

## Syllabus for CS460 Computer Graphics

### Web-based 3D Visualizations and beyond!

After completion of this course, you will be able to develop rich and interactive web-based 3D visualizations for computers, smartphones, and tablets! By using WebGL, you will learn to create immersive and high-quality graphics including 3D geometric transformations, camera transformations, the image-rendering process, as well as materials and texture mapping. This course also includes advanced topics such as color representations, light simulation, dealing with geometries, and creating animations. And since everything runs in the browser, you can show your work to your friends with a link to a website—how cool is that!

#### We will learn and use:

- JavaScript (including some HTML and CSS)
- XTK (<https://goXTK.com>)
- Three.js (<https://threejs.org>) and other computer graphics frameworks of your choice
- GLSL and "vanilla" WebGL and WebGPU!
- glTF (<https://www.khronos.org/glTF/>)
- Github / git (for version control and assignment submission)
- Overleaf /  $\text{\LaTeX}$  (for reports)

### Teaching Staff

Instructor: Daniel Haehn

Teaching Assistants: Vidhya Sree Narayanappa, Edward Gaibor, Argo Kiernan-Paadre

Contact: @staff on Discord

### Lectures

Tuesdays and Thursdays

12:30-1:45pm

Wheatley W01-0006

### Office Hours

Tuesdays and Thursdays

11:00am-12:30pm and by request

McCormack M03-2120, please use <https://calendly.com/haehn/> to reserve a slot.

### Canvas Access

Please use Canvas to access course materials.

Login at <https://umassboston.instructure.com/>.

### Discord Access

The teaching staff is available via Discord. The invite link will be shared in class.

## Questions and Concerns

Please direct questions and concerns of any kind (now and during the semester) to the teaching staff in person or via Discord @staff or in the #help channel.

## Course Structure

29 Lectures

10 Assignments (30% of final grade, plus 10% bonus)

13 Quizzes (20% of final grade, take-home through Canvas)

Final Project (40% of final grade)

Participation (in-class, in-office, and as part of Discord discussions, 10% of final grade)

No exams

We will have **multiple guest lectures** from experienced graphics researchers.

## Final Grade

The weighted scores from above will result in a final grade as follows:

$\geq 90 = A$	69-66 = C
89-86 = A-	65-62 = C-
85-82 = B+	61-58 = D+
81-78 = B	57-54 = D
77-74 = B-	53-50 = D-
73-70 = C+	below 50 = F

## The "STRAIGHT A"-Shortcut

There are **two special ways to get a straight A** in this course: **(1)** if we can submit your final project to the International ACM Conference on 3D Web Technology (<https://www.web3d.org/conferences>), or **(2)** if your final project significantly contributes to an existing open source library and gets merged back into the parent code repository (new features, or important bugfixes).

## Interactive Lectures (Bring your Laptop!)

Lectures will include interactive components. Please bring your laptop. If you do not have a laptop, please contact the teaching staff via Discord.

## Assignments

Weekly assignments include research questions and coding challenges. All assignments require a written report in  $\text{\LaTeX}$ . You will use a standard git workflow paired with an online form to submit your work. **Assignments are due Tuesdays at 11:59pm. No late submissions.**

## Quizzes

Quizzes include multiple-choice and free-text questions. They are take-home quizzes and available in the Blackboard system. **Quizzes are due Thursdays at 11:59pm. No late submissions.**

## Final Project

The final project is the capstone of this course and counts as 40% of your final grade. This is your chance to apply your newly learned skills. You can fully enjoy the freedom and come up with your project idea or you can ask the teaching staff for suggestions. Project teams are encouraged but working alone is also fine. In the Fast Forward lecture, all students will present their final project plans in 2 minutes or less. Then, all students will present progress towards their final delivery

during the Final Project Presentations. **And finally, all projects, including reports are due on 12/19/2024. No late submissions.**

## Participation

In-class participation and Discord activity count towards your grade. If class attendance drops below 50%, surprise tests may happen during lectures.

