Course Specification of Computer Graphics and Visualization

Course No (.....)

2020/2021

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Academic Development center and Quality
Dr. Ahmed Al-shalabi	Dr. Anwar Al-Shamiri	Dr. Nagi Al-Shibani	Assoc. Prof. Dr.Huda Al.Emad

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Prof. Dr. Qassim Mohammed Abbas

I. Course Identification and General Information:

1	**Course Title:**	Computer Graphics and Visualization				
2	**Course Code & Number:**					
3	**Credit hours:**	C.H				TOTAL
		Th.	Seminar	Pr	Tr.	
		2		2		3
4	**Study level/ semester at which this course is offered:**	3rd Level / 1st semester				
5	**Pre –requisite (if any):**	Design and Analysis of Algorithms				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	Computer Science				
8	**Language of teaching the course:**	English/Arabic				
9	**Study System**	Term Based System				
10	**Mode of delivery:**	Full Time				
11	**Location of teaching the course:**	Faculty of Computer and Information Technology				
12	**Prepared By:**	Dr.Nabil A.SH. ALshaweea				
13	**Date of Approval**					

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II. Course Description:

This course provides an introduction of the fundamental algorithms in computer graphics, their theoretical as well as implementation aspects. The course includes important topics on two- and three-dimensional transformations, projections, viewing functions, and advanced topics on three-dimensional modeling. It covers the following topics: Overview of Computer Graphics, Graphics Displays, Output Devices and Physical Interactive Devices, Graphical User Interfaces, Graphics Image File Formats. Raster Scan Graphics: Line Drawing Algorithms, DDA, Bresenham's Algorithm, Circle Generations; Characters and Polygons, Polygon Filling Algorithms,2D/3D transformation including scaling, translation, rotation and reflection about any arbitrary Axis; Windowing and Clipping: Viewing Transformations; Two Dimensional Clipping, Simple Visibility Algorithm, Polygon Clipping, 3-Dimensional Clipping Hidden surface elimination.

III. Course Intended learning outcomes (CILOs) of the course (maximum 8CILOs)		Referenced PILOs (Only write code number of reference Program Intended learning outcomes
a.1	Show Understanding of the concepts related to basics of computer graphics, 2D/3D object representations, geometric transformations, clipping techniques and visualization.	A1. A4. A5.
a.2	Demonstrate understanding of graphics and imaging systems and different hardware and software used for this field.	A2. A4. A5.
b.1	Design appropriate algorithm, tools and application dealing with representing 2D/3D objects.	B1. B2. B3
b.2	Distinguish the appropriate computer drawing algorithms according to their functions.	B2
c.1	Employ the mathematical foundations, algorithms, programming skills, tools and techniques to implement the computer graphics topics such as geometrical transformations, illumination models, removal of hidden surfaces and rendering.	C1. C3
c.2	Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling and clipping.	C3. C4
c.3	Design the 3D object using any programming languages environments.	C4.C6

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d.1	Work cooperatively in a team or individually to accomplish a common goal in designing objects and engage in a life-long self-learning.	D1. D3

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1.Understanding the concepts related to basics of computer graphics, 2D/3D object representations, geometric transformations, clipping techniques and visualization.	▪ Lectures ▪ Tutorials ▪ Group discussion ▪ Individual presentations	▪ Assignment ▪ exam
a2. Demonstrate the understanding of graphics and imaging systems and different hardware and software used for this field.		

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Design appropriate algorithm, tools and application dealing with representing 2D/3D objects.	▪ Lectures ▪ Tutorials ▪ Group discussion ▪ Individual presentations ▪ Brainstorming	▪ Assignment ▪ Exams
b2. Distinguish the appropriate computer drawing algorithms according to their functions.		

