Course Outline

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Course Details

Course Code	COMP3421
Course Title	Computer Graphics
Units of Credit	6
Course Website	http://cse.unsw.edu.au/~cs3421 (http://cse.unsw.edu.au/~cs3421)
Handbook Entry	http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP3421.html (http://www.handbook.unsw.edu.au/undergraduate/courses/current/COMP3421.html)

Course Summary

This course teaches the fundamental algorithms underlying computer graphics in both 2D and 3D. It introduces students to an industry standard graphics API (OpenGL) and gives them experience developing graphical applications.

Course Staff

Lecturer in Charge:

Rob Everest

robertce@cse.unsw.edu.au

Consultations: Friday 1pm in K17 G01

Course Timetable

The course timetable is available here (https://webcms3.cse.unsw.edu.au/COMP3421/18s2/timetable) (/COMP3421/16s2/timetable) (https://webcms3.cse.unsw.edu.au/COMP3421/17s2/timetable) .

Course Aims

This course aims to teach the fundamental algorithms underlying computer graphics in both 2D and 3D. The course also aims to introduce students to an industry standard graphics API (OpenGL) and give them experience developing graphical applications using Java.

Student Learning Outcomes

After successfully completing this course, students will:

- have knowledge and understanding of

    - **modeling:** the mathematical representation and computer implementation of lines, curves, surfaces, and transformations
    - **rendering:** the mathematics of projection, hidden surface removal and local and global illumination; the computer implementation of this in the graphics pipeline
    - how modeling and rendering work together in graphics hardware and software
- be able to use OpenGL to write interactive computer programs to manipulate and render complex 3D scenes.

This course contributes to the development of the following graduate capabilities:

Graduate Capability	**Acquired in**
scholarship: understanding of their discipline in its interdisciplinary context	lectures, assignments
scholarship: capable of independent and collaborative enquiry	assignments
scholarship: rigorous in their analysis, critique, and reflection	tutorials
scholarship: able to apply their knowledge and skills to solving problems	tutorials, assignments
scholarship: ethical practitioners	all course-work by doing it yourself
scholarship: capable of effective communication	tutorials, final assignment demonstration
scholarship: digitally literate	everywhere in CSE
leadership: enterprising, innovative and creative	assignments
leadership: collaborative team workers	assignments
professionalism: capable of operating within an agreed Code of Practice	assignments

Assumed Knowledge

The formal prerequisite for COMP3421 is COMP2511 or COMP2911.

For COMP9415 there is no formal prerequisite, but you are still expected to have the requisite knowledge.

Both undergrads and postgrads are expected to have a working knowledge of:

- Programming in Java
- Object-oriented design with interfaces and patterns
- Basic linear algebra: matrices and vectors

Teaching Rationale

Computer Graphics is fun. You can use it to make cool games and amazing special effects in movies. So learning it should be fun.

Computer Graphics is hard. The reason why the world looks like it does is because there are gazillions of photons bouncing around between all the objects. Simulating all the photons and the properties of the objects is too hard to do, so we have to come up with mathematical approximations and clever algorithms.

So you are going to have to work hard to understand the maths and the algorithms. But then you get the reward of making pretty pictures. Which is even more fun because you have earned it.

Teaching Strategies

Lectures

Lectures will be used to introduce theoretical concepts and will include exercises, demonstrations and live coding examples.

Labs

In **week 1** you can go to an optional **lab** where you can get help setting up eclipse to work with OpenGL and work through your first graphics program. This is your chance to get help setting up on your laptops too if you need it, so bring them along as well.

Tutorials

Tutorials aim to clarify ideas from lectures. There will be a number of exercises set for each tutorial class. The aim of the class is *not* to simply get the tutor to give you the answers; the aim is to focus on just one or two of the exercises and work through them in detail, discussing as many aspects, alternative approaches, fine details, etc. as possible. You must be active and ask questions in tutorials. Ideally, students should run the entire tute themselves, with the tutor being a moderator and occasionally providing additional explanations or clarifications. Any questions that are not completed during tutorials can be used for self study and revision. Sample solutions to most tutorial questions will be provided at the end of each week.

Assignments

Assignments are a very important part of the course. They allow students apply the techniques introduced in the course and the final assignment involves students working in pairs to create a significant application.

Quizzes

The online quizzes assess your comprehension of the lecture content throughout the course. You are encouraged to submit the quiz shortly after attending or viewing the lecture. They are all automatically marked.

