PVP 23

**PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY**
**(Autonomous) Kanuru, Vijayawada-520007**
**Department of Computer Science & Engineering (AI&ML)**
**IV B. Tech – I Semester**
**Augmented Reality and Virtual Reality**

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | 23AM4702B | **Year** | IV | **Semester** | I |
| **Course Category** | PEC | **Branch** | CSE (AI&ML) | **Course Type** | Theory |
| **Credits** | 3 | **L-T-P** | 3-0-0 | **Prerequisites** | Computer Graphics, Computer Vision |
| **Continuous Internal Evaluation** | 30 | **Semester End Evaluation** | 70 | **Total Marks** | 100 |

| **Course Outcomes** | | |
|---|---|---|
| Upon successful completion of the course, Student will be able to | | |
| **CO1** | Describe the fundamental concepts of Augmented Reality including history, displays, tracking systems and related technologies to understand AR Systems. | **L2** |
| **CO2** | Apply computer vision techniques, Interaction methods and Software architecture to develop **AR applications.** | **L3** |
| **CO3** | Use the principles of Virtual Reality including geometry, light, optics and human perception **to design realistic and immersive virtual environments**. | **L3** |
| **CO4** | Analyze motion, interaction and audio systems in virtual environments to design effective and realistic VR experiences. | **L4** |

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(3: Substantial, 2: Moderate, 1: Slight)**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | | | | | | | | | | | |
| **CO2** | 3 | | | | | | | | | | | | |
| **CO3** | 3 | | | | | | | | | | | | |
| **CO4** | | 2 | | | | | | | | | 3 | | |

| Unit No. | Syllabus Contents | Mapped CO |
|---|---|---|
| I | **Introduction to Augmented Reality**: Augmented Reality - Defining augmented reality, history of augmented reality, Examples, Related fields.<br>**Displays:** Multimodal Displays, Visual Perception, Requirements and Characteristics, Spatial Display Model, Visual Displays.<br>**Tracking:** Tracking, Calibration and Registration, Coordinate Systems, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors. | **CO1, CO2** |
| II | **Computer Vision for Augmented Reality**: Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Outdoor Tracking. **Interaction**: Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Augmented Paper, Multi-view Interfaces, Haptic Interaction Software Architectures: AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Dataflow, Scene Graphs. | **CO1, CO2** |
| III | **Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception The Geometry of Virtual Worlds: Geometric Models, Axis-Angle Representations of Rotation, Viewing Transformations Light and Optics: Basic Behavior of Light, Lenses, Optical Aberrations, The Human Eye, Cameras, Displays. | **CO1, CO2, CO3** |
| IV | **The Physiology of Human Vision**: From the Cornea to Photoreceptors, From Photoreceptors to the Visual Cortex, Eye Movements, Implications for VR Visual **Perception**: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color Visual Rendering: Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Immersive Photos and Videos | **CO1, CO3, CO4** |
| V | **Motion in Real and Virtual Worlds:** Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Interaction: Motor Programs and Remapping, Locomotion, Social Interaction Audio: The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering | **CO1, CO3, CO4** |

| Learning Resources |
|---|
| **Text Books** |
| 1. Augmented Reality: Principles & Practice by Schmalstieg /Hollerer. First Edition , 2016, Pearson Education India.<br>2. Virtual Reality, Steven M.LaValle, First Edition, 2016, Cambridge University Press. |
| **References** |
| 1. AR Game Development –Allan Fowler, First Edition , 2018, A Press Publications.<br>2. Designing for Mixed Reality Kharis O'Connell, First Edition, 2016. O'Reilly Media. |
| **e-Resources and other Digital Material** |
| 1. https://onlinecourses.nptel.ac.in/noc26_cs03/preview<br>2. http://www.digimat.in/nptel/courses/video/121106013/L90.html<br>3. Augmented Reality, Virtual Reality and Computer Graphics. De Paolis, 2017, Springer |