



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya

Tel: +254(0) 799 529 958, +254(0) 799 529 959, + 254 (0) 712 524 293,

Website: [info@must.ac.ke](mailto:info@must.ac.ke) Email: [info@must.ac.ke](mailto:info@must.ac.ke)

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## University Examinations 2024/2025

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY, BACHELOR OF EDUCATION ARTS, BACHELOR OF EDUCATION SCIENCE, BACHELOR OF SCIENCE IN COMPUTER SCIENCE, BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY

### CIT 3401: COMPUTER GRAPHICS

DATE: JANUARY 2025

TIME: 2 HOURS

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INSTRUCTIONS: Answer question *one* and any other *two* questions

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#### QUESTION ONE (30 MARKS)

- Consider how the advent of computer graphics has transformed industries like film and video games. Discuss a specific example of how it has revolutionized one of these industries? (5 Marks)
- Imagine you're a photographer setting up a shot. Discuss how camera analogy help us understand viewing transformations in computer graphics, and how does it aid in rendering scenes? (5 Marks)
- When designing graphics on a computer, how are your screen coordinates translated into physical pixels on a display? Discuss why screen resolution is crucial in this mapping process. (5 Marks)
- Think about wearing a VR headset and exploring a virtual world. Explain virtual reality use computer graphics to create such immersive experiences, and what technical challenges arise when rendering these VR environments? (5 Marks)

- e. When you view images on a screen, what is rasterization, and why is it important in the rendering process? How does it differ from working with vector graphics? (5 Marks)
- f. Consider a movie where actors wear special suits to capture their movements. Discuss how motion capture technologies work with computer graphics to create realistic animations? Can you provide an example from the film or gaming industry? (5 Marks)

### **QUESTION TWO (20 MARKS)**

- a. Imagine you're editing a high-resolution image. How does memory mapping relate to pixel manipulation on a computer screen, and explain how it affect the image's resolution? (6 Marks)
- b. In rendering a 3D scene with realistic lighting, what role does the Phong lighting model play? What are its strengths and limitations in generating lighting effects? (8 Marks)
- c. Suppose you need to send high-quality images over the internet. Explain how image file compression work, and what are the key differences between lossy and lossless compression techniques? (6 Marks)

### **QUESTION THREE (20 MARKS)**

- a. Think of a frame buffer as a canvas where your image is assembled before being displayed. Why are frame buffers important in a graphics system, and how do they contribute to rendering an image on the screen? (7 Marks)
- b. In a 3D game, objects farther away might appear dimmer. Discuss light attenuation affect visual realism in 3D graphics, and can you provide an example where it's significant? (7 Marks)
- c. When rendering a 3D model using OpenGL, how do transformations like scaling, rotation, and translation impact vertex data? Explain the sequence of operations involved in the OpenGL rendering pipeline. (6 Marks)

### **QUESTION FOUR (20 MARKS)**

- a. While drawing connected lines in OpenGL, what's the difference between a line strip and a line loop? In what situations would you choose one over the other in a graphical application? (8 Marks)

- b. In 3D modeling, how do normal vectors influence the appearance of surfaces concerning lighting and shading? Discuss an example of their application in rendering a 3D object?  
(6 Marks)
- c. When rendering a 3D scene, how do local and global illumination models differ? How does global illumination enhance the realism of scenes?  
(6 Marks)

**QUESTION FIVE (20 MARKS)**

- a. Imagine you're developing a 2D game where a character needs to rotate to face different directions. Discuss why rotation transformation crucial in this scenario, and how is rotation calculated in a 2D environment?  
(7 Marks)
- b. Suppose you're creating an animation where an object needs to lean or slant. Discuss how shear transformation alter the shape of the object, and when might this be practically used in graphics applications?  
(7 Marks)
- c. When rendering a complex 3D scene, not all objects are within the viewer's field of vision. Discuss the role of clipping in this context, and how does the Cohen-Sutherland algorithm improve the clipping process?  
(6 Marks)