

**Subject Code: 01ME0506**
**Subject Name: Computer Graphics**
**B.Tech. V Year (Sem-III) Mechanical Engineering.**
**Type of course:** Engineering Science

**Rationale:** Computer have become inevitable in today era and find their application in various stages of product design. Computer Graphics is intended to impart the fundamental knowledge of various input output devices, geometric transformations and 2D/3D modeling. This course intends to introduce students to learn computer graphics designed to give an overview of fundamental principles.

**Teaching and Examination Scheme:**

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Tutorial/Practical Marks		
				ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	5	50	30	20	25	25	150

**Content:**

Sr. No.	Content	Total Hrs	%Weight - age
1	<b>Introduction:</b> A typical product cycle, CAD tools for the design process of product cycle, CAD / CAM system evaluation criteria, Input / Output devices; Graphics Displays: Refresh display, DVST, Raster display, pixel value and lookup table, estimation of graphical memory, LCD, LED fundamentals. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System, Screen Coordinate System. Line and Curve generation algorithm: DDA, Bresenham's algorithms. Graphics exchange standards and Database management systems.	08	20%

<b>2</b>	<b>Curves and Surfaces:</b>  Parametric representation of lines: Locating a point on a line, parallel lines, perpendicular lines, distance of a point, Intersection of lines. Parametric representation of circle, Ellipse, parabola and hyperbola. Synthetic Curves: Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines and NURBS.  Various types of surfaces along with their typical applications.	<b>10</b>	<b>24%</b>
<b>3</b>	<b>Mathematical representation of solids:</b>  Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations. Schemes: B-rep, CSG, Sweep representation, ASM, Primitive instancing, Cell Decomposition and Octree encoding.	<b>05</b>	<b>12%</b>
<b>4</b>	<b>Geometric Transformations:</b>  Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D; Orthographic and perspective projections. Window to View-port transformation.	<b>07</b>	<b>16%</b>
<b>5</b>	<b>Viewing:</b>  Viewing world co-ordination system, Normalized co-ordinate system, Device/Image co-ordination system, Window definitions, View port definitions, Viewing transformation.	<b>06</b>	<b>14%</b>
<b>6</b>	<b>Clipping:</b>  Clipping: Point clipping, Line clipping, Cohen- Sutherland clipping, Midpoint clipping method, Sutherland and Hodgman Clipping.	<b>06</b>	<b>14%</b>

**References:**

1. Ibrahim Zied, CAD / CAM: Theory and Practice, McGraw-Hill
2. Hearn E J and Baker M P, Computer Graphics, Pearson.
3. Sinha & Udai, Computer Graphics, McGraw-Hill Education

**Course Outcomes:**

1. Understand and appreciate use of computer in product development.
2. Apply algorithms of graphical entity generation.
3. Understand mathematical aspects of geometrical modelling.
4. To understand the various computer graphics hardware technologies.
5. Various 2D and 3D objects transformation techniques .

**List of Experiments:**

1. Develop the DDA Line drawing algorithm using C language.
2. Develop the Bresenham's Line drawing algorithm using C language.
3. Develop the Bresenham's Circle drawing algorithm using C language.
4. Perform the following 2D Transformation operation Translation, Rotation and Scaling.
5. Introductory exercise for 3-D modelling and editing options.
6. Exercise for surface modelling.
7. Exercise for Assembly modelling.
8. Exercise for advanced 3-D modelling.

**List of Open Source Software/learning website:**

1. <http://nptel.iitm.ac.in>
2. Inkscape - Open Source vector graphics editor