(C) ***Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:***		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies

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c1. Employ the mathematical foundations, algorithms, programming skills, tools and techniques to implement the computer graphics topics such as geometrical transformations, illumination models, removal of hidden surfaces and rendering.	▪ Lectures ▪ Tutorials ▪ problem solving ▪ coursework ▪ case study independent study	▪ Assignment ▪ exam
c2. Apply fundamental principles and concepts within information visualization and scientific visualization.		
c3. Design the 3D object using any programming languages environments.		

(D) ***Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:***

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Work cooperatively in a team or individually to accomplish a common goal in designing objects and engage in a life-long self-learning.	▪ Guided reading ▪ coursework assignments ▪ Supporting lectures ▪ Literature study	▪ Projects evaluation ▪ case study ▪ coursework ▪ assignments

IV. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Introduction to Computer Graphics	a1, a2	History of computer graphics, applications, graphics pipeline, physical and synthetic images, synthetic camera, modelling, animation, rendering, relation to computer vision and image processing, review of basic mathematical objects (points, vectors, matrix methods)	2	4

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2	Introduction to Programming Environments	a1, a2, b1,b2,c1	Environments architecture, primitives and attributes, simple modeling and rendering of two- and three-dimensional geometric objects, indexed and RGB color models, frame buffer, double buffering, interaction, events.	1	2
3	Mathematical Concepts and Algorithms	a1, a2, b2,c1,c3	Mathematical theory, line is drawing algorithms, Curves and circles drawing Algorithm.	3	6
4	Geometric Objects and Transformations	a1, a2, b1,b2, c1, c2	Homogeneous coordinates affine transformations (translation, rotation, scaling, shear, and reflection), concatenation, matrix stacks and use of model view matrix in Environmental programming (Open GL or MATLAB).	3	6
5	Viewing	a1, a2,b1, b2, c1, d1	Classical three-dimensional viewing, computer viewing, specifying views, parallel and perspective projective transformations; Visibility- z-Buffer, BSP trees, Environmental programming (Open GL or MATLAB) culling, hidden-surface algorithms.	**2**	4
	Lighting and Shading	a1, a2b1,b2, c1, c2	Light sources, illumination model, Gouraud and Phong shading for polygons. Rasterization- Line segment and polygon clipping, 3D clipping, scan conversion, polygonal fill, Bresenham's algorithm	**1**	2
7	Discrete Techniques	a1, a2,b1,b2, c1	Texture mapping, compositing, textures in OpenGL or MATLAB; Ray Tracing- Recursive ray tracer, ray-sphere intersection	**1**	**2**

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8	Representation and Visualization	a1, a2, b1,b2, c1, c2, d1	Bezier curves and surfaces, B-splines, visualization, interpolation, marching squares algorithm	1	**2**
Number of Weeks /and Units Per Semester				**14**	**28**

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Implement program to draw and display the lines, circles, curves and polygons.	**1**	**2**	a1, a2, b1,b2,c1,c2
2	Implement]program of drawing line's algorithm	**1**	**2**	a1, a2, b1,b2,c1,c2,d1
3	Implement program of drawing Circle's and curve's algorithms	**2**	**4**	a1, a2, b1,b2,c1,c2
4	Implement program for2D Geometric transformations	**2**	**4**	a1, a2b1,b2, c1, c2,d1
	Implement program to draw and display 3D objects	**2**	**4**	a1, a2, b1,c1, c2,d1
7	Implement program for3D Geometric transformations	**2**	**4**	a1, a2, b1,b2, c1, c2, d1
8	Implement program to Viewing and shading the 3D object	**2**	**4**	a1, a2, b1,b2, c1, c2, d1
9	Implement the Discrete Techniques	**2**	**4**	a1, a2, b1,b2, c1, c2, d1
Number of Weeks /and Units Per Semester			**28**	

V. Teaching strategies of the course:

- Interactive Lectures
- Practical classes
- Project-based learning
- Problem solving

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▪ seminars
▪ oral presentation

