

Course Title:	CS864 Scientific Visualization
Credit Hours:	3+0
Pre-requisites:	▪ Computer Graphics ▪ Data Structures
Course Description:	In this course topics related to volume visualization and flow visualization will be covered. We will discuss visualization techniques for 3D, 3D+T and higher dimensional datasets. Various application areas of scientific visualization and current research trends will also be part of the course work.
Tools and Technologies:	<i>OpenGL and GLSL</i>
Learning Outcomes:	On successful completion of this course students will be able to: 1. Produce large scale visualization systems for multi dimensional datasets 2. Conduct research in industrial visualization, medical imaging and other volume and flow visualization topics.
Tentative MS Thesis:	▪ Artifact detection in industrial CT scan datasets ▪ Surface model to volumetric dataset registration
Text Books:	▪ Charles D. Hansen and Chris R. Johnson (2005): Visualization Handbook. (Elsevier).
Reference Books:	▪ Barthold Lichtenbelt et. al. (1998): Introduction to Volume Rendering (Prentice Hall) ▪ Chun-houh Chen et. al. (2008): Handbook of Data Visualization. (Springer) ▪ Markus Hadwiger et. al. (2006): Real-time Volume Graphics. (A K Peters)
Course Contents:	▪ Scientific Visualization Pipeline ▪ Data Acquisition and Representation ▪ Filtering and Data Reconstruction ▪ Multi-planar reformatting ▪ Traditional Mapping Techniques ○ Diagrams

	○ Plots and Height Fields ○ Isolines ○ Color coding ○ Glyphs ▪ Indirect Volume Rendering ○ Surface Extaction Techniques ○ Acceleration Techniques ▪ Segmentation and Classification Techniques ▪ Registration techniques ▪ 3D Image Processing ▪ Volume Visualization ○ Transfer Functions (2D and multi-dimensional) ○ Shading ○ Ray Casting ○ Splatting ○ Shear Warp ○ MIP ▪ GPGPU techniques for Volume Rendering ▪ Visualizing 3D+T data ▪ Tools, issues and current research in Volume Visualization ▪ Flow Visualization ○ Arrows and Glyphs ○ Particle Tracing ○ Streamlines ○ Texture based Visualization ▪ Tensor Field Visualization ▪ Vector and Tensor Field Visualization Applications
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