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**Computer Graphics**

**COMP-4471 WA/WAO**

**Instructor Information:**

Instructor: Dr. Saad Bin Ahmed

Office Location: AT5020

E-mail: sbinahm@lakeheadu.ca

Office Hours: Wednesday 12:00pm - 1:00pm

(Zoom link will be shared through announcement.)

**Teaching Assistant:** To be defined

**TA Email:** To be defined

**Course Identification:**

Course Number: COMP-4471-WA/WAO

Course Name: Computer Graphics

Course Delivery: Lectures, MyCourseLink/D2L

Room and Time: Zoom, T/Th 5:30 PM - 7:00 PM

Final Date to Withdraw (Drop): Friday, March 8, 2024

Final Day of Classes: Tuesday, April 9, 2024

Winter Study Week: February 19 to 23, 2024

**Attendance and participation lectures are highly recommended!**

**Description:**

A computer graphics course typically focuses on the principles and techniques involved in creating, manipulating, and displaying visual images and animations using computers. The course covers both theoretical concepts and practical skills related to computer graphics. Students often learn about fundamental topics such as 2D and 3D graphics, rendering, modeling, animation, and image processing.

**Course Learning Objectives:**

Upon successful completion of the "Computer Graphics" course, students should demonstrate the following learning outcomes:

* Demonstrate a comprehensive understanding of fundamental principles in computer graphics, including concepts related to 2D and 3D graphics, coordinate systems, transformations, and color models.
* Acquire skills in image processing techniques, including filtering, blending, and color manipulation, to enhance and modify digital images.
* Demonstrate proficiency in creating and manipulating geometric models, understanding key concepts such as polygons, curves, surfaces, and transformations.
* Understand and apply various rendering techniques, including shading, lighting models, and texture mapping, to produce realistic and visually appealing graphics.
* Apply principles of animation to design and implement dynamic and interactive graphics, including keyframing, interpolation, and motion control.
* Explore the principles of HCI as they relate to computer graphics, including user interface design, usability, and user experience considerations.
* Gain an understanding of the concepts and technologies behind virtual and augmented reality, including 3D modeling for immersive environments.
* Develop skills that are directly applicable to industry demands, preparing students for careers in fields such as game development, animation, simulation, and graphic design.

**Suggested Text Resource:**

* **Interactive Computer Graphics, A Top-Down Approach Using OpenGL,** Third Edition by Edward Angel
* **Computer Graphics with OpenGL**, Fourth Edition by Hearn, Baker, Carithers

| **Weeks** | **Topics to cover** |
| --- | --- |
| Week 1 | Introduction to Computer Graphics, Computer Graphics Hardware |
| Week 2 | Computer Graphics Software, The OpenGL API |
| Week 3 | Spatial Transformation, 3D Rotation and Complex Transformations |
| Week 4 | Perspective Projection and Texture Mapping, Depth and Transparency |
| Week 5 | Introduction to Geometry, Meshes and Manifolds |
| Week 6 | Break (Fall Reading Week) |
| Week 7 | Digital Geometry Processing, Geometric Queries |
| Week 8 | Spatial Data Structures, Color |
| Week 9 | Radiometry, The Rendering Equations |
| Week 10 | Numerical Integrations, Monte Carlo Rendering |
| Week 11 | Variance Reduction, Introduction to Animation |
| Week 12 | Dynamics and Time Integration, Introduction to Optimization |
| Week 13 | Physically-Based Animation and PDEs, Course Wrap-up |

**Assignments and Evaluations:**

Students taking this course must understand and agree that:

(1) Unless otherwise allowed by the course instructor, students must complete the assignments in this course without the assistance of anyone else.

(2) Unless otherwise allowed by the course instructor, students must not access any sources or materials (in print, online, or in any other way) to complete any course exam.

**Academic Integrity:**

Students must further understand and agree that, if they violate either of these two rules, or if

they provide any false or misleading information about their completion of course assignments

or exams, they may be prosecuted under the Lakehead University Student Code of Conduct –

Academic Integrity, which requires students to act ethically and with integrity in academic

matters and to demonstrate behaviors that support the University’s academic values.

