Department of Mathematics & Statistics
Concordia University

MATH 354 (MAST 334)
Numerical Analysis
Fall 2015

Instructor*: _____

Office/Tel No.: _____

Office Hours: _____

*Students should get the above information from their instructor during class time. The instructor is the person to contact should there be any questions about the course.

Course Examiner: Dr. A. Shnirelman

Objectives: Numerical analysis deals with the approximate numerical solutions of the problem whose exact solution is either impossible or unreasonably complicated. Thus, numerical analysis is an interface between the theoretical mathematics and its innumerable applications. In this courses the students will learn how to solve the basic numerical problems. This will require some advanced analytical tools, and the use of powerful computational systems for the actual computations.

Texts:

1. *Numerical Analysis*, by R. Burden and D. Faires, 9th Edition, Brooks/Cole, Cengage Learning, 2011. Copy of the textbook is reserved or the course in Concordia Webster Library, LB building.

2. *Numerical Analysis*, course-pack, by D. Dryanov, Concordia University, 2013. It contains the basic theory, exercise problems and Maple codes.

Assignments: Students are expected to submit assignments weekly. Assignments are very important as they indicate the level of difficulty of the problems that students are expected to solve and understand them independently. The assignments will be corrected and graded. These grades together are worth a maximum of 10% of the final grade. The assignment problems and solutions to the assignment problems will be posted on Moodle.

Project: Each student will be given an individual project (i.e. different students will be given different problem). The project is more serious than just another assignment problem, it requires a combination of two or more

methods in one problem. The take home projects will be given during week 8 for one week.

Final Grade: The highest of the following: (10% assignments + 20% project + 70% final exam) or (10% assignments + 90% final exam).

Software: This course assumes extensive numerical computations. Simple calculators are not adequate for its purposes. So, the students are supposed to download and install a free computational system FreeMat, (or Octave, or Scilab) on their personal computers, or/an MathMatiz on their mobile phones. Of course, Matlab is the best. No preliminary knowledge of programming is assumed; instructors will help you with downloading and installing the programs, and explain how to use them.

Calculators: Only calculators approved by the Department (with a sticker attached as proof of approval) are permitted in the class test and final examination. The preferred calculators are the **Sharp EL531** and **Casio FX 300MS**, available at the Concordia Bookstore.

Plagiarism: Cases of plagiarism (including the assignments, the midterm test and the final exam) will be treated according to the University policy.

Week	Topics
1	Introduction: the purpose of Numerical Analysis; a bit of its history. Approximate numbers, absolute and relative error. Two souses of errors, roundoff error (numerical noise) and error of a numerical method. Error behaviour under arithmetic operations. Numeric algorithms, their convergence and stability. Pitfalls of instability. Function computation by the Taylor series and the remainder estimate.
2	Location of solutions of non-linear equations in intervals; Bisectional method; Fixed-point method.
3	Newton-Raphson and Secants Methods.
4	Error analysis for iterative methods, order of convergence, Accelerated convergence – Aitken's method, Steffenson's method
5	Polynomial interpolation; Lagrange interpolating polynomial; interpolation error. Divided difference and Newton interpolation formula. Interpolation in tables.
6	Interpolation by trigonometric polynomials; discrete Fourier transform. Chebyshev polynomials as projection of trigonometric polynomials. Minimal property of the Chebyshev polynomial and the error estimate of the Chebyshev interpolation.

7	Cubic Spline interpolation.
8	Approximation by trigonometric polynomials: Best continuous least squares approximants; Best discrete least squares approximants. The Legendre and Chebyshev least square approximations. Project.
9	Numerical differentiation and Richardson extrapolation.
10	Euler-McLaurin formula. Quadrature formula on the circle and its error estimate.
11	Newton-Cotes quadrature formulae, error estimate. Composite quadrature formulae.
12	Richardson extrapolation and Romberg integration method. Gaussian quadrature formulae.
13	Overview