



**University/Academy:** Arab Academy for Science, Technology & Maritime Transport  
**Faculty/Institute:** College of Engineering & Technology  
**Program:** B.Sc Computer Engineering

### Form no. (12): Course Specification

#### 1- Course Data

Course Code: <b>CC416</b>	Course Title: <b>Computer Graphics</b>	Academic Year/Level: <b>4<sup>th</sup> year / 7<sup>th</sup> semester</b>
Specialization: <b>Computer Engineering</b>	No. of Instructional Units <b>3</b>	Lecture <b>2</b>
		Practical <b>2</b>

#### 2- Course Aim

This course introduces students to the theory and practice of Interactive Computer Graphics. Its principal aim is to teach the fundamental principles of two- and three-dimensional Interactive Computer Graphics. OpenGL is used as the platform for practical C programming exercises, and as an example of a system which incorporates many of the fundamental ideas and algorithms of modern computer graphics.

#### 3- Intended Learning Outcomes

<b>a- Knowledge and Understanding</b>	<p><b>Through knowledge and understanding, students will be able to:</b></p> <p><b>a1. Concepts and theories of mathematics and sciences, appropriate to the computer engineering.</b></p> <ul style="list-style-type: none"> <li>• Provide an overview of the computer graphics field.</li> </ul> <p><b>a5. Engineering principles in the fields of logic design, circuit analysis, machine and assembly languages, computer organization and architectures, memory hierarchy, advanced computer architectures, embedded systems, signal processing, operating systems, real-time systems and reliability analysis.</b></p> <ul style="list-style-type: none"> <li>• Learn the basic ingredients found in every openGL program.</li> <li>• Describe the important input and output graphics devices</li> <li>• Explore the basic features of graphics video display devices</li> <li>• Study the nature of color and its numerical description.</li> <li>• Examine some standards for color representation.</li> <li>• Define and use various color spaces</li> <li>• Explain the properties of circle</li> <li>• Explain the properties of ellipses</li> </ul> <p><b>a6. Related research and current advances in the field of computer software and hardware and contemporary engineering topics.</b></p> <ul style="list-style-type: none"> <li>• Survey the areas in which computer graphics is applied</li> </ul> <p><b>a7. Technologies of data, image and graphics representation and organization on computer storage media.</b></p> <ul style="list-style-type: none"> <li>• Explain spline technologies</li> <li>• Motivate the use of 2D and 3D transformations in computer graphics.</li> <li>• Introduce world coordinates and the world window</li> <li>• Introduce clipping</li> <li>• Introduce filling</li> </ul>
<b>b- Intellectual Skills</b>	<p><b>Through intellectual skills, students will be able to:</b></p> <p><b>b1. Select/Apply appropriate mathematical and computer-based methods for modeling and analyzing problems and select appropriate solutions for engineering problems based on analytical thinking.</b></p> <ul style="list-style-type: none"> <li>• Demonstrate Bresenham line drawing algorithm</li> <li>• Demonstrate Midpoint circle algorithm</li> <li>• Demonstrate Midpoint ellipse algorithm</li> </ul>

