

# **GD410**

## **Game Engines and Production**

### **[Onsite]**

**Course Description:**

This course analyzes both commercial and open-source game engines, and how to apply different technologies based on the type of game being developed. Additionally the strategies for building game engines from scratch will be explored.

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

Prerequisite: GD345 C++ Programming for Game Developers or equivalent

**Credit hours: 4**

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

# SYLLABUS

Instructor: \_\_\_\_\_

Office hours: \_\_\_\_\_

Class hours: \_\_\_\_\_

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## MAJOR INSTRUCTIONAL AREAS

1. Identify the purpose of a game engine.
2. Explain and apply linear and rotational transformations.
3. Identify the features of a game engine.
4. Identify the tools used to develop games using a game engine.
5. Compare different game engines.
6. Identify different criteria for game engine selection.
7. Select an appropriate game engine for a given game project.
8. Identify the various steps involved in the development of game engine.

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## COURSE OBJECTIVES

1. Identify the purpose of a game engine.
2. Describe the features of a game engine.
3. Demonstrate the stages of a 3 Dimensional (3D) graphics pipeline.
4. Analyze the steps involved in the development of a game engine.
5. Identify an appropriate game engine for a given game project.
6. Demonstrate the appropriate use of tools to develop games.
7. Demonstrate the effective and efficient use of the ITT Tech Virtual Library.

## Related SCANS Objectives

1. Analyze and Interpret data.
2. Generate new ideas.
3. Use efficient learning techniques to acquire and apply new knowledge and skills.
4. Use critical thinking to apply the new knowledge learned.
5. Use ideas or information to gain new perspectives.

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## COURSE OUTLINE

**Notes:**

- **Unit 1:** All the concepts will be covered in the class; therefore, the specified readings are merely for your reference.
- **For all units, except unit 1:** It is recommended that you complete the readings before attending the class.
- In addition to general class participation and in-class activities, all discussion questions will be graded under the Participation evaluation category.

| Unit #                     | Activities for the Unit   |
|----------------------------|---|
| 1–Game Engine Architecture | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Core Techniques and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 2, “Game Architecture,” pp. 3-34</li> </ul> </li> </ul> </li> <li>• Writing Assignments: 1 and 2</li> <li>• Lab: 1</li> </ul>   |
| 2–Core Systems             | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Core Techniques and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 5, “User Input,” pp. 59-85</li> <li>▪ Chapter 12, “3D Pipeline Overview,” pp. 187-221</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul> |
| 3–Design Patterns          | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Core Techniques and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 4, “Design Patterns,” pp. 35-58</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> </ul>   |

| Unit #                     | Activities for the Unit  |
|----------------------------|--|
|                            | <ul style="list-style-type: none"> <li>• Lab: 1</li> </ul>   |
| 4—Requirements             | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Level design for games—creating compelling game experiences:</i> <ul style="list-style-type: none"> <li>▪ Chapter 3, “Enemies and Obstacles: Choosing Your Challenges,” pp. 381-402</li> <li>▪ Chapter 5, “Designing With a Diagram,” pp. 403-444</li> </ul> </li> <li>○ <i>Core Techniques and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 2, “Game Architecture,” pp. 3-34</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul> |
| 5—Constraints              | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Level design for game—creating compelling game experiences:</i> <ul style="list-style-type: none"> <li>▪ Chapter 6, “The Template,” pp. 445-505</li> <li>▪ Chapter 8, “Taking It to 11,” pp. 531-583</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul>  |
| 6—Cinematics and Scripting | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Mastering Unreal Technology—The Art of Level Design:</i> <ul style="list-style-type: none"> <li>▪ Chapter 9, “Interactive Elements,” pp. 617-655</li> <li>▪ Chapter 13, “Matinee: Creating Custom Cinematics,” pp. 683-720</li> <li>▪ Chapter 14, “Creating Scripted Sequences,” pp. 721-738</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> </ul>  |

| Unit #                | Activities for the Unit  |
|-----------------------|--|
|                       | <ul style="list-style-type: none"> <li>• Lab: 1</li> </ul>   |
| 7–Character Animation | <ul style="list-style-type: none"> <li>• Content Covered                             <ul style="list-style-type: none"> <li>○ <i>Core Technologies and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 15, “Character Animation,” pp. 223-259</li> </ul> </li> <li>○ <i>Mastering Unreal Technology–The Art of Level Design:</i> <ul style="list-style-type: none"> <li>▪ Chapter 22, “Importing Characters into UnrealEd,” pp. 757-786</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul>                                       |
| 8–AI Fundamentals     | <ul style="list-style-type: none"> <li>• Content Covered                             <ul style="list-style-type: none"> <li>○ <i>Core Technologies and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 6, “Fundamental AI Technologies,” pp. 87-128</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul>   |
| 9–Genre –Specific AI  | <ul style="list-style-type: none"> <li>• Content Covered                             <ul style="list-style-type: none"> <li>○ <i>Core Technologies and Algorithms in Game Programming:</i> <ul style="list-style-type: none"> <li>▪ Chapter 7, “Action-Oriented AI,” pp. 129-156</li> <li>▪ Chapter 8, “Tactical AI,” pp. 157-186</li> </ul> </li> <li>○ <i>Mastering Unreal Technology–The Art of Level Design</i> <ul style="list-style-type: none"> <li>▪ Chapter 12, “Advanced Bot/AI Navigation,” pp. 657-682</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul> |

| Unit #                   | Activities for the Unit   |
|--------------------------|---|
| 10–Optimization          | <ul style="list-style-type: none"> <li>• Content Covered               <ul style="list-style-type: none"> <li>○ <i>Level Design for games creating compelling game experiences:</i> <ul style="list-style-type: none"> <li>▪ Chapter 7, “Improving Your Level,” pp. 507-530</li> <li>▪ Chapter 9, “Ship It!,” pp. 585-613</li> </ul> </li> <li>○ <i>Mastering Unreal Technology–The Art of Level Design:</i> <ul style="list-style-type: none"> <li>▪ Chapter 15, “Level Optimization (Zoning) and Distribution,” pp. 739-755</li> </ul> </li> </ul> </li> <li>• Writing Assignment: 1</li> <li>• Lab: 1</li> </ul> |
| 11–Review and Final Exam | <ul style="list-style-type: none"> <li>• Final Exam</li> </ul>  |