Assessment

Assessment will be based on 2 assignments and a final exam and is subject to scaling. Contributions are as follows:

Task	Value
Quizzes	10%
Assignment 1	10%
Assignment 2	20%
Exam	60%

Assignment 1

This is an individual assignment

Released: Week 2

Due: End of week 5

Covers: 2D drawing and transformations

Late Penalty: 10% per day off the maximum mark

Assignment 2

This will be a pair assignment

Released: Week 7

Initial milestone due: End of week 10

Final submission due: End of week 12. Demo in week 13

Covers: 3D drawing and transformations

Late Penalty: 10% per day off the maximum mark for the final submission.

Quizzes

There will be 5 quizzes throughout the semester (worth a varying number of marks, but coming to a total of 10% of the overall course mark). They will be released after the lecture in weeks 1, 3, 5, 7 and 9. The first four will be due on Friday at 11:59PM in the following week. For example, the quiz for week 1 will be due on the Friday of week 2. The final week 9 quiz will be due on Friday at 11:59PM in week 11.

Exam

There will be a two hour final exam at a time to be arranged, covering the entire syllabus.

The exam will be open book. Calculators and rulers will also be allowed into the exam.

A supplementary exam will only be awarded under the following situations:

- You are unable to sit the exam due to illness or misadventure (see below), OR
- Your final mark is in the range 45 to 49 and your mark for the practical component (quizzes and assignments) is greater than 19.

Special Consideration

If you cannot attend the Final Exam because of illness or misadventure, then you must submit a Special Consideration request, with documentation, through MyUNSW within 48 hours of the exam. If your request is reasonable, then you will be awarded a Supplementary Exam.

If your work on assignments in this course is affected by unforseen adverse circumstances, you should apply for Special Consideration through MyUNSW, including documentation on how your have been affected. If your request is reasonable and your work has clearly been impacted then you may be offered an extension.

If you are registered with Disability Services, please forward your documentation to Robert Clifton-Everest within the first two weeks of semester.

Student Conduct

The **Student Code of Conduct** (Information (https://student.unsw.edu.au/conduct) , Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them, and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW

courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer (mailto:ethics-officer@cse.unsw.edu.au) , Grievance Officer (mailto:grievance-officer@cse.unsw.edu.au) , or one of the student representatives.

Plagiarism is defined as (https://student.unsw.edu.au/plagiarism) using the words or ideas of others and presenting them as your own. UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism (https://student.unsw.edu.au/plagiarism)

The pages below describe the policies and procedures in more detail:

- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy Statement (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism.

Course Schedule

The (tentative and subject to change) schedule of lecture topics is:

Week	**Lectures**	**Tutes**
Week 1	Introduction, getting started with graphics	**Optional Lab**
Week 2	2D Transformations	Introduction to the course and the basics
Week 3	Homogeneous Coordinates, Vector Geometry, Shaders	2D Transformations
Week 4	3D Graphics, Depth, Perspective	Homogeneous Coordinates, Vector Geometry, Shaders
Week 5	Hidden Surface Removal, Clipping, Illumination I	3D Graphics, Depth, Perspective
Week 6	Illumination II, Meshes	Hidden Surface Removal, Clipping, Illumination
Week 7	Modeling	Meshes
Week 8	Textures	Modeling and VBOs
Week 9	Rasterisation	Textures
Week 10	NO LECTURE	NO TUTORIAL
Week 11	Ray Tracing	Rasterisation
Week 12	Radiosity, Splines	Ray Tracing, Radiosity, Revision
Week 13	Advanced Topics, Revision, Exam Info	**Assignment 2 Demos**

Week 13 will be an assignment demo instead of a tutorial. Locations for the assignment demos will be arranged closer to the date. The rest of the weeks will be tutorials in your allocated tutorial rooms.

Resources for Students

There is no texbook for this course. You may find the following books useful as references:

- Fundamentals of Computer Graphics by Erik Reinhard, Kelvin Sung, Michael Ashikhmin, Michael Gleicher, Peter Shirley, Peter Willemsen, Stephen R. Marschner, and William B. Thompson
- Computer Graphics: Principles and Practice by Andries van Dam, James D. Foley, John F. Hughes, and Steven K. Feine

Note that neither of these books use Java for their examples, so should be viewed as references for the theoretical underpinnings rather than programming guides.

Course Evaluation and Development

This course is evaluated each session using the My Experience system. Students are also encouraged to provide informal feedback during the session and to let the lecturer in charge know of any problems as soon as they arise. Suggestions will be listened to very openly, positively, constructively and thankfully, and every reasonable effort will be made to address them.

Feedback from last year indicated that some students found it hard to be motivated to keep up with the course and wanted more ongoing assessments. To resolve that, this year we have introduced online quizzes. Other students wanted more opportunities for feedback for the second assignment. This year we address that by having two milestones. Both milestones will be opportunities to get marks and feedback on the assignment.

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