



OTTERBEIN  
UNIVERSITY

# Syllabus

## COMP 4290-01

### Special Topics: Computer Graphics

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*Fall Semester 2023*

#### Basic Information

**Credits:** 3.0  
**Time:** MWF 12:40 - 1:35 p.m.  
**Location:** Point 113  
**Prerequisite:** COMP 2100

#### Instructor Information

**Name:** Dr. Barry Wittman  
**E-mail:** [wittman1@otterbein.edu](mailto:wittman1@otterbein.edu)  
**Office:** Point 105  
**Phone:** (614) 823-2944  
**Office hours:** MWF 1:45 – 3:00 p.m.,  
WF 4:00 – 5:00 p.m.,  
TR 1:00 – 4:00 p.m.,  
and by appointment

#### Text Book

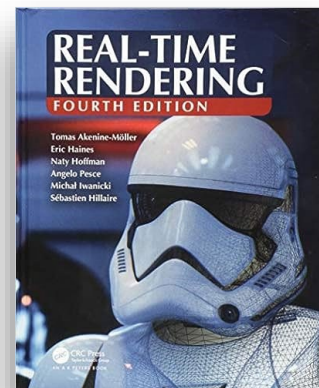
Tomas Akenine-Möller, Eric Haines, Naty Hoffman, Angelo Pesce, Michael Iwanicki, and Sébastien Hillaire

***Real-Time Rendering***

Fourth Edition, 2018, AK Peters / CRC Press

ISBN-10: 9781138627000

ISBN-13: 978-1138627000



#### Course Catalog Description

This course gives an overview of the fundamentals of computer graphics, with an emphasis on the real-time rendering done in modern video games. Key topics include the rendering pipeline, transformations, texturing, shading, lighting, hidden surface removal, and other advanced techniques. Related material in geometry and linear algebra will be reviewed as needed.

## Student Learning Outcomes

By the end of the course, students will be able to:

- I. Apply knowledge of computing and mathematics appropriate to the discipline, including common data structures, basic algorithms, and linear algebra
- II. Analyze a problem and identify and define the computing requirements appropriate to its solution
- III. Function effectively on teams and use software engineering principles to accomplish a common goal
- IV. Communicate effectively with a broad range of audiences
- V. Explain how the rendering pipeline functions
- VI. Apply concepts from geometry to graphics problems
- VII. Use a modern GPU to render graphics efficiently
- VIII. Apply matrix transformations to manipulate geometry
- IX. Explain the principles of digital image representation
- X. Apply textures to surfaces
- XI. Describe the challenges and algorithms used in local and global lighting models
- XII. Apply hidden surface remove techniques

## Program Learning Outcomes

The Computer Science major has a set of 10 Student Learning Outcomes (SLOs). Work in this course contributes to the following SLOs:

2. Students can methodically solve algorithmic problems in at least one programming language.
5. Students can apply development practices and processes to a variety of problems.
6. Students can independently learn and apply new methods and tools.
7. Students can effectively present a technical topic to an audience.
9. Students can effectively collaborate in team projects.

## Method for Determining Course Grade

The final grade for this course will depend upon the grades and scores earned on course components weighted as follows:

**45%** Three equally weighted team projects

**Tentative** due dates:

**Project 1:** 09/22/2023

**Project 2:** 10/27/2023

**Project 3:** 12/01/2023

**12%** Homework assignments

**5%** Pop quizzes

- 3%** Three-sentence summaries
- 20%** Two equally weighted midterm exams
- Exam 1:** Tentatively scheduled for 9/29/2023
- Exam 2:** Tentatively scheduled for 10/30/2023
- 15%** **Final Exam:** Wednesday, 12:30 - 2:30 p.m., 12/06/2023

Grades will be computed by rounding numerical percentages to the nearest integer and applying the following table:

<b>A</b>	93-100	<b>B-</b>	80-82	<b>D+</b>	67-69
<b>A-</b>	90-92	<b>C+</b>	77-79	<b>D</b>	60-66
<b>B+</b>	87-89	<b>C</b>	73-76	<b>F</b>	0-59
<b>B</b>	83-86	<b>C-</b>	70-72		

Grades for each project, assignment, quiz, and exam will be recorded in [Blackboard](#). Students may compute their current average by using these scores with the weights listed above.

## COVID-19 Related Responsibilities

We are relying on our Cardinal Community to help us stay healthy and stay strong so we can stay together. Otterbein is currently a mask-optional campus. This means masks are optional for all individuals on campus, regardless of vaccination status. While individuals are no longer required to wear masks on campus, they are welcome to wear one if they choose. Otterbein is a mask-friendly campus. We support those who choose to continue to wear a mask or need to wear a mask due to health concerns. If you are sick, do not come to campus. Perform a daily self-assessment and if you are not feeling well, stay at home and call your doctor if necessary.

You can find COVID-related FAQs and any updated information [here](#).

