JEPPIAAR ENGINEERING COLLEGE

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CS6504

COMPUTER GRAPHICS

QUESTION BANK

III YEAR A & B / BATCH: 2015 -2019

VISION OF INSTITUTION

To build Jeppiaar Engineering College as an Institution of Academic Excellence in Technical education and Management education and to become a World Class University.

MISSION OF INSTITUTION

M1	To excel in teaching and learning, research and innovation by promoting the principles of scientific analysis and creative thinking
M2	To participate in the production, development and dissemination of knowledge and interact with national and international communities
M3	To equip students with values, ethics and life skills needed to enrich their lives and enable them to meaningfully contribute to the progress of society
M4	To prepare students for higher studies and lifelong learning, enrich them with the practical and entrepreneurial skills necessary to excel as future professionals and contribute to Nation's economy

PROGRAM OUTCOMES (POs)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of computer science engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

VISION OF DEPARTMENT:

To emerge as a globally prominent department, developing ethical computer professionals, innovators and entrepreneurs with academic excellence through quality education and research.

MISSION OF DEPARTMENT

M1	To create computer professionals with an ability to identify and formulate the engineering problems and also to provide innovative solutions through effective teaching learning process.
M2	To strengthen the core-competence in computer science and engineering and to create an ability to interact effectively with industries.
M3	To produce engineers with good professional skills, ethical values and life skills for the betterment of the society.
M4	To encourage students towards continuous and higher level learning on technological advancements and provide a platform for employment and self-employment.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 01: To address the real time complex engineering problems using innovative approach with strong core computing skills.

PEO 02: To apply core-analytical knowledge and appropriate techniques and provide solutions to real time challenges of national and global society.

PEO 03: Apply ethical knowledge for professional excellence and leadership for the betterment of the society.

PEO 04: Develop life-long learning skills needed for better employment and entrepreneurship.

PROGRAMME SPECIFIC OUTCOME (PSOs)

PSO1 – An ability to understand the core concepts of computer science and engineering and to enrich problem solving skills to analyze, design and implement software and hardware based systems of varying complexity.

PSO2 - To interpret real-time problems with analytical skills and to arrive at cost effective and optimal solution using advanced tools and techniques.

PSO3 - An understanding of social awareness and professional ethics with practical proficiency in the broad area of programming concepts by lifelong learning to inculcate employment and entrepreneurship skills.

SYLLABUS

UNIT I INTRODUCTION 9

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives.

UNIT II TWO DIMENSIONAL GRAPHICS 9

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

UNIT III THREE DIMENSIONAL GRAPHICS 10

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces.
TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

UNIT IV ILLUMINATION AND COLOUR MODELS 7

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model -YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

UNIT V ANIMATIONS & REALISM 10

ANIMATION GRAPHICS: Design of Animation sequences – animation function – raster animation –key frame systems – motion specification –morphing – tweening.
COMPUTER GRAPHICS REALISM: Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons –space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

TEXT BOOKS:

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, Addison Wesley Professional,2013. (UNIT I, II, III, IV).
2. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007(UNIT V).

REFERENCES:

1. Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL", 4 th Edition, Pearson Education, 2010.
2. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., "Computer Graphics", Maxwell Macmillan" , 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.
5. William M. Newman and Robert F.Sproull, "Principles of Interactive Computer Graphics", Mc Graw Hill 1978.
6. http://nptel.ac.in/

COURSE OUTCOMES :

C305.1	**pret** output primitives drawing algorithms
C305.2	y two dimensional transformations, viewing and clipping.
C305.3	**lop** three dimensional objects and **Apply** them viewing and clipping
C305.4	**ıin** Illumination and color models
C305.5	**;n** animation sequences and to create graphics realism

INDEX

UNIT NO	REFERENCE BOOK	PAGE NO
Unit - I	d Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007	**1-7**
Unit - II	Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007	**8-15**
Unit - III	d Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007	**16-23**
Unit - IV	Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007	**24-30**
Unit - V	John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", , 3rd Edition, Addison Wesley Professional,2013	**31-36**

UNIT – I

INTRODUCTION

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms; