

1. Course number and name

COE 49411 – Virtual and Augmented Reality

2. Credits and contact hours

3 credit hours, 3 contact hours

3. Instructor's or course coordinator's name

Dr. Hicham H. Hallal

4. Textbook, title, author, and year

Recommended:

- The VR Book: Human-Centered Design for Virtual Reality, Jason Jerald, ACM Books, 2015.
- Unity Virtual Reality Projects: Explore the world of virtual reality by building immersive and fun VR projects using Unity 3D, Jonathan Linowes, 2015.

Supplemental material

- Learning Virtual Reality, Tony Parisi, O'Reilly Media, Inc., 2015
- Eloquent JavaScript, Marijn Haverbeke, 3rd edition.
- Handouts and Lecture notes through iLearn.

5. Specific course information

a. Brief description of content of the course (catalog description)

Focuses on hardware and software aspects of virtual reality (VR) and augmented reality (AR) systems. Addresses the integration of AR and VR technologies in the development of computer games and other engineering applications. Covers 3D modeling, inertial measurement units (IMUs) and sensors, scene management, user interactivity, performance evaluation, single and multiplayer games, use of patterns in game development.

b. Prerequisites or co-requisites

Prerequisites: COE 312 or CMP 256

6. Specific goals for the course

a. Specific outcomes of instruction

Upon completing the course, student will be able to:

1. Understand the main concepts and technologies involved in developing AR and VR systems.
2. Analyze and evaluate the hardware requirements of developing AR and VR systems.
3. Analyze and evaluate the software requirements of developing AR and VR systems.
4. Use development environments to build AR and VR based applications.
5. Design and develop a computer game application using AR and VR technologies.
6. Identify and evaluate the usage of relevant design patterns in the development lifecycle of AR/VR applications.

b. Contribution of Course to Program Outcomes

BSCoE Program Outcomes	Emphasis in this course
(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	○
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	○
(3) An ability to communicate effectively with a range of audiences	●
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	○
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	◐
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	○
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	○

Emphasis: ● High; ◐ Medium; ○ Low; Blank – Nothing Specific Expected

BSCS Program Outcomes	Emphasis in this course
(1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	○
(2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	●
(3) Communicate effectively in a variety of professional contexts.	◐
(4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	○

(5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	●
(6) Apply computer science theory and software development fundamentals to produce computing-based solutions.	○

Emphasis: ● High; ◐ Medium; ○ Low; Blank – Nothing Specific Expected

7. Brief list of topics to be covered

- i. Introduction: Immersive environments: AR , VR, and Computer games
- ii. VR and AR hardware
- iii. 3D graphics for VR and AR
- iv. User interactivity in VR and AR systems
- v. IMUs and sensors
- vi. Introduction to Unity 3D
- vii. Game design and development
- viii. Multiplayer game development
- ix. Advanced topics in game development
- x. Assessment and project evaluation