	<ul style="list-style-type: none"> <li>• Determine and describe mathematically key properties of useful curves</li> </ul> <p><b>b2. Think in a creative and innovative way in problem solving and design using the latest technologies and solve engineering problems, often on the basis of limited and possibly contradicting information while identifying symptoms in problematic situations.</b></p> <ul style="list-style-type: none"> <li>• Develop the mathematical properties of Bezier and spline curves</li> <li>• Demonstrate Bezier Curves algorithm</li> <li>• Introduce the fundamental concepts of affine transformations.</li> <li>• Show how elementary affine can perform scaling, rotation, translation, and shearing</li> <li>• Demonstrate how to combine many affine transformations</li> <li>• Discuss the key properties of all affine transformations</li> <li>• Describe window-to-viewport transformation.</li> </ul> <p><b>b5. Select, synthesize, and apply suitable IT tools to computer engineering problems.</b></p> <ul style="list-style-type: none"> <li>• Demonstrate the uses of window-to-viewport transformation.</li> <li>• Develop a classical clipping algorithm</li> <li>• Describe flood filling algorithm</li> <li>• Describe scan-line filling algorithm</li> </ul>
<b>c- Professional Skills</b>	<p><b>Through professional and practical skills, students will be able to:</b></p> <p><b>c4. Apply numerical modeling methods to engineering problems.</b></p> <ul style="list-style-type: none"> <li>• Write programs to produce pictures</li> <li>• Develop some elementary graphics tools for drawing lines, polylines, and polygons.</li> <li>• Develop tools that allow the user to control a program with the mouse and keyboard.</li> <li>• Develop Bresenham's line drawing algorithm</li> <li>• Develop Mid-point circle/ ellipse drawing algorithms.</li> <li>• Develop tool to design Bezier curves</li> <li>• Develop tools for transforming one object into another</li> <li>• Develop functions that apply affine transformations to objects in computer program</li> </ul> <p><b>c7. Design and operate computer-based systems specifically designed for business applications.</b></p> <ul style="list-style-type: none"> <li>• Develop a tool for window-to-viewport transformation</li> <li>• Implement Cohen-Sutherland clipping algorithm</li> <li>• Build tools for filling regions</li> </ul>
<b>d- General Skills</b>	<p><b>Through general and transferable skills, students will be able to:</b></p> <ul style="list-style-type: none"> <li>• none</li> </ul>

#### 4- Course Content

<b>Week No.1</b>	Introduction, history and survey of computer graphics applications
<b>Week No.2</b>	Overview of graphics systems: raster and random scan display
<b>Week No.3</b>	Color models
<b>Week No.4</b>	Bresenham's line drawing algorithm
<b>Week No.5</b>	Mid-point circle/ ellipse drawing algorithms
<b>Week No.6</b>	Drawing free curves: Bezier and spline technologies
<b>Week No.7</b>	Drawing free curves: Bezier and spline technologies (Cont.)
<b>Week No.8</b>	7th week Exam+ Revision
<b>Week No.9</b>	2D transformations
<b>Week No.10</b>	2D transformations (cont.)
<b>Week No.11</b>	Viewing transformation
<b>Week No.12</b>	Line and polygon clipping algorithms
<b>Week No.13</b>	12th week Exam+Revision
<b>Week No.14</b>	Filling Algorithms
<b>Week No.15</b>	Revision
<b>Week No.16</b>	Presentation of projects and Final Exam.

## 5- Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

## 6-Teaching and Learning Methods for Students with Special Needs

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

The academic advisors of each student, as well as dedicated department TAs monitor the students' progress and solve any problem he/she may encounter.

## 7- Student Assessment

<b>a-Procedures used</b>	1-Written Examinations to assess The Intended Learning Outcomes.	
	2-Class Activities (Reports, Discussions, -----) to assess The Intellectual Skills.	
<b>b- Schedule:</b>	Assessment 1	7 <sup>th</sup> Week Written Exam
	Assessment 2	12 <sup>th</sup> Week Written Exam
	Assessment 3	Continuous
	Assessment 4	16 <sup>th</sup> Week Final Written Exam
<b>c- Weighing of Assessment</b>	7 <sup>th</sup> Week Examination	30 %
	12 <sup>th</sup> Week Examination	20 %
	Final-term Examination	40 %
	Oral Examination	00 %
	Practical Examination	00 %
	Semester Work	10 %
	Total	100%

## 8- List of References:

<b>a- Course Notes</b>	
<b>b- Required Books</b> (Textbooks)	• D. Hearn and M.P. Baker, <i>Computer Graphics Open Gl Version</i> , 3 <sup>rd</sup> edition, Prentice Hall, 2004.
<b>c- Recommended Books</b>	• Francis S. Hill, Jr. <i>Computer Graphics Using OpenGL</i> , 2nd edition, Prentice Hall, 2000.
	• Foley J., Van Dam, A., Feiner, S., Hughes, J., C Edition, <i>Interactive Computer Graphics: Principles and Practice</i> , 2nd edition, Addison – Wesley, 1996.
<b>d- Periodicals, Web Sites, etc.</b>	

**Course Instructor:**  
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**Dean of College of Engineering and  
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**Executive Manager of Quality Assurance  
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Signature:

Signature: