

448/548 Virtual Reality

Computer Science

| | Description |
|---------------------|---------------------|
| Instructor | Dr. Ehsan Aryafar |
| Office | FAB 115-12 |
| Availability | By Appointment Only |
| Email | earyafar@pdx.edu |
| Credits | 4/3 |

Course Description

Provides a broad introduction to various techniques that are used in virtual reality (VR) systems ranging from hardware and software requirements for VR to tracking, three-dimensional interaction, applications, and neuroscience and human brain perception as they relate to VR. Students engage in discussion about the potential future developments and challenges in the VR landscape and gain practical experience in implementing and evaluating VR systems.

Course Outcomes/Learning Objectives

Upon the successful completion of this class, students will be able to:

- Explain the current hardware and software trends that are used to build VR systems.
- Explain how VR translation, orientation, and rotation is done through matrix transformations.
- Explain the properties of light and lenses, and how the learnings can be used to determine the required VR visual display characteristics.
- Explain the perceptual aspects of VR and its relation to designing motor programming skills for the virtual world.
- Explain fundamentals of VR position tracking through both internal and external sensors.
- **Graduate students only:** Develop an ability to read and summarize VR research papers.

Course Prerequisites

None.

Required Materials

The course does not have a required textbook. For reference, students can refer to the following book:

- "Virtual Reality" by Steven M. Lavalley. Here is the free [online link](#).

Students are expected to have access to a desktop or laptop computer to complete the required coursework.

Outline of Course Content

Some of the major topics discussed are as follows:

- Overview of VR Hardware and Software
- Geometry of Virtual Worlds
- Light and Optics
- The Psychology of Human Vision
- Visual Perception
- Visual Rendering
- Motion in Real and Virtual Worlds
- Tracking Mechanisms
- Interaction Design Principles
- VR Application Development Framework

Technology

Recording Technology Notice

We will use technology for virtual meetings and recordings in this course. Our use of such technology is governed by FERPA, the [Acceptable Use Policy](#) and PSU's [Student Code of Conduct](#). A record of all meetings and recordings is kept and stored by PSU, in accordance with the Acceptable Use Policy and FERPA. I will not share recordings of your class activities outside of course participants, which include your fellow students, TAs/GAs/Mentors, and any guest faculty or community-based learning partners that we may engage with. **You may not share recordings outside this course. Doing so may result in disciplinary action.**

Turnitin

Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of Turnitin.com page service is subject to the Usage Policy and Privacy Pledge posted on the Turnitin.com site.

Major Assignments

Assignments: There will be four homework assignments.

Exam: There will be a single in-class exam.

Participation: The course has discussion posts. Students are expected to participate in the discussion posts.

Grading Criteria

This class is letter graded only. The weight for different class activities are:

Participation: 20%

Homework: 40%

Exam: 40%

Flexibility Statement

The instructor reserves the right to modify course content and/or substitute assignments and learning activities in response to institutional, weather, or class situations.

PSU Policies and Resources

Academic Integrity

Academic integrity is a vital part of the educational experience at PSU. The [Student Code of Conduct](#) is the university's policy on academic dishonesty. A confirmed violation of that code in this course may result in failure of the course.

Student Services

Disability Access Statement

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the [Disability Resource Center](#) to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is at 116 Smith Memorial Student Union, 1825 SW Broadway; 503-725-4150; drc@pdx.edu.

Basic Needs at Portland State

It can be challenging to do your best in class if you have trouble meeting basic needs like safe shelter, sleep, and nutrition. Resource centers across campus are here to provide assistance, referrals, and support. Please contact anyone on this list for assistance:

- **Basic Needs Hub:** basicneedshub@pdx.edu
- **Portland State Food Pantry:** psufp.com or pantry@pdx.edu
- **C.A.R.E. Program:** askdos@pdx.edu, (503) 725-4422

- **Student Health & Counseling:** askshac@pdx.edu, (503) 725-2800

Understanding Sexual Misconduct

PSU desires to create a safe campus. As part of that mission, PSU requires all students to take the [Understanding Sexual Misconduct and Resources learning module](#). If you or someone you know has been harassed or assaulted, you can find the appropriate resources on PSU's [Sexual Misconduct Response website](#).

Title IX Reporting

Students frequently come to me for assistance in matters not related to the course material. Please be aware that PSU's policies require instructors to report any instance of sexual harassment, sexual and relationship violence and/or other forms of prohibited discrimination to university officials, who will keep the information private. If you would rather share information about these matters with a PSU staff member who does not have these reporting responsibilities and can keep the information confidential, please use these campus resources:

- Confidential Advocates: 503-894-7982 or [schedule online](#) (for matters regarding sexual harassment and sexual and relationship violence)
- Center for Student Health and Counseling: 1880 SW 6th Avenue #200; 503-725-2800

Discrimination and Bias Incidents

[The Office of Equity and Compliance](#) (OEC) addresses complaints of discrimination, discriminatory Harassment, and sexual harassment against employees (faculty and staff). If you or someone you know believes they have been discriminated against, you may file a complaint. Someone from the OEC will contact you to discuss how to best address your complaint.

[The Bias Review Team](#) (BRT) gathers information on bias incidents that happen on and around campus, and gives resources and support to individuals who experience them. You can report a bias incident you experienced or learned about. A member of the BRT will contact you if you indicate you would like to be contacted.

Religious Accommodations

If you would like to obtain religious accommodations, such as flexibility in attending evening courses or extension on assignments, please contact your instructors. If you need additional assistance, please contact the Office of the Dean of Student Life (DOSL) by emailing askdos@pdx.edu.

Cultural Resource Centers

Cultural Resource Centers (CRCs) create a student-centered inclusive environment that enriches the university experience. They honor diversity, explore social justice issues, celebrate cultural traditions, and foster student identities, success, and leadership. They provide opportunities for student leadership, employment, and volunteering; student resources such as computer labs, event, lounge, and study spaces; and extensive programming. All are welcome!

- Multicultural Student Center
- La Casa Latina Student Center
- Native American Student and Community Center
- Pan African Commons
- Pacific Islander, Asian, and Asian American Student Center
- Middle East, North Africa, South Asia Initiative

COVID-19 Response

The University has established rules and policies to make the return to the classroom as safe as possible. To learn about Portland State's activities to reduce the spread of COVID-19, visit [PSU's COVID-19 Response page](#).

If you need advice on testing and/or quarantine, visit [The Center for Student Health and Counseling \(SHAC\)'s COVID-19 FAQ page](#) or call 503-725-2800.

Also, please notify me (i.e. your instructor), should you need to miss a class period for any of these reasons so that we can discuss strategies to support your learning during this time. If I become ill or need to quarantine during the term, either I or the department chair will notify you via PSU email about my absence and how course instruction will continue.

Failure to Comply with Any of these Rules

As the instructor of this course, the University has given me the authority to require your compliance with these policies. If you do not comply with these requirements, I may ask you to leave the classroom, or I may need to cancel the class session entirely.

In addition, failure to comply with these requirements may result in a referral to the Office of the Dean of Student Life to consider charges under PSU's Code of Conduct. A student found to have violated a university rule (or rules) through the due process of student conduct might face disciplinary and educational sanctions (or consequences). For a complete list of sanctions, see Section 14 of the [Student Code of Conduct & Responsibility](#).

Guidance May Change

Please note that the University rules, policies, and guidance may change at any time at the direction of the CDC, State, or County requirements. Please review the University's main [COVID-19 Response](#) webpage and look for emails from the University on these topics.