COMPENG 2SH4
Principles of Programming

COURSE OUTLINE

Please refer to course website for updated information.

COURSE DESCRIPTION

Fundamental concepts of programming languages: data types, assignment, control constructs, basic data structures, iteration, recursion, exceptions; imperative and object-orientated paradigms; composing and testing small programs.
Three lectures, one tutorial, one lab (every other week); first term.

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): ENGINEER 1D04 or ENGINEER 1P13 and registration in a program in Electrical and Computer Engineering or Integrated Biomedical Engineering and Health Science (IBEHS) program.

Antirequisite(s): COMPSCI 1XC3, COMPSCI 2S03, SFWRENG 2S03, and SFWRENG 2XC3

SCHEDULE and MODE OF DELIVERY

The material for this course will be delivered in a semi-flipped classroom arrangement - pre-lecture online videos, in-person lectures with coding activities, in-person tutorials with live coding practice, and asynchronous laboratories and project activities with selected in-person feature-based demos. Unless otherwise announced, lectures and tutorials will not be recorded by default.

Lecture:

Section C01 – Mondays and Thursdays 1:30 pm – 2:20 pm, Tuesdays 12:30 pm – 1:20 pm, in-person semi-flipped classes.

Section C02 – Mondays and Thursdays 9:30 am – 10:20 am, Wednesdays 1:30 pm – 2:20 pm, and Thursdays 1:30 pm – 2:20 pm – In-person, semi-flipped classes.

Tutorial:

Section T01 – Wednesdays 1:30 pm to 2:20 pm– In-person.

Section T02 – Wednesdays 10:30 am to 11:20 am – In-person.

Lab: Asynchronous lab sessions start on Sep. 3, 2024 (Week 1). However, project preparation activities (PPAs) would require in-person feature-based demos that would take place in the designated lab times which are given below.

L01 Fridays 2:30 pm – 5:20 pm of Weeks 2, 4, 6, 8, 10, 12
L02 Wednesdays 2:30 pm – 5:20 pm of Weeks 3, 5, 7, 9, 11, 13
L03 Wednesdays 2:30 pm – 5:20 pm of Weeks 2, 4, 6, 8, 10, 12
L04 Wednesdays 2:30 pm – 5:20 pm of Weeks 3, 5, 7, 9, 11, 13
L05 Fridays 2:30 pm – 5:20 pm of Weeks 2, 4, 6, 8, 10, 12
L06 Mondays 2:30 pm – 5:20 pm of Weeks 3, 5, 7, 9, 11, 13
L07 Fridays 2:30 pm – 5:20 pm of Weeks 2, 4, 6, 8, 10, 12
L08 Mondays 2:30 pm – 5:20 pm of Weeks 3, 5, 7, 9, 11, 13
L09 Tuesdays 2:30 pm – 5:20 pm of Week 2, 4, 6, 8, 10, 12
L10 Tuesdays 2:30 pm – 5:20 pm of Week 3, 5, 7, 9, 11, 13

INSTRUCTOR

Dr. Scott Chen
E-mail: chenw184@mcmaster.ca
Office: ITB-A316
Phone: 905-525-9140 ext.26063
Office Hours: see course website for details

TEACHING ASSISTANTS

Names, contact information and office hours are provided on the course website.

COURSE WEBSITE/S

http://avenue.mcmaster.ca

COURSE OBJECTIVES

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

- Recognize and use fundamental program design concepts – procedural programming in C, and object-oriented programming in C++.
- Master the C syntax, write C programs, and become proficient in using programming tools such as C functions, arrays, pointers, strings, structures, and dynamic memory allocation.
- Master the C++ syntax, write C++ programs, and become proficient in using programming tools such as C++ functions, arrays, classes and objects.

- Acquire hands-on experience for designing, implementing, and debugging computer programs in C and C++.
- Recognize the fundamental computer memory structure and acquire basic skills in memory management strategies using compiled programming language without automated memory management modules.
- Gain experience in the practical software development lifecycle and sustainable incremental engineering design process and workflow.
- Gain practical skills to write working programs to solve engineering problems, including testing, and debugging.

CEAB GRADUATE ATTRIBUTES (GAS)

Note: The CEAB Graduate Attributes (GAs) 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

Attributes	Indicators		Measurement Method(s)
	Number	Description	
Knowledge Base for Engineering	1.4	Competence in Specialized Engineering Knowledge	Labs, Exams
Problem Analysis	2.2	Proposes problem solutions supported by substantiated reasoning, recognizing the limitations of the solutions.	Labs, Project, Exams
Design	4.2	Explores a breadth of potential solutions, considering their benefits and trade-offs as they relate to the project requirements.	Labs, Project
Use of Engineering Tools	5.1	Evaluates engineering tools, identifies their limitations, and selects, adapts, or extends them appropriately.	Labs, Project, Exams
Use of Engineering Tools	5.2	Successfully uses engineering tools.	Labs, Project, Exams

ASSUMED KNOWLEDGE

Writing programs in Python to solve simple problems.

COURSE MATERIALS

Recommended Texts:
[1] Brian W. Kernighan, Dennis M. Ritchie “C Programming Language” 2nd edition.

[2] S. B. Zakhour, S. Kannan, and R. Gallardo, The Java Tutorial: A Short Course on the Basics, 5th Ed., Addison - Wesley, ISBN: 0132761696.

[3] Bruce Eckel, “Thinking in Java”, 4th Ed., Prentice Hall, 2006, ISBN: 0131872486.

Asynchronous Lab and Project Tools:
Software: Visual Studio Code, all details are provided in the first lab (i.e., Lab 0).

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

Other: Lecture notes, lab / project manuals, and pre-lecture videos.

COURSE OVERVIEW

Week	Topic
1-2	Introduction to C, Python to C through simple examples, basic data types in C, C functions and prototypes, C scope of fields, course project overview.
3	C primitive data types and operators, console and file I/O, selection and repetition statements; structured program development.
4	C primitive arrays, strings, qualifiers.
5	Debugging, C structures, arrays of structures, structures and functions.
6	Pointers, pass by pointer / reference / value, pointers and primitive arrays.
7	Computer memory structure, dynamic memory allocation, array of pointers.
8	C modularizations, memory management tips, Introduction to C++.
9-10	Object-oriented programming principles, C++ classes implementation, UML diagram, project briefing.
11	Array list, Array list applications.
11-12	Inheritance
12	Project sprint and debriefing. Recursion
13	Polymorphism. C++ template classes.

At certain points in the course, it may make good sense to modify the schedule. The instructor may modify elements of the course and will notify students accordingly (in class, course website).

LABORATORY AND PROJECT OVERVIEW

Lab	Topic
0	Introduction, environment setup, version control, debugger and memory profiler, and unit testing.
1	**Test-Driven Experiment –** Write simple C programs using loops and decision statements, arithmetic, relational and logic operators. **Project Preparation Activity 1 (PPA 1)** – Basic program setup and non-blocking interactive program design.
2	**Test-Driven Experiment –** Write programs using C functions and arrays. **Project Preparation Activity 2 (PPA 2)** – Animated programs and interactive design using finite state machine.
3	**Test-Driven Experiment –** Write programs using C strings, pointers, arrays of strings, dynamic memory allocation, structures. **Project Preparation Activity 3 (PPA 3)** – Interactive C Program – McMaster ECE Scavenger Hunt!
4	**Test-Driven Experiment –** Classes, arrays, and dynamic memory allocation in C++. **Mini Project (4-Week) -** Interactive C++ Program with OOD – Topic to be announced in class.

