

# Carleton University

## Department of Systems and Computer Engineering

ECOR 2606 C & D

Numerical Methods

Winter2011/12

### Course Outline

#### Instructors:

Sect	Instructor	Office	Telephone	Email
C&D	John Bryant	4246ME	520-2600 X 1375	<a href="mailto:bryant@sce.carleton.ca">bryant@sce.carleton.ca</a>

#### Course Description:

Numerical algorithms and tools for engineering and problem solving. Sources of error and error propagation, solution of systems of linear equations, curve fitting, polynomial interpolation and splines, numerical differentiation and integration, root finding, solution of differential equations. Software tools.

Precludes additional credit for SYSC 2606

Prerequisites: MATH 1005 and ECOR 1606 and (ECOR 1010 or ELEC 1908).

#### Instructional Resources:

- Course material will be posted on WebCT. The URL is <http://webct6.carleton.ca>
- Textbook: *Numerical Methods for Engineers and Scientists*, Amos Gilat and Vish Subramaniam, 2nd edition, ISBN-13 9780470565155
- Alternative Text: The material is also well covered in *Applied Numerical Methods with MATLAB* by Steven C Chapra (second or third edition). A used copy of this book is a good alternative to buying the text.

#### Grading Scheme:

Element	Dates	Weight
Lab Exams	See lab schedule (next page)	25% (5% each)
Assignments	Details TBA	10%
Midterm Exam (80 min)	Week of Feb 27 to March 2 (during a scheduled class time)	15%
Final (3 hours)	During the university's exam period	50%

a) In order to pass the course, students must pass the final exam.

b) The final examination is for evaluation purposes only and will not be shown to or returned to students.

c) There will be no alternate scheduled time for the midterm examination. Students who miss it will receive a mark of zero unless they have a legitimate reason for being absent (in which case the weight of the midterm will be added to the weight of the final examination).

#### Calculators:

Only approved calculators may be used during tests. The list of approved calculators will be posted on Web CT. Students whose calculators are not on this list may apply to have them added to it.. Any such applications must be made **well in advance** of a test. Graphing and programmable calculators will **not** be considered..

#### Health and Safety:

Every student should have a copy of our Health and Safety Manual. An electronic version of the manual can be found at <http://www.sce.carleton.ca/courses/health-and-safety.pdf>

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**Lab Schedule:**

Lab No		L3, L4, L6 (M)	L1, L5 (T)	L2 (W)	L7 (Th)
1		Jan 16	Jan 17	Jan 18	Jan 19
2		Jan 23	Jan 24	Jan 25	Jan 26
3	Exam #1	Jan 30	Jan 31	Feb 1	Feb 2
4		Feb 6	Feb 7	Feb 8	Feb 9
5	Exam #2	Feb 13	Feb 14	Feb 15	Feb 16
6		Feb 27	Feb 28	Feb 29	Mar 1
7	Exam #3	Mar 5	Mar 6	Mar 7	Mar 8
8		Mar 12	Mar 13	Mar 14	Mar 15
9	Exam #4	Mar 19	Mar 20	Mar 21	Mar 22
10		Mar 26	Mar 27	Mar 28	Mar 29
11	Exam #5	Apr 2	Apr 3	Apr 4	Apr 5

**Outline:**

Topic	Text	Chapra 2nd ed
Introduction		Ch 1
Root Finding - Matlab: the basics, functions, vectors, plotting, fzero - Theory: Bisection, Secant Method, Newton's Method	Appendix A, Ch 3	Ch 2, 3, 5, 6
Minimization / Maximization - Matlab: fminbnd - Theory: Golden Section Searches	Not covered	Ch 7
Systems of Linear Equations (Direct methods) - Matlab: matrices, left division, inv, lu - Theory: Gaussian elimination, Gauss-Jordan elimination numerical errors, matrix condition, matrix inverse, LU Factorization	Ch 4.1-4.6, 1.2-1.3, 4.8- 4.11	Ch 8, 9, 4, 10, 11, 12 (Gauss- Jordan not covered)
Systems of Linear Systems (Iterative methods)	Ch 4.7	Ch 12
Regression (Linear and General Least Squares) - Matlab: polyfit, left division, qr - Theory: least squares, QR factorization	Ch 5.1-5.4	Ch 13, 14
Interpolation - Matlab: polyfit, interp1 - Lagrange polynomial, Newton's polynomial, splines	Ch 5.5 - 5.6	Ch 15, 16
Numerical Integration - Matlab: trapz, quad - Theory: trapezoidal integration, Simpson's rules, Richardson extrapolation (Romberg integration)	Ch 7	Ch 17, 18
Numerical Differentiation - Matlab: diff, gradient - Theory: forward, backward, and central difference formulas, Richardson extrapolation	Ch 6	Ch 19
Differential Equations - Matlab: ode23, ode45 - Theory: Euler's method and improvements on it	Ch 8	Ch 20

**Course Outline**

**Students with Disabilities:**

Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities for a formal evaluation of disability-related needs. Registered PMC students are required to contact the Centre, 613-520-6608, every term to ensure that I receive your Letter of Accommodation no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you require accommodation for your formally scheduled exam in this course, please submit your request for accommodation to PMC by March 7th, 2012.