INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

VIRTUAL REALITY								
VI Semester: CSE (AI&ML)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
ACAD29	Elective	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisites: Python Programming / Applied Artificial Intelligence								

I. COURSE OVERVIEW:

This course will introduce you to Virtual Reality (VR). The course will teach you everything from the basics of VR, the hardware and the history of VR- to different applications of VR, the psychology of Virtual Reality, and the challenges of the medium. The main objective of the course is to teach evaluation existing VR applications, and design, test, and implement their own VR experiences/games. This course reaches students through power point presentations, lecture notes, and lab which will give you the chance to apply knowledge of Virtual Reality.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Basic concepts of virtual environment and compelling virtual reality experience.
II. Fundamental issues of virtual reality.
III. Human Factors, Virtual Hardware and Software related to Virtual Reality.
IV. Applications of Virtual Reality.

III. COURSE OUTCOMES:

CO1 **Explain** the fundamental concepts, components, and architecture of Virtual Reality systems including display technologies, tracking mechanisms, and interaction modalities.
CO2 **Analyze** various VR hardware and software technologies to evaluate their suitability for specific applications such as training, entertainment, simulation, and healthcare.
CO3 **Apply** 3D modeling, scene construction, and interaction techniques to build basic Virtual Reality environments using industry-standard tools and frameworks.
CO4 **Demonstrate** the ability to design and implement an interactive VR prototype incorporating navigation, gesture-based interaction, and real-time rendering.
CO5 **Evaluate** VR systems based on usability, immersion, latency, performance metrics, and human-computer interaction principles to recommend improvements.
CO6 **Develop** and present a VR-based solution to a real-world problem, articulating design choices, implementation challenges, limitations, and potential enhancements.

IV. COURSE CONTENT:

MODULE – I: INTRODUCTION TO VIRTUAL REALITY (10)

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 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism-Stereographic image.

MODULE – II: GEOMETRIC MODELLING (10)

Geometric Modelling: Introduction, from 2D to 3D, 3D spaces curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE. Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

MODULE – III: VIRTUAL ENVIRONMENT (10)

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, 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.

MODULE – IV: VR HARDWARE AND SOFTWARE (09)

factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

MODULE – V: VR APPLICATIONS (09)

Introduction, Engineering, Entertainment, Science, Training. The Future: Virtual environment, modes of interaction.

V. TEXTBOOKS:

1. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007 Edition.

VI. REFERENCE BOOKS:

1. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.
2. Adams, “Visualizations of Virtual Reality”, Tata McGraw Hill, 2000.
3. Grigore C. Burdea, Philippe Coiffet , “Virtual Reality Technology”, Wiley Inter Science, 2nd Edition, 2006.
4. William R. Sherman, Alan B. Craig, “Understanding Virtual Reality: Interface, Application and Design”, Morgan Kaufmann, 2008.

VII. WEB REFERENCES

1. http://www.vrac.iastate.edu/

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open-ended experiments

5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)