

## Course Syllabus

### **Advanced Graphics & Animation (AGA)**

(Instructor: Prof Anupam Agrawal)

Introduction, 2D and 3D transformations, Matrix representation of transformations, Composite transformations, 2D viewing pipeline, Window-to-viewport coordinate transformation, 3D viewing pipeline, Synthetic camera analogy, Transformation from world-to-viewing coordinates, Projective transformations, Canonical view volume.

Object representation: Hierarchical modeling of polygonal surfaces, Quadric surfaces, Constructive solid geometry methods, Octrees, BSP trees, Fractals, Bezier and B-Spline curves.

Acceleration algorithms: Spatial data structures, Culling techniques, Hierarchical view frustum culling, Level of Detail.

Image-based effects: Fixed-view effects, Skyboxes, Sprites, Billboarding, Particle systems, Impostors, Motion blur, Fog, Volume rendering.

Introduction to OpenGL Graphic programming, OpenGL data types, Using the GL, GLU and GLUT libraries, Basic drawing, Texture & shadow, Programming assignment (lab work).

Different generations of GPUs, GPU architecture overview, CUDA programming model, Memory models, CUDA hardware interface on the GPU, CUDA programming examples (lab work).

Principles of animation, Overview of various animation techniques, Storyboards for animation, Key-frame system, Tweening and Morphing.

Modeling & Animating Human Figure: Virtual human representation, Reaching & grasping, Walking, Clothing & Hair; Facial Animation: Human face, Facial models, Animating the face, Lip-Sync animation; Physically-based Animation.

Detailed Case study on Real-time Rendering & Visualization of very Large 3D Datasets.

#### References:

1. Rick Parent, "Computer Animation: Algorithms & Techniques", Morgan Kaufmann Pub.
2. Tomas Akenine-Möller and Eric Haines Naty Hoffman, "Real-Time Rendering, 2<sup>nd</sup> Ed.", A.K. Peters.
3. D. Hearn & M.P. Baker, "Computer Graphics with OpenGL", 4<sup>th</sup> Ed., Pearson Education.
4. Francis S Hill Jr., Stephen M Kelley, "Computer Graphics Using OpenGL", Prentice Hall of India.
5. NVidia CUDA Repository, URL: <http://developer.nvidia.com/category/zone/cuda-zone>.