



Prescription

This course addresses the central algorithms, mathematical knowledge and programming for Computer Graphics. It will include topics such as geometry manipulation and computing, curvature and graphics applications of linear algebra and numerical integration. Students will implement algorithms using scripting tools and develop simple plugins for 3D computer graphics tools.

Course learning objectives

Students who pass this course should be able to:

1. Implement a basic OpenGL application in C++ when given an appropriate basic framework from which to start. Be able to load, view, shade and manipulate a polygon mesh in OpenGL.
2. Explain and implement three-dimensional rigid object animation using physical simulation.
3. Demonstrate an ability to use a range of algebraic tools, including trilinear and tricubic interpolation, vector arithmetic (dot and cross products), intersection calculations between a ray and various primitive objects, ray tracing, velocity and position updates in physical simulation.

Course content

2022: The course is primarily offered in-person, and there are components such as tests, labs, tutorials, and marking sessions which require in-person attendance. There will be remote alternatives for all the components of the course, but these are only available to students studying from outside the Wellington region. The remote option for tests will use a Zoom-based system for online supervision of the tests.

Students taking this course remotely must have access to a computer with camera and microphone and a reliable high speed internet connection that will support real-time video plus audio connections and screen sharing. Students must be able to use Zoom; other communication applications may also be used. A mobile phone connection only is not considered sufficient. The computer must be adequate to support the programming required by the course: almost any modern windows, macintosh, or unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

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The course has two components:

1. **Programming in C++ and OpenGL:** getting to grips with the programming language and library that are used in most professional computer graphics situations.
2. **Mathematics and graphics in OpenGL:** example uses of OpenGL that allow expression of some of the mathematics used in computer graphics, including interpolation, mesh handling, ray tracing, object animation, and simulation.

Required Academic Background

Students must have passed CGRA 151 to give them an understanding of the basic concepts on which this course builds. Students must have passed an appropriate C programming course (NWEN 241). Students must have the mathematical background to be able to handle the algebra (either ENGR 121 or MATH 151 is required; alternative mathematical preparation can be considered with Head of School permission).

Withdrawal from Course

Withdrawal dates and process:

<https://www.wgtn.ac.nz/students/study/course-additions-withdrawals>

Lecturers

Dr Alex Doronin (Coordinator)

alex.doronin@vuw.ac.nz 04 463 9682

CO 330 Cotton Building (All Blocks), Gate 7, Kelburn Parade, Kelburn

Zohar Levi

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CO 338 Cotton Building (All Blocks), Gate 7, Kelburn Parade, Kelburn

Teaching Format

This course will be offered in-person and online. For students in Wellington, there will be a combination of in-person components and web/internet based resources. It will also be possible to take the course entirely online for those who cannot attend on campus, with all the components provided in-person also made available online.

During the trimester there are three lectures per week.

Student feedback

Student feedback on University courses may be found at:

www.cad.vuw.ac.nz/feedback/feedback_display.php

Dates (trimester, teaching & break dates)

- Teaching: 11 July 2022 - 14 October 2022
- Break: 22 August 2022 - 04 September 2022
- Study period: 17 October 2022 - 20 October 2022
- Exam period: 21 October 2022 - 12 November 2022

Class Times and Room Numbers

11 July 2022 - 21 August 2022

- **Tuesday** 16:10 - 17:00 – 120, Easterfield, Kelburn
- **Wednesday** 16:10 - 17:00 – 120, Easterfield, Kelburn
- **Thursday** 16:10 - 17:00 – 120, Easterfield, Kelburn

05 September 2022 - 16 October 2022

- **Tuesday** 16:10 - 17:00 – 120, Easterfield, Kelburn
- **Wednesday** 16:10 - 17:00 – 120, Easterfield, Kelburn
- **Thursday** 16:10 - 17:00 – 120, Easterfield, Kelburn

Other Classes

Tutorial sessions will be held in lecture times, as notified by the course lecturers.

Set Texts and Recommended Readings

Required

There are no required texts for this offering.

Mandatory Course Requirements

There are no mandatory course requirements for this course.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

The course is assessed on programming assignments, mid and final trimester tests

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Assignment 1	Week 4	CLO: 1	10%
Assignment 2	Week 6	CLO: 1,3	15%
Assignment 3	Week 9	CLO: 2,3	15%
Assignment 4	Week 12	CLO: 1,2,3	20%
Mid-Trimester Test	Week 6	CLO: 1,3	20%
Final Test	Week 12	CLO: 2,3	20%

Penalties

Assignments submitted late receive a 25% penalty for each day late.

Extensions

The ECS submission system will automatically allocate up to three late days with no penalty. Additional extensions require the permission of the Course Coordinator and should be supported by appropriate documentation, e.g. a doctor's certificate.

Submission & Return

All work is submitted through the ECS submission system, accessible through the course web pages. Marks and comments will be returned through the ECS marking system, also available through the course web pages.

Workload

The course requires 150 hours of work. There are 3 hours per week of scheduled class time. Students are expected to spend up to 7 hours per week consolidating what they have learnt in class and working on the assignments.

Teaching Plan

See https://ecs.wgtn.ac.nz/Courses/CGRA251_2022T2/LectureSchedule

Communication of Additional Information

All online material for this course can be accessed at https://ecs.wgtn.ac.nz/Courses/CGRA251_2022T2/

Links to General Course Information

- Academic Integrity and Plagiarism: <https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism>
- Academic Progress: <https://www.wgtn.ac.nz/students/study/progress/academic-progress> (including restrictions and non-engagement)
- Dates and deadlines: <https://www.wgtn.ac.nz/students/study/dates>
- Grades: <https://www.wgtn.ac.nz/students/study/progress/grades>
- Special passes: Refer to the Assessment Handbook, at <https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf>
- Statutes and policies, e.g. Student Conduct Statute: <https://www.wgtn.ac.nz/about/governance/strategy>
- Student support: <https://www.wgtn.ac.nz/students/support>
- Students with disabilities: https://www.wgtn.ac.nz/st_services/disability/
- Student Charter: <https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter>
- Terms and Conditions: <https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract>
- Turnitin: <http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin>
- University structure: <https://www.wgtn.ac.nz/about/governance/structure>
- VUWSA: <http://www.vuwsa.org.nz>

Offering CRN: [28399](#)

Points: 15

Prerequisites: CGRA 151, NWEN 241; ENGR 121 or MATH 151 or permission of Head of School

Duration: 11 July 2022 - 13 November 2022

Starts: Trimester 2

Campus: Kelburn