Programme: BICTE
Course Title: **Computer Graphics**
Course No. : ICT Ed 466 | Nature of Course: Theoretical + Practical
Level: Bachelor | Credit Hours: 3 (2T+1P)
Semester: Six | Teaching Hours: 64 (32T+32P)

1. **Course Description**
   This course deals with computer graphics consisting of history and application of computer graphics, output primitives, geometrical transformations 2D and 3D, color models, clipping, introduction to three-dimensional graphics, projection and its types, visible surface detection algorithms, illumination model, polygon rendering methods and understanding of computer simulation, animation and virtual reality.

2. **General Objectives**
   - To familiarize the students with computer graphics and its applications
   - To understand the Input hardware and Output Hardware with architecture
   - To make the students competent in implementing algorithm of graphical primitives: point, line and circle.
   - To enable the students to implement two and three – dimensional transformations
   - To apply the students to demonstrating rendering and illumination techniques
   - To know about different color models
   - To understand computer animation and virtual reality.

3. **Specific Objectives and Contents**

Specific Objectives	Contents
• to summarize key milestones in the history of computer graphics. • to illustrate real-world applications of computer graphics in diverse field • to compare and contrast of raster and random scan displays architecture • to identify the different graphical input devices and output devices • to explain the working principles of CRTs and flat-panel displays.	**Unit I: Computer Graphics and Hardware** **4T+3P** • History and Applications of Computer Graphics • Input Devices: Mouse, Keyboard, Touch Panel, Light Pen, Digitizer, Data Glove, Bar Code, OCR, OMR, MICR • Hardcopy Output Devices: Printer, Plotter • Display Devices: CRT (monochrome and color), LED, LCD Plasma • Architecture of Raster Scan and Random Scan System **<u>Practical Work</u>** Prepare Case Study Report on one or more topics mentioned below:

	• Touch Panel • CRT • LED and LCD • Bar Code • History and Application of Computer Graphics
• to define the concept of pixel • to recall the definition of points and lines in computer graphics. • to implement the DDA algorithm. • to implement the Bresenham's line drawing algorithm. • to utilize the Midpoint Circle algorithm to draw circle	**Unit II: Output Primitives 6T+9P** 2.1 Pixel and Straight Line 2.2 Line Drawing Algorithms: Digital Differential Analyzer (DDA), Bresenham's Line Drawing 2.3 Midpoint Circle Algorithm **Practical Works** • Write program to draw a line using DDA algorithm. • Write program to draw a line using Bresenham's line drawing algorithm. • Write program to draw a circle using Midpoint circle algorithm. • Write program to draw different geometrical shapes with the help of library functions/methods.
• To define different types of 2D and 3D Transformations • To represent 2D and 3D transformations in homogeneous form • to generate successive and composite transformations • To define viewing pipeline • to apply transform objects from world coordinate to viewing coordinate	**Unit III: 2D and 3D Transformation 6T+6P** 3.1 2D and 3D Transformations: Translation, Rotation (about origin and arbitrary point), Scaling (about origin and arbitrary point), Reflection and Shear 3.2 Representation of 2D and 3D Transformation in Homogeneous Coordinate System 3.3 Successive and Composite Transformations 3.4 Window to Viewport Transformations 3.5 2D and 3D Viewing Pipeline **Practical Works** • Write program to illustrate all types of 2D and 3D transformations

• to understand clipping and its need • to apply point clipping • to utilize Cohen-Sutherland line clipping algorithm • to illustrate Sutherland-Hodgeman polygon clipping algorithm	**Unit IV: Clipping 4T+6P=10** 4.1 Introduction to Clipping 4.2 Point Clipping 4.3 Line Clipping ○ Cohen-Sutherland Line Clipping Algorithm 4.4 Polygon Clipping ○ Sutherland-Hodgeman Polygon Clipping Algorithm **Practical Works** Write program to implement • Point Clipping • Cohen-Sutherland line clipping algorithm • Sutherland Hodgeman Polygon Clipping algorithm
• to define 3D object • to derive the parallel and perspective projection matrices • to understand different types of visible surface detection methods • to identify basic illumination models • to apply polygon rendering methods • to know the idea behind color models	**Unit V: Three Dimensional Graphics 9T+5P** 5.1 3D Object Representation : Polygon Table 5.2 Projection: Definition and Types, Derivation of Parallel and Perspective Projection Matrices 5.3 Visible Surface Detection Methods: Object Space (Depth Sorting) and Image Space (Z-Buffer, A-Buffer and Scanline) Methods 5.4 Basic Illumination model: Ambient Light, Specular Highlights and Diffuse Reflection 5.5 Polygon Rendering Methods: Constant, Gouraud and Phong Shading 5.6 RGB, HSV and CMYK Color models **Practical Works** • Write program to create 3D object. • Write program to illustrate parallel projection

	• Write program to illustrate perspective projection
• to understand the simulation, animation and virtual reality concept • to make use of animation tool	**Unit VI: Computer Simulation, Animation and Virtual Reality** **3T+3P** 6.1 Introduction to Computer Animation 6.3 Introduction to Simulation 6.4 Introduction of Virtual Reality **Practical Works** • Use Animation tool to create simple animated video

4. Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to specific units.

5.1 General Techniques

- Providing the reading materials to the students to familiarize the units.
- Lecture, question-answer, discussion, brainstorming, practical, and buzz session.

5.2 Specific Instructional Techniques

5. Evaluation

Evaluation of students' performance is divided into parts: Internal assessment and internal and external practical examination and theoretical examinations. The distribution of points is given below:

Internal Assessment	External Practical Exam/Viva	Semester Examination (Theoretical exam)	Total Points
40 Points	20 Points	40 Points	100 Points

***Note**: Students must pass separately in internal assessment, external practical exam and semester examination.*

5.1 Internal Assessment (40 Points)

Internal assessment will be conducted by subject teacher based on following criteria:

1) Class Attendance 5 points
2) Learning activities and class performance 5 points
3) First assignment (written assignment) 10 points
4) Second assignment (Case Study/project work with presentation) 10 points

5) Terminal Examination	10 Points
Total	40 points

5.2 Semester Examination (40 Points)

Examination Division, Dean office will conduct final examination at the end of semester.

Objective question (Multiple choice questions 10 x 1 point)	10 Points
Short answer questions (6 questions x 5 marks)	30 Points
Total	40 points

5.3 Practical Exam/Viva (20 Points)

Examination Division, Dean Office will conduct final practical examination at the end of semester. Practical record book, practical written test, demonstration of practical activities and viva are assessment indicators.

6. Prescribed Textbook

Hearn and Baker, "*Computer Graphics, C Version*", Second Edition, Prentice- Hall of India Private Limited, 2003

7. Recommended Books and References

1. Edward Angel and Dave Shreiner *Interactive Computer Graphics A Top-Down Approach With Shader-Based OPENGL, 6th edition* ISBN-13: 978-0-13-254523-5
2. Peter Shirley and Steve Marschner ,*Fundamentals of Computer Graphics*, Third Edition CRC Press Taylor & Francis Group 13: 978-1-4398-6552-1
3. Issac Victor Kerlow, The Art of 3D Computer Animation and Effects, John Wiley, 2004, ISBN:0471430366.