

Virtual Reality - Video course

COURSE OUTLINE

Fundamentals of virtual reality systems, including geometric modeling, transformations, graphical rendering, optics, the human vision, auditory, and vestibular systems, interface design, human factors, developer recommendations, and technological issues.

COURSE DETAIL

Module No:	Topic
Module I: Introduction	<ol style="list-style-type: none"> 1. Course mechanics 2. Goals and VR definitions 3. Historical perspective 4. Birds-eye view (general) 5. Birds-eye view (general), contd 6. Birds-eye view (hardware) 7. Birds-eye view (software) 8. Birds-eye view (sensation and perception)
Module II: Geometry of Virtual Worlds	<ol style="list-style-type: none"> 9. Geometric modeling 10. Transforming models 11. Matrix algebra and 2D rotations 12. 3D rotations and yaw, pitch, and roll 13. 3D rotations and yaw, pitch, and roll, contd 14. Axis-angle representations 15. Quaternions 16. Converting and multiplying rotations 17. Converting and multiplying rotations, contd 18. Homogeneous transforms 19. The chain of viewing transforms 20. Eye transforms 21. Eye transforms, contd 22. Canonical view transform 23. Viewport transform 24. Viewport transform, contd
Module III: Light and Optics	<ol style="list-style-type: none"> 25. Three interpretations of light 26. Refraction 27. Simple lenses 28. Diopters 29. Imaging properties of lenses



NP-TEL

NPTEL

<http://nptel.ac.in>

Computer Science and Engineering

Pre-requisites:

Basic maths and exposure to engineering

Additional Reading:

- Doug A. Bowman, Ernst Kruijff, Joseph J. LaViola, and Ivan Poupyrev, 3D User Interfaces, Addison-Wesley, 2005.
- K. S. Hale and K. M. Stanney, Handbook on Virtual Environments, 2nd edition, CRC Press, 2015.

Coordinators:

Prof Steven LaValle
IITM & UIUC

	<ul style="list-style-type: none"> 30. Lens aberrations 31. Optical system of eyes
Module IV: Visual Physiology	<ul style="list-style-type: none"> 32. Photoreceptors 33. Sufficient resolution for VR 34. Light intensity 35. Eye movements 36. Eye movements, contd 37. Eye movement issues for VR 38. Neuroscience of vision
Module V: Visual Perception	<ul style="list-style-type: none"> 39. Depth perception 40. Depth perception, contd 41. Motion perception 42. Frame rates and displays 43. Frame rates and displays contd
Module VI: Tracking Systems	<ul style="list-style-type: none"> 44. Overview 45. Orientation tracking 46. Tilt drift correction 47. Yaw drift correction 48. Tracking with a camera 49. Perspective n-point problem 50. Filtering 51. Lighthouse approach
Module VII: Visual Rendering	<ul style="list-style-type: none"> 52. Visual Rendering-Overview 53. Visual Rendering-overview, contd 54. Shading models 55. Rasterization 56. Pixel shading 57. VR-specific problems 58. Distortion shading 59. Post-rendering image warp
Module VIII: Audio	<ul style="list-style-type: none"> 60. Physics and physiology 61. Auditory perception 62. Auditory localization 63. Rendering 64. Spatialization and display 65. Combining other senses

**Module IX:
Interfaces**

- 66. Interfaces -overview
- 67. Locomotion
- 68. Manipulation
- 69. System control
- 70. Social interaction
- 71. Evaluation of VR Systems

References:

1. <http://msl.cs.uiuc.edu/vr/>
2. George Mather, Foundations of Sensation and Perception: Psychology Press; 2 edition, 2009.
3. Peter Shirley, Michael Ashikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3 edition, 2009.