Detailed Course Description - Course Plan Development and Updating Procedures/ Department of Computer Science	QF01/0408-3.0E

Faculty	Science & I.T.	Department	Computer Science
Course number	0112462	Course title	Computer Graphics
Number of credit hours	3	Pre-requisite/co-requisite	Linear Algebra 1

Brief course description

This course aims to present basic principles for the design, use, and understanding of computer graphics systems and applications. Its topics cover 2D and 3D shapes, their representations, drawing algorithms, and transformations. Implementation of graphics algorithms is explained with examples using a high-level language (such as C++ or Java) and OpenGL library.

	Course goals and learning outcomes
Goal 1	Ability to use the principles of computer science in understanding, implantation and analysis of mathematical problems and finding their solutions.
Learning outcomes	1.1 Student should be able to write programs to plot different mathematical functions. 1.2 Student should be able to use mathematical concepts in algorithm analysis. 1.3 Apply and implement line and polygon clipping. 1.4 Apply and implement linear transformations.
Goal 2	Ability to analyze, design and implement efficient and reliable computer programs.
Learning outcomes	2.1 Student should know different programming methods. 2.2 Choose the suitable methods for drawing lines and shapes based on the required applications. 2.3 Student should be able to account for hardware and environment limitations when implementing computer programs with graphics.
Goal 3	Ability to draw shapes with vector graphics.
Learning outcomes	3.1 Student should know the concepts of vector graphics and differentiate them from other types of image representations. 3.2 Student should be able to write programs to draw 2D and 3D vector graphics in a high-level language (such as C++ or Java) and OpenGL library.
Goal 4	Ability to apply and implement common computer graphics algorithms.
Learning outcomes	4.1 Apply common algorithms for drawing 2D and 3D shapes. 4.2 Apply common algorithms for graph processing, such as filling and transformation. 4.3 Student should be able to map world coordinates to viewing coordinates and to perform the required clipping.
Textbook	1. V. Scott Gordon and John L. Clevenger, *Computer Graphics Programming in OpenGL with Java*, Mercury Learning & Information; Har/Cdr Edition, 2017. (*Main textbook used in the course timeline*) 2. D.D. Hearn, M.P. Baker and W. Carithers, *Computer Graphics with OpenGL*, 4th Ed., 2010.
Supplementary references	1. Edward Angel and Dave Shreiner, *Interactive computer graphics: a top down approach with WebGL*, 7th Ed. (Global Edition), 2015. 2. Graham Sellers, Richard S. Wright, Jr., Nicholas Haemel, *OpenGL SuperBible: Comprehensive Tutorial and Reference*, 7th Ed., 2015. 3. John Kessenich, Graham Sellers, Dave Shreiner, OpenGL Programming Guide:

	The Official Guide to Learning OpenGL, 9th Ed., 2016.

Course timeline				
Week	**Number of hours**	**Course topics**	**Pages (textbook)**	**Notes**
01	1 1 1	A Survey of Computer Graphics Applications Computer Graphics Hardware Video Display Devices	Ch1 & Ch2	
02	1 1 1	Three-Dimensional Viewing Devices Stereoscopic and Virtual-Reality Systems Graphics Workstations and Viewing Systems Input Devices Computer Graphics Software Functions & Standards	Ch2	
03	1 1 1	Other Graphics Packages & Introduction to OpenGL Basic OpenGL Syntax & Related Libraries Header Files & Display-Window Management Using GLUT	Ch3& Ch4	
04	1 1 1	A Complete OpenGL Program Examples & review	Ch3& Ch4	
05	1 1 1	Point Drawing & Line-Drawing Algorithms Line Equations & DDA Algorithm Bresenham's Line Algorithm	Ch6	
06	1 1 1	**First Exam** Properties of Circles Midpoint Circle Algorithm	Ch6	
07	1 1 1	General Scan-Line Polygon-Fill Algorithm Scan-Line Fill for Regions with Curved Boundaries Boundary-Fill Algorithm Flood-Fill Algorithm	Ch6	
08	1 1 1	Two-Dimensional Geometric Transformations Translation, Rotation & Scaling Matrix Representations, Homogeneous Coordinates Translation Matrix, Rotation Matrix, & Scaling Matrix	Ch7	
09	1 1 1	Pivot-Point Rotation General & Fixed-Point Scaling Two-Dimensional Composite Transformations Reflection Shear	Ch7	
10	1 1 1	Clipping Window Viewing-Coordinate Clipping Window World-Coordinate Clipping Window Normalization and Viewport Transformations Mapping the Clipping Window into a Normalized Viewport	Ch8	

11	**1** **1** **1**	Two-Dimensional Point Clipping Two-Dimensional Line Clipping Cohen-Sutherland Line Clipping Sutherland--Hodgman Polygon Clipping	Ch8	
12	**1** **1** **1**	Examples and Review **Second Exam**		
13	**1** **1** **1**	Three-Dimensional Translation & Rotation Coordinate-Axis Rotations, General Rotations Quaternion Methods for Three-Dimensional Rotations	Ch9	
14	**1** **1** **1**	Three-Dimensional Scaling & Composite Three-Dimensional Transformations Three-Dimensional Reflections Three-Dimensional Shears	Ch9	
15	**1** **1** **1**	Overview of Three-Dimensional Viewing Concepts Viewing a Three-Dimensional Scene Projections Review	Ch10	
16	**1** **1**	**Final Exam**		

Theoretical course evaluation methods and weight	Participation = 10% First exam 20% Second exam 20% Final exam 50%	**Practical (clinical) course evaluation methods**	Semester students' work = 50% (Reports, research, quizzes, etc.) Final exam = 50%

Approved by head of department		**Date of approval**	

Extra information (to be updated every semester by corresponding faculty member)

Name of teacher		Office Number	
Phone number (extension)		Email	
Office hours			