

**COMP ENG 3SK3**  
Computer-Aided Engineering

**COURSE OUTLINE**

Please refer to course website for updated information.

**COURSE DESCRIPTION**

Numerical analysis; linear and nonlinear systems; least squares; polynomials, optimization; numerical integration and differentiation; interpolation; engineering applications.

**PRE-REQUISITES AND ANTI-REQUISITES**

Pre-requisite(s): ELECENG 2CJ4; and MATH 2Z03  
Anti-requisite(s): SFWRENG 3X03, 4X03, COMPSCI 4X03

**SCHEDULE**

**Lectures:** Tuesday, Wednesday & Friday 9:30am – 10:20am (TSH-B128)  
**Tutorial:** Tuesday 11:30am – 12:20pm (JHE-376)  
**Labs:** (None)

**INSTRUCTOR**

**Dr. Xiaolin Wu**  
ITB-A315  
xwu@mail.ece.mcmaster.ca  
905-525-9140 ext. 24190

**Office Hours:**  
By appointment

**TEACHING ASSISTANTS**

Contact information and office hours for the TAs are provided on the course website.

**COURSE WEBSITE**

<http://www.ece.mcmaster.ca/~xwu>  
<http://avenue.mcmaster.ca/>

**COURSE OBJECTIVES**

By the end of this course, students should be able to:

- Learn computer-aided techniques (numerical methods)
- Apply computer-aided techniques to practical engineering problems
- Reinforce programming skills by implementing computer-aided techniques.

**ASSUMED KNOWLEDGE**

Calculus, basic matrix operations, ordinary differential equations, and circuit analysis.

**COURSE MATERIALS**

**Required Texts:** (Any one of the two below)

[1] Steven Chapra and Raymond Canale, Numerical Methods for Engineers, 6th Edition, McGraw-Hill, 2014.

[2] Steven Chapra and Raymond Canale, Numerical Methods for Engineers, 7th Edition, McGraw-Hill, 2015.

**Calculator:**

Only the McMaster Standard Calculator (Casio FX-991 MS or MS Plus) will be permitted in tests and examinations. This is available at the Campus Store.

**COURSE OVERVIEW**

Date/Week	Topic	Readings
1	Computer representation of numbers and errors	Text Ch. 3, lecture notes
2	Taylor series	Text Ch. 4, lecture notes
3	Roots of nonlinear equations	Text Ch. 5-6, lecture notes
4	Roots of polynomials	Text Ch. 7, lecture notes
5	One-dimensional unconstrained optimization	Text Sec. 13.1, 13.3, lecture notes
6	Multi-dimensional unconstrained optimization	Text Ch.14, lecture notes
7	Numerical differentiation	Text Sec. 23.1, lecture notes
8	Numerical integration	Text Sec. 21.1-21.2, Ch.22, lecture notes
9	Linear algebraic equations	Text Ch. 9-11, lecture notes
10	Singular value decomposition	Lecture notes
11	Least-squares regression	Text Sec. 17.1-17.4, lecture notes
12	Interpolation	Text Sec. 18.1-18.3, 18.6, lecture notes
13	Numerical solutions of ordinary differential equations	Text Sec. 25.1-25.4, Ch.26, lecture notes

**ASSESSMENT**

Component	Weight
Projects (2)	20 %
Tests (2)	20 %
Final Exam	60 %
Total	100%

Late submissions of assignments or project report are subject to 20% penalty per day (less than one day is counted as one day).

No make-up midterm tests will be granted. Weight of a missed midterm test will be transferred to final exam.

A passing grade is required for the exam in order to pass the course.

### ACCREDITATION LEARNING OUTCOMES

Note: The *Learning Outcomes* defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student's actual grade in the course. For more information on accreditation, please ask your instructor or visit: <http://www.engineerscanada.ca>.

Outcomes	Indicators	Measurement Methods(s)
Demonstrate knowledge in mathematics on selected subjects, including solving a set of 2 or 3 simultaneous linear equations analytically, solving one-dimensional and two-dimensional unconstrained optimization problems, solving ordinary differential equations of special forms, expanding functions into Taylor series and applying Taylor theorem.	1.1	Project/test/exam
Demonstrate ability to select appropriate numerical methods when solving a certain type of problems.	2.2	Project/test/exam
Demonstrate ability to estimate accuracy and errors in numerical calculations, for example truncation errors in numerical integration and differentiation and absolute and relative errors of an estimated root of a nonlinear equation, and the ability to apply appropriate numerical methods to achieve required accuracy.	3.3	Project/test/exam
Proposes solutions to open-ended problems.	4.3	Project/test/exam
Critically evaluate and applies knowledge, methods and skills procured through self-directed and self-identified sources, including those that lie outside the nominal course curriculum, so that to apply appropriate numerical methods in solving practical electrical and computer engineering problems.	12.1	Project/test/exam

### ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of

credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at <http://www.mcmaster.ca/academicintegrity>

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

#### **ACADEMIC ACCOMMODATIONS**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca) . For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to the Engineering Student Services office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations.

Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

#### **NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK**

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work": <http://www.mcmaster.ca/msaf/>

#### **NOTICE REGARDING POSSIBLE COURSE MODIFICATION**

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

#### TURNITIN.COM STATEMENT

In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically to Turnitin.com and in hard copy so that it can be checked for academic dishonesty. Students who do not wish to submit their work to Turnitin.com must still submit a copy to the instructor. No penalty will be assigned to a student who does not submit work to Turnitin.com. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, etc.). To see the Turnitin.com Policy, please go to <http://www.mcmaster.ca/academicintegrity/>.

#### ON-LINE STATEMENT FOR COURSES REQUIRING ONLINE ACCESS OR WORK

In this course, we will be using Avenue To Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

#### REFERENCE TO RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to <http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf>.