JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN COMPUTER SECURITY AND FORENICS

4TH YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: **ICB 1411**

COURSE TITLE: **COMPUTER GRAPHICS**

EXAM VENUE: LAB 14 **STREAM: BSC CSF**

DATE:9/1/25 **EXAM SESSION: 14-16.00 HRS**

TIME: **2.00 HOURS**

INSTRUCTIONS:

1. **Answer Question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE **[30 MARKS]**

(a) Write a Python program that implements Bresenham's line generation algorithm. [6 Marks]

(b) In question 1(a) above, give comments to explain how your code works and the significance of using this algorithm over the DDA (Digital Differential Analyzer) algorithm. [4 Marks]

(c) Distinguish between the difference between the RGB and CMYK color models. [2 Marks]

(d) While referring to question 1(c) above, explain using supported reasons for real-world applications where each of the mentioned color models are applied. [3 marks]

(e) Consider a case where a graphics design company is tasked with producing realistic 3D images for a video game.

(i) Discuss how ray tracing is applied to achieve realism in image synthesis. [4 Marks]
(ii) Explain how light, reflections, and shadows are handled in ray tracing. [6 Marks]

(f) In a recent forensic case, investigators needed to enhance and analyze low-quality digital images to identify potential suspects. Using your knowledge of image synthesis and anti-aliasing techniques, explain how the investigators might apply these techniques to improve image quality for clearer identification. [5 Marks]

QUESTION TWO **[20 MARKS]**

(a) Maridadi Technology Ltd is deciding whether to invest in CAD (Computer-Aided Design) software for their product development.

(i) Based on what your knowledge about the classification of computer graphics applications, explain the advantages CAD offers over traditional design methods. [5 Marks]

(ii) Discuss a real-world example where CAD has dramatically improved the design process. [5 Marks]

(b) Implement and compare the DDA and Bresenham's algorithms by drawing a straight line between two points. [6 Marks]

(c) Based on your implementation from question 2(b) above, analyze the accuracy and efficiency of both algorithms in handling diagonal and horizontal lines. [4 marks]

QUESTION THREE **[20 MARKS]**

(a) In a video-editing software development project, explain how would you choose between using the RGB and HSB color models. [4 Marks]

(b) While referring to question 3 (a) above, explain the scenarios where each would be ideal, and provide an example from the film industry that demonstrates the use of color models to enhance visual effects. [6 Marks]

(c) Given a 2D object represented by the vertices (1,1), (2,1), and (1,2), apply the following affine transformations:

(i) Rotate the object 90° counterclockwise. [5 Marks]

(ii) Scale the object by a factor of 2 in both x and y directions. [5 Marks]

Draw the transformed object and provide the new coordinates of the vertices in each case.

QUESTION FOUR **[20 MARKS]**

(a) Consider a case where you are developing a video rendering software where only certain parts of a scene need to be displayed at a time.

(i) Explain how you would implement the Cohen-Sutherland clipping algorithm to efficiently display only relevant content. [4 Marks]

(ii) Discuss a scenario in video streaming where clipping is essential for performance optimization. [6 Marks]

(b) Using a simple 3D object, explain how flat shading, Gouraud shading, and Phong shading would render different visual effects. [6 Marks]

(c) Generate a pseudo-code to demonstrate the shading differences. [4 Marks]

QUESTION FIVE **[20 MARKS]**

(a) Consider a case where a game development company is facing issues with jagged edges on textures in their graphics, which affects the visual quality of their game.

(i) Explain how anti-aliasing techniques, combined with texture mapping methods, can solve this problem. [4 Marks]

(ii) Briefly analyze how these techniques are applied in the gaming industry to enhance visual realism. [6 Marks]

(b) Write a program that implements the basic texture mapping and ray tracing in a 3D scene. [6 Marks]

(c) Explain how these techniques contribute to realistic image synthesis, using examples from architectural visualization or movie production. [4 Marks]

- END –