SH. A.

أكاديميــة الشــروق

المعهد العالى للحاسبات وتكنولوجيا المعلومات
مدينة الشروق ـ القاهرة
شعبة علوم الحاسب

Course specification

Course Code: CS 444

Course Title: Virtual Reality

Academic Year: /

Course specification
(CS 444 - Virtual Reality)

Course Outline	
Faculty:	*HICIT- (**Higher Institute for Computers & Information Technology**-El Shorouk Academy)*
Programme(s) on which the course is given:	Undergraduate program in Computer Science
Major or minor element of programme:	Compulsory
Department offering the program	Department of Computer Science
Department offering the course:	Department of Computer Science
Level	Fourth Level -2nd Semester
Date of specification approval	DD/MM/YYYY

Basic Information			
Code:	CS 444	***Title:***	Virtual Reality
Prerequisites:	CS 312 Analysis of Algorithms		
Weekly Hours:			
Lecture: 2	**Exercise: 2**	**Practical:**	**Total:** 3 credit hours

Professional Information

Course Aims:

This course is designed to introduce students the fundamentals of virtual reality systems, including geometric modeling, transformations, graphical rendering, optics, the human vision, auditory, tracking systems, interface design, human factors, developer recommendations, and technological issues.

After completing this course students must be able to:

1-Understand the history and evolution of virtual reality technology.
2- Identify different types of virtual reality systems and their applications.
3- Explain the technical aspects involved in creating virtual environments.
4- Analyze human perception in virtual environments.
5- Evaluate different interaction techniques used in virtual reality systems.
6- Discuss ethical considerations related to the use of virtual reality technology

a3	Show a critical understanding of Requirements, practical constraints and computer-based systems.
a7	Show a critical understanding of the principles of artificial intelligence, image Processing, Machine Learning, Neural Networks, and Virtual Reality.
b2	Perform comparisons between (algorithms, methods, techniques, etc.).
b12	Create and/or justify designs to satisfy given requirements (synthesis, evaluation, application).
c8	Apply the principles of human-computer interaction to the evaluation and construction of a wide range of materials including user interfaces, web pages, and multimedia systems.
c14	Operate computing equipment efficiently, taking into account its logical and physical properties.
d1	Communicate effectively by oral, written and visual means.
d2	Work effectively as an individual and as a member of a team.

Program ILOs Covered by Course			
Knowledge and understanding	**Intellectual Skills**	**Professional and practical skills**	**General and Transferable skills**
A3,A7	,B2,B12	C8.C14	D1,D2

Intended learning outcomes of course (ILOs)

a. Knowledge and Under-Standing

a1. Demonstrate an understanding of the fundamental concepts, technologies, and components of virtual reality systems.

a2. Explain the geometry, physics, and perception of virtual worlds, as well as the principles of light and optics and their application to virtual reality displays.

a3. Analyze the challenges and opportunities of motion in real and virtual worlds, including velocities, acceleration, and collision detection, as well as tracking systems and their application to virtual reality.

a4. Identify different interaction techniques and audio systems in virtual reality and how they impact the design and evaluation of virtual reality systems and experiences.

b. Intellectual Skills:

b1. Analyze and evaluate the design and implementation of virtual reality systems.

b2. Develop strategies for solving problems related to virtual reality, including geometric modeling, tracking, and interaction.

b3. Critically evaluate research and development in the field of virtual reality, including its impact on society and human behavior.

c. Professional and practical skills

c1. Develop practical skills in the design and implementation of virtual reality systems, including visual rendering, motion simulation and tracking, interaction techniques, and audio rendering and auralization.

c2. Apply evaluation methods to assess the effectiveness and usability of virtual reality systems and experiences, and develop recommendations for improvement.

d. General and transferable skills

d1. Develop effective communication skills, including oral and written communication of technical concepts related to virtual reality.

d2. Develop collaborative skills by working in teams on virtual reality projects.

