Land Acknowledgement

We respectfully acknowledge the Syilx Okanagan Nation and their peoples, in whose traditional, ancestral, unceded territory UBC Okanagan is situated.

COSC 414/COSC 536I: Computer Graphics

Faculty: Irving K. Barber Faculty of Science

Department: Computer Science, Mathematics, Physics, and Statistics

Instructor(s): Dr. Shan Du

Instructor(s) Email: shan.du@ubc.ca

Duration: Term 2 Winter 2024

Delivery Modality: In-Person

Course Location: ART 103

Course Days: Wed/Fri

Class Hours: 3:30PM - 5:00PM

Office hours: 12:00PM - 1:00PM Wednesday on Canvas 12:00AM - 1:00AM Friday on Canvas

Prerequisites

All of COSC 221, COSC 222 and one of MATH 221, APSC 179.

Corequisites

None

Other Instructional Staff

TAs:

Xinlong Zhao, geek1234@mail.ubc.ca
Alex Xu, xpinjing@student.ubc.ca
Grace Shang, gracesqy@student.ubc.ca

Course Description

Human vision and colour, modelling, geometric transformations, algorithms for 2-D and 3-D graphics, hardware and system architectures, shading and lighting, animation. [3-0-0]
Prerequisite: All of COSC 221, COSC 222 and one of MATH 221, APSC 179.

Course Structure

The course is structured by lectures only. Course materials will be available on Canvas.

Course Overview, Content and Objectives

Topics include raster graphics, graphics architectures, application programming interface, interactive graphics, two- and three-dimensional computer graphics primitives and attributes, transformations, viewing, animation, hidden surface removal, and color and shading. The programming assignments will be designed to use many of the graphics features discussed in class.

Learning Outcomes or Objectives
Upon successful completion of this course, students will be able to…

• Interpret the core concepts and mathematical foundations of computer graphics
• Understand fundamental computer graphics algorithms and data structures
• Apply basic mathematics and concepts in the development of graphics applications
• Design and develop interactive 2D and 3D programs using WebGL

Methods of Assessment

Grading: Total 100%
• Programming Assignments (4): 40%
• Quizzes (4): 10%
• Midterm Exam: 15%

• Final Exam: 35%

In-class Participation Bonus

Learning Activities

• Quizzes are closed-book Canvas tests. No course materials, cell phones, or other electronic devices are allowed during the test time. Computers are only used for the tests, not for checking, discussing or searching solutions. Calculator is allowed.
• Exams are paper-based, closed-book tests with cheat sheets allowed. You may bring a maximum of 16 (one side) or 8 (both sides) pages (8.5 by 11 inches, photo-reduction allowed) and any calculator you wish (but NO other electronic equipment such as a laptop, portable computer, printing devices, communication devices etc.)
• The course website contains the most up-to-date information and important dates for main events such as assignments due dates and tests. Students need to check regularly.
• Attendance is required in lectures.
• If you feel any mark was unfair or incorrectly recorded, ensure that I am aware of the problem before the last week of classes.

Course schedule

Week	Contents
1	Introduction, Image Formation and Graphics Pipeline
2	Graphics Programming and API 1, Graphics Programming and API 2
3	Graphics Programming and API 3, Interaction and Animation, Quiz 1
4	Geometric Objects, Coordinate Systems and Frames
5	Transformations, Transformations in WebGL
6	Viewing, Projections 1, Quiz 2
7	Midterm Break

8	Midterm Exam, Projections 2
9	Hidden Surface Removal, Light Sources
10	Reflection, Normal Vectors and Shading 1, Quiz 3
11	Shading 2, Lighting Calculation
12	Buffer and Texture Mapping 1, Texture Mapping 2
13	Texture Mapping 3, Texture Mapping 4, Quiz 4, Final Exam Review

Learning Materials

Textbook and Reference Materials
• Course website on Canvas
• Lecture Notes (available electronically).
• No required textbook
• Recommended Textbooks (Optional):
o Interactive Computer Graphics: A Top-Down Approach with WebGL Seventh/Eighth Edition. Edward Angel and Dave Shreiner. Addison-Wesley (2015/2020).
o Computer Graphics from Scratch. Gabriel Gambetta. No Starch Press (2021).
o WebGL Programming Guide: Interactive 3D Graphics Programming with WebGL. Kouichi Matsuda and Rodger Lea. Addison-Wesley (2013).

Programming Language and Libraries
We will be using HTML5, JavaScript and WebGL.

Other Course Policies:

Late policy

Late assignments will be deducted 10% per day up to 3 days (after which they will receive 0 marks).

Missed exam policy

For final exam, the student may retake a make-up final exam with the permission of the Dean's office. Note that a make-up exam may have a question format different from the original regular exam.

Missed Activity Policy:

There will be no deferred quizzes/midterm exam. If you miss any of the quizzes with a valid excuse (according the UBC Okanagan policy on excused absences from examinations), duly documented and reported to the instructor within one week of the exam, then the weight of that quiz will be transferred to other quizzes.
For midterm exam, the grade will be deferred to the final exam. No midterm make-up or retake will be done.

Passing/Grading Criteria

Students MUST achieve a passing grade in overall in order to pass the course.

UBC Values

UBC creates an exceptional learning environment that fosters global citizenship, advances a civil and sustainable society, and supports outstanding research to serve the people of British Columbia, Canada, and the world. UBC's core values are excellence, integrity, respect, academic freedom, and accountability.

Policies and Regulations

Visit UBC Okanagan's Academic Calendar for a list of campus-wide regulations and policies, as well as term dates and deadlines.

