



UNIVERSITY OF  
GLOUCESTERSHIRE

at Cheltenham and Gloucester

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# Graphics Programming with Shaders

**CT6025**

Module Outline

2017/18

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**Contains:**

Module Evaluation Summary

Module Content

Module Programme

Recommended Reading

Assessment Brief

Course Blog Address – <http://ct.glos.ac.uk/cgp/>  
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School of Computing & Technology

Faculty of Arts & Technology

**[www.glos.ac.uk](http://www.glos.ac.uk)**

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## Learning Outcomes

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A student passing this module should be able to:

1. Explain, develop and implement shader programs
2. Comprehend the use of DirectX technology
3. Develop graphics applications using the programmable render pipeline
4. Analyse the difference between OpenGL and Direct3D
5. Critically evaluate the programmable render pipeline

## Module Evaluation

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In this current academic year 2017/18 you will be given the opportunity to undertake a mid-module evaluation which will feed into the course board of studies meeting and will inform module design for the following year. In addition there will be an independent end of year level evaluation distributed by the University.

# Scheme of work

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Date w/c	Topic	Practical work	
22-Jan-18	The graphics pipeline	From CPU to GPU to Screen	JS
29-Jan-18	Intro to Shaders	Post processing effects	JS
05-Feb-18	Lighting	Blinn-Phong shading	JS
12-Feb-18	Your Future Plan Week		
19-Feb-18	Advanced Texturing	Application of textures	JS
26-Feb-18	The Geometry Shader	GPU Particle Systems	JS
05-Mar-18	Tessellation Shaders	Making triangle soup	JS
12-Mar-18	Your Future Plan Employability & Professional Development Week		
19-Mar-18	Shadows	How to do shadows	JS
26-Mar-18	Easter Break – 2 Weeks		
09-Apr-18	Post Processing Effects	Different Effects	JS
16-Apr-18	Deferred Rendering	Setting up a deferred rendering	JS
23-Apr-18	Forward+ Rendering	An alternative to deferred	JS
30-Apr-18	Global Illuminations	Better lighting & HDR	JS
07-May-18	Ray Tracing	Ray Tracing in a shader	JS

# Recommended Reading

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## Suggested Text

Sellers, G. Wright Jr, R. Haemel, N.(2015) *OpenGL SuperBible, seventh edition*, Addison Wesley.

Akenine-Möller, T. Haines, E. Hoffman, N. (2008) *Real-Time Rendering (Third Edition)*. CRC Press.

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## Other Resources

The module will be supported by a Moodle web site. This site contains tutorial information, lecture notes, reading list and showcase material. Moodle web site can be accessed at: <http://moodle.glos.ac.uk/>.

## Assessment

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<b>1. Module code and title</b>	<b>CT6025 Graphics Programming with Shaders</b>
<b>2. Module tutor</b>	Jamie Stewart
<b>3. Tutor with responsibility for this Assessment</b>	Jamie Stewart This is your first point of contact.
<b>4. Assignment</b>	001: 100% Individual, Coursework: Create a real time 3D rendered dynamically lit environment (1600 words or equivalent).  You will be penalised according to the <b>Academic Regulations for Taught Provision</b> if you exceed the size limit.
<b>5. Submission deadline</b>	<b><i>Monday 21st<sup>th</sup> May 2018</i></b>  Your attention is drawn to the penalties for late submission; <b>see Academic Regulations for Taught Provision.</b>
<b>6. Arrangements for submission</b>	<b>EMA</b>
<b>7. Date and location for return of work</b>	<b>Written feedback and provisional mark will be within 20 working days of submission</b>
<b>8. Students with Disabilities</b>	Alternative assessment arrangements may be made, where appropriate, for disabled students. However, these will only be implemented upon the advice of the Disability Advisor. Disabled students wishing to be considered for alternative assessment arrangements must give notification of the disability (with evidence) to the Disability Advisor by the published deadlines.
<b>9. University Regulations for Assessment</b>	All assessments are subject to the <b>Academic Regulations for Taught Provision</b> . These include regulations relating to Errors of Attribution and Assessment Offences. In exercising their judgement, Examiners may penalise any work here the

	standard of English, numeracy or presentation adversely affects the quality of the work, or where the work submitted exceeds the published size or time limits, or where the work fails to follow normal academic conventions for acknowledging sources.
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## 10. The requirements for assessment 1:

For this assessment you are to implement a real time 3D virtual environment. Your rendered scene must make use of lighting techniques that are implemented within a programmable shader, you are required to have more than one light source for your scene or apply a lighting technique that is more complex than a simple global illumination.

Any objects in your scene where appropriate must cast shadows which react to the light sources that are present to influence them.

One or more elements of your scene must be programmatically generated, this generated geometry must be textured.

Elements for your scene can be created by you or from freely available 3D assets that you have legal permission to use within your assessments (Open source or GPL assets).

At least one element within your scene must be animated, this can either be an applied procedural animation or an animated component of your scene that has its animation data stored within the associated asset file.

You must implement tessellation within your scene to generate higher levels of detail for geometry that is located closer to the cameras view, this technique does not need to be applied to all geometry in your scene and should only be applied to appropriate terrain or objects of significant geometric detail.

