Course Code	Course Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/ Practical	Tutorial	Total
TEITC501	Computer Graphics And Virtual Reality	04 Hrs./Week	02 Hrs./Week	---	04	01	---	05

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
TEITC501	Computer Graphics And Virtual Reality	20	20	20	80	25	25	---	150

Course Objectives	
1	The objective of the course is to equip students with the fundamental knowledge and basic technical competence in the field of computer graphics.
2	Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes so as to fit them as per the picture definition.
3	Provide an understanding of mapping from a world coordinates to device coordinates, clipping, solid modeling, rendering, and projections.
4	To comprehend and analyze the fundamentals of animation, virtual reality, underlying technologies, principles, and applications.

Course Outcomes	
1	Students shall have understood basic concepts of computer graphics.
2	Students shall have understood algorithms to scan convert the basic geometrical primitives, transformations, Area filling, clipping.
3	Students shall have understood the fundamentals of animation, Virtual reality ,the related technologies, and shall be able to describe applications of Virtual Reality.

DETAILED SYLLABUS

Sr. No.	Module	Detailed Content	Hours
1.	**Introduction to Computer graphics and Output primitives**	Introduction, Display Devices, Bitmap and Vector based graphics, Overview of Coordinate system, Scan Conversion of**:**point, line using Digital differential analyzer& Bresenham's algorithm, circle using midpoint approach, Curve Generation **:** Bezier and B-Spline curves. Introduction to fractals: generation procedure, classification, dimension and Koch Curve.	**10**
2.	**Area Filling and Two Dimensional Transformations**	Area filling **:** Inside/Outside Test , Scan line Polygon Fill Algorithm , Boundary Fill and Flood Fill algorithm. Basic Geometrical 2D transformations : Translation, Rotation, Scaling, Reflection, Shear, their homogeneous Matrix representation and Composite transformation.	**8**
3.	**Two Dimensional Viewing**	Introduction ,Viewing Pipeline , View Coordinate reference frame ,Window to viewport transformation, Point clipping, Line clipping**:** Cohen Sutherland Algorithm, Liang Barsky algorithms, Polygon clipping**:** Sutherland Hodgeman polygon clipping and Weiler Atherton. Text Clipping.	**6**
4.	**Three Dimensional Transformation,Viewing and Projection.**	Three Dimensional transformations**:** Translation, Scaling, Rotations, Composite. Three Dimensional object representation: Polygon Surfaces, Tables, Meshes. Three Dimensional Viewing Pipeline , Viewing transformation , Projections **:** Parallel(Oblique and orthographic), Perspective (one Point)	**6**
5.	**Introduction to Animation**	Key Frame Animation, Animation Sequence, Motion Control Methods, Morphing, Warping(only Mesh Warping).	**2**
6.	**Introduction to Virtual Reality**	Virtual Reality : Basic Concepts , Classical Components of VR System , Types of VR Systems, Three Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture	**8**

		Interfaces, Graphical Display, Sound displays, and Haptic Feedback . Input Devices ,Graphical Rendering Pipeline , Haptic Rendering Pipeline, Open GL rendering pipeline.Applications of Virtual Reality.	
7	**Modeling**	Geometric Modeling: Virtual Object Shape, Object Visual Appearance.Kinematics Modeling: Object Position, Transformation Invariants, Object Hierarchies, Physical Modeling: Collision Detection, Surface Deformation, Force Computation. Behavior Modeling.	**4**
8	**Introduction to VR programming**	Introduction , Programming through VRML : Defining and Using Nodes and Shapes , VRML Browsers , Java 3D :Visual Object Definition by Shape 3D instances , Defining personal visual object class, ColorCube Class, Geometric – Utility Classes, Geometry Classes , Attributes.	**4**

Text Books

1 Donald Hearn and M. Pauline Baker, "Computer Graphics", Pearson Education.

2 R. K Maurya, "Computer Graphics with Virtual Reality", Wiley India.

Reference Books

1 Grigore Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley.

2 Steven Harrington, "Computer Graphics", McGraw Hill.

3 Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill.

4 Vince, "Virtual Reality Systems", Pearson Education.

5 F.S. Hill , Stephen M. Kelley , "Computer Graphics using Open GL" Prentice Hall

Term work: Term Work shall consist of programs based on the given list. Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Suggested Practical List:

1. Implementation of Line Drawing algorithms : DDA , Bresenham and using them generating line with different styles like dotted , dashed , centered and thick line.
2. Implementation of Circle generation algorithm : Midpoint and using it generating concentric circles.
3. Implementation of Area Filling Algorithm : Boundary Fill , Flood Fill and Scan line Polygon Fill.
4. Curve Generation : Bezier for n control points , B Spline (Uniform)
5. Fractal Generation (Koch Curve)
6. Program for performing Two Dimensional Transformations : Translation , Scaling , Rotation , Reflection , Shear by using a homogeneous Matrix representation ,use of a function for matrix multiplication is desirable , so as to perform composite transformation.
7. Implementation of Line Clipping Algorithm : Cohen Sutherland , Liang Barsky.
8. Implementation of Polygon Clipping Algorithm : Sutherland Hodgman.
9. Program to represent a 3D object using polygon surfaces and then perform 3D transformation.
10. Program to perform projection of a 3D object on Projection Plane : Parallel and Perspective.
11. Program for Animation.

    It is desirable to implement some of the experiments by using Open GL.

    In addition at least 3 programs using VRML and JAVA 3D APIs.

    It is recommended to encourage the student to form a group for a mini project (a simple graphical utility) and for them submitting a theoretical Q. / A. type assignments can be kept optional.

Theory Examination:

- Question paper will comprise of 6 questions, each carrying 20 marks.
- Total 4 questions need to be solved.
- Q.1 will be compulsory, based on entire syllabus.
- Remaining question will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.