17CS42E4 – VIRTUAL REALITY

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | General awareness on computing basics | **Sessional Evaluation:**  **Univ.Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Course Objectives** | * Design a virtual environment and compelling virtual reality experience. * Comprehend and analyze the fundamental issues of virtual reality. | | |

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| **Course Outcomes** | Upon successful completion of the course, the students will be able to: | |
| CO1 | Understand the fundamental issues of virtual reality with example transformations |
| CO2 | Learn the basic dynamic model of virtual environment to track users. |
| CO3 | Study and apply the role of visual and acoustic modalities in virtual reality |
| CO4 | Explore haptic modality and learn the basics of augmented reality |
| CO5 | Learn the interaction with virtual environment and study multimodal simulations |
| CO6 | Study various individual applications based on Virtual and Augmented realities |
| **Course Content** | **UNIT – I**  **Introduction to Virtual Reality**: Definition of Virtual Reality, History of Virtual Reality, Applications of Virtual Reality, Virtual Reality System.  **Degrees of Freedom, Pose, Displacement and Perspective**: Degree of Freedom, Translational Transformation, Rotational Transformation, Pose and Displacement, Pose of Elements in Mechanical Assembly and Perspective Transformation Matrix.  **UNIT – II**  **Dynamic Model of a Virtual Environment**: Equations of Motion, Mass, Center of Mass and Moment of Inertia, Linear and Angular Momentum, Forces and Torques Acting on a Rigid Body, Collision Detection, Computation of Body Motion.  **Tracking the User and Environment**: Pose Sensor, Measuring Interaction Forces and Torques, Motion Tracking and Physical Input Devices.  **UNIT – III**  **Visual Modality in Virtual Reality**: Human Visual Perception, Computer Graphics, Visual Displays  **Acoustic Modality in Virtual Reality**: Acoustic Modality, Fundamentals of Acoustics, Sound Perception, the Spatial Characteristics of Hearing, Recording Techniques.  **UNIT – IV**  **Haptic Modality in Virtual Reality**: Human Perceptions and Motor System, Haptic Representation in Virtual Reality, Collision Detection, Haptic Rendering in Virtual Reality, Control of Haptic Interfaces, Haptic Displays.  **Augmented Reality**: Definition, Modeling the Real Environment, Displays, User Interfaces and Applications.  **UNIT – V**  **Interaction with a Virtual Environment**: Manipulation within Virtual Environment, Navigation Within the Virtual Environment, Interaction with Other Users  **Design of a Multimodal Virtual Environment**: Interactive Computer Game, Simulated Operation of Complex Systems, Modeling and Simulation of an Avatar, Interactive Configuration of Products  **UNIT – VI**  **Exploring Virtual Reality Use Cases**: Art, Education, Entertainment and Healthcare  **Exploring Augmented Reality Use Cases**: Art, Education, Industry and Commerce, Entertainment and Utilities | |
| **Text Books and References:** | **Text Book(s):**   1. Virtual Reality Technology and Applications by Matjaz Mihelj, Domen Novak Samo Begus, Springer publishers, New York/ London. 2. Virtual and Augmented Reality for dummies (a wiley brand) by Paul Mealy, John Wiley & Sons publishers   **Reference Book(s):**   1. “Developing Virtual Reality Applications - Foundations of Effective Design” by Alan B. Craig, William R. Sherman, and Jeffrey D. Will, Morgan Kaufmann Publishers 2. Designing Virtual Reality Systems The Structured Approach by Gerard Jounghyun Kim, Springer-Verlag London | |
| **E-Resources** | 1. <https://nptel.ac.in/courses> 2. <https://freevideolectures.com/university/iitm> | |