may use software programs including Python, C, C++, FORTRAN and Matlab.

Course Description: This course is an introduction to the numerical analysis. The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer.

Main Topics:

1. Preliminaries of Computing
   a) Basic concepts: round-off errors, floating point arithmetic, Convergence.

2. Numerical solution of Nonlinear Equations
   a) Bisection method, fixed-point iteration, Newton’s method.
   b) Error analysis for Iterative Methods.
   c) Computing roots of polynomials.

3. Interpolation and Polynomial Approximation
   a) Lagrange Polynomial
   b) Divided Differences
   c) Hermite Interpolation

4. Numerical integration and differentiation
   a) Trapezoidal rule, etc., Gaussian quadrature and Euler-Maclaurin formula.

5. Applied Linear Algebra
   a) Direct methods for solving linear systems, numerical factorizations.
   b) Eigenvalue problems.

6. IVP problems for ODE
   a) Euler’s Taylor, Runge-Kutta, and multistep methods. Stability.

7. Numerical linear algebra
   a) Direct methods
   b) Iterative methods

8. Approximation theory
   a) Least square approximation
9. Approximating Eigenvalues
   a) Power method, Householder’s method

10. BVP for ODE
   a) Shooting methods

**Grading scheme:**
Two in class exams: 200 points (100 points each)
Homework: 100 points
Computer projects: 100 points
Final Exam: 150 points

**Homework:** Homework is assigned within each lecture. The homework assigned within a week is due on the next Friday. By this way you can work on the problems over the weekend, and seek help if necessary.

**Computer Projects:** Computer projects must be done individually and will be collected electronically via Sakai. Instructions for using university computers and submitting computer codes will be given.

**Grading Policy:**
1) For an unexcused late homework or computer projects, there will be a 20% penalty for 1 to 7 days late. Holidays, Saturdays and Sundays are included in the counting.
2) An unexcused homework or computer project that is late for 8 days or more will receive no credit.

**Important dates:**
First in class exam: 09/21 (F)
Second in class exam: 10/31 (W)
Final comprehensive exam: Place and time to be announced

**Attendance:** You are expected to attend every class including your assigned tutorials. Excessive absences may result in lowering your grade and even failing the course.

**Missed Exams:** There will be two midterm exams and a final exam. A student who misses an examination will receive zero points for that exam unless he or she has written permission from the Vice president for residential life. If you have a valid excuse (illness, excused athletic absence etc) for missing an exam, please see me ASAP (before the exam) and a makeup exam will be scheduled.

**Exam conflicts:** Conflicts with the exams in other courses must be resolved during the first week of classes. Exams may be made up only with an excused absence from the Assistant Vice President for Residence Life.

**Honor Code:** As a member of the Notre Dame community, I will not tolerate academic dishonesty. All examinations, homework and computer projects are conducted under the Honor Code. You are encouraged to work together on the homework assignments and projects, but copying in any form or submitting work done by others as your own is a violation of the Honor Code. Examinations are closed book and are to be done completely by yourself.