

## Module Specification

1. Factual information			
<b>Module title</b>	<b>TM240: Computer Graphics and Multimedia</b>	<b>Level</b>	<b>2</b>
<b>Module tutor</b>	TBA	<b>Credit value</b>	<b>15</b>
<b>Module type</b>	Taught	<b>Notional learning hours</b>	<b>4</b>
2. Rationale for the module and its links with other modules			
<p>This module targets to cope with the current advances in computer graphics and multimedia and providing clear and concise explanations of the basic concepts of computer graphics and multimedia. This module is expected to enable students to gain understanding of basics of modelling, viewing, animation principles in both 2D and 3D and the impact of such topics on modern multimedia aspects.</p>			
3. Aims of the module			
<p>The aims of this module are to:</p> <ol style="list-style-type: none"> <li>1. Introduce all aspects of the hardware and software components of computer graphics.</li> <li>2. Provide Knowledge to perform 2D and 3D geometric transformations.</li> <li>3. Describe the algorithms for projection, viewing and clipping of graphs.</li> <li>4. Identify how to graphics software and hardware.</li> <li>5. Provide Knowledge to evaluate the performance of graphics systems.</li> </ol>			
4. Pre-requisite modules or specified entry requirements			
<p>Students are expected to have completed study of MT132 &amp; TM105 module before they can undertake this module.</p>			

<b>5. Intended learning outcomes</b>	
<b>A. Knowledge and understanding</b>	<b>Learning and teaching strategy</b>
<p>Upon completing this module, <b>student should be able to:</b></p> <p>A1. Describe the basic principles of computer graphics.  A2. Explain the different operations in graphics systems such as transformations, projects, views, texturing, lighting, shading, animation and clipping.  A3. Select the suitable hardware and software of a graphics system for a specific application.  A4. Explain graphics algorithms.  A5. Develop graphics applications in Java.</p>	<ul style="list-style-type: none"> <li>• 25% face-to-face tutorial sessions.</li> <li>• Class discussions.</li> <li>• Independent study.</li> <li>• Forums on the LMS.</li> <li>• Office hour discussions.</li> <li>• Feedback and guidance on TMA and MTA.</li> <li>• Module textbook and support video material.</li> </ul>
<b>B. Cognitive skills</b>	<b>Learning and teaching strategy</b>
<p>Upon completing this module, <b>student should be able to:</b></p> <p>B1. Evaluate graphics hardware and software.  B2. Compare the different computer graphics applications.  B3. Select the suitable graphics hardware for different applications.  B4. Evaluate 3D modelling techniques.</p>	<ul style="list-style-type: none"> <li>• 25% face-to-face tutorial sessions.</li> <li>• Class discussions.</li> <li>• Independent study.</li> <li>• Forums on the LMS.</li> <li>• Office hour discussions.</li> <li>• Feedback and guidance on TMA and MTA.</li> <li>• Module textbook and support video material.</li> </ul>
<b>C. Practical and professional skills</b>	<b>Learning and teaching strategy</b>
<p>Upon completing this module, <b>student should be able to:</b></p> <p>C1. Develop graphics applications using advanced APIs</p>	<ul style="list-style-type: none"> <li>• 25% face-to-face tutorial sessions.</li> </ul>

C. Practical and professional skills	Learning and teaching strategy
C2. Apply computer graphics concepts and techniques to develop graphics and visualization applications C3. Model 3D objects.	<ul style="list-style-type: none"> <li>• Class discussions.</li> <li>• Independent study.</li> <li>• Forums on the LMS.</li> <li>• Office hour discussions.</li> <li>• Feedback and guidance on TMA and MTA.</li> <li>• Module textbook and support video material.</li> </ul>

D. Key transferable skills	Learning and teaching strategy
Upon completing this module, <b>student should be able to:</b> D1. Effectively communicate oral and written. D2. Work in a team. D3. Effectively manage resources and time.	<ul style="list-style-type: none"> <li>• 25% face-to-face tutorial sessions.</li> <li>• Class discussions.</li> <li>• Independent study.</li> <li>• Forums on the LMS.</li> <li>• Office hour discussions.</li> <li>• Feedback and guidance on TMA and MTA.</li> <li>• Module textbook and support video material.</li> </ul>

6. Indicative content.
This module will cover the following topics: <b>Chapter 1. Overview of Computer Graphics</b> 1.1 Introduction 1.2 Computer Graphics Systems and Related Fields 1.3 Java Programming Language 1.4 Java 2D and Java 3D <b>Chapter 2. 2D Graphics: Basics</b> 2.1 Introduction 2.1 Introduction 2.2 2D Rendering Process

