ITT Technical Institute

GD320

Physics of Animation

Onsite Course

SYLLABUS

Credit hours: 4

Contact/Instructional hours: 50 (30 Theory Hours, 20 Lab Hours)

Prerequisite(s) and/or Corequisite(s):

Prerequisites: CD340 Physical and Computer-Aided 3D Modeling or equivalent or IT209 3D Modeling or equivalent, IT309 Animation I or equivalent, GE192 College Mathematics II or equivalent

Course Description:

This course introduces concepts for simulating the real world in a virtual game environment. Topics include: simulating gravity, simulating friction, modeling acceleration and velocity, trajectories, kinematics and motion control, collision detection and response and object mass displacement.

Syllabus: Physics of Animation

Instructor:	_____
Office hours:	_____
Class hours:	_____

Major Instructional Areas

1. Points and lines
2. Application of collision detection
3. Trigonometric functions
4. Vector operations
5. Transformations
6. Speed and velocity
7. Acceleration
8. Motion
9. Newton's Laws
10. Kinetic energy
11. Potential energy
12. Momentum and collisions
13. reactor dynamics: collision detection
14. Process of game development
15. Level creation: Unreal Engine
16. Working with volumes in the Unreal Engine
17. Lighting in the Unreal Engine
18. Application of materials using the Unreal Engine
19. Application of interactive elements using the Unreal Engine

Course Objectives

1. Define lines and points and their uses in game physics.
2. Apply geometric and trigonometric principles to physical problems.
3. Relate vector and matrix operations to game physics.
4. Describe motion based on transformations and derivatives.
5. Perform energy and force calculations related to game design.
6. Create physical simulations in 3ds max.
7. Design and create a level for Unreal Tournament.

SCANS Objectives

SCANS is an acronym for Secretary's Commission on Achieving Necessary Skills. The committee, created by the National Secretary of Labor in the early 1990s, created a list of skills and competencies that the committee feels are necessary for employees to function in a high-tech job market.

1. Respond to written directions.
2. Participate in conversation, discussion, and group demonstrations.

3. Perform basic computations; use basic numerical concepts such as whole numbers and percentages in practical situations; make reasonable estimates of arithmetic results without a calculator, and use tables, graphs, diagrams, and charts to obtain or convey quantitative information.
4. Discern the meaning of unknown or technical vocabulary and judge its accuracy and appropriateness of use for a designated audience.

Course Outline

Note: All graded activities, except the Project, are listed below in the pattern of <Unit Number>.<Assignment Number>. For example, Labs: 3.1 refers to the first lab activity in Unit 3.

Unit	Activities
1—Points and Lines	• Content Covered: *Beginning Math and Physics for Game Programmers*: o Chapter 1, "Points and Lines" 3ds max reactor help files: o Intro and Rigid Bodies • Assignments: 1.1 • Labs: 1.1
2—Geometry Snippets	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 2, "Geometry Snippets" • Read from 3ds max help files: o Deformable Bodies • Assignments: 2.1 • Labs: 2.1
3—Trigonometry Snippets	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 3, "Trigonometry Snippets" • Read from 3ds max help files: o Water o Wind • Assignments: 3.1 • Labs: 3.1
4—Vector and Matrix Operations	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 4, "Vector Operations" o Chapter 5, "Matrix Operations" • Read from 3ds max help files: o Reactor Utility o Real-Time Preview • Assignments: 4.1 Labs: 4.1
5—Transformations	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 6, "Transformations" • Read from *Physics in 3D Animation*: o Chapter 1, "Reactor Dynamics: Collision Detection" o Chapter 2 "Particle Flow: A System for Organizing Chaos" • Assignments: 5.1 • Labs: 5.1
6—Motion in One Dimension	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 8, "Motion in One Dimension" • Read from *Physics in 3D Animation*: o Chapter 3, "Unreal Technology: The Big Picture" o Chapter 4, "The Process of Game Development" • Assignments: 6.1 • Labs: 6.1