## Attendance and Participation Policy

Attendance is expected of every student at every lecture. Students are responsible for all content covered in class as well as assigned book chapters. Students should come to class with their text books, having read the material to be covered that day. Students who have not prepared for class may be asked to leave. Due to their nature, pop quizzes cannot be made up.

Students are expected to attend in-person class sessions as indicated on the schedule. However, if a student is not feeling well and especially if that student is exhibiting the signs of COVID-19, that student should not come to the in-person class session that day. To catch up on work, students should visit the instructor during office hours or another scheduled meeting time.

Students are expected to come to class with a three-sentence summary of the reading for that day. Roughly three times a semester without advance warning, each student will be expected to recite their summary in front of the class. Summaries are not expected to be perfect. These summaries are intended to ensure adequate preparation.

Except in the case of documented emergencies, exams cannot be made up afterwards. For excused absences, students must arrange to take the exam *before* the normally scheduled time. Arrangements must be made with the instructor at least two weeks prior to the scheduled time.

Students are expected to maintain an attitude of respect at all times toward their colleagues, the equipment, and the instructor. Students are expected to refrain from using the computers for non-course related purposes during class time and will be penalized 1% of the final grade for each occurrence. Mobile phones and similar devices should be turned off before entering the classroom. Students who use offensive language, misuse computing facilities, or are otherwise disruptive of the classroom will be asked to leave.

## Expectations for Out-of-Class Work

### Projects

All projects are team projects in this course. For each project, all students must form teams of two (or three in the case of an odd number of students). Students are permitted to select their own teams; however, no two students may partner up for more than one project. In other words, each team will be different for each project. Students should select their teams through [Blackboard](#).

Teams are responsible for dividing their workload. Except under extreme circumstances, all members of the team will receive the same grade for each project. The files for each project should be zipped up and uploaded using [Blackboard](#) before the due date. If the project is late, the group will receive a score of 0. **If the project does not compile, the group will receive a score of 0.**

Projects will be graded based on the following criteria:

- |                                    |   |
|------------------------------------|---|
| 1. <b>Correctness:</b>             | Finding the right answer                          |
| 2. <b>Efficiency:</b>              | Efficiently using processor and memory resources  |
| 3. <b>Style and Documentation:</b> | Producing readable code with appropriate comments |

Late projects will not be accepted, with the following exception. Each student has 3 grace days. These grace days may be used together or separately to allow a 24-hour extension of the project deadline per grace day. A team wishing to use a grace day must inform the instructor via e-mail *before* the normal deadline. Both students in the team will have the appropriate number of

grace days deducted. If the members of a team have different numbers of grace days available, the team will be treated as if it has the maximum number of grace days of any of its members.

**Under no circumstances should a team member look at the code written by another team. Tools will be used to detect code similarity automatically.**

## Homework Assignments

All homework assignments are to be done individually. Each assignment must be uploaded into [Blackboard](#) before 11:59 p.m. on the due date. Assignments submitted after the deadline will not be accepted. Programming assignments will receive a score of 0 if they do not compile. Written (non-programming) assignments must be turned in as a LaTeX, Word, or PDF document. LaTeX is strongly encouraged and will earn extra credit. Grace days are not available for assignments.

## Academic Honesty

Academic dishonesty includes cheating, complicity, falsification, multiple submission, and plagiarism. To understand better what each of these kinds of dishonesty entails, see the full statement on Academic Dishonesty in the [Campus Life Handbook](#), beginning at the bottom of page 47.

All cases of suspected Academic Dishonesty will be forwarded to Academic Affairs. To learn more about the process, see the above cited section of the [Campus Life Handbook](#). Academic Dishonesty may result in automatic failure of the assignment or the course itself, or even suspension or expulsion proceedings.

You are plagiarizing when you:

1. Copy material from a source without using quotation marks and proper citation.
2. Follow the movement of the source, substituting words and sentences but keeping its meaning, without citing it.
3. Lift phrases or terms from a source and embed them in your own prose without using quotation marks and proper citation.
4. Borrow ideas (that are not common knowledge) from a source without proper citation.
5. Turn in a paper wholly or partially written by someone else.

If you are uncertain about when and how to cite sources, or what is allowable in completing assignment and exams, please speak with your professor.

All projects must be completed by the students in a given team, without assistance from anyone other than the instructor. Homework assignments must be completed individually. Students can discuss the course material with each other, but all work must be done individually or within the team, as appropriate. For projects, exams, homework, and all other activities in the course, students are

expected to act according to the official policy on academic dishonesty and the highest standards of personal integrity.

Although generative AI tools like ChatGPT are impressive, they must not be used to write any code that a student is expected to turn in for this class. ChatGPT may be used to explain existing code or to suggest improvements for code but only *after* the project or lab in question has been turned in. Students who do not write code themselves have missed the opportunity to gain the skills of logical problem solving and translation to a formal programming language that are essential for computer scientists.

For the first infraction of academic honesty in this course, the instructor will seek a penalty of a 0 for the project, assignment, or exam in question and a reduction of a full letter grade in the final grade. If a second infraction occurs, the instructor will seek the maximum penalty possible under the University's regulations.

