# CPS 643: Virtual Reality

**Winter 2024**

## Instructor Information

* **Instructor:** T. McInerney
* **Office Location:** ENG262
* **Office Hours:** Wed 1pm-3pm or by appointment
* **Course Website:** my.torontomu.ca (D2L)
* **Email Address:**   tmcinerney@torontomu.ca

### Email Policy

In accordance with the Policy on TMU Student E-mail Accounts (Policy 157), Toronto Metropolitan University (TMU) requires that any electronic communication by students to TMU faculty or staff be sent from their official university email account.

## Prerequisite

CPS511 Computer Graphics

## Course Description

This course describes the underlying concepts and algorithms of Virtual Reality (VR) systems. A review of current VR technology and the fundamental principles of interaction, modelling and simulation for VR are presented. This is a lab-based and project-based course in which students will use VR hardware and a VR software framework to design, model, and program an interactive virtual environment for various application areas.

Weekly Lecture:3 hrs. Lab 2 hrs.

## Course Details

### Teaching Methods

In-person lectures, course slides (PDF) posted weekly, weekly labs, course project.

### Course Materials

Recommended: Virtual Reality (http://vr.cs.uiuc.edu/), Steven M. LaValle. To be published by Cambridge University Press

### Course Learning Outcomes

At the end of the course, a successful student will be able to:

1. Understand basic principles and concepts of Virtual Reality

2. Design and implement a complex Virtual Reality application

### Topics and Course Schedule

### (Note: dates are approximate, some topics may be omitted due to time constraints)

|  |  |  |
| --- | --- | --- |
| Week | Date | Topic |
| Week 1 | Jan 12, Jan 15 | * Introduction, Intro to Unity3D, Intro to HMDs * Graphics Review: Modeling and Rendering |
| Week 2 | Jan 22 | * Modeling I: Animation, Orientation, Hierarchical |
| Week 3 | Jan 29 | ● Interaction: Selection, Manipulation, Travel, UI for VR |
| Week 4 | Feb 5 | * Interaction: Selection, Manipulation, Travel, UI for VR |
| Week 5 | Feb 12 | * Perception and Display Technologies * VR Headset Intro, Tracking and Input Devices, * Unity Shader Programming |
|  | Feb 19 | * Study Week – No Lectures |
| Week 6 | Feb 26 | * Modeling II: Physics, Collision Detection and Response |
| Week 7 | Mar 4 | * Modeling III: Behavior (AI) |
| Week 8 | Mar 11 | * Advanced Rendering I |
| Week 9 | Mar 18 | * Advanced Rendering II |
| Week 10 | Mar 25 | * Miscellaneous: Haptics, Sound, Augmented Reality, Collaborative VR |
| Week 11 | Apr 1 | * TBA |
| Week 12 | Apr 8 | * Project Presentations |

### Evaluation and Grading Requirements

* Students must obtain at least 50% on the Final Exam to be eligible to pass the course
* Rationale: If a student achieved a perfect score on the lab and project assignments then without any conditions, the student would be eligible to pass the course. An exam score of at least 50% is deemed necessary for demonstrating a sufficient understanding of the course concepts.
* Students must obtain at least 50% of the lab marks to be eligible to pass the course and at least 50% of the project marks.
* Rationale: Achieving at least 50% on the practical components of the course is deemed necessary to demonstrate sufficient mastery of practical realization of the course concepts.
* Projects can be done individually or in groups of two.
* Students are responsible for checking the D2L course web site for all instructions and announcements related to the course. All marks will be posted on D2L.

### Assessment Weighting Breakdown

|  |  |  |
| --- | --- | --- |
| Evaluation Component | Percentage of Final Grade | Date (Approximate) |
| Labs | 25 | 5 labs, posted weekly |
| Term Project | 35 |  |
| Final Exam | 40 | Exam Week |
| Total: | 100% |  |

* Results for lab assignments will be returned within 3 weeks of due date.

## University Policies

Students must be reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on [the Senate website](http://ryerson.ca/senate/course-outline-policies).