A statement on academic integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are

imposed. For example, incidences of plagiarism or cheating usually result in a failing grade or mark of zero on the assignment or in the course. Careful records are kept to monitor and prevent recidivism.

A more detailed description of academic integrity, including the University's policies and procedures, may be found in the [Academic Calendar](#).

A statement on academic misconduct

The academic enterprise is founded on honesty, civility, and integrity. Violations of academic integrity (i.e., [academic misconduct](#)) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred for consideration for academic discipline. Careful records are kept to monitor and prevent recurrences. Any instance of cheating or taking credit for someone else's work, whether intentionally or unintentionally, can and often will result in at minimum a grade of zero for the assignment, and these cases will be reported to the Head of the Department and Associate Dean Academic of the Faculty.

Student Service Resources:

Disability Resource Centre

The Disability Resource Centre (DRC) facilitates disability-related accommodations and programming initiatives to that ameliorate barriers for students with disabilities and/or ongoing medical conditions. If you require academic accommodations to achieve the objectives of a course please contact the DRC at:

UNC 215   250.807.8053
Email: drc.questions@ubc.ca

Web: www.students.ok.ubc.ca/drc

Equity and Inclusion Office

Through leadership, vision, and collaborative action, the Equity & Inclusion Office (EIO) develops action strategies in support of efforts to embed equity and inclusion in the daily operations across the campus. The EIO provides education and training from cultivating respectful, inclusive spaces and communities to understanding unconscious/implicit bias and its operation within in campus environments. UBC Policy 3 prohibits discrimination and harassment on the basis of BC's Human Rights Code. If you require assistance related to an issue of equity, educational programs, discrimination or harassment please contact the EIO.

UNC 325H   250.807.9291

Email: equity.ubco@ubc.ca

Web: www.equity.ok.ubc.ca

Office of the Ombudperson

The Office of the Ombudsperson for Students is an independent, confidential and impartial resource to ensure students are treated fairly. The Ombuds Office helps students navigate campus-related fairness concerns. They work with UBC community members individually and at the systemic level to ensure students are treated fairly and can learn, work and live in a fair, equitable and respectful environment. Ombuds helps students gain clarity on UBC policies and procedures, explore options, identify next steps, recommend resources, plan strategies and receive objective feedback to promote constructive problem solving. If you require assistance, please feel free to reach out for more information or to arrange an appointment.

UNC 328   250.807.9818

Email: ombuds.office.ok@ubc.ca

Web: www.ombudsoffice.ubc.ca

Student Learning Hub

The Student Learning Hub is your go-to resource for free math, science, writing, and language learning support. The Hub welcomes undergraduate students from all disciplines and year levels to access a range of supports that include **tutoring in math, sciences, languages, and writing, as well as help with academic integrity, study skills and learning strategies**. Students are encouraged to visit often and early to build the skills, strategies and behaviors that are essential to being a confident and independent learner. For more information, please visit the Hub's website.

LIB 237   250.807.8491

Email: learning.hub@ubc.ca

Web: www.students.ok.ubc.ca/slh

Sexual Violence Prevention and Response Office (SVPRO)

The Sexual Violence Prevention and Response Office (SVPRO) is a confidential place for those who have been impacted by any form of sexual or gender-based violence, harassment, or harm, regardless of where or when it took place. SVPRO aims to be a safer space for all UBC students, faculty, and staff by respecting each person's unique and multiple identities and experiences. All genders and sexualities are welcome.

Nicola Townhome 120, 1270 International Mews   250.807.8053

Email: svpro@okangan@ubc.ca

Web: www.svpro.ok.ubc.ca

Wellbeing and Accessibility Services (WAS)

Wellbeing and Accessibility Services (WAS) supports holistic student wellbeing in body, mind, and spirit. Students can access nurses, physicians and counsellors for health care and counselling related to physical health, emotional/mental health and sexual/reproductive health concerns. WAS is also home to the Disability Resource Centre, Spiritual and Multi-Faith Services, and Campus Health and Education. If you require assistance with your health, please contact Wellbeing and Accessibility Services for more information or to book an appointment.

UNC 337   250.807.9270

Email: healthwellness.okanagan@ubc.ca

Web: www.students.ok.ubc.ca/was

Walk-In Well-Being Clinic

The Walk-In Well-Being clinic offers no-fee, brief, single-session psychological services. Sessions are led by a doctoral student in clinical psychology and supervised by a registered psychologist (UBCO Faculty member). Clinicians can provide support with stress management, sleep, self-care, depression, anxiety, interpersonal issues, substance misuse, coping with academic demands/stressors, and provide options for connecting to additional resources. Virtual or in-person sessions are available at the UBCO Psychology Clinic, located in ASC 167 with or without an appointment, on Tuesdays and Thursdays between 10 am and 3 pm from September to June, excluding campus closures.

UNC 337   250.807.8421 (ext. 1)

Email: ipc.ok@ubc.ca

Web: https://psych.ok.ubc.ca/psychology-clinic/walk-in-wellness/

Safewalk

Don't want to walk alone at night? Not too sure how to get somewhere on campus? Call Safewalk at **250-807-8076**.

Web: www.security.ok.ubc.ca

© Copyright Statement

All materials of this course (course handouts, lecture slides, assessments, course readings, etc.) are the intellectual property of the Course Instructor or licensed to be used in this course by the copyright owner. Redistribution of these materials by any means without permission of the copyright holder(s) constitutes a breach of copyright and may lead to academic discipline.

A statement PROHIBITING the use of GenAI in this course

Do not use generative artificial intelligence (AI): The use of generative AI tools, including ChatGPT and other similar tools, to complete or support the completion of any form of assignment or assessment in this course is not allowed and would be considered academic misconduct. Learn more through [the Generative AI website](#).