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Practical report about representation Shapes	a2, b1, b2, c1, c3, d1	4th Week	2
2	Practical report about representation 2D/3D objects and geometric transformations	a1, a2, b1, b2,c1, c2, c3, d1	10th Week	4
3	Practical report about viewing and shading the 3d object	b1, b2,c1, c2, c3.d1	13th Week	4

VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Attendance and Participations	Weekly	5	5%	a1, a2, b1,b2,c1,c2
2	Quizzes	4th and 11th	5	5%	a1, a2, b1,b2,c1,c2
3	Mid-term exam (Theory)	9th	10	10%	a1, a2, b1,b2,c1,c2

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4	Assignments and Lab-reports	14th , 10th ,13th	10	10%	a1, a2b1,b2, c1
5	Final exam (Lab)	16th	10	10%	a1, a2, b1,b2, c1, c2,d1
6	Final exam (Theory)	16th	60	60%	a1, a2, b1,b2, c1, c2,d1

VIII.Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1- Peter Shirley and Steve Marschner, 2016, Fundamentals of Computer Graphics Fourth Editi CRC Press.
2- Edward Angel and Dave Shreiner, 2012, Interactive Computer Graphics A Top-Down Appr with OpenGL, Sixth Edition, Addison-Wesley .

2- Essential References.

1-Peter Shirley and Steve Marschner,2010 Computer Graphics (first edition), A. K. Peters.
2- Computer Graphics: Principles and Practice, 3rd edition

3- Electronic Materials and Web Sites *etc*.

1-http://www.cs.cornell.edu/%E2%88%BCsrm/fcg3/.We
2-https://www.bkstr.com/Home/10001-10734-1?demoKey=d
3-https://developer.mozilla.org/en-US/docs/Web/API/WebGL_API

IX. Course Policies:

Unless otherwise stated, the normal course administration policies and rules of the Faculty of Computer and Information Technology apply. For the policy, see: ----------

The University Regulations on academic misconduct will be strictly enforced. Please refer to ----------

1 **Class Attendance:**
A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam

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	failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he will be considered as absent.
3	**Exam Attendance/Punctuality:** A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
4	**Assignments & Project** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5	**Cheating:** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
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7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments my given directly to students using soft or hard copy

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Department of Computer Science

Program of Computer Science

Course syllabus of Computer Graphics and Visualization

Course No (.....)

2020/2021

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Computer Graphics and Visualization Course Plan

(Syllabus)

I. - Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	**Dr.Nabil A.SH. ALshaweea**	**Office Hours**					
Location& Telephone No.	776545406	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	nabilsh12@yahoo.com						

II. Course Identification and General Information:						
1	**Course Title:**	Computer Graphics and Visualization				
2	**Course Number & Code:**					
3	**Credit hours:**	C.H				Total
		Th.	Seminar	Pr.	F. Tr.	
		2	-	2	-	3
4	**Study level/year at which this course is offered:**	3rd Level / 1st semester				
5	**Pre –requisite (if any):**	**Design and Analysis of Algorithms**				
6	**Co –requisite (if any):**	**None**				
7	**Program (s) in which the course is offered**	**Computer Science**				
8	**Language of teaching the course:**	**English/Arabic**				
9	**System of Study:**	**Term Based System**				
1	**Mode of delivery:**	**Full time**				
1	**Location of teaching the course:**	**Faculty of Computer and information Technology**				

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III. Course Description:

This course provides an introduction of the fundamental algorithms in computer graphics, their theoretical as well as implementation aspects. The course includes important topics on two- and three-dimensional transformations, projections, viewing functions, and advanced topics on three-dimensional modeling. It covers the following topics: Overview of Computer Graphics, Graphics Displays, Output Devices and Physical Interactive Devices, Graphical User Interfaces, Graphics Image File Formats. Raster Scan Graphics: Line Drawing Algorithms, DDA, Bresenham's Algorithm, Circle Generations; Characters and Polygons, Polygon Filling Algorithms,2D/3D transformation including scaling, translation, rotation and reflection about any arbitrary Axis; Windowing and Clipping: Viewing Transformations;Two Dimensional Clipping, Simple Visibility Algorithm, Polygon Clipping, 3-Dimensional Clipping Hidden surface elimination.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop:

a1. Show understanding of the concepts related to basics of computer graphics, 2D/3D object representations, geometric transformations, clipping techniques and visualization.
a2. Demonstrate the understanding of graphics and imaging systems and different hardware and software used for this field.

