

Western University  
Applied Mathematics 3611F  
Introduction to Object Oriented Scientific Programming  
Course Outline Fall 2015

**Instructor:** Dr. Zinovi Krougly, Office WSC 270  
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**Class Times:** M W F 8:30 - 9:30 a.m. in MC 17

**Office Hours:** M W F 9:30 – 10:30 a.m. in WSC 270 or by appointment

**Prerequisite(s):** Calculus 1301A/B, 1501A/B, or Applied Mathematics 1413;  
Applied Mathematics 2413, 2415, or 2813B.

**Textbook: None**

**Course Web Site:** a set of C++ topics, source codes, and a PDF version of lecture notes will be given on the course website <http://owl.uwo.ca>

**Course Description:** Basic introduction to C++, review of numerical methods applicable to problems in linear algebra and differential equations, introduction to the concept of object-oriented programming techniques, applications to scientific computation.  
Grade is based upon assignments / quizzes, two projects and a presentation.

**Course Outline by Topical Areas:**

- An Overview of Programming Languages
- Object-Oriented Programming and C++
- Basic C++, Fundamental Types and Basic Operators
- Functions, Recursion, Iteration Technique
- Vectors and Arrays, Pointers and References, Dynamic Memory Allocation
- Structures, Classes, Friends, Overloading Operators, Inheritance
- Templates, Standard Library
- Input and Output, Testing and Debugging
- Numerical Integration
- Complex Analysis
- Matrix Computations, System of Linear Equations
- Numerical Methods for Differential Equations
- Optimization
- C# (CSharp) application for the .NET Platform

**Projects and Optional:**

Computer algebra system, Partial differential equations, Eigensystem, Optimization, Quadratic programming,  
Portfolio optimization, Statistics, Interface Matlab with C++, Simulating and numerical computing, High precision software,  
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Applications in Physics, Biomedicine, Economics, Financial Modeling, Environmental Science, etc.

### ***Method of Evaluation:***

5%	Assignment 1 – September 30, 2015
5%	Assignment 2 – October 16, 2015
20%	Programming project 1 - October 30, 2015
5%	Assignment 3 – November 18, 2015
45%	Programming project 2 – November 25, 2015
10%	Presentation – December 2, 4, 7, 9, 2015
10%	In Class Portion

***In class portion:*** The in class portion of your grade will be determined by your instructor, and may include points for participation, in class quizzes, etc.

### **Optional Reading and References:**

There are a large number of C++ books; here is a list of some that I have found useful.

1. Joyce Farrell, Object-Oriented Programming Using C++, Fourth Edition. Course Technology, 2009, ISBN 13: 978-1-4239-0257-7
2. Introducing C++ for Scientists, Engineers and Mathematicians, by D. Capper, 2<sup>nd</sup> edition, Springer, 2001.
3. C++ How to Program, by H. Deitel and P. Deitel, Prentice Hall, 4<sup>th</sup> edition, 2004.
4. Engineering Problem Solving with C++, 2<sup>nd</sup> ed., by D. Etter and J. Ingber, Pearson, 2008.
5. Essential C++ for Engineers and Scientists, by J. Hanly, Addison Wesley, 1997.
6. C++ for everyone, by C. Horstmann, Wiley, 2009.
7. Solving PDEs in C++: Numerical Methods in a Unified Object-Oriented Approach, by Y. Shapira, SIAM, Society for Industrial and Applied Mathematics, 2006.
8. Problem Solving with C++, by W. Savitch, 8th ed., Addison Wesley, 2012.
9. C++ and Object Oriented Numeric Computing for Scientists and Engineers, by D. Yang, 2001.
10. A First Course in Computational Physics and Object-Oriented Programming with C++, by David Yevick, Cambridge University Press, 2005.

### **Addendum to all Applied Mathematics Course Outlines:**

The UWO Senate Academic Handbook has specified that the following points should be added to all course outlines:

Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information: <http://www.uwo.ca/univsec/handbook/appeals/medical.pdf>.

A student requiring academic accommodation due to illness, should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's

Office) for visits to Student Health Services. The form can be found here:  
[https://studentservices.uwo.ca/secure/medical\\_document.pdf](https://studentservices.uwo.ca/secure/medical_document.pdf)