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**Presidency University**

**Bengaluru**

**SCHOOL OF INFORMATION SCIENCE**

**SUMMER TERM END TERM EXAMINATION –AUGUST 2024**

**Academic Year**: 2023 - 24

**Course Code**: CSA1011

**Course Name**: Introduction to 3D animation

**Program & Sem**: BCA AR/VR Summer Term

 **Date**: 06-08-2024

**Time**: 01.00 PM to 04:00 PM

 **Max Marks**: 100

 **Weightage**: 50%

**Part A**

**Answer all the Questions. Each question carries 2 marks. (5Qx 2M= 20M)**

1. What is the importance of ‘motion paths’?

Motion paths define how characters and objects move through a scene, contributing to the storytelling and visual appeal.

2. Give two reasons for importance of animation?

Animation allows complex ideas, stories, and concepts to be conveyed visually, making them more accessible and engaging.

Animation offers limitless creative potential, enabling creators to bring their imaginations to life without the constraints of the physical world.

3. Define Vertices and faces?

A vertex (plural: vertices) is a point in 3D space, defined by its coordinates (x, y, z). Vertices are the corner points of a 3D model.

A face is a flat surface enclosed by edges, which are the lines connecting vertices. In 3D modeling, faces are usually polygons (most commonly triangles or quadrilaterals) that form the surfaces of the 3D object.

4. Why is the ‘line of action’ important?

Visualizes the main flow of energy through a body. It involves calculating the intermediate values for the spatial properties (position, rotation, scale) of an object between two keyframes. This is done to create a smooth path or motion from one keyframe to another.

5. What is spatial interpolation with reference to keyframes?

Spatial interpolation with reference to keyframes in animation refers to the process of determining the positions of objects in space between keyframes.

6. What do you understand by extrusion?

extrusion in 3D modeling refers to the process of extending a line, edge, or profile along a specified path to create a 3D shape or object. This technique is commonly used to create complex geometries from simpler shapes.

7. Write the full form of NURBS?

Non-Uniform Rational B-Splines

8. What is scaling?

Scaling in 3D modeling refers to the process of changing the size of an object or its parts.

9. What is the importance of GPU in 3D animation?

impacts performance, efficiency, and visual quality

10. How is ‘eevee’ different from ‘cycles’ while rendering?

Eevee is a real-time rendering engine designed for fast previewing and interactive design. It uses rasterization techniques similar to those found in game engines. It approximates lighting and shading effects to achieve fast rendering times.

Cycles is a path-tracing renderer that simulates the way light interacts with objects to produce highly realistic images. Cycles uses ray tracing techniques to accurately simulate reflections, refractions, shadows, and global illumination. It calculates light paths and complex interactions to achieve photorealistic results.

 **PART B**

**Answer all the Questions. Each question carries 10 marks. (4Qx10M=40M)**

11. What principles would you follow to produce animation for a short film?

Squash and Stretch gives the sense of weight and volume

Anticipation  it shows that something will happen, almost nothing happens

Staging to attract audience so that audience’s attention is directed toward that scene

Straight Ahead, all frames are drawn from beginning to the end and then fill all the interval or scene.

Flow through and overlapping action, two object’s action have different speed in any scene

Slow in and Slow out, has max acceleration inbetween

Arc all objects follow curved line and not a straight line

Secondary action has to be included.

Playing a given action a perfect timing is very important.

Exaggeration creates extra reality.

3D animation in preferred and should look solid.

The character should appeal to the people and need not look exactly same as a real character.

12. You are required to model a face in high poly and in low poly. What difference would the number of vertices make? How would the shading change with change in number of faces?

A high-poly face model has a large number of vertices, resulting in a dense mesh. This allows for very detailed features and smooth curves. The increased number of vertices allows for intricate details, such as fine wrinkles, pores, and other subtle facial features. This density provides more control over the model’s shape, resulting in a more realistic appearance.

Shading algorithms (like Gouraud or Phong shading) interpolate vertex normals to create the illusion of a smooth surface. High-poly models capture surface detail more accurately. Fine details are visible, and light interacts with the surface in a more realistic manner. This allows for more natural and accurate shading, including subtle variations in skin texture. Due to fewer faces, low-poly models might exhibit shading artifacts like noticeable edges or harsh transitions. High-poly models generally require more processing power and time to render due to the large number of polygons.

13. You are producing a simulation of a gun shooting a bullet. Describe the production process from the concept stage to the post production stage.

The first step in the animation workflow is to develop a clear concept or idea for the animation. This involves brainstorming, storyboarding, and creating a visual plan for the animation. It is important to define the purpose, target audience, and desired message of the animation during this stage.

In the pre-production phase, the focus is on planning and organizing the project. This includes creating a detailed script, designing characters, creating concept art, and developing the visual style of the animation. Additionally, decisions regarding the software, tools, and techniques to be used are made during this stage.