***Assignments:*** There is **Zero-Tolerance** for plagiarism cases. All such cases will be dealt with according to University prescribed rules. All assignments are individual. Students should understand that their assignments must go through a similarity check and if there is similarity detected then **ZERO** mark will be awarded to those students involved in copying.

***Late Assignments:*** Late assignments will automatically receive a **ZERO** however they will be

reviewed to provide formative evaluation feedback and must be submitted for course

Completion.

**Evaluation Map**

Following are the evaluation strategies and their percentage in their final Grades will be based on:

* 4 assignments (worth 10% each)
* 3 quizzes (each worth 5%, every quiz will be conducted via D2L)
* a final exam, worth 45% of the final marks

**Schedule**(tentative, some of the dates might change) All assignments are due on D2L course link at 23:55 pm on the date indicated.

* Assignment 1 due on February 8.
* Assignment 2 due on February 27.
* Assignment 3 due on March 21.
* Assignment 4 due on April 5.

**Course Policies:**

* Behavioral standards to follow: Student Code of Conduct - Academic Integrity
* Attendance and participation in class discussions is highly recommended.
* Students can communicate with the instructor through email using the **COMP-4471** - as a prefix in the subject line of their message.
* The course outline and schedule are not fixed and subject to change based on class flow.
* A passing mark is normally 50% of the total weight of all components.
* University’s attendance policy is followed.
* There will be 4 assignments. The late penalty for assignments is [2.5^i] (2.5 to the i-th power, rounded to the nearest integer), where i>0 is the number of days you are late. So, if you hand-in your assignment 1 day late, you will be penalized 3%, a delay of 2 days will decrease your grade by 6%, 3 days is penalized 16% and 4 days takes 39% off your grade. You cannot be more than 4 days late, Extensions will be granted only by the course instructor. If you have serious medical or compassionate grounds for an extension, you should take supporting documentation to the office of the Dean of your faculty, who will contact the instructor.
* Assignments and time will be posted on MyCourseLink/D2L and announced via emails to all registered students.
* There will be 2 quizzes. Quizzes’ date and time will be announced in advance.

**Copyright:**

Students should be aware that all instructional, reference, and administrative materials prepared for this course are protected in their entirety by copyright. Students are expected to comply with this copyright by only accessing and using the course materials for personal educational use related to the course, and that the materials cannot be shared in any way, without the written authorization of the course instructor. If this copyright is infringed in any way, students may be prosecuted under the Lakehead University Student Code of Conduct – Academic Integrity, which requires students to act ethically and with integrity in academic matters and to demonstrate behaviors that support the University’s academic values.

**Regulations:**

It is the responsibility of each student registered at Lakehead University to be familiar with, and comply with all the terms, requirements, regulations, policies and conditions in the Lakehead University Academic Calendar. This includes, but is not limited to, Academic Program Requirements, Academic Schedule of Dates, University and Faculty/School Policies and Regulations and the Fees and Refund Policies and Schedules (Lakehead University Regulations webpage, 2023-24).

**Academic Integrity:**

A breach of Academic Integrity is a serious offense. The principle of Academic Integrity, particularly of doing one’s own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students should view the Student Code of Conduct - Academic Integrity for a full description of academic offenses, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

**Support for Students:**

There are many resources available to support students. These include but are not limited to:

● [Health and Wellness](https://www.lakeheadu.ca/students)

● [Student Success Centre](https://www.lakeheadu.ca/students/academic-success/student-success-centre)

● [Student Accessibility Centre](https://www.lakeheadu.ca/students/student-life/student-services/accessibility/)

● [Library](https://library.lakeheadu.ca/)

● [Lakehead International](https://www.lakeheadu.ca/international)

● [Indigenous Initiatives](https://www.lakeheadu.ca/indigenous)

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities and/or medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS)

and register as early as possible. For more information, please contact Student Accessibility Services (SC0003, 343-8047 or sas@lakeheadu.ca