

**ADVANCED ANIMATION**  
**COURSE CODE: 5351**

**COURSE DESCRIPTION:** Advanced Animation teaches students how to use 3D software to model, animate, and render with a focus on establishing a working knowledge of animation tools and techniques. Emphasis is placed on career awareness, fundamentals of modeling, storyboard creation, cameras and lighting. Students will learn how 3D technology is used for film, broadcast, and games. This course prepares students for industry certification.

**OBJECTIVE:** Given the necessary equipment, supplies, and facilities, the student will complete all of the following core standards successfully.

**RECOMMENDED GRADE LEVELS:** 11-12

**COURSE CREDIT:** 1 unit (120 hours)

**PREREQUISITE:** Foundations of Animation

**COMPUTER REQUIREMENT:** one computer per student with GPU;  
Internet access

**RECOMMENDED SOFTWARE:** Autodesk Maya, Blender or other 3D  
Software

**RESOURCES:** See Additional Materials and Resources

**INDUSTRY CREDENTIALS/CERTIFICATIONS AVAILABLE:**

Autodesk Certified User for Maya (All core units are required for certification.)

Unity Certified User: Artist

**SAFETY**

**Professionals know the academic subject matter, including safety as required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Review school safety policies and procedures.
2. Review classroom safety rules and procedures.
3. Review safety procedures for using equipment in the classroom.
4. Identify major causes of work-related accidents in office environments.
5. Demonstrate safety skills in an office/work environment.

## STUDENT ORGANIZATIONS

**Professionals know the academic subject matter, including professional development, required for proficiency within their area. They will use this knowledge as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Identify the purpose and goals of a Career and Technology Student Organization (CTSO).
2. Explain how CTSOs are integral parts of specific clusters, majors, and/or courses.
3. Explain the benefits and responsibilities of being a member of a CTSO.
4. List leadership opportunities that are available to students through participation in CTSO conferences, competitions, community service, philanthropy, and other activities.
5. Explain how participation in CTSOs can promote lifelong benefits in other professional and civic organizations.

## TECHNOLOGY KNOWLEDGE

**Professionals know the academic subject matter, including the ethical use of technology as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate proficiency and skills associated with the use of technologies that are common to a specific occupation.
2. Identify proper netiquette when using e-mail, social media, and other technologies for communication purposes.
3. Identify potential abuse and unethical uses of laptops, tablets, computers, and/or networks.
4. Explain the consequences of social, illegal, and unethical uses of technology (e.g., piracy; cyberbullying; illegal downloading; licensing infringement; inappropriate uses of software, hardware, and mobile devices in the work environment).
5. Discuss legal issues and the terms of use related to copyright laws, fair use laws, and ethics pertaining to downloading of images, photographs, documents, video, sounds, music, trademarks, and other elements for personal use.
6. Describe ethical and legal practices of safeguarding the confidentiality of business-related information.
7. Describe possible threats to a laptop, tablet, computer, and/or network and methods of avoiding attacks.

## PERSONAL QUALITIES AND EMPLOYABILITY SKILLS

**Professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria**

**are considered essential for students in any program of study.**

1. Demonstrate creativity and innovation.
2. Demonstrate critical thinking and problem-solving skills.
3. Demonstrate initiative and self-direction.
4. Demonstrate integrity.
5. Demonstrate work ethic.
6. Demonstrate conflict resolution skills.
7. Demonstrate listening and speaking skills.
8. Demonstrate respect for diversity.
9. Demonstrate customer service orientation.
10. Demonstrate teamwork.

## **PROFESSIONAL KNOWLEDGE**

**Professionals know the academic subject matter, including positive work practices and interpersonal skills, as needed in their role. The following accountability criteria are considered essential for students in any program of study.**

1. Demonstrate global or “big picture” thinking.
2. Demonstrate career and life management skills and goal-making.
3. Demonstrate continuous learning and adaptability skills to changing job requirements.
4. Demonstrate time and resource management skills.
5. Demonstrates information literacy skills.
6. Demonstrates information security skills.
7. Demonstrates information technology skills.
8. Demonstrates knowledge and use of job-specific tools and technologies.
9. Demonstrate job-specific mathematics skills.
10. Demonstrates professionalism in the workplace.
11. Demonstrate reading and writing skills.
12. Demonstrates workplace safety.

## **A. PRE-PRODUCTION: ADVANCED STORYBOARDING AND CHARACTER DEVELOPMENT**

**Animation professionals demonstrate advanced pre-production techniques. The following accountability criteria are considered essential for students in Information Technology.**

1. Describe the purpose of the 3d graphics, including the target audience (e.g., for film, video games, and/or animation).
2. Explore different types of storyboards (e.g., linear, branching, modular).
3. Enhance the visual narrative and visual effects by developing scenes, adding annotations, camera views, lighting and audio.

4. Link action sequences.
5. Experiment and iterate the storyboard to refine and polish the content.
6. Examine and improve the storyboard through testing and feedback.
7. Refine characters, environments, and the world of animation.
8. Develop character turnarounds or model sheets.

## **B. PRODUCTION: UNDERSTANDING THE ANIMATION SOFTWARE**

**Animation professionals demonstrate knowledge and usage of various animation software. The following accountability criteria are considered essential for students in Information Technology.**

1. Use menu bars, command panels, and software navigation tools.
2. Navigate, organize, and customize the workspace.
3. Demonstrate the use of hotkeys (shortcut keys/commands).
4. Demonstrate the ability to map between the various coordinate systems.
5. Compare and contrast use of Orthographic/Perspective Views.
6. Organize a hierarchy of objects and components.
7. Use transformations, (i.e., move tool, scale tool, and rotation tool).

