

**FACULTY OF MEDIA AND COMMUNICATION**

**NCCA**

Advanced Mathematics

For

Computer Graphics

**UNIT GUIDE**

**24-25**

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**Disclaimer**

Information contained within this programme handbook is correct at the time of going to press (Sept 2019). However, some information may change and Bournemouth University reserves the right to make changes to procedures, regulations and processes subject to maintaining equivalent standards.

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## WELCOME FROM THE UNIT TUTOR

Welcome to the Advanced Maths unit. This unit builds on the maths you learnt last year, combining it with your programming to implement mathematical solutions in code. The unit includes both theoretical and practical elements, as you’ll be expected to implement many of the techniques taught in lectures in the workshop sessions

## ATTENDANCE AND ENGAGEMENT

Lectures, seminars and workshop attendance are not optional, and the expectation is that you will engage with your programme of study. Non-attendance limits your ability to take full advantage of the programme and learning opportunities provided on the degree. These include opportunities to engage in formative tasks and assessments, which support deep learning and enable you to do your best work on assignments.

Please refer to your Programme Handbook for further details.

### Terms of Engagement for Unit

The Unit is highly incremental in nature, and techniques taught during lectures will be required for the workshop sessions, and subsequent lectures. In addition, the software you develop during each workshop will be used as a starting point in the next workshop. It’s therefore essential that you stay up to date with the material and use your private study time to ensure you are prepared for the following sessions.

There will be regular timetabled sessions, and these should be used to raise any issues with the unit tutor. In addition, questions regarding the workshop assignments can be raised on MSTeams at any time. If for any reason this is not possible, then email should be used as an alternative. This will normally be replied to within two days.

## INTENDED LEARNING OUTCOMES

Having completed this Unit, the student is expected to:

* demonstrate an advanced knowledge and understanding of the mathematical and algorithmic techniques utilised in computer graphics and animation systems;
* demonstrate an understanding of the relevance and effectiveness of the principal computer graphics and animation techniques;
* demonstrate the ability to construct algorithms utilising appropriate computer graphics and animation techniques.

## LEARNING AND TEACHING METHODS

This Unit will be taught as a sequence of formal lectures supported by workshop sessions and private study.

Lectures will be used to introduce theoretical material, with an explanation of its practical application to computer graphics. In most cases you will be asked to implement techniques from the lecture in software, in the subsequent workshop.

In addition, each week’s workshop assignment will develop the software you have written to incorporate the new techniques. As such it’s important to complete each workshop to a reasonable degree, to enable the further development of your code.

Workshops are broken into two sessions – one where work will be set, and you can ask any initial questions.. A second workshop session will review the assignment and allow you to share and receive feedback on your completed work. In most cases it should be possible to complete the work within the scheduled workshop time, but you may need to spend additional private study time to ensure that you complete the work by the end of the second session.

Private study time should also be used to ensure you are comfortable with the theoretical material, and that your practical work is up to date.

## ASSESSMENT

### Formative

The workshop sessions will allow you to demonstrate your command of the material, and offer the opportunity for formative feedback on your progress.

### Summative

ILOs 1-3 will be assessed by timed assessment (100%).

#### Examination:

The unit will be assessed by a time limited assignment. This assignment will be similar in nature to the weekly workshop assignments, with a slightly increased scope. You will be set a task and have approximately one working week to write a short piece of code which implements a mathematical technique to solve a specific problem.

The dates for the assessment are from 12pm on Mon 20th January 2024 until 12pm pm on Friday 24th January. This is subject to final confirmation by the university, and you should refer to the official exam timetable provided.

## INDICATIVE KEY LEARNING RESOURCES / READING LIST

### Essential reading:

Computer Animation Systems Techniques Notes and Handouts, I. Stephenson, will be made available during each session.

www.scratchapixel.com

“Production Rendering: Design And Implementation”, I Stephenson (2006), Springer.

### Advanced Reading:

Bertels, R. H., Beatty, J. C. and Barsky, B. A. (1987), "An Introduction to Splines for use in Computer Graphics Modelling", Morgan-Kaufman, Los Altos, California 94022.

Farin, G. (1997), "Curves and Surfaces for CAGD", 4th Edition, Academic press.

### Background Reading

ACM-SIGGRAPH Conference Proceedings and Course Notes.

Eurographics Conference Proceedings.

Imagina Conference Proceedings.

ACM-Transactions on Computer Graphics.

IEEE-Computer Graphics & Applications.

The Visual Computer.

Computers & Graphics.

Graphics Gems, Vols. 1-5.

## OUTLINE OF LECTURE AND SEMINAR PROGRAMME

| **Week number** | **Topic** |
| --- | --- |
| **1** | Calculus Revision |
| **2** | Basic Surfaces, Projection and Rays |
| **3** | Vector Calculus and Surface Normals |
| **4** | Bicubic surfaces |
| **5** | Light Surface Interaction |
| **6** | Ray Tracing And Path Tracing |
| **7** | Sample Generation |
| **8** | Randomness And Low Discrepancy Sequences |
| **9** | Complex Numbers (Revision) & Quaternions |
| **10** | Fourier & Nyquist |
| **11** | Noise |
| **12** | Review and Revision |