

COMP ENG 3SK3 Section/s: C01 Academic Year: 2023/2024 Term: Winter

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

Prerequisite(s): ELECENG 2CJ4; and MATH 2Z03 Antirequisite(s): SFWRENG 3X03, 4X03, COMPSCI 4X03

SCHEDULE

Lectures: Monday, Tuesday, Thursday, Friday 11:30 – 12:20 Tutorial: Tuesday 17:30 – 18:20 Labs: (None)

INSTRUCTOR

Dr. Xiaolin Wu ITB-A315 xwu@mail.ece.mcmaster.ca 905-525-9140 ext. 24190 **Office Hours:** By appointment

TEACHING ASSISTANTS

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	Торіс	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 (3)	30 %
In-class tests (3)	30 %
Final exam	40 %
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: <u>http://www.engineerscanada.ca</u>.

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 differentiate equations of special formats, expanding functions into Taylor serious 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 <u>sas@mcmaster.ca</u>. 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.



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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.

www.eng.mcmaster.ca/ece

Electrical and Computer Engineering Lab Safety



Information for Laboratory Safety and Important Contacts

This document is for users of ECE instructional laboratories in the Information Technology Building (ITB).

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

- 1. Food and beverages are not permitted in the instructional laboratories.
- 2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
- 3. Laboratory equipment should only be used for its designed purpose.
- 4. Proper and safe use of lab equipment should be known before using it.
- 5. The course TA leading the lab should be informed of any unsafe condition.
- 6. The location and correct use of all available safety equipment should be known.
- 7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
- 8. Proper waste disposal procedures should be followed.

Location of Safety Equipment

Fire Extinguisher On walls in halls outside of labs **First Aid Kit** ITB A111, or dial "88" after 4:30 p.m.

Telephone On the wall of every lab near the door Fire Alarm Pulls Near all building exit doors on all floors



Who to Contact

<u>Emergency Medical / Security</u>: On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.

Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.

<u>University Security (Enquiries / Non-Emergency)</u>: Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.

<u>See TA or Instructor</u>: For problems with heat, ventilation, fire extinguishers, or immediate repairs <u>Environmental & Occupational Health Support Services (EOHSS)</u>: For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.

<u>ECE Specific Instructional Laboratory Concerns</u>: For non-emergency questions specific to the ECE laboratories, please contact 24103.

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!

2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.

3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!

4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm. 5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.

6. Do not attempt to fight a major fire on your own.

7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people

1. Douse with water from safety shower immediately or

2. Roll on floor and scream for help or

3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.



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Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:

- 1. Immediately discontinue use of the equipment.
- 2. In Power Lab, press wall-mounted emergency shut-off button.
- 3. Inform your TA of the problem.
- 4. Wait for further instructions from your TA.
- 5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask a TA!

Defined Roles

ТА	The first point of contact for lab supervision		
ECE Lab Supervisor	Steve Spencer- ITB 147	steve@mail.ece.mcmaster.ca	
ECE Chair	Tim Davidson- ITB A111	davidson@mcmaster.ca	
ECE Administrator	Kerri Hastings- ITB A111	hastings@mcmaster.ca	
ECE Course Instructor	Please contact your specific course instructor directly		