Syllabus

Course Information	CS 451: Computer Graphics Location: Distance Education/Blackboard
Instructor	Please refer to your online course: https://mymasonportal.gmu.edu/ Office Hours by appointment.
Course Description	Basic graphics principles, and programming. Topics include scan conversion, transformation, viewing, lighting, blending, texture mapping, and some advanced graphics techniques.
Course Objectives	Upon completion of the course, students will be able to: 1. Implement OpenGL programs using JAVA/JOGL. 2. Apply trigonometry, geometry, vector analysis, and linear algebra to solve real world problems in graphics. 3. Utilize transformation and viewing for 3D animation. 4. Utilize GPU shaders for vertex and fragment lighting. 5. Describe some advanced graphics capabilities, including raytracing, blending, texture mapping, bump mapping, displacement mapping, geometry shader, and shadows.
Course Methodology	The class format will combine reading, lectures, presentations, and other learning tools. The class will be interactive and require every student to be engaged in the classroom discussion and assignments. In addition to the lectures, screencasts and timely completion of assignments, every student will be expected to be an active participant and a dedicated individual applying what you learn to every element of the course work.
Required textbook(s) and/or materials	Required Text: V. Scott Gordon and John L. Clevenger, Computer Graphics Programming in Open GL with Java, January 2017, or latest. Jim X. Chen and Chunyang Chen, Foundation of 3D Graphics Programming Using JOGL and Java3D, Second Edition, Springer Verlag.
Computer Requirements	**Hardware:** You will need access to a Windows computer with at least 2 GB of RAM and access to a fast and reliable broadband internet connection (e.g., cable, DSL). A larger screen is recommended for better visibility of course material. You will need speakers or headphones to hear recorded content and a headset with a microphone is recommended for the

	best experience. For the amount of Hard Disk Space required taking a distance education course, consider and allow for: 1. the storage amount needed to install any additional software and 2. space to store work that you will do for the course. If you consider the purchase of a new computer, please go to Patriot Tech to see recommendations. **Software:** Many courses use Blackboard as the learning management system. You will need a browser and operating system that are listed compatible or certified with the Blackboard version available on the myMason Portal. See supported browsers and operating systems. Log in to myMason to access your registered courses. Some courses may use other learning management systems. Check the syllabus or contact the instructor for details. Online courses typically use Acrobat Reader, Flash, Java, and Windows Media Player, QuickTime and/or Real Media Player. Your computer should be capable of running current versions of those applications. Also, make sure your computer is protected from viruses. Students owning Macs or Linux should be aware that some courses may use software that only runs on Windows. Although CS 451 could be worked out on Macs or Linux, Windows is strongly recommended. You can set up a Mac computer with Boot Camp or virtualization software so Windows will also run on it. Watch this video about using Windows on a Mac. Computers running Linux can alsobe configured with virtualization software or configured to dual boot with Windows. Note: If you are using an employer-provided computer or corporate office for class attendance, please verify with your systems administrators that you will be able to install the necessary applications and that system or corporate firewalls do not block access to any sites or media types. **Course-specific Hardware/Software** Check the syllabus for your course or contact the instructor prior to the start of the course to find out about specific technical requirements for your class. Hardware or software required for your course or program may be available for purchase at Patriot Computers (the University's computer store that offers educational discounts and special deals).
Course Website	Blackboard will be used for this course. You can access the site at http://mymasonportal.gmu.edu. Login and click on the "Courses" tab. You will see CS 451 course NOTE: Username and passwords are the same as your Mason email account. You must have consistent access to an internet connection in order to complete the assignments in this course through Blackboard (http://mymason.gmu.edu). Note the technology requirements in your Blackboard course menu—it contains details of minimum technology requirements.

Participation	Learning can only happen when you are playing an active role. It is important to place more emphasis on developing your insights and skills, rather than transmitting information. Knowledge is more important than facts and definitions. It is a way of looking at the world, an ability to interpret and organize future information. An active learning approach will more likely result in long-term retention and better understanding because you make the content of what you are learning concrete and real in your mind. Although an active role can look differently for various individuals, it is expected in this class that you will work to explore issues and ideas under the guidance of the professor and your peers. You can do this by reflecting on the content and activities of this course, asking questions, striving for answers, interpreting observations, and discussing issues with your peers.

Rules and Expectations	In correspondence/communication students will be expected to:
	  a) Be professional and respectful in correspondence
	  b) Make reasonable requests of the instructor. We will be happy to clarify course material and answer legitimate questions; however, please exhaust other information sources (e.g., syllabus, Blackboard) for answering your question before contacting me and remember, "Poor planning on your part does not constitute an emergency on my part"
	In regard to honesty in work students will be expected to:
	  a) Review the University integrity and honesty policies in the student handbook for guidelines regarding plagiarism and cheating (summarized below). I will gladly clarify my stance on any questionable or "grey area" issues you may have.
	  b) Refrain from dishonest work as it will receive a minimum penalty of zero on the assignment and a maximum penalty of a zero for the course with a report to the Honor committee. The GMU Honor Code requires that faculty submit any suspected Honor Code violations to the Honor Committee. Therefore, any suspected offense will be submitted for adjudication.

Mason Honor Code	**The complete Honor Code is as follows:** *To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this honor code:* **Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.** *(From the Catalog – catalog.gmu.edu)*
Cheating Policy	Any form of cheating on an activity, project, or exam will result in zero points earned. "Cheating" includes, but is not limited to, the following: reviewing others' exam papers, having ANY resources utilized when not allowed, collaborating with another student during an individual assignment. If you have questions about when the contributions of others to your work must be acknowledged and appropriate ways to cite those contributions, please talk with the professor or utilize the GMU writing center.

Plagiarism and the Internet	Copyright rules also apply to users of the Internet who cite from Internet sources. Information and graphics accessed electronically must also be cited, giving credit to the sources. This material includes but is not limited to e-mail (don't cite or forward someone else's e-mail without permission), newsgroup material, information from Web sites, including graphics. Even if you give credit, you must get permission from the original source to put any graphic that you did not create on your web page. Shareware graphics are not free. Freeware clipart is available for you to freely use. If the material does not say "free," assume it is not. Putting someone else's Internet material on your web page is stealing intellectual property. Making links to a site is, at this time, okay, but getting permission is strongly advised, since many Web sites have their own requirements for linking to their material. Review the Honor Code here.
Individuals with Disabilities	Students with documented disabilities should contact the Office of Disability Services (703) 993-2474) to learn more about accommodations that may be available to them. *(From the 2019-2020 Catalog – catalog.gmu.edu)*
Academic Integrity and Inclusivity	This course embodies the perspective that we all have differing perspectives and ideas and we each deserve the opportunity to share our thoughts. Therefore, we will conduct our discussions with respect for those differences. That means, we each have the freedom to express our ideas, but we should also do so keeping in mind that our colleagues deserve to hear differing thoughts in a respectful manner, i.e. we may disagree without being disagreeable. http://oai.gmu.edu/
Student Privacy Policy	George Mason University strives to fully comply with FERPA by protecting the privacy of student records and judiciously evaluating requests for release of information from those records. Please see George Mason University's student privacy policy https://registrar.gmu.edu/students/privacy/
E-Mail Policy	Web: masonlive.gmu.edu Mason uses electronic mail to provide official information to students. Examples include notices from the library, notices about academic standing, financial aid information, class materials, assignments, questions, and instructor feedback. Students are responsible for the content of university communication sent to their Mason e-mail account and are required to activate that account and check it regularly. Students are also expected to maintain an active and accurate mailing address in order to receive communications sent through the United States Postal Service. *(From the 2017-18 Catalog – catalog.gmu.edu)*
Course Grading & Evaluation	There are all together 100 points: • Homework assignments (20 points) • Quizzes and exercises (20 points) • One programming project (25 points)

	• A Final Exam (35 points) • Discussion participations (Optional: 5 extra points) • Your overall course score, S, will be the sum of these points. • A: S is at least 90 points • B: S is at least 75 points • C: S is at least 60 points • D: S is at least 40 points • F: S is fewer than 40 points Each assignment/project late may not be accepted. Therefore, you should plan on working early. If there is an accident or emergency and you let me know, I will consider it accordingly.
Discussions– 5%	Your challenge is to immerse yourself in the topics and perspectives presented in the course. You will want to be able to comment on the discussion topics with authority. You are encouraged to make notes on your own thoughts about the various concepts and issues, and consider possible issues/outcomes. Your posts should be to the point and include sufficient technical detail for others to respond. You should present your opinions, but justify them with facts and proper sources. What did you disagree with and why, or not understand? **Initial/Original Post** Please provide response with a clear, well-formulated thesis; sentence structure, grammar, punctuation, and spelling count. Support all posts with appropriate rationale and citations from readings; appropriately document sources. **Responding to Others** Responses to classmates' postings should be thoughtful, and substantial. Consider points of agreement, disagreement, assumptions, and value judgments. **Instructions** Each student will make at least one original post each lesson 3 days before the homework due.
Assignments and quizzes – 40%	Each week a programming assignment is required to be uploaded to Blackboard. Also, after finishing reviewing, there is a weekly online quiz in Blackboard. Assignments and quizzes are due as stated. Refer to the course schedule and weekly overviews for details.
Exams – **30%**	The Final Exam will be an open-book test online in Blackboard that must be finished in 2 hours.
Final Project – 25%	The project will be announced in Blackboard with technical details.
Need Help? Utilize the "Course Q&A" discussion forum or email your instructor directly.	

Expect to work 15-20 hours per week on the assignment and quiz for this course.

Unless otherwise stated, all assignments and quizzes are due by the end of the following week in which they are assigned. For the purposes of this course, a week is defined as **beginning at 12:01 am each Monday EST**, and **ending at 11:59 pm on the Sunday EST.**

To help you manage your schedule and time to complete the assignments and quizzes in this course, please follow the recommended timeline below. If you have a question or concern or encounter a problem about an assignment, please contact me immediately so we can discuss and work out a resolution.