## Statement on Credit Hour Definition/Expectation for Student Work

For each credit hour of classroom or direct faculty instruction, students are expected to engage in two hours of out-of-class work (readings, homework, studying, project preparation, etc.). A three-credit-hour course requires six hours per week of out-of-class work. These expectations are the same for blended and online courses, with some or all of the direct faculty instruction occurring online instead of in a classroom.

## Nondiscrimination at Otterbein

Otterbein University is committed to providing a welcoming environment free from unlawful discrimination. To this end, the University prohibits any form of discrimination against any person on the basis of race, color, sex, gender, pregnancy, religion, creed, marital status, partnership status, age, sexual orientation, gender identity, gender expression, national origin, disability, military status, or any other legally protected status in its programs and activities. All Otterbein faculty and staff share in the responsibility to create a safe learning environment for all students and for the campus as a whole. Students who believe they have been discriminated against should contact the Office of Human Resources, (614) 823-1805 / [hr@otterbein.edu](mailto:hr@otterbein.edu).

Any person may report sexual harassment, sexual violence, dating violence, and stalking by contacting Julie Saker, Deputy Title IX Coordinator at (614) 823-1154 / [jsaker@otterbein.edu](mailto:jsaker@otterbein.edu).

If a student would prefer to share information about sexual harassment, sexual violence or discrimination to a *confidential* employee who does not have a reporting responsibility, they can contact

the Counseling Center, (614) 823-1333 / [counseling@otterbein.edu](mailto:counseling@otterbein.edu), or the WGSRC Peer Advocates, [wgsrc@otterbein.edu](mailto:wgsrc@otterbein.edu).

Information about these policies can be found [here](#).

## **Disability Services**

The University has a continuing commitment to providing access and reasonable accommodations for students with disabilities, including mental health diagnoses and chronic or temporary medical conditions. Students who may need accommodations or would like referrals to explore a potential diagnosis are urged to contact Disability Services (DS) as soon as possible. DS will facilitate accommodations and assist the instructor in minimizing barriers to provide an accessible educational experience. Please contact DS at [DisabilityServices@otterbein.edu](mailto:DisabilityServices@otterbein.edu). More info can also be found [here](#). Your instructor is happy to discuss accommodations privately with you as well.

## **Counseling Services**

Given the level of uncertainty about issues related to COVID-19, many students might experience feelings of threat, fear, and uneasiness. For extra support – in the way of just being able to verbalize your feelings to an interested outsider, gaining some reassurance and validation of your feelings, making plans to move forward optimistically and safely – reach out to any staff. Otterbein staff want to provide not only respect but also verbal and emotional support and encouragement. The Counseling Center can be reached at (614) 823-1333. You can also call or text 988, the Suicide and Crisis Lifeline of Ohio, for 24/7 access to a mental health professional.

## **Academic Support Center**

The Academic Support Center (ASC) helps students develop and strengthen the skills necessary to attain their academic goals. They support student learning and success through: tutoring, teaching, disability services, and academic coaching. Students will also find many useful resources on the [ASC Tips and Tools page](#). All services are free for Otterbein students. Their purpose is to help students be academically successful. Please contact them to request a tutor or learn more about the ASC by calling (614) 823-1610 or visiting the [ASC website](#).

## **Library Services**

The Courtright Memorial Library provides a broad range of services and resources, from color printing and a game collection to 24/7 access to more than 220 scholarly databases and e-books [here](#). On-campus students can access in-person help, quiet study spaces, and open computer labs during the library's [open hours](#).

Students can also access the many e-textbooks on reserve by clicking the Course Reserves tab on the library [web page](#) or find help for a specific subject area by searching [LibGuides](#).

Need more help? Students can chat with a librarian by clicking the Ask Me tab on the right side of the library homepage. Students also may e-mail the library at [library@otterbein.edu](mailto:library@otterbein.edu). For in-depth research help, make an appointment for a virtual research consultation with your [personal librarian](#).

## Tentative Schedule

The following is a tentative schedule of the topics to be covered in each week. This schedule is subject to change as need dictates. Students will be informed of changes by the instructor in class. A schedule will be kept on the [course webpage](#).

Week	Starting	Topics	Chapters	Notes
1	08/21/23	Graphics basics	Notes and 2	
2	08/28/23	Rendering pipeline	2	
3	09/04/23	GPU architecture	3	
4	09/11/23	Linear algebra review	Appendices A and B	
5	09/18/23	Transforms	4	Project 1 Due
6	09/25/23	Visual appearance	5	Exam 1
7	10/02/23	Texturing	6	
8	10/09/23	Advanced shading	6	
9	10/16/23	Environmental lighting	7 and 9	
10	10/23/23	Global illumination	10 and 11	Project 2 Due
11	10/30/23	Image-based effects	12 and 13	Exam 2
12	11/06/23	Non-photorealistic rendering	15	
13	11/13/23	Intersections and collision detection	16 and 22	
14	11/20/23	Virtual and augmented reality	21	Thanksgiving
15	11/27/23	Review	All	Project 3 Due