



Title : *Virtual Reality*

Code : CSE-867

Credit Hours: 3-0

Description: Virtual Reality (VR) technology transports us to real or synthetic places that may be inaccessible, breathtaking, complex beyond our wildest imagination, or just simple and relaxing. It detaches us from our reality into an alternate reality that only exists in cyberspace. Applications include entertainment, social interaction, virtual travel, remote training, architectural walkthroughs, cultural appreciation, and learning and enhancement. Virtual reality systems are used for simulating real and unreal scenarios. This course provides a fundamental understanding of the concepts, tools, devices and techniques used in different components of a Virtual Reality system.

Prerequisites: NIL

Objectives: Objectives of the course are:

1. To provide an introduction to the current state-of-the-art in virtual reality.
2. To help set a foundation for a common taxonomy of virtual reality technologies and applications.
3. To introduce the VR software tools commonly available for building VR applications.
4. To provide students with a deep understanding of the fundamentals of VR. The students will be able to design and analyze VR systems that are cost effective and comfortable.

Course Contents:

Week	Topic
1	Introduction to virtual reality
2	Structure of the virtual world
3-4	Graphics pipeline and virtual world appearance
5-6	Optics and the visual system
7-8	Perception of color, depth and motion. Place, plausibility and embodiment illusions
9-10	VR specific issues in visual rendering and latency reduction
11	Stereo rendering
12-13	Collision detection and physics of the virtual world
14	Haptics and VR Interaction
15-16	Tracking and Navigation (Locomotion)
17	A generic VR system and Recent trends in AR/VR/MR

Text Books/Reference Material:

14. Steven M. LaValle, *Virtual Reality*. Cambridge University Press 2023.
15. William R. Sherman and Alan B. Craig, 2018. *Understanding Virtual Reality - Interface, Application, and Design*. 2nd Edition. The Morgan Kaufmann Series in Computer Graphics, Elsevier

Nature of Assessment:

As per NUST Policy

Comparative Chart:

S. No.	Existing	Proposed
1	Introduction to Virtual Reality and Cyberspaces	Introduction to virtual reality
2	Real reality: fundamental physiological trends about recognition of the external world	Structure of the virtual world
3	Cognition in the real world: human factors, vision and human haptics	Graphics pipeline and virtual world appearance
4	Interfaces: Devices, sensors and interaction mechanism in a 3D environment	Optics and the visual system
5	Tracking in the virtual environment and orientation estimation	Perception of color, depth and motion. Place, plausibility and embodiment illusions
6	Navigation techniques	VR specific issues in visual rendering and latency reduction
7	Output devices: HMDs, immersive projection displays, force feedback devices	Stereo rendering
8	Visual rendering, speed-up techniques and stereoscopic rendering	Collision detection and physics of the virtual world
9	Collision detection	Haptics and VR Interaction
10	Haptics technology and rendering	Tracking and Navigation (Locomotion)
11	Immersive interaction and simulation	A generic VR system
12	A Generic VR system, its requirements and behavior	Recent trends in AR/VR/MR