## 6. Indicative content.

2.3 2D Geometry and Coordinate Systems

2.4 The Graphics2D Class

2.5 Graphing Equations

2.6 Geometric Models

2.7 Constructive Area Geometry

2.8 General Path

### **Chapter 3. 2D Graphics: Rendering Details**

3.1 Introduction

3.2 Colors and Paints

3.3 Strokes

3.4 Affine Transformation

3.5 Compositions of Transformations

3.6 Transparency and Compositing Rules

3.7 Clipping

3.8 Text and Font

### **Chapter 4. 2D Graphics: Advanced Topics**

4.1 Introduction

4.2 Spline Curves

4.3 Custom Primitives

4.4 Image Processing

4.5 Creating Fractal Images

4.6 Animation

4.7 Printing

### **Chapter 5. Basic 3D Graphics**

5.1 Introduction

5.2 3D Rendering Process

5.3 Java 3D API Overview

5.4 Java 3D Scene Graphs

5.5 The Superstructure

5.6 The Nodes

5.7 The Node Components

## 6. Indicative content.

5.8 The Structure of a Java 3D Program

5.9 Backgrounds and Bounds

5.10 Compiling Scene Graphs and Capacity Bits

### **Chapter 6. Graphics Contents**

6.1 Introduction

6.2 Points and Vectors

6.3 Geometry

6.4 Geometry-Info

6.5 Primitives

6.6 Fonts and Texts

6.7 Appearance and Attributes

### **Chapter 7. Geometric Transformation**

7.1 Introduction

7.2 3D Affine Transformations

7.3 Transformations in Scene Graphs

7.4 Composite Transforms

7.5 Constructing Geometries with Transformations

### **Chapter 8. Views**

8.1 Introduction

8.2 Projections

8.3 Specification of a View

8.4 Java 3D View Model

8.5 Picking

8.6 Head Tracking

### **Chapter 9. Lighting and Texturing**

9.1 Introduction

9.2 Lights

9.3 Illumination Models

9.4 Material

9.5 Atmospheric Attenuation and Depth Cueing

9.6 Texture Mapping

<b>6. Indicative content.</b>
9.7 Texture Coordinates Generation <b>Chapter 11. Animation</b> 11.1 Introduction 11.2 Alpha Objects 11.3 Interpolators 11.4 Morphing 11.5 LOD 11.6 Billboard
<b>7. Assessment strategy, assessment methods and their relative weightings</b>
TMA Work: 20% MTA: 30% Exam: 50%

<b>8. Mapping of assessment tasks to learning outcomes</b>															
<b>Assessment map</b>	<b>Learning Outcomes</b>														
<b>Assessment tasks</b>	<b>A1</b>	<b>A2</b>	<b>A3</b>	<b>A4</b>	<b>A5</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B4</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>D1</b>	<b>D2</b>	<b>D3</b>
TMA	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓
MTA	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				
Final	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓

<b>9. Teaching staff associated with the module</b>	
<b>Tutor's name and contact details</b>	<b>Contact hours</b>
TBA	

<b>10. Key reading list</b>				
<b>Author</b>	<b>Year</b>	<b>Title</b>	<b>Publisher</b>	<b>Location</b>
Klawonn, Frank	2012	Introduction to Computer Graphics Using Java 2D and 3D	Springer	
Hong Zhang Y. Daniel Liang, Armstrong Atlantic	2007	Computer Graphics Using Java 2D and 3D	Prentice Hall	
Edward Angel	2012	Interactive Computer Graphics: A Top-Down Approach Using OpenGL, 6/E	Addison-Wesley	
Donald D. Hearn, M. Pauline Baker and Warren Carithers	2011	Computer Graphics with Open GL, 4/E	Prentice Hall	
Watt	2000	3D Computer Graphics, 3/e	Addison-Wesley	
Foley, van Dam, Feiner, Hughes & Phillips	1994	Introduction to Computer Graphics, 1/e	<b>Addison-Wesley Professional</b>	
Laszlo	1996	Computational Geometry and Computer Graphics in C++, 1/e	<b>Prentice Hall</b>	
Foley, van Dam, Feiner & Hughes	1996	Computer Graphics: Principles and Practice in C, 2/e	<b>Addison-Wesley Professional</b>	
Hill, Jr. & Kelley	2007	Computer Graphics Using OpenGL, 3/e	<b>Prentice Hall</b>	
Angel & Shreiner	2012	Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL, 6/e	<b>Addison-Wesley</b>	
Lueptow	2008	Graphics Concepts for Computer-Aided Design, 2/e	<b>Prentice Hall</b>	
Chen, J., & Chen, C.	2008	Foundations of 3D graphics programming: using JOGL and Java3D (2nd ed.).	<b>Springer Verlag</b>	<b>London</b>

<b>11. Other indicative text (e.g. websites)</b>
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1. **www.arabou.edu.kw**
2. Companion Website for the Textbook Computer Graphics Using Java 2D and 3D, by Hong Zhang and Y. Daniel Liang at (<http://www.cs.armstrong.edu/liang/graphics/graphicsinstructor.html>).
3. **35 Video lectures on Introduction to Computer Graphics** (<http://learnerstv.com/Free-Computers-Video-lectures-Itv046-Page1.htm>).
4. **43 Video lectures on Computer Graphics** (<http://learnerstv.com/Free-Computers-Video-lectures-Itv106-Page1.htm>).
5. JOGL API Project, <https://jogl.dev.java.net/>.
6. Java 3D API Tutorial, <http://java.sun.com/developer/onlineTraining/java3d/index.html>.
7. Java 3D Web Site, <https://java3d.dev.java.net/>.
8. Java 3D Wiki, <http://wiki.java.net/bin/view/Javadesktop/Java3D>
9. Java 2D Graphics Tutorial, <http://java.sun.com/docs/books/tutorial/2d/index.html>