b1. Design appropriate algorithm, tools and application dealing with representing 2D/3D objects.
b2. Distinguish the appropriate computer drawing algorithms according to their functions.

c1. Employ the mathematical foundations, algorithms, programming skills, tools and techniques to implement the computer graphics topics such as geometrical transformations, illumination models, removal of hidden surfaces and rendering.

c2. Implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling and clipping.

c3. Design the 3D object using any programming languages environments.

d1. Work cooperatively in a team or individually to accomplish a common goal in designing objects and engage in a life-long self-learning

V. Course Content:

- Distribution of Semester Weekly Plan of Course Topics/Items and Activities.

A – Theoretical Aspect:

Order	Topics List	Week Due	Contact Hours
1	Introduction to Computer Graphics	Week 2	4
2	Introduction to Programming Environments	Week 3	2
3	Mathematical Concepts and Algorithms	Week 6	6
4	Midterm exam	Week 9	2
5	Geometric Objects and Transformations	Week 11	6
6	Viewing	Week 12	4
7	Lighting and Shading	Week 13	2
8	Discrete Techniques	Week 14	2
9	Representation and Visualization	Week 15	2
10	Final exam	Week 16	2
Number of Weeks /and Units Per Semester		16	32

B – Practical Aspect: *(if any)*

Order	Topics List	Week Due	Contact Hours
1	Implement program to draw and display the lines, circles, curves and polygons.	W 1	2

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2	Implement]program of drawing line's algorithm	**W 2**	2
3	Implement program of drawing Circle's and curve's algorithms	**W 4**	4
4	Implement program for2D Geometric transformations	**W 6**	4
5	Implement program to draw and display 3D objects	**W8**	4
6	Midterm Exam	**W9**	2
7	Implement program for3D Geometric transformations	**W11**	4
8	Implement program to Viewing and shading the 3D object	**W13**	4
9	Implement the Discrete Techniques	**W15**	4
10	Final Exam	**W16**	2
Number of Weeks /and Units Per Semester		**16**	**32**

VI. Teaching strategies of the course:

- Interactive Lectures
- Practical classes
- Project-based learning
- Problem solving
- Seminars
- Oral presentation
- Group Dissections
- Brain storm

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VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Practical report about representation Shapes	a2, b1, b2, c1, c3, d1	10th Week	2
2	Practical report about representation 2D/3D objects and geometric transformations	a1, a2, b1, b2,c1, c2, c3, d1	13th Week	4
3	Practical report about viewing and shading the 3d object	b1, b2,c1, c2, c3.d1	14th Week	4

VIII. Schedule of Assessment Tasks for Students During the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Attendance and Participations	Weekly	5	5%
2	Quizzes	4th and 11th	5	5%
3	Mid-term exam (Theory)	9th	10	10%
4	Assignments and Lab-reports	14th , 10th ,13th	10	10%
5	Final exam (Lab)	16th	10	10%
6	Final exam (Theory)	16th	60	60%

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اللجنة الإشرافية			
م.	الاســـم	الصـــــفة	التوقيع
١	أ.م.د. عبد الماجد الخليدي	نائب عميد الكلية للشؤون الأكاديمية	
٢	أ.م.د. احمد مجاهد	نائب عميد مركز التطوير الأكاديمي وضمان الجودة	
٣	د. حسين الأشول	ممثل المركز في الكلية	
٤	أ.د. إبراهيم المطاع	نائب رئيس الجامعة للشؤون الأكاديمية	

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