## Collaboration Policy and AI Policy

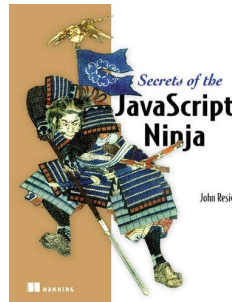
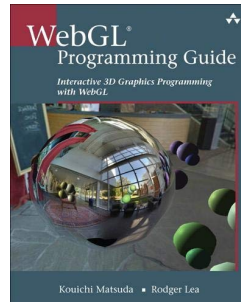
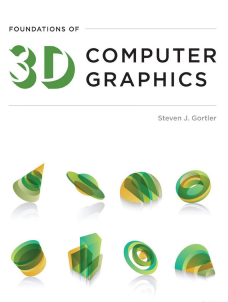
You are allowed and encouraged to collaborate with anybody. However, please make sure to give proper credit. For instance, if your friend helps you with an assignment or you copied code from another source, you must acknowledge their name in your code and the assignment report. **Students are expected to use AI tools and resources ethically and responsibly.** This includes ensuring that any data used in AI systems is properly licensed, and that any AI-generated content is appropriately cited.

## Open Source License

The course material is publicly available under the MIT license (<https://opensource.org/licenses/MIT>). This includes assignment code. You are free to adopt a different license for your assignment solutions.

## Readings

There are no required readings for this course. However, the material is based on the following three books:



- Foundations of 3D Computer Graphics by S. Gortler
- WebGL Programming Guide: Interactive 3D Graphics Programming with WebGL by K. Matsuda and R. Lea
- Secrets of the JavaScript Ninja by J. Resig and B. Bibeault

Limited copies of all books are available through the teaching staff. While the books are great, **you do not need to purchase them**—the most up-to-date information is available online.

## Disability Accommodations

If you have a disability and feel you will need accommodation to complete course requirements, please contact the Ross Center for Disability Services at 617.287.7430.

## Other Policies

We follow the Academic Policies of the Office of the Registrar.

See [https://www.umb.edu/registrar/academic\\_policies](https://www.umb.edu/registrar/academic_policies) or contact [staff@cs460.org](mailto:staff@cs460.org) for questions.

## Timeline

Date		Lecture	Due at 11:59pm
09/03/2024	Tu	01 Introduction and Web Developer Tools	
09/05/2024	Th	02 JavaScript and XTK Intro	Quiz 1
09/10/2024	Tu	03 Scene and Camera	Assignment 1 (TBA)
09/12/2024	Th	04 Three.js Intro	Quiz 2
09/17/2024	Tu	05 The Rendering Pipeline	Assignment 2 (TBA)
09/19/2024	Th	06 Shaders and WebGL I	Quiz 3
09/24/2024	Tu	07 WebGL II	Assignment 3 (TBA)
09/26/2024	Th	08 WebGL III	Quiz 4
10/01/2024	Tu	09 Transformations	
10/03/2024	Th	10 The Scene Graph	Quiz 5
10/08/2024	Tu	11 Quaternions and The Arcball	Assignment 4 (TBA)
10/10/2024	Th	12 Information Visualization	Quiz 6
10/15/2024	Tu	13 3D Picking	
10/17/2024	Th	14 Colors	Quiz 7
10/22/2024	Tu	15 Animations	Assignment 5 (TBA)
10/24/2024	Th	16 Generative AI	Quiz 8
10/29/2024	Tu	17 Guest Lecture: Manuel Sainsily	Assignment 6 (TBA)
10/31/2024	Th	18 Guest Lecture: Allyssa A Lewis	Quiz 9
11/05/2024	Tu	19 Textures	Assignment 7 (TBA)
11/07/2024	Th	20 Geometry	Quiz 10
11/12/2024	Tu	21 Materials and Lighting	Assignment 8 (TBA)
11/14/2024	Th	22 Volume Rendering	Quiz 11
11/19/2024	Tu	23 glTF	Assignment 9 (TBA)
11/21/2024	Th	24 Final Project Fast Forward	Quiz 12
11/26/2024	Tu	25 Field Trip / Outside Lecture	
11/28/2024	Th	No Class (Thanksgiving Recess)	
12/03/2024	Tu	26 Skybox	Assignment 10 (TBA)
12/05/2024	Th	27 Final Project Presentations I	Quiz 13
12/10/2024	Tu	28 Final Project Presentations II	
12/12/2024	Th	29 Recap Lecture	
12/17/2024	Tu	No class / Office hours only	
12/19/2024	Th	No class / Office hours only	Final Project