



CVM
UNIVERSITY

Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2020-21

Programme: Bachelor of Engineering (Computer Engineering)

Semester: VIII

Course Code: 102047802

Course Title: Augmented Reality and Virtual Reality

Course Group: Professional Elective Course - VI

Course Objectives: The objective of the course is to expose learners to the basics of AR/VR technology and devices and understand various elements and components used in AR/VR Hardware and Software. In this course, students will learn the industrial application of AR/VR technology with hands-on experience through more informative and practical exploration. This course intends to establish and cultivate a broad and comprehensive understanding of this rapidly evolving and commercially viable field of Computer Science. Gaining knowledge of AR/VR technologies can increase efficiency in business, increase user engagement, boost in brand loyalty, better advertising products, and many more.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	40/14	60/21	20/07	30/10	150/52

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Introduction: Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical Development of VR, Scientific Landmark.	5
2	Computer Graphics and Geometric Modeling: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory, Conversion From 2D to 3D, 3D spaces curves, 3D boundary representation, Simple 3D modeling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.	9



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3	Virtual Environment: Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc. Output: Visual /Auditory / Haptic Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems. Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.	6
4	Augmented Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments, evaluating ARsystems.	9
5	Development Tools and Frameworks: Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML	6
6	AR / VR Applications: Introduction, Engineering, Entertainment, Science, Training.	5
Total		40

List of Practicals / Tutorials:

1	VR development basics with XR interaction toolkit.
2	Full body VR interaction with ready player ME and Final IK
3	VR development basics with oculus integration.
4	Basics of hand tracking with interaction SDK.
5	Write an application to create AR Greeting card.
6	Write an AR application to create virtual buttons.
7	Design menus inside unity.
8	Write an AR application to create AR Business card using multiple virtual buttons.
9	Build the AR object tracking app.
10	Create AR video playback application
11	Understanding VUFORIA cloud recognition.

Reference Books:

1	Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley 2016
2	Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.



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3	Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
4	John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
5	Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

Supplementary learning Material:

1	https://stanford.edu/class/ee267/syllabus.html
2	https://nptel.ac.in/courses/106/106/106106138/
3	https://nptel.ac.in/courses/121/106/121106013/

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying; N: Analyzing; E: Evaluating; C: Creating
R	U	A	N	E	C	
15%	25%	25%	15%	20%	---	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the fundamental concepts of Augmented Reality & Virtual Reality.	26
CO-2	Identify the applications of Augmented Reality & Virtual Reality.	26
CO-3	Know the hardware and software for AR & VR.	26
CO-4	Design and Develop Augmented Reality & Virtual Reality based applications.	22

Curriculum Revision:

Version:	1.0
Drafted on (Month-Year):	June-2020
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	June-2025