

<b>Elective</b>		<b>Computer Graphics and Multimedia</b>	<b>3-1-0-4</b>
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**Prerequisite:** Any course on the Design and Analysis of Algorithms and Programming, or its equivalent:

- a) Must have sufficient exposure to various algorithms and strong programming skills (C/C++).
- b) Knowledge of basic linear algebra (i.e., vector and matrix multiplication, dot and cross products).

**1. Outline:** Multimedia is content that uses a combination of different content forms such as text, audio, images, animations, video and interactive content. Computer graphics are pictures and films created using computers. Both multimedia and graphics are strongly intertwined. Usually, the term refers to computer-generated image data created with the help of specialized graphical hardware and software. The phrase was coined in 1960, by computer graphics researchers Verne Hudson and William Fetter of Boeing. Applications in computer vision, robotics, CAD modelling, mechanics, Game design (AR/VR applications) etc.

## **2. Objectives:**

Introductory courses on Computer Graphics will enable students to know about geometry primitives such as vector graphics, 3D modelling, ray tracing etc.

## **3. Course Content:**

**Multimedia and Graphic System Primitives and Transformations: Multimedia representation (Image/Video/Audio/Graphics):** Digital representation of audio, video, meshes and images, sampling rate, quantization, resolution, storage formats for audio, video, meshes image, Raster-Scan vs. random-Scan Systems. Input and Output Devices. Homogeneous Coordinate System for 2D and 3D, various 2D, 3D Transformation matrices (Translation, Scaling, Rotation, Shear), Rotation about an arbitrary point (2D), Rotation about an arbitrary axis (3D)

**Lines and Curves: Bresenham's Line Drawing Algorithm, Mid-point Circle Drawing Algorithm, Clipping Algorithms:** Line and Polygon Clipping Algorithms, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, Conditions for smoothly joining curve segments, B-Spline Curves, Cubic B-Spline curves

**Projection and Solid Modelling:** Parallel Projection, Oblique Projection on xy plane, Isometric Projection, Perspective Projection, One Vanishing Point (V.P.) projection from a point on z axis, Generation of 2 V.P. Projection, Isometric Projection, Perspective Projection, one vanishing Point (VP), projection from 0 point on z axis, Solid Modelling.

**Multimedia compression & retrieval:** image compression, fidelity, lossy compression, lossless compression, symmetric compression techniques, asymmetric compression techniques, redundancy, variable length coding, run length coding, predictive coding,

transform coding, JPEG, Motion Compensation, Motion estimation, MPEG, I,B,P frames, retrieval methods.

Multimedia Communication Protocols and Illumination and Shading effects in graphics

#### **4. Books/References:**

##### **Text Books:**

- a) Ze Nian Li and Mark S. Drew, "Fundamentals of Multimedia", Prentice Hall, 2004.
- b) D. Hearn and P. Baker, "Computer Graphics", Prentice Hall, 1986.
- c) Foley et. al., "Computer Graphics Principles & practice", Addison Wesley, 1999.

##### **Reference Books:**

- a) Morgan, Kaufmann, "The Morgan Kaufmann Series in Multimedia Information and Systems"
- b) D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw Hill International Edition, 1989.
- c) David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill Book Company, 1985.
- d) R. Plastock and G. Kalley, "Theory and Problems of Computer Graphics", Schaum's Series, McGraw Hill, 1986.