You are required to document the techniques that you will be employing in your 3D scene and submit this document as part of your assessment submission. This document should include:

- Any problems that were encountered and what was done to overcome them;
- Improvements that could be made, or that were made to the solution; and
- What has been learnt.
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A user guide describing how to install, run and use the application. Include the specifications for hardware required to run your application

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## 11. Special instructions

None.

## 12. Assessment 1 criteria

The grade table on the following page is a guide to the level of practical content required for the assignments. You need to achieve at least 40% to pass this assessment.

*Assesses learning outcomes (1) (3) and (4)*

Grade	Content
To achieve <30	No accompanying documentation; project does not compile, contains compilation errors or does not run.
To achieve <40	Project code compiles, but contains multiple unaddressed warnings. Assessment is incomplete or missing key components (e.g. documentation, lighting). Level of technical detail is not at required level for this module.
To achieve 40+	Level of programming meets minimum requirements of assessment in that the project is able to be compiled and run without error. The majority of features have been implemented. Scene is complete but has a low framerate.
To achieve 50+	Meets the requirements for <b>40+</b> . Project is feature complete with some level of complexity demonstrated, there is a good level of detail with the rendered scene. Demonstration of good programming practice is evident in any source code.
To achieve 60+	Meets the requirements for <b>50+</b> , and additionally shows effort has been made to make sure code is as efficient and as clean as possible with thorough commenting throughout. Sound knowledge of programming principles is demonstrated in source code. The rendered scene is to high standard and feature complete.
To achieve 70+	Meets the requirements for <b>60+</b> , and additionally exceeds the expectations for this project. Rendered scene covers advanced features not covered during lectures. All code is well written and efficient, good knowledge of programming principles is demonstrated in source code. Rendered scene meets a professional standard of quality.

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*Note that the overall grade will be determined by the application of the School of Business & Computing course assessment criteria grid below.*

Mark %	Comment	Grade & Characteristics	Theory & Academic Approach	Practice & Deliverables
0		<b>Fail</b>	plagiarism, collusion, non-pres., name only	as theory
1-39		<b>Reassess:</b> <i>inadequate but recoverable with effort</i>	no understanding, very short, inadequate, factual but little interpretation, lacks coherence, short, errors, misconceptions, coherent but mechanical notes, partial - rudimentary answer, limited interpretation, lack of knowledge of topic, no evidence of background reading, weak English but some appropriate use of language of topic.	poor effective deliverables, requirements not met, deliverables partially complete, limited response to brief.
40-49		<b>3rd, D</b> <b>Pass: Sufficient for award of credit</b> <i>adequate mainly descriptive approach, fair, limited conceptual or theoretical ability</i>	adequate response, demonstration of basic knowledge, relevant content, clear intention communicated, evidence of reading, acceptable minimum level of English for business presentation but may lack precision, some limited analysis / application of knowledge / theory / weighting of evidence, inconsistent	deliverables meet basic requirement correctly but limited, just adequate but not innovative, interesting or exciting, for higher marks, 45+ just exceeds minimum specification, might be good in some areas but not consistent
50-59		<b>2ii, C</b> <b>Satisfactory</b> <i>Satisfactory with some conceptual ability but lacks good evaluation or synthesis of ideas</i>	good response to task, collates info, <i>satisfactory</i> analysis & judgement, constructs generalisations based on evidence & opinion, argues clearly, logically & constructs a case, some limited ability to state a personal position, correct English with few imprecise statements	good deliverables, some evidence of good design or execution, coherent and organised product, some limited evidence of self criticism concerning deliverable, some independence, initiative, autonomy, appropriate techniques, integration of knowledge for task
60-69		<b>2i, B</b> <b>Good.</b> <i>Good analysis, evaluation, synthesis, integration &amp; argument.</i>	evaluates info. & synthesises generalisations, good ability to state & defend personal position, good analysis & judgement, applies knowledge to new situations, sound on theory, critical, understands limitations of methods, selective coherent & logical approach, well written with clear, correct and precise English	all criteria met to <b>good</b> standard, evidence of good design or execution, good integration of academic & practical issues, solid evidence of self critique/evaluation of deliverables, products well organised - documented - coherent. Evidence of independence, initiative, autonomy, creativity, adaptability, resourcefulness. Integration of knowledge,
70-79		<b>First class, A,</b> <b>Excellent.</b> <i>as above but also stronger evidence of excellent, original, innovative, articulate work</i>	very strong ability to state & defend position, uses criteria & weighting in judgements, wide knowledge and theoretical ability, full understanding of possibilities and limitations of methods & theories, 75+ more original, innovative approach, command of critical positions, lively articulate writing, excellent grasp of material - synthesis of ideas	most criteria met to <b>high</b> standard, strong evidence of evaluation of deliverables, 75+: deliverables excellent - all criteria met in clear and definite manner, evidence of excellent design or execution, elegance, innovation, very good evaluation of deliverables,
80-89		<b>Outstanding.</b> <i>as above but also authoritative, superlative, creative</i>	<b>as above but also :-</b> seen all possibilities in task, gone beyond accepted conceptual/critical positions, evidence of creative, intelligent, innovative approach consistently & forcefully expressed	<b>as above but also :-</b> all aspects of deliverables superlative beyond 80% emphasis on theory rather than practice/deliverables
90-100		<b>Faultless</b>	<b>as for 80-89 but also :-</b> all work superlative & without fault	as for 80-89

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