

Master in Multimedia Development Examination, 2024

(First Year Second Semester)

ADVANCED GRAPHICS & ANIMATION

Time: Three Hours

Full Marks: 100

(Answer any *five* questions)

All parts of a question must be answered together

1. a) How polynomials are used for the mathematical modeling of splines?
 b) Find the equation of a quadratic spline passing through three points (3, 2), (8, -4), and (6, 5) in parametric form sub-division ratio $k=0.6$ and also find the Blending Functions of this spline. 8+12=20

2. a) A cubic curve has the following BFs where a, b, c are constants: $L_0 = -4at, L_1 = at^3, L_2 = bt^2, L_3 = -c$. Find its basis matrix.
 b) Find the parametric equation of cubic C-R spline with points (0,-1), (1, 1), (4, 3), (5,-2).
 c) A cubic Bezier curve is associated with the following CPs : (3,-4), (2, 3), (0, 0) and (-2,-3). Find its equation. 7+7+6=20

3. a) Find the length of the parametric curve $x=2\sin t$ and $y=2\cos t$ for $0 \leq t \leq 2\pi$
 b) Find critical points of the curve $f(x) = -2.67x + 0.67x^3$
 c) Find the centroid for the region bounded by $y=2\sin(2x)$ and $y=0$ on the interval $[0, \pi/2]$. 6+6+8=20

4. a) A square having vertices A(-1, -1), B(1, -1), C(1, 1), D(-1, 1) is translated by amounts (-5, 2), then scaled by amounts (2, 0.5), and finally rotated by angle 60° CW around the origin. Find its new vertices.
 b) A triangle having vertices at (1, 2), (3, 2), (3, 4), is reflected about the X axis, Y axis, and the origin. Find its new vertices for each case.
 c) Explain the steps of Window to Viewport transformation. 9+6+5=20

[Turn over

5. a) Find whether vectors $\mathbf{a}=3\mathbf{i}+5\mathbf{j}-2\mathbf{k}$ and $\mathbf{b}=2\mathbf{i}-2\mathbf{j}-2\mathbf{k}$ are perpendicular or parallel to each other.
 b) Find the magnitude and angles the vector $P = 4\mathbf{i} - 2\mathbf{j} + 4\mathbf{k}$ makes with coordinate axes.
 c) Find the vector equation of the line along which two planes $3x + 4y - 2z = 1$ and $4x - 2y + 3z = 1$ meet. 6+8+6=20
6. a) Differentiate between 2D rotation and 3D rotation.
 b) A cube with center at origin and vertices at $(-1, 1, 1), (1, 1, 1), (1, -1, 1), (-1, -1, 1), (-1, 1, -1), (1, 1, -1), (1, -1, -1), (-1, -1, -1)$ is rotated by 45° about the X axis. Find its new vertices.
 c) A cube with center at origin and vertices at $(-1, 1, 1), (1, 1, 1), (1, -1, 1), (-1, -1, 1), (-1, 1, -1), (1, 1, -1), (1, -1, -1), (-1, -1, -1)$ is subjected to a shear along the Z axis with parameters $(1.5, 2.5)$. Find its new vertices. 4+8+8=20
7. a) Find the area and volume of the surface generated when part of the curve $y = \sqrt{9 - x^2}$ between $x = -2$ and $x = +2$ is rotated about the X-axis.
 b) A parametric surface $(s^2, 2s, t)$ is translated using $T(1,0,-1)$ and then scaled using $S(-1, 0, 1)$. Find the parametric representation of the resulting surface
 c) Explain surface illumination considering different types of reflections. 7+7+6=20
8. Write a short note on *any four*
- a) Fractal
 - b) Law of vector addition
 - c) Quad Tree
 - d) Texture Mapping
 - e) Hermite Spline 5×4=20