## Instructional Methods

The curriculum is designed to promote a variety of teaching strategies that support the outcomes described in the course objectives and that foster higher cognitive skills. Delivery makes use of various media and delivery tools in the classroom.

The course is composed of both theory and laboratory components.

Collaboration in class and laboratory activities will create a climate of high values with respect to both diversity and inclusiveness. An open communication environment will help to ensure useful interactions between you and the instructor and also among other students. Information obtained in the class activities will let you know what you need to accomplish, who will execute a procedure, and how to gauge if the laboratory activity was successful and meets the instructor’s expectation.

## Instructional Materials and References

### Student Textbook Package

- Sanchez, Daniel, Crespo Dalmau, Phil Co, Jason Busby, Zak Parrish, and Joel Van Eenwyk. *Game Engines and Production*. Indianapolis: Pearson Custom Publishing, 2007.
- CD ROM: Files to accompany Game Engines and Production: Pearson Custom Publishing, Indianapolis, IN: 2007.

## References and Resources

### ITT Tech Virtual Library

Log on to the ITT Tech Virtual Library (<http://www.library.itt-tech.edu/>) to access online books, journals, and other reference resources selected to support ITT Tech curriculums.

- **Books**

The following books are related to this course and are available through the ITT Tech virtual Library:

### Books>Ebrary

- Harbour, Jonathon. *Beginning Game Programming*. Course Technology, 2004.
- Bjork, Staffan and Jussi Holopainen. *Patterns in Game Design*. Charles River Media, 2004.
- Flynt, John and Omar Salem. *Software Engineering for Game Developers*. Course Technology, 2004.
- Anthony, Kelly. *Decision Making Using Game Theory: An Introduction for Managers*. Cambridge University Press, 2003.



- Sheldon, Lee. *Character. Development and Storytelling for Games. Course Technology Crisp, 2004.*
- Bates, Bob. *Games Design, Second Edition. Course Technology, 2004.*
- Bryne, Ed. *Game Level Design. Charles River Media, 2004.*
- Yau, Esther, and Yau Ching-Mei Esther. *At Full Speed: Hong Kong Cinema in a Borderless World. University of Minnesota Press, 2001.*
- Hawkins, Brian M. *Real-Time Cinematography for Games. Charles River Media, 2005.*
- Liverman, Matthew. *Animator's Motion Capture Guide: Organizing, Managing, and Editing. Charles River Media, 2004.*
- Kennedy, Sanford. *3Ds Max 6 Animation and Visual Effects Techniques. Charles River Media, 2004.*
- Schwab, Brian. *AI Game Engine Programming. Charles River Media, 2004.*
- Vlahavas, Ioannis, and Vrakas Dimitris. *Intelligent Techniques for Planning. Idea Group Publishing, 2004.*
- Schwab, Brian. *AI Game Engine Programming. Charles River Media, 2004.*
- Buckland, Mat. *AI Techniques for Game Programmers. Course PTR, 2002.*

- Boespflug, Koenig, and P Charles Schultz. *Game Testing All in One. Course Technology: Incorporated, 2005.*

### Books>Netlibrary

- Eberly, David H. *3D Game Engine Architecture: Engineering Real-time Applications With Wild Magic. Amsterdam ; Boston: Elsevier, 2005.*
- LaMothe, Andre. *Tricks of the 3D Game Programming Gurus: Advanced 3D Graphics and Rasterization. Indianapolis: Ind Pearson Education, Inc., 2003.*

### ■ Other Resources

### Web Sites

- “The Case For Game Design Patterns”  
[http://www.gamasutra.com/features/20020313/kreimeier\\_02.htm](http://www.gamasutra.com/features/20020313/kreimeier_02.htm)
- “The 400 Project”  
[http://www.theinspiracy.com/400\\_project.htm](http://www.theinspiracy.com/400_project.htm)
- “3D Game and Graphics Engine Database”  
<http://www.devmaster.net/engines>
- Website for Real time 3D animation:

[www.machinima.com](http://www.machinima.com)

All links to web references outside of the virtual library are always subject to change without prior notice.

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## EVALUATION & GRADING

### COURSE REQUIREMENTS

#### 1. Attendance and Participation

Regular attendance and participation are essential for satisfactory progress in this course.

#### 2. Completed Assignments

Each student is responsible for completing all assignments on time.

#### 3. Team Participation (if applicable)

Each student is responsible for participating in team assignments and for completing the delegated task. Each team member must honestly evaluate the contributions by all members of their respective teams.

### Evaluation Criteria Table

The final grade will be based on the following weighted categories:

| CATEGORY        | WEIGHT      |
|-----------------|-------------|
| Assignments     | 25%         |
| Lab Assignments | 25%         |
| Participation   | 15%         |
| Final Exam      | 35%         |
| <b>Total</b>    | <b>100%</b> |

## Grade Conversion Table

Final grades will be calculated from the percentages earned in class as follows:

| Grade | Percentage | Credit |
|-------|------------|--------|
| 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    |