Weeks	Lessons	Assignments
Week 1	**Lesson 1:** Setting up working environment	- Read Week1 ppt; watch the corresponding recording - Read Chapter 1 (Gordon); Chapter 1.1 (Chen) - Complete Lesson 1 Assignment: set up your working environment - Take Quiz1 - Participate in the Online Discussion
Week 2	**Lesson 2:** Introduction	- Read Week2 ppt; watch the corresponding recording - Read Chapter 1.1-1.3 (Chen) - Complete Lesson 2 Assignment: open a display and change its color and size. - Take Quiz2 - Participate in the Online Discussion
Week 3	**Lesson 3:** Hardware and Rendering	- Read Week3 ppt; watch the corresponding recording - Read Chapter 2 (Gordon) - Complete Lesson 3 Assignment: vertex and fragment shaders. - Take Quiz3 - Participate in the Online Discussion
Week 4	**Lesson 4:** Animation and Math	- Read Week4 ppt; watch the corresponding recording - Read Appendix A (Chen); Chapter 3.1-3.6 (Gordon) - Complete Lesson 4 Assignment: animate a point on a circle path. - Take Quiz4 - Participate in the Online Discussion
Week 5	**Lesson 5:** Rasterization and Clipping	- Read Week5 ppt; watch the corresponding recording - Read Chapter 1.3 (Chen); Chapter 4.1-4.2 (Gordon) - Complete Lesson 5 Assignment: Bounce points in a circle. - Take Quiz5 - Participate in the Online Discussion
Week 6	**Lesson 6:** Characters and Attributes	- Read Week6 ppt; watch the corresponding recording - Read all Chapter 1 (Chen) - Complete Lesson 6 Assignment: draw characters as outlines. - Take Quiz6 - Participate in the Online Discussion
Week 7	**Lesson 7:**	Read Week7 ppt; watch the corresponding recording

	Primitives and 3D Models	• Read Chapter 2.3.3, 2.3.4, 2.3.6 (Chen); Chapter 4.5-4.6, 4.9-4.11 (Gordon) • Complete Lesson 7 Assignment: draw a sphere to demonstrate effects in OpenGL. • Take Quiz7 • Participate in the Online Discussion
Week 8	**Lesson 8:** 2D Geometrical Transformation	• Read Week8 ppt; watch the corresponding recording • Read Chapter 2.1-2 (Chen); Chapter 3.1-3.5 (Gordon) • Complete Lesson 8 Assignment: start the semester project and continue until the due date – integrating point, line, font, trigonometry, geometry, vector operations, linear algebra, and transformations in an animation. • Take Quiz8 • Participate in the Online Discussion
Week 9	**Lesson 9:** 3D Geometrical Transformation	• Read Week9 ppt; watch the corresponding recording • Read Chapter 2.3 (Chen); Chapter 3.6 (Gordon) • Complete Lesson 9 Assignment: Implement 3D animation with a robot arm and generalized solar system. • Take Quiz9 • Participate in the Online Discussion
Week 10	**Lesson 10:** Viewing	• Read Week10 ppt; watch the corresponding recording • Read all Chapter 2 (Chen); all Chapter 3, 4.4 (Gordon) • Complete Lesson 10 Assignment: multiple projections and viewports with different viewpoints. • Take Quiz10 • Participate in the Online Discussion
Week 11	**Lesson 11:** Lighting for a Point	• Read Week11 ppt; watch the corresponding recording • Read Chapter 3.1-3.3 (Chen); Chapter 7.1-7.4 (Gordon) • Complete Lesson 11 Assignment: calculate lighting for cylinder vertices. • Take Quiz11 • Participate in the Online Discussion
Week 12	**Lesson 12:** Shading Models for a Surface	• Read Week12 ppt; watch the corresponding recording • Read all Chapter 3 (Chen); Chapter 7.5 (Gordon) • Complete Lesson 12 Assignment: calculate Phong shading for cylinders in the fragment shader. • Take Quiz12 • Participate in the Online Discussion

Week 13	**Lesson 13:** Blending for Transparency, Antialiasing, and Fog	• Read Week13 ppt; watch the corresponding recording • Read Chapter 4.1-4.2 (Chen); Chapter 14.1-14.2 (Gordon) • Complete Lesson 13 Assignment: calculate per-pixel fog using a cloud image with texture animation. • Take Quiz13 • Participate in the Online Discussion
Week 14	**Lesson 14:** Texture Mapping	• Read Week14 ppt; watch the corresponding recording • Read Chapter 4.3 (Chen); Chapter 5 (Gordon) • Lesson 14 Assignment: (Optional, extra credits) texture mapping on to the cylinders (of the robot arm). • Take Quiz14 • Participate in the Online Discussion
Week 15	**Lesson 15:** Advanced Texture and Applications	• Read Week15 ppt; watch the corresponding recording • Read all Chapter 4 (Chen); Chapter 8-10, 13 (Gordon) • Take Quiz15 (Optional, extra credits) • Participate in the Online Discussion