

# MATH 6020 – Scientific Computing Fall 2016

Department of Mathematics and Statistics, University of Guelph

**Instructor:** A. Willms, MACN 512, ext. 52736

**Office Hours:** Mon. 13:00–15:00

**Lectures:** MWF 9:30–10:20 in MACS 301

**Web Site:** University's CourseLink system, <http://www.courselink.uoguelph.ca/>.

## Calendar Description

This course covers the fundamentals of algorithms and computer programming. This may include computer arithmetic, complexity, error analysis, linear and nonlinear equations, least squares, interpolation, numerical differentiation and integration, optimization, random number generators, Monte Carlo simulation; case studies will be undertaken using modern software.

## Objectives

This course typically has students from a broad range of backgrounds. The objective is to teach students basic programming skills and introduce them to a number of different numerical algorithms for the solution of scientific programming problems.

## Topics

We will mostly cover linear algebra topics including QR factorization and least squares minimization, eigenvalues and the singular value decomposition. A significant portion of the course will be devoted to iterative methods to solve linear systems.

## Resources

Much of the material in the course will come from the text

- *Numerical Linear Algebra*, L.N. Trefethen and D. Bau III, SIAM, Philadelphia, 1997.

This text is on reserve in the library. If you want your own copy of this excellent text, I noticed some on Amazon for about \$55.

The material on iterative methods will come primarily from the following two texts, which are also available on course reserve:

- *Iterative Methods for Sparse Linear Systems*, 2nd edition, Y. Saad, SIAM 2003.
- *Templates for the Solution of Linear Systems*, 2nd edition, R. Barrett et al., SIAM, 2006.

Other texts that are on reserve and would be useful references include:

- *Numerical Analysis*, 8th edition, R. Burden and D. Faires, Thompson Brooks/Cole, 2005.
- *Numerical Analysis*, 2nd edition, T. Sauer, Pearson, 2012.
- *Accuracy and Stability of Numerical Algorithms*, 2nd edition, N. Higham, SIAM, Philadelphia, 2002.

In addition, several texts to help with programming in C or Fortran are on reserve (the two Fortran books are e-books).

- *Introduction to programming with Fortran with coverage of Fortran 90, 95, 2003, 2008 and 77* I.D. Chivers and J. Sleighthome, Springer, London, 2012.
- *Fortran 95 including Fortran 90, details of High Performance Fortran (HPF), and the Fortran module for variable-length character strings* M. Counihan, UCL Press, London, 1996.
- *The C programming language* 2nd edition, B.W. Kernighan, D.M. Ritchie, Prentice Hall, Englewood Cliffs, N.J., 1988.

## Evaluation

The three assignments and final take home exam will all contain a significant programming component. You will be required to write and submit computer code written in either C or Fortran.

Assessment	date	weight
3 Assignments	7 Oct., 31 Oct., 25 Nov., 9:30 a.m.	60%
Take-home Final Exam	Issued 2 Dec. Due 12 Dec., 4:30 p.m.	40%

## University Policies

### E-mail Communication

All students are required to check their University of Guelph e-mail account regularly; e-mail is the official route of communication between the University and its students.

### Academic Accommodation of Religious Obligations

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:

[http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec\\_d0e2268.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2268.shtml)

### Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:

[http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec\\_d0e2232.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2232.shtml)

### Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Graduate Calendar:

[http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec\\_d0e2709.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2709.shtml)

### Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. For more information, see:

[http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec\\_d0e2395.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e2395.shtml)

### Drop date

The last date to drop one-semester courses, without academic penalty, is the 40th day of classes. See the Graduate Calendar Schedule of Dates:

<http://www.uoguelph.ca/registrar/calendars/graduate/current/sched/index.shtml> (If you are incapable of determining the date of the 40th day of classes, despite all this information, then you probably should not be taking this course.)

### Recording of Materials

Presentations which are made in relation to course work, including lectures, cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a student, or guest lecturer. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the presenter.