LABORATORY OPERATION

- **Lab Experiments:** Every student must conduct the lab experiment individually and asynchronously.
- TAs will be present in the lab time slots to provide help to students (in addition to their office hours). However, in-person PPA demos will take place in the lab time slots (see below).
- **Project Preparation Activities (PPAs):** Every student must conduct the project preparation activities individually and asynchronously. In-class guided development will be provided as needed. In-person feature-based evaluation will be carried out after each PPA is due (in the designated lab time slot).
- **Project:** A group project to be conducted by a team of two students asynchronously. In-class guided development will be provided as needed. Peer evaluation and teaching team evaluation will be deployed. No in-person demo is required.
- **Submission Requirements:** Students need to submit their activity outcomes (for labs and PPAs) on github classroom on the due date described in the lab/PPA manual. **No late submission will be accepted. No uncompilable solutions will be accepted.**

ASSESSMENT

Component	Weight	
Labs (5)	18 %	(Lab 0: 2%; Labs 1-4: 4% each)
Project (1) + Preparation Activities (3)	22 %	(PPAs 1-3: 4% each; Project 10%)
Mid-term Exam (1)	25 %	(Midterm will take place in Week 7)
Final Exam (1)	35 %	
Total	100 %	

Grading and Evaluation Policies

- There are five (5) labs, three (3) project preparation activities, one (1) course project, one (1) mid-term exam, and one (1) final exam to be evaluated in this course.
- Use of books, notes, other copied materials, cell phones are not allowed during exams.
- The final exam must be written else a final grade of F will be awarded with the notation DNW (Did Not Write) regardless of the student's course aggregate achieved without the final exam. Statistical adjustments (such as bell curving) will not normally be used.
- No make-up midterm tests will be granted. Weight of a missed midterm test will be transferred to the final exam only after an approved MSAF is received.
- If a student achieves a higher grade on the final exam compared to the midterm, then the midterm mark will be replaced by the final exam mark. However, this does not apply to a missed midterm exam in which case an approved MSAF will be required to transfer the midterm weight to the final exam (see the point above).
- In a case where the component weight cannot be fulfilled as a result of unforeseen and/or uncontrollable circumstance(s) in the course operation or execution, the grades assigned to that component may be pro-rated.

See Avenue to Learn for dates, times, and instructions for Midterm Exam and Final 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. It is your responsibility to understand what constitutes academic dishonesty.
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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/app/uploads/Academic-Integrity-Policy-1-1.pdf

The following illustrates only three forms of academic dishonesty:

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

Note: The use of generative AI tools (such as ChatGPT) is prohibited in this course unless explicitly allowed by the instructor. Any violation in this regard will constitute academic dishonesty.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g., A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g., e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, usernames 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online. It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g., use of Avenue 2 Learn, Microsoft Teams, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATIONS

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Students requiring academic accommodations based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty 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.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC WORK

McMaster Student Absence Form (MSAF): 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". Applicable Policy: https://secretariat.mcmaster.ca/app/uploads/MSAF-Policy-McMaster-Student-Absence-Form-Policy.pdf

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

www.eng.mcmaster.ca/ece

Electrical and Computer Engineering Lab Safety

Information for Laboratory Safety and Important Contacts

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 and online: https://hr.mcmaster.ca/app/uploads/2019/07/McMaster-Lab-Manual.pdf

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following whether conducting lab work at school or at home:

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.
9. Personal ergonomics should be practiced when conducting lab work. https://bit.ly/3fOE71E
10. Current University health and safety issues, and protocols should be known. https://hr.mcmaster.ca/resources/covid19/workplace-health-and-safety-guidance-during-covid-19/

Location of Safety Equipment

Fire Extinguisher	**First Aid Kit**
On walls in halls outside of labs	ITB A111, or dial "88" after 4:30 p.m.
Telephone	**Fire Alarm Pulls**
On the wall of every lab near the door	Near all building exit doors on all floors

Who to Contact

Emergency Medical / Security: 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.
University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.
See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs.
Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.
ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE laboratories, please contact 24103.

In Case of a Fire (On Campus 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 non-flammable 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.

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 labs, 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

In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

Defined Roles

TA	The first point of contact for lab supervision	
ECE Lab Supervisor	Steve Spencer- ITB 147	spencers@mcmaster.ca
ECE Chair	Shahram Shirani- ITB A111	shirani@mcmaster.ca
ECE Administrator	Shelby Gaudrault- ITB A111	gaudraus@mcmaster.ca
ECE Course Instructor	Please contact your specific course instructor directly	