

VIRTUAL REALITY

(Professional Elective V)

Course Code: 19CT1154

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Course Outcomes: At the end of the Course the student will be able to:

CO1: Describe the concept of virtual reality and Communication Media.

CO2: Summarize the human perceptual system.

CO3: Explain various input and output devices used in the virtual reality

CO4: Illustrate the concepts of Representation and Rendering of the Virtual World.

CO5: Develop a Virtual Reality Application.

UNIT-I **(10 Lectures)**

INTRODUCTION TO VIRTUAL REALITY (VR): Defining Virtual Reality, Five key elements of the virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace, History of Virtual Reality.

VR-THE MEDIUM: Communicating through a Medium, Communication: Conveyance of Ideas, Common Issues of Human Communication Media.

Learning Outcomes: At the end of the unit, students will be able to

1. compare Virtual and Augmented Reality. (L2)
2. outline the history of Virtual Reality. (L2)
3. describe about communication media.. (L2)

UNIT-II **(10 Lectures)**

THE HUMAN IN THE LOOP: The Human Perceptual System: Sensation-The Physiological Side of Perception, Visual Perception, Aural Perception, Haptic Perception, Vestibular Perception, Olfactory Perception, Gustation Perception, Cross-Sensory Effects and Virtual Reality.

PRESENCE AND EMBODIMENT: The Concept of Presence, The Determinants and Responses of Presence, Measuring Presence, Embodiment.

Learning Outcomes: At the end of the unit, students will be able to

1. classify different human perceptions. (L2)
2. describe the determinants and responses of presence. (L2)
3. illustrate the sense of embodiment in virtual reality. (L2)

UNIT-III **(10 Lectures)**

Interfacing the Participant(s) with the Virtual World (INPUT): Input Technologies-Input Classifications, Position-Tracking Technologies, Using Inputs within a Virtual Reality System-Position Tracking the Body, Physical Input Devices, Body Posture and Gesture Recognition, Speech Recognition(Audio Input). Input Technologies-Input Classifications, Position-Tracking Technologies, Using Inputs within a Virtual Reality System-Position Tracking the Body, Physical Input Devices, Body Posture and Gesture Recognition, Speech Recognition(Audio Input).

INTERFACING THE VIRTUAL WORLD WITH THE PARTICIPANT(S)(OUTPUT): Visual Displays-Nonocclusive Head-Based Displays, Smartphone-Virtual Reality Head-Based Displays, Handheld Virtual Reality, Summary of Visual Display Paradigms; Aural Displays-Properties of Aural Displays, Aural Display Paradigms; Haptic Displays-Properties of Haptic Displays, Haptic Display Paradigms, Tactile Haptic Displays, End-Effector Displays.

Learning Outcomes: At the end of the unit, students will be able to

- 1.demonstrate the usage of inputs within the virtual world..(L2)
- 2.summarize visual display paradigms. (L2)
- 3.explain about Aural and Haptic Displays. (L2)

UNIT-IV

(10 Lectures)

PRESENTING THE VIRTUAL WORLD: Representation of the Virtual World- Verisimilitude, Human Perception, Choosing a Mapping, Quantitative and Qualitative Representations; Visual Representation in VR, Aural Representation in VR, Haptic Representation in VR; Rendering Systems- Visual Rendering Systems, Sonic Rendering Systems, Haptic Rendering Systems.

Learning Outcomes: At the end of the unit, students will be able to

- 1.explain the representation of the virtual world. (L2)
- 2.describe Visual Rendering System. (L2)
- 3.differentiate Sonic and Haptic Rendering Systems. (L3)

UNIT-V

(10 Lectures)

USER INTERFACE METAPHORS: Manipulating a Virtual World, Navigating in a Virtual World, Interacting with Others.

THE VIRTUAL REALITY EXPERIENCE: Immersion, providing the Context, Physical/Sensory Immersion, Mental Immersion, The virtual World: Substance of the Virtual World, Object Modelling and World Layout. Rules of the Virtual World: Physics-Types of Virtual World Physics, Extent of the World Physics, Simulation Model, Object Co interaction. VR Software Integration, Game Engines, Building your first VR application.

DESIGN: APPLYING VR TO A PROBLEM: Conceiving a New VR Application, Designing a VR Experience

Learning Outcomes: At the end of the unit, students will be able to

- 1.explain key interactions to manipulate, navigate and interact in a Virtual World. (L2)
- 2.identify the role of Immersion in VR..(L1)
- 3.develop an application with VR experience. (L3)

TEXT BOOKS:

1. William R. Sherman and Alan B. Craig, *Understanding Virtual Reality Interface, Application, and Design*, 2nd Edition, Morgan Kaufmann Publishers, Elsevier, 2019.

REFERENCES:

1. Rajesh K. Maurya, *Computer Graphics with Virtual Reality System*, 3rd Edition, Wiley Publication, 2018.
2. Grigore C. Burdea, Philippe Coiffet, *Virtual Reality Technology*, 2nd Edition, Wiley,2017.
3. K.S. Hale and K. M. Stanney, *Handbook on Virtual Environments*, 2nd Edition, CRC Press, 2015.

WEB REFERENCES:

1. <http://vr.cs.uiuc.edu/vrbook.pdf>
2. <https://nptel.ac.in/courses/106/106/106106138/>