# BOWIE STATE UNIVERSITY
## Syllabus
### Department of Computer Science

**COSC 829 (3 Cr)** **Advanced Virtual Reality Systems**


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| Instructor: | Dr. Sharad Sharma |
| Office Location: | Computer Science Building Room 317 |
| Phone: | 301-860-4502 |
| Email: | ssharma@bowiestate.edu |
| Office Hours: | Wednesday: 2:30 – 7:30 PM, or by appointment |
| Class Hours: | Wednesday: 7:30 PM – 10:00 PM, CSB 312 |
| Course website: | http://www.cs.bowiestate.edu/sharad/VR2/ |


## COURSE DESCRIPTION

The course explains how to build complex virtual worlds being able to be distributed on the networks. Advanced concepts for real-time animation, 3d interaction, gesture recognition, audio, haptic rendering, collision detection and response, facial communication, voice recognition and synthesis will be covered. Students will design and develop an interactive, three-dimensional (3D) game or educational application.

**COURSE PREREQUISITE** COSC 729 or permission of instructor

## REQUIRED TEXTS

D. Bowman, E. Kruijff, J.LaViola Jr., and I.Poupyrev, *3D User Interfaces: Theory and Practice*, Addison-Wesley, Boston, 2005, ISBN 0-201-75867-9

## STUDENT EXPECTED OUTCOMES

Upon completion of this course, the student will be able to:

- Describe the importance of VR as an area of the software market.
- Understand the process of creating virtual environments.
- Identify and describe applications for current virtual reality hardware and software.
- Design and develop a complete multi-user VR application.
- Assess and identify and describe social, philosophical, and psychological factors and implications of virtual reality.

## STUDENT LEARNING OBJECTIVES

The essential objectives for this course are to:

1. Develop proficiency in developing and producing a VR application, most importantly the code and user documentation.
2. Synthesize the fundamental principles of Virtual Reality.
3. Demonstrate and show that you are able to adapt a process to your needs and select an appropriate set of best practices that will guide you in completing a software development project.
4. Acquire skills for developing and to learn about the criteria for defining VR applications for education and games.
5. Create VR Applications using games engines for 3D interactive virtual worlds.

**TEACHING MODES**

All course material will be provided on a course web site including lecture notes, useful links on the web, recommended references, time schedule, and contact information for faculty, guidelines for projects, coding standards, and more. The primary teaching mode will be lecture and discussion.

**COURSE REQUIREMENTS AND EXPECTATIONS**

***Policy on Attendance:*** Regular attendance in the class is mandatory. Students will be responsible for any loss of information, assignments, and projects due to absence from class.

***Departmental Policy on Submission of Late Work:*** There will be no make-up for any missed classes, projects, assignments, and exams. 1/2 letter grade off for assignment each day late without documented excuse; papers more than one week late will not be accepted.

***Academic Integrity:*** Academic dishonesty includes plagiarism, cheating, and other illegal or unethical behaviors in doing the work of the course. Plagiarism is the act of representing another's ideas, words or information as one's own. If you receive assistance on an assignment from someone else, you must avoid plagiarism by giving proper credit for this assistance. Include in your assignment a comment naming the person who assisted you and stating what the assistance was. Students who are guilty of academic dishonesty are subject to severe penalties ranging from a reduction in points (and possible failure) for the assignment/project, to failing the course, or in extreme cases, dismissal from the University. Do not copy other student's projects, codes, and design. A group of students working together on a project must change their forms and codes to differentiate from others.

**EVALUATION:** Following is the Evaluation system for the Final Grade. Students are responsible for completing them as scheduled.

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| 1. Assignments | 30% |
| 2. Presentations | 20% |
| 3. Final Exam | 20% |
| 4. Final Project | 30% |

**Paper Presentations:** Research papers will be assigned to students to read, analyze and present to the class. In total 20-25 minutes for each presentation should include: Brief description of (1) introduction/idea; (2) method (experimental design, participants, apparatus, experiment procedure, data collection); (3) results; (4) discussion and/or conclusion; and (5) etc. Presentations will be structured as follows:

- Presentation
- Questions to presenter
- Open discussion

For each paper, students should write a review answering each of the following questions:

1. What problems (with prior work or the lack thereof) were addressed or surveyed by the authors?
2. What solutions were proposed or surveyed by the authors?
3. What are the technical strengths and main contributions of the paper's proposed solutions?
4. What are the technical weaknesses of the paper's proposed solutions?

**Assignment 2:** The purpose of the assignment 2 is to provide the students with the knowledge of Virtual Reality hardware and the skills to apply it on an assigned project. Each student will be assigned a project on a particular VR/AR hardware assigned by the instructor. The hardware to be used will be assigned by the instructor.

**Research/Application paper assignment:** Each student is expected to do a research/application paper on a VR/AR topic. Topics will be assigned after the first week of the class. The paper will follow IEEE journal template.

**Final Project**: The students will be exposed to the process of modeling and scripting the virtual environment, by developing a complete VR application. The project must include:

- Vision: Use of textures and 3D models to provide detailed information in the project.
- Sound: Use speech, music or ambient sounds to help provide information about this place.
- Animation: Use at least three animated object in the project.
- Interactivity: Use at least three user-triggered events in the project.
- Sensors: Use at least three different types of sensors (Cylinder, Plane, Proximity, Sphere, Time, Touch, and Visibility).in the project.
- Multi-user Environment: More than two people to be present in the same environment.
- AI: AI functionality depending upon the project (navigation, behaviors, etc.)

**GRADING**: Academic dishonesty will result in grade F. The following grade scale will be used:

90 % - 100% = A
80 % - 89% = B
70 % - 79% = C

Final grades will be computed based upon credits earned for all the four components mentioned above.

## COURSE/TOPICAL OUTLINE

Check Course website

***ADA statement***: Students with disabilities who wish to receive ADA accommodations should report to the 1330 Office of Special Populations, CBGS Building (telephone 301-860-4067)

## SELECTED BIBLIOGRAPHICAL REFERENCES


1. Burdea, C. & Coiffet, P. (2003) Virtual *Reality Technology, 2nd ed.* Wiley-Interscience.
2. Sherman, W., & Craig, B. (2003) *Understanding Virtual Reality*. Morgan Kaufmann Publishers.
3. Castranova, E. (2007). *Exodus to the Virtual World: How online fun is changing reality.* New York: Palgrave Macmillan.
4. Oliver G., (2003) *Virtual Art: From Illusion to Immersion (Leonardo Book Series).* Cambridge/Massachusetts: MIT-Press.
5. Erel, E., Aiyenibe, B., & Butler, P. E. (2003). Microsurgery simulators in virtual reality: Review. *Microsurgery, 23*(2), 147-152.
6. Moore, K., Wiederhold, B. K., Wiederhold, M. D., & Riva, G. (2002). Panic and agoraphobia in a virtual world. *Cyberpsychology & Behavior, 5*(3), 197-202.
7. May, G., & Badcock, D. R. (2002). Vision and virtual environments. In K. M. Stanney (Ed.), *Handbook of virtual environments: Design, implementation, and applications* (pp. 29-64). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
8. Stanney, K. M. ed. (2002). *Handbook of Virtual Environments: Design, Implementation, and Applications.* Lawrence Erlbaum Associates, Inc., Mahwah, New Jersey.