INTERNATIONAL UNIVERSITY OF EAST AFRICA
'Learning to Succeed'

FACULTY OF SCIENCE AND TECHNOLOGY

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: BSSE
YEAR/SEM: YEAR 4/SEMESTER 2
COURSE CODE: SWE4200
NAME: ADVANCE COMPUTER GRAPHICS

DATE:
TIME:

INSTRUCTIONS TO CANDIDATES:

SECTION A

Attempt All questions in this Section

Question 1:

a) Differentiate between Vector scan display and Raster scan display. (4 marks)

b) Write a program in C to draw following shapes with given points. (8 marks)

i. Line (20,20,60,60)

ii. Circle (100,100,25)

c) Explain the stages of rasterization in OpenGL, including vertex processing, primitive assembly, rasterization, and fragment processing (8 marks)

d) Write the DDA line drawing algorithm. (5 marks)

e) Consider the line from (5, 5) to (13, 9). Use the Bresenham’s algorithm to rasterize this line. (6 marks)

f) Write a program in C to fill polygon using Boundary fill algorithm. (5 marks)

g) Explain graphics pipeline in detail. (4 marks)

Question 2:

a) Define ray tracing and explain its differences from rasterization in terms of rendering techniques. (6 marks)

b) Describe the ray tracing process in OpenGL, including ray generation, intersection testing, shading, and rendering. (8 marks)

c) Discuss the advantages and disadvantages of ray tracing compared to rasterization in terms of rendering quality and computational complexity (6 marks)

d) Define transformations in the context of computer graphics and their importance in rendering scenes. (4 marks)

e) Using illustrations explain the types of transformations supported by OpenGL (8 marks).

f) Discuss the matrix-based representation of transformations in OpenGL and how they are applied to vertices in the rendering pipeline.(6 marks)

SECTION B

Attempt any three Questions from this Section

Question 1:

a) Explain the concept of double buffering in OpenGL and its purpose. (6 Marks)

b) Write a code snippet to enable double buffering and swap buffers in a GLUT program. (7 Marks)

c) Discuss why single buffering can cause flickering in animations. (7 Marks)

Question 2:

a) Define computer graphics and explain its role in modern applications. (6 Marks)

b) What is OpenGL, and how does it interact with the GPU? (7 Marks)

c) Explain using examples three advantages of using OpenGL for graphics programming. (7 Marks)

Question 3:

a) Explain the purpose of GLUT (OpenGL Utility Toolkit) in an OpenGL program. (6 Marks)

b) Write a simple C/C++ code snippet to initialize an OpenGL window using GLUT. (8 Marks)

c) Describe one common issue beginners face when setting up OpenGL and how to resolve it. (6 Marks)

Question 4:

a) What is the difference between immediate mode and retained mode in OpenGL? (6 Marks)

b) Write an OpenGL code snippet to draw a red triangle using glBegin() and glEnd(). (8 Marks)

c) Explain why immediate mode (e.g., glBegin()) is considered outdated in modern OpenGL. (6 Marks)

Question 5:

a) Describe the 2D Cartesian coordinate system used in OpenGL. (6 Marks)

b) Explain how the glTranslatef() function works and provide an example of its use. (7 Marks)

c) Discuss the effect of applying a translation followed by a rotation on a 2D object. (7 Marks)

Question 6:

a) Explain how colors are represented in OpenGL using RGB values. (6 Marks)

b) Write a code snippet to set the background color to blue and draw a yellow square. (8

Marks)

c) Describe the difference between flat shading and smooth shading in OpenGL. (6 Marks)

Question 7:

a) What is the purpose of the viewport in OpenGL, and how is it set using glViewport()? (6 Marks)

b) Differentiate between orthographic and perspective projections with examples. (8 Marks)

c) Write a code snippet to set up an orthographic projection for a 2D scene. (6 Marks)

Question 8:

a) List three OpenGL primitives (e.g., GL_POINTS, GL_LINES) and their uses. (6 Marks)

b) Write a code snippet to draw a green line segment from (0,0) to (1,1). (7 Marks)

c) Explain how GL_TRIANGLE_STRIP differs from GL_TRIANGLES in rendering. (7 Marks)

Question 9:

a) Define the purpose of the glRotatef() function in OpenGL. (6 Marks)

b) Write a code snippet to rotate a square 45 degrees around the origin. (8 Marks)

c) Explain how scaling with glScalef() affects the size of an object, with an example. (6 Marks)

Question 10:

a) What is the role of the glutDisplayFunc() in an OpenGL program? (6 Marks)

b) Write a simple code snippet to continuously rotate a triangle using glutIdleFunc(). (8 Marks)

c) Describe one challenge in creating smooth animations in OpenGL and a solution. (6 Marks)

Question 11:

a) Define ambient lighting in OpenGL and its effect on a scene. (6 Marks)

b) Write a code snippet to set up a basic ambient light source in OpenGL. (8 Marks)

c) Explain how diffuse lighting differs from ambient lighting in terms of object appearance. (6 Marks)

Question 12:

a) Describe the role of the z-axis in 3D graphics with OpenGL. (6 Marks)

b) Write a code snippet to draw a simple 3D cube using GL_QUADS. (8 Marks)

c) Explain the purpose of enabling depth testing with glEnable(GL_DEPTH_TEST). (6 Marks)