

# CGRA251 (2018) - Computer Graphics

## 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, and manipulate a polygon mesh in OpenGL. Be able to explain and implement, in OpenGL, object picking, trilinear and tricubic interpolation, and basic space deformation based on a control lattice.
2. Explain and implement three-dimensional rigid object animation using physical simulation of position, velocity, acceleration and forces. Apply appropriate forces to a simulated object based on the position and velocity of other objects in the simulated scene.
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, velocity and position updates in physical simulation.

## Course content

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, mesh deformation, object animation, and simulation.

## Required Academic Background

Students must have passed CGRA 151 to give them an understanding of several of the basic concepts on which this course builds. Students must have passed an appropriate programming course (either COMP 103 or MDDN 242). Experience with C or C++ would be helpful (e.g., NWEN 241). Students must have mathematical background to be able to handle the algebra (either ENGR 121 or MATH 151 are required; for those who took ENGR 121, ENGR 122 would also be useful; alternative mathematical preparation can be considered with Head of School permission).

## Withdrawal from Course

Withdrawal dates and process:

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

## Lecturers

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Zohar Levi (Coordinator)

[zohar.levi@vuw.ac.nz](mailto:zohar.levi@vuw.ac.nz)

04 463 5233 ext 7045

# Teaching Format

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](http://www.cad.vuw.ac.nz/feedback/feedback_display.php)

## Dates (trimester, teaching & break dates)

- Teaching: 05 March 2018 - 08 June 2018
- Break: 23 April 2018 - 27 April 2018
- Study period: 11 June 2018 - 14 June 2018
- Exam period: 15 June 2018 - 04 July 2018

## Class Times and Room Numbers

### 05 March 2018 - 25 March 2018

- **Thursday** 16:10 - 17:00 – LT206, Easterfield, Kelburn

### 05 March 2018 - 01 April 2018

- **Tuesday** 16:10 - 17:00 – LT206, Easterfield, Kelburn
- **Wednesday** 16:10 - 17:00 – LT206, Easterfield, Kelburn

### 02 April 2018 - 22 April 2018

- **Thursday** 16:10 - 17:00 – LT206, Easterfield, Kelburn

### 09 April 2018 - 22 April 2018

- **Tuesday** 16:10 - 17:00 – LT206, Easterfield, Kelburn
- **Wednesday** 16:10 - 17:00 – LT206, Easterfield, Kelburn

### 30 April 2018 - 10 June 2018

- **Tuesday** 16:10 - 17:00 – LT206, Easterfield, Kelburn
- **Wednesday** 16:10 - 17:00 – LT206, Easterfield, Kelburn
- **Thursday** 16:10 - 17:00 – LT206, 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 entirely on programming assignments.

Assignment 1: Introduction to C++	Week 4	CLO: 1	10%
Assignment 2: Introduction to OpenGL	Week 6	CLO: 2,3	15%
Assignment 3: Creating a lattice	Week 8	CLO: 2,3	25%
Assignment 4: Boids: flocking animation	Week 10	CLO: 2,3	35%
Assignment 5: Lattice deformation	Exam period	CLO: 2,3	15%

## 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

## Communication of Additional Information

All online material for this course can be accessed at [https://ecs.victoria.ac.nz/Courses/CGRA251\\_2018T1/](https://ecs.victoria.ac.nz/Courses/CGRA251_2018T1/)

## Links to General Course Information

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

**Offering CRN:** [28399](#)

**Points:** 15

**Prerequisites:** CGRA 151; COMP 103 or MDDN 242; ENGR 121 or MATH 151 or permission of Head of School

**Duration:** 05 March 2018 - 04 July 2018

**Starts:** Trimester 1

**Campus:** Kelburn