Once the pre-production is complete, the next step is to create the necessary assets for the animation. This involves creating or importing 2D or 3D models, designing backgrounds, texturing, rigging characters, and creating any other visual elements required for the animation.

The animation phase is where the actual movement and performance of the characters or objects take place. Animators use keyframes, interpolation, and various animation techniques to bring the characters and objects to life. This stage requires careful attention to timing, spacing, and movement principles to achieve a convincing and appealing animation.

After the animation is complete, the next step is to render the animation frames into a final video format. Rendering involves the processing and outputting of each frame with the desired lighting, shading, and effects. This can be a time-consuming process, especially for complex or high-resolution animations.

Once the animation is rendered, it may undergo post-production processes such as editing, compositing, and adding sound effects or music. This stage involves combining the rendered animation with other elements, adjusting colors, adding special effects, and refining the final output.

14. Explain the fundamentals of keyframe animation and the different methods in which transition is made from one keyframe to the next.

A keyframe is a point (one frame) on a video timeline where you tell the video editing software a specific properties settings. Some common properties are scale, rotation, opacity and volume. Interpolation is how the software calculates the values between two points interpolation can be spatial, and or temporal. Spatial Interpolation relates an element’s motion path. By utilizing spatial interpolation you change the path of keyframes from harsh to smooth or vice-versa. Temporal deals with changes to the time at which an element or layer will be at a certain point or points.

LINEAR KEYFRAMES utilizes a straight uniform rate of change between two keyframes. This keyframe type is always abrupt and very mechanical. Auto bezier takes linear keyframes and smooth out the rate of change by automatically generating curves to the keyframes. allows the element to move more fluidly. CONTINUOUS BEZIER - auto bezier smoothed out the rate of change automatically, continuous bezier does so manually. you need to highlight the keyframes you want to change and manually adjust the interpolation. BEZIER KEYFRAMES - full manual control and functionality over the motion path and or the value graph. (ease interpolation). Hold keyframe - holds a the layer on a specific keyframe. This is great for freezing footage.

**PART C**

**Answer all the Questions. Each question carries 20 marks. (2Qx20M=40M)**

 15. You are tasked with making an animated scene of children playing. What are the different types of animation that you would consider? What are their advantages and limitations? Which one would you choose if your budget is unlimited? Would the limitation of the users’ devices such as mobile phone or desktops affect the process in which the animated video is made?

2D Animation: Traditional Animation: Hand-drawn frames, often digitized for final production. Advantages: Artistic, unique style; highly customizable. Limitations: Labor-intensive, time-consuming, requires skilled artists. Digital 2D Animation: Created using software like Adobe Animate or Toon Boom Harmony. Advantages: Easier to edit and manage, faster production, reusable assets. Limitations: Can be less expressive than traditional hand-drawn animation. 3D Animation: Created using software like Blender, Maya, or 3ds Max. Advantages: Realistic movements, versatile, allows for complex scenes and interactions. Limitations: High learning curve, resource-intensive, can be expensive. Stop Motion Animation: Uses physical objects and models, photographed frame by frame. Advantages: Unique, tactile quality; highly creative and engaging. Limitations: Extremely time-consuming, requires physical space and materials, difficult to correct errors. Motion Graphics: Graphic elements and text, often used for informational or abstract animation. Advantages: Good for explanatory and stylistic scenes, relatively quick to produce. Limitations: Limited in storytelling and character animation. Cut-Out Animation: Uses flat characters and props, often with jointed parts. Advantages: Cost-effective, distinctive style, easier than traditional 2D. Limitations: Limited in depth and dynamic movement. Rotoscoping: Tracing over live-action footage to create realistic animations. Advantages: Very realistic, can be faster than traditional animation. Limitations: Limited by the quality and movements in the live-action footage, can look unnatural if not done well.

16. In the making of animated simulations what are the reasons for the use of:

 a) Lines of action

 b) Textures

 c) UV Mapping

d) Illumination

e) Rendering

a) Lines of Action

The line of action is an imaginary line that extends through the main action of a character's pose, showing the direction and flow of the movement. Dynamic Poses, Movement Guidance, Visual Clarity, Exaggeration

b) Textures

Textures are images or patterns applied to the surface of 3D models to give them color, detail, and realism. Realism, Detail, Variety, Depth

c) UV Mapping

UV mapping is the process of projecting a 2D image (texture) onto a 3D model's surface by unwrapping the model into a 2D plane. Accurate Texturing, Customization, Optimization, Consistency

d) Illumination

Illumination refers to the lighting used in a scene to simulate realistic light behavior and enhance the visual appeal of the animation. Realism, Mood and Atmosphere, Focus, Depth

e) Rendering

Rendering is the process of generating the final image or animation from the 3D scene, including all textures, lighting, and effects. Final Output Quality, Realism, Effects such rendering allows for the inclusion of post-processing effects such as motion blur, depth of field, and color correction, which add to the visual appeal of the animation.