NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI-ABUJA
FACULTY OF COMPUTING
DEPARTMENT OF COMPUTER SCIENCE
2025_1 EXAMINATION

COURSE CODE: CIT371
COURSE TITLE: Introduction to Computer Graphics and Animation
COURSE CREDIT: 3 Units
TIME ALLOWED: $2\frac{1}{2}$ Hours
INSTRUCTION: Answer Question One (1) and any other Three (3)

Question 1

1a. Describe the following concepts used in traditional animation. **(6 Marks)**
- i. Key frames
- ii. Cell animation
- iii. Kinematics

1b. User Driven Animation and Procedural Animation are types of animation techniques. Give two (2) examples of each. **(2 Marks)**
1ci. Highlight five (5) important 3D transformations. **(5 Marks)**
1cii. Explain this statement: 'Modelling and animation are loosely coupled' **(2 Marks)**
1d. Discuss Ray tracing. **(5 Marks)**
1e. Highlight three (3) uses of Binary Space Partition (BSP) trees. **(3 marks)**

Question 2

2a. Explain the following terms; **(6 Marks)**
- i) Spectroradiometer
- ii) Complementary colours
- iii) Dominant wavelength.

2b. A quadtree is a tree data structure used to represent a 2D space partitioned into smaller squares (quadrants). Provide a formal definition of a Quadtree for a set of points P in a square Q = [x1Q, x2Q] × [y1Q, y2Q]. **(6 Marks)**
2c. An alternative to the bounding box or bounding sphere hierarchy is to use splitting planes to divide space. Quadtrees/Octrees, KD trees, and BSP trees are all splitting plane algorithms. Describe the main differences among these approaches. **(3 Marks)**

Question 3

3a. With the aid of diagrams describe vector addition and vector subtraction for a pair of 2D vectors a = $[u, v]^T$ and b = $[s, t]^T$. **(8 Marks)**
3b. Prove that a ◦ b = |a||b|cosθ using the Law of Cosines. (**7 Marks**)

Question 4

4a. Given two matrices $a = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$ and $b = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix}$, write down the Matrix Multiplication operation C = AB. (**2 Marks**)
4b. Write down three (3) properties of Matrix Multiplication. **(3 Marks)**
4c. The quality of a curve is characterized by the continuity at points where the piecewise polynomial curves are joined together. **(8 marks)**
- i. Define C^0 and G^0 continuity
- ii. Define G^1 continuity
- iii. Define C^1 continuity
- iv. Define C^N continuity

4d. Describe the components of a two-part Texture Mapping. **(2 Marks)**

Question 5

5a. Briefly describe five (5) Pixel Operations used in graphics processing. **(10 Marks)**

5b. The rendering pipeline for 3D Camera Transforms mimics photography. Explain the following transforms; **(3 Marks)**

i. The Viewing transform
ii. Model transform
iii. Projection transform

5c. State any two (2) constraints for Bezier curves. **(2 Marks)**

Question 6

6a. Describe two (2) common frame buffer formats. **(7 Marks)**

6b. What are Spline Curves? **(1 Mark)**

6c. Derive an equation for the Intersection between a Ray and a Sphere. **(7 Marks)**

For the following conditions,

i. The Ray is specified by the parametric expression $E + tv = E + tv$
ii. The Sphere is centred at (x_c, y_c, z_c) and can be specified by the implicit equation $(x - x_c)^2 + (y - y_c)^2 + (z - z_c)^2 - R^2 = 0$