Contents

Topic	Contact Hours	
	lecture	Lab
Introduction to Virtual Reality	2	2
Geometry of Virtual Worlds	4	4
Light and Optics	2	2
Visual Physiology	3	3
Visual Perception	3	3
Tracking Systems	4	4
Visual Rendering	4	4
Audio	3	3
Interfaces	3	3

Teaching and learning methods

Teaching and learning methods	Used
Lectures	√
Tutorial Exercises	√
Practical Lab	√
Discussions.	√

Student assessment methods & Schedule

Methods	Used	Week#
Midterm Exam	√	8
Final Exam	√	16
Course Project	√	2-14
Course Work & Quizzes	√	2-14
Practical Exam	√	15

Assessment Weight

Assessment	Weight %
Mid Term Exam	15
Practical Exam and Project	15
Final Exam	60%
Course Work & Quizzes	10%
Total	100

Course Work &Quizzes

Short Exams, Assignments, Research, Reports, Presentations
Class/Project discussion

List of references	
Essential books (textbooks)	1. "VIRTUAL REALITY", Steven M. LaValle. Cambridge University Press, 2023.
Course notes	E-Learning Portal
Recommended books	1. "Virtual Reality Technology" by Grigore C. Burdea and Philippe Coiffet 2. "Understanding Virtual Reality: Interface, Application, and Design" by William R Sherman and Alan B Craig .

Required Facilities		
Tools & SW (Technology facilities):	– LABS equipped computers with high-end specifications capable of running VR software smoothly. This would typically include a powerful graphics card, at least 16GB of RAM, and a fast processor. – VR hardware such as headsets, and controllers. – VR development tools such as Unity or Unreal Engine. software for creating 3D models or animations.	
Teaching facilities:	Whiteboard	√
	Computer Lab	√
	Data show	√
	E-Learning	√
	Videos	√
	Website	√

Course Content/ILO Matrix											
Course Contents	**Knowledge & understanding**				**Intellectual skills**			**Professinal and practical skills**		**General and transferable skills**	
	a1	a2	a3	a4	b1	b2	b3	c1	c2	d1	d2
Introduction to Virtual Reality	✓										
Geometry of Virtual Worlds		✓				✓		✓			
Light and Optics		✓									
Visual Physiology	✓						✓				
Visual Perception	✓						✓	✓	✓	✓	✓
Tracking Systems			✓		✓	✓		✓	✓	✓	✓
Visual Rendering			✓					✓	✓	✓	✓
Audio				✓				✓	✓	✓	✓
Interfaces				✓	✓	✓	✓	✓	✓	✓	✓

Learning Method /ILOs Matrix											
Learning Methods	**Knowledge and understanding**				**Intellectual skills**			**Professional and practical skills**		**General**	
	a1	a2	a3	a4	b1	b2	b3	c1	c2	d1	d2
Lectures	x	x	x	x	x	x	x	x	x		
Tutorial Exercises		x	x	x	x	x	x	x	x		
Reading material	x	x	x	x	x	x	x	x	x		
Websites search	x	x	x	x	x	x	x	x	x		
Research and reporting	x	x									
Problem solving					x	x	x	x	x		
Group work										x	x
Case study					x	x	x	x	x	x	x
Practical Lab	x	x	x	x	x	x	x	x	x		
Discussions.	x	x	x	x	x	x	x	x	x		

Learning Method /ILOs Matrix

Learning Methods	Knowledge and understanding				Intellectual skills			Professional and practical skills		General	
	a1	a2	a3	a4	b1	b2	b3	c1	c2	d1	d2
Mid Term Exam	x	x	x	x	x	x	x	x	x		
Final Exam	x	x	x	x	x	x	x	x	x		
Course Project	x	x	x	x	x	x	x	x	x	x	x
Course Work &Quizzes	x	x	x	x	x	x	x	x	x	x	x
Practical Exam					x	x	x	x	x		

Course ILOs Vs Program ILOs

Prog ILOs / Course ILOs		Knowledge & understanding		Intellectual skills		Professional and practical skills		General	
		A3	A7	B2	B12	C8	C14	D1	D2
Knowledge and understanding	a1	x	x						
	a2	x	x						
	a3	x	x						
	a4	x	x						
Intellectual skills	b1			x	x				
	b2			x	x				
	b3			x	x				
Professional and practical skills	c1					x	x		
	c2					x	x		
General skills	d1							x	x

Course Coordinator : Dr. Osama Shafik Elshehry **(   )**
Head of Department : Dr. Ahmed El-Abbassy   **(   )**
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