## Important Resources Available at Toronto Metropolitan University

* [**The Library**](https://library.ryerson.ca/) provides research workshops and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or go to [Library Online Workshops](https://library.ryerson.ca/workshops/).
* [**Student Life and Learning Support**](https://www.ryerson.ca/student-life-and-learning/learning-support/) offers group-based and individual help with writing, math, study skills, and transition support, as well as [resources and checklists to support students as online learners.](https://www.ryerson.ca/student-life-and-learning/learning-support/)
* You can submit an [**Academic Consideration Request**](https://prod.apps.ccs.ryerson.ca/senateapps/acadconsform) when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the [Senate website](https://www.ryerson.ca/senate/) and select the blue radial button on the top right hand side entitled: Academic Consideration Request (ACR) to submit this request).  
    
  Please note that the Provost/ Vice President Academic and Dean's approved a COVID-19 statement for Fall 2022 related to academic consideration. This statement will be built into the Online Academic Consideration System and will also be on the [Senate website](http://www.ryerson.ca/senate) ([www.ryerson.ca/senate](http://www.ryerson.ca/senate)) in time for the Fall term:

*Policy 167: Academic Consideration for Fall 2022 due to COVID-19: Students who miss an assessment due to cold or flu-like symptoms, or due to self-isolation, are required to provide a health certificate. All absences must follow Senate*[*Policy 167: Academic Consideration*](https://www.ryerson.ca/content/dam/senate/policies/pol167.pdf)*.*

Also NOTE: Policy 167: Academic Consideration does allow for a once per term academic consideration request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. If the absence is more than 3 days in duration and/or is for a final exam/final assessment, documentation is required. For more information please see Senate [Policy 167: Academic Consideration.](https://www.ryerson.ca/content/dam/senate/policies/pol167.pdf)

* [TMU COVID-19 Information and Updates for Students](https://www.ryerson.ca/covid-19/students/) summarizes the variety of resources available to students during the pandemic.
* [TMU COVID-19 Vaccination Policy](https://www.ryerson.ca/policies/policy-list/vaccination-policy/)
* If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The [Remote Learning guide](https://www.ryerson.ca/centre-for-excellence-in-learning-and-teaching/learning-guide/) for students includes guides to completing quizzes or exams in D2L Brightspace, with or without [Respondus LockDown Browser and Monitor](https://www.ryerson.ca/courses/students/tutorials/quizzes-respondus/), [using D2L Brightspace](https://www.ryerson.ca/courses/students/), joining online meetings or lectures, and collaborating with the Google Suite.
* Information on Copyright for [Faculty](https://library.ryerson.ca/copyright/faculty/copyright-faqs/my-teaching-materials-have-been-posted-online/) and [students](https://library.ryerson.ca/copyright/home/copyright-for-students-2/students-course-sharing-websites-and-file-sharing/).

## Accessibility

* Similar to an [accessibility statement](https://pressbooks.library.ryerson.ca/dabp/chapter/creating-an-accessibility-statement/), use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
* Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
* Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

### Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

* Learn more about Academic Accommodation Support
* Learn [how to register with AAS](https://www.ryerson.ca/accommodations/registration/)

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about [Academic Accommodations versus Academic Consideration](https://www.torontomu.ca/accommodations/manage/aas_vs_acr/) and how to access each.

## Wellbeing Support

At Toronto Metropolitan University (TMU), we recognize that things can come up throughout the term that may interfere with a student’s ability to succeed in their coursework. These circumstances are outside of one’s control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

* Distress Line: 24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416–408–4357)
* Good2Talk: 24/7-hour line for postsecondary students (phone: 1-866-925-5454)
* Keep.meSAFE: 24/7 access to confidential support through counsellors via [My SSP app](https://myssp.app/ca/home) or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

* Centre for Student Development and Counselling: 416-979-5195 or email [csdc@ryerson.ca](mailto:csdc@ryerson.ca%20)
* Consent Comes First – Office of Sexual Violence Support and Education: 416-919-5000 ext: 553596 or email [osvse@ryerson.ca](mailto:osvse@ryerson.ca)
* Medical Centre: call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the [Toronto Metropolitan University Mental Health and Wellbeing](https://www.ryerson.ca/mental-health-wellbeing/) website.