## **C. PRODUCTION: MODELING**

**Animation professionals demonstrate knowledge and skills in 2-d and 3-d modeling. The following accountability criteria are considered essential for students in Information Technology.**

1. Create standard, extended and architectural primitives.
2. Modify object properties.
3. Transform and clone objects.
4. Create and use object arrays.
5. Build compound objects.
6. Construct spline objects.
7. Employ techniques to extrude a 2D object into a 3D object.
8. Apply modifiers that will rotate a spline to create a circular cross section.
9. Employ various techniques to modify edges, faces, and vertices.
10. Convert objects to Editable Mesh, Polygons, Patch and Nurbs.

## **D. PRODUCTION: APPLYING MATERIALS AND MAPS**

**Animation professionals demonstrate knowledge and skills in applying materials and maps. The following accountability criteria are considered essential for students in Information Technology.**

1. Specify the ambient and diffuse color of an object.
2. Specify the specular, reflective, and luminosity material properties of objects.
3. Add filters to an object.
4. Create various surface patterns such as smoke, tiles, and swirls.
5. Compare and contrast physics engine techniques for simulating land and water.
6. Create reflections and refractions on objects.
7. Use UV mapping techniques to wrap an image around an object.
8. Create depth maps to create an illusion of depth and detail.
9. Apply environmental maps to create the visual complexity that the eye expects to see from shiny reflections.
10. Compare, contrast, and use opacity versus transparency.

## **E. PRODUCTION: PAINT EFFECTS**

**Animation professionals demonstrate appropriate knowledge and skills in using paint effects. The following accountability criteria are considered essential for students in Information Technology.**

1. Demonstrate the user interface for paint effects for preset brushes and paint realistic effects like noodles, plants, hair, fire, feathers, oil paints, pastels, and watercolors.
2. Create pressure curves showing how you can adjust the lines(nerves) and/or points to make it curve.
3. Create cycling animation which involves rigging, creating the separate parts and building a structure that will work together through the Timeline.
4. Create a custom brush.
5. Use paint effects mesh.
6. Modify object shading.
7. Change mesh settings and mesh environments.
8. Change texture settings.
9. Create illuminating and shadowing paint effects.

## **F. PRODUCTION: KEYFRAME ANIMATION**

**Animation professionals demonstrate appropriate knowledge and skills in keyframe animation. The following accountability criteria are considered essential for students in Information Technology.**

1. Define keyframe.
2. Create a simple keyframe animation using position and rotation on objects, cameras,

- lights, etc.
3. Edit keyframe animations using graph editor.
  4. Describe how different tangent settings affect an animation.
  5. Edit keyframe animations using dope sheet to keep track of what happens to the animation over time (summary/timeline).
  6. Create a keyframe animation using driven keys.
  7. Create a keyframe animation using a motion path.
  8. Ghost an object's trajectory.

## **G. PRODUCTION: CHARACTER RIGGING**

**Animation professionals demonstrate appropriate knowledge and skills in character rigging. The following accountability criteria are considered essential for students in Information Technology.**

1. Define rigging tools.
2. Define skinning tools.
3. Create a skeleton using joints.
4. Define inverse kinematics (IK) and forward kinematics (FK).
5. Describe parent/child hierarchy.
6. Use influence objects.
7. Impose limits and constraints on skeleton joints.

## **H. PRODUCTION: CHARACTER ANIMATION**

**Animation professionals demonstrate appropriate knowledge and skills in character animation. The following accountability criteria are considered essential for students in Information Technology.**

1. Create inverse kinematics (IK) handles and mirroring joints.
2. Create foot and knee controls.
3. Create a foot roll from scratch.
4. Create the back spine.
5. Connect back spine to legs.
6. Create back and hip controls.
7. Add constraints to controls.
8. Insert joints into a joint chain and head controls.
9. Build arm inverse kinematics (IK) controls and elbow pole vector controls.
10. Create fingers.
11. Adjust local rotation of the finger joints.
12. Use the paint weight tool to influence skin.

## **I. POSTPRODUCTION: RENDERING**

**Animation professionals demonstrate rendering techniques. The following accountability criteria are considered essential for students in Information Technology.**

1. Describe bringing together the visuals, from the shadows and lighting effects to the textures, and generate the final result.
2. Preview a render an animation using Viewport 2.0
3. Render an animation using Arnold.
4. Set up and use a GPU Renderer.

## **J. PRODUCTION: LIGHTING TECHNIQUES (OPTIONAL)**

**Animation professionals demonstrate knowledge and skills in lighting. The following accountability criteria are considered essential for students in Information Technology.**

1. Identify key principles in effective lighting.
2. Compare and contrast the effectiveness of natural light versus artificial light.
3. Describe and use three-point lighting.
4. Apply principles of basic color theory to lighting.
5. Employ various lighting types. (e.g., backlight, point light, etc.)

## **K. PRODUCTION: CAMERA TECHNIQUES (OPTIONAL)**

**Animation professionals demonstrate effective camera techniques. The following accountability criteria are considered essential for students in Information Technology.**

1. Compare and contrast the difference between a free and an aim camera.
2. Calculate and change the camera's focal length.
3. Describe the impact of depth of field on an object.
4. Describe and apply the use of motion blur on an object.

## **L. PARTICLE SYSTEMS, EFFECTS, AND FIELDS (OPTIONAL)**

**Animation professionals demonstrate knowledge and skills in particle systems, effects, and fields. The following accountability criteria are considered essential for students in Information Technology.**

1. Define effects, fields, and particles.
2. Create a particle emitter.
3. Apply a field to a particle system.
4. Create collisions between your particle system and objects in your scene.

5. Apply effects to an object.

Course Materials and Resources

Course Academic Standards and Indicators

Computer Science Academic Alignment