Unit	Activities
	• Project: Deliverable 1
7—Derivative Approach to Motion in One Dimension	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 9, "Derivative Approach to Motion in One Dimension" • Read from *Physics in 3D Animation*: o Chapter 5, "Creating Your First Level with UnrealEd" o Chapter 6, "Advanced Brush Techniques" • Assignments: 7.1 • Labs: 7.1
8—Motion in Two and Three Dimensions	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 10, "Motion in Two and Three Dimensions" • Read from *Physics in 3D Animation*: o Chapter 7, "Terrain" • Assignments: 8.1 • Labs: 8.1
9—Newton's Laws	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 11, "Newton's Laws" • Read from *Physics in 3D Animation*: o Chapter 8, "Working with Volumes" o Chapter 9, "Lighting in Unreal" • Assignments: 9.1 • Labs: 9.1
10—Energy	• Read from *Beginning Math and Physics for Game Programmers*: o Chapter 12, "Energy" • Read from *Physics in 3D Animation*: o Chapter 10, "Creating Materials in Unreal" o Chapter 11, "Creating Particle Effects" • Assignments: 10.1 • Labs: 10.1
11—Final Exam and Final Project	• Final Exam • Project: Deliverable 2

Instructional Methods

This course is designed to promote learner-centered activities and support the development of cognitive strategies and competencies necessary for effective task performance and critical problem solving. The course utilizes individual and group learning activities, performance-driven assignments, problem-based cases, projects, and discussions. These methods focus on building engaging learning experiences conducive to development of critical knowledge and skills that can be effectively applied in professional contexts.

Instructional Materials and References

Student Textbook Package

- Stahler, W. (2006). Beginning Math and Physics for Game Programmers (Custom 1st ed.). Boston, MA: Pearson Custom
- Busby, Jason, and Ted Boardman. *Physics in 3D Animation*. Indianapolis: Pearson Custom Publishing, 2010.
- CD to accompany *Physics in 3D Animation*.

Equipment and Tools

- Autodesk 3ds Max 2012
- Unreal Tournament/UnrealEd

References

ITT Tech Virtual Library

Log on to the ITT Tech Virtual Library at http://library.itt-tech.edu/ to access online books, journals, and other reference resources selected to support ITT Tech curricula.

Books

You may click "Books" or use the Library Catalog function on the home page to find the following books.

Books24x7>

- Derakhshani, Dariush, and Randi Lorene Munn. *Introducing 3ds Max 2008*. Alameda, CA: Sybex, 2008.
- Rabin, Steve. *Introduction to Game Development*. 2nd ed. Boston: Cengage Learning, 2010.

School of Study

You may click "School of Study" then "School of Drafting and Designs" find the following resources.

- Recommended Links
  - Gamasutra
  - Gamedev.net
  - Game Research and Technology

Other References

The following resources may be found **outside** of the ITT Tech Virtual Library, whether online or in hard copy.

Web sites

- Autodesk's AREA Digital Entertainment & Visualization Community

http://area.autodesk.com/ (accessed 9/14/2010)
AREA is an Autodesk online community for 2D and 3D artists with free tutorials and downloads.

- Gamasutra – The Art & Business of Making Games

http://gamasutra.com/ (accessed 9/14/2010)
The online free version of Game Developer Magazine that includes weekly articles on game design and threads for discussion.

- Game Artisans.org V3

http://www.gameartisans.org/forums/index.php (accessed 9/14/2010)
A Game Art competition gallery and forum for concept and 3D game art creators.

Periodicals

- Game Developer Magazine

http://www.gdmag.com/homepage.htm
This site offers digital downloads of the monthly magazine for a fee.

All links to Web references outside of the ITT Tech Virtual Library are always subject to change without prior notice.

Course Evaluation and Grading

Evaluation Criteria Table

The final grades will be based on the following categories:

CATEGORY	WEIGHT
Assignments	20%
Lab Assignments	20%
Project	30%
Final Exam	30%
Total	**100%**

Note: Students are responsible for abiding by the Plagiarism Policy.

Grade Conversion Table

The final grades will be calculated from the percentages earned in the course, as follows:

A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

(End of Syllabus)