Rutgers University, Department of Electrical and Computer Engineering  
ABET COURSE SYLLABUS  
COURSE: 14:332:378

Course Catalog Description: 14:332:378 – Virtual Reality Laboratory (1)  
Introduction to Unity 3D programming, stereoscopic display  
programming, scene graphs and hierarchical models, bi-manual game  
interfaces, haptic interfaces (touch feedback) and real-time interaction  
techniques, term project.

Pre-Requisite Courses: none

Co-Requisite Courses: 14:332:376

Pre-Requisite by Topic: 1. Computer Architecture (14:332:331) or equivalent


Lab Manual: Unity 3D Lab Manual (Verhurst and Burdea, 2012 on Sakai)

Overall Educational Objective: To develop skills in real-time programming of virtual worlds  
and use of high-end human-computer interfaces (3D sound,  
stereo glasses, gesture and haptic devices).

Course Learning Outcomes: A student who successfully fulfills the course requirements  
will have demonstrated:

1. an ability to understand and program using Unity 3D Pro  
   game programming language.

2. an ability to understand the principles and hardware used  
   to create stereoscopic graphics.

3. an ability to program virtual sensors and update the  
   simulation loop in real time.

4. an understanding and programming of dynamic scene  
   graphs, including control of the scene view point.

5. ability to program and control a virtual hand used in  
   combination with a bi-manual (Razer Hydra) interface.

6. an ability to understand and use scene hierarchical  
   graphics objects

7. an ability to program and integrate object intelligent  
   behavior (such as reflex behavior, collision detection)

8. an ability to program multi-sensorial interactions  
   (graphics, sound, haptics).

9. an ability to work independently and as a team to create  
a virtual reality application.
How Course Outcomes are Assessed:
Homework assignments (60 %)
In-class participation (10 %)
Final Term Project (30 %)

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<tr>
<th>Outcome</th>
<th>Level</th>
<th>Proficiency assessed by</th>
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<tbody>
<tr>
<td>(a) an ability to apply knowledge of Mathematics, science, and engineering</td>
<td>H</td>
<td>Homework, Programming assignments, Term project</td>
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<tr>
<td>(b) an ability to design and conduct experiments and interpret data</td>
<td>S</td>
<td>Homework, Programming assignments, Term project</td>
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<tr>
<td>(c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability</td>
<td>N</td>
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<td>(d) an ability to function as part of a multi-disciplinary team</td>
<td>H</td>
<td>Term project</td>
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<tr>
<td>(e) an ability to identify, formulate, and solve ECE problems</td>
<td>H</td>
<td>Homework, Programming assignments, Term project</td>
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<td>(f) an understanding of professional and ethical responsibility</td>
<td>N</td>
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<td>(g) an ability to communicate in written and oral form</td>
<td>S</td>
<td>Homework, Programming assignments, Term project</td>
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<td>(h) the broad education necessary to understand the impact of electrical and computer engineering solutions in a global, economic, environmental, and societal context</td>
<td>S</td>
<td>Term project</td>
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<td>(i) a recognition of the need for, and an ability to engage in life-long learning</td>
<td>N</td>
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<td>(j) a knowledge of contemporary issues</td>
<td>H</td>
<td>Homework, Programming assignments, Term project</td>
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<tr>
<td>Basic disciplines in Electrical Engineering</td>
<td>H</td>
<td>Homework, Programming assignments, Term project</td>
</tr>
<tr>
<td>Depth in Electrical Engineering</td>
<td>S</td>
<td>Homework, Programming assignments, Term project</td>
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<tr>
<td>Basic disciplines in Computer Engineering</td>
<td>S</td>
<td>Homework, Programming assignments, Term project</td>
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<tr>
<td>Depth in Computer Engineering</td>
<td>S</td>
<td>Homework, Programming assignments, Term project</td>
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<tr>
<td>Laboratory equipment and software tools</td>
<td>H</td>
<td>Homework, Programming assignments, Term project</td>
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<td>Variety of instruction formats</td>
<td>S</td>
<td>Lecture, office hour discussions, project demonstrations</td>
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Topics Covered week by week:
Week 1, 2: Unity 3D Core
Week 3, 4: Giving life to Unity
Week 5, 6: Interfacing with Unity 3D
Week 7, 8: Terrain and Haptic Feedback
Week 9, 10: Particle Effects
Week 11-12: Networking in Unity 3D
Week 13-14: Term project (individual or team) programming and report writing
Week 15: Project demonstration

Computer Usage:
Laboratory Experiences: It is a laboratory course associated with 14:332:376
Design Experiences: HW problems, Term Project
Independent Learning Experiences: Term Project, report writing, presentation

Contribution to the Professional Component:
(a) College-level mathematics and basic sciences: 0.25 credit hours
(b) Engineering Topics (Science and/or Design): 0.75 credit hours
(c) General Education: 0 credit hours
Total credits: 1

Prepared by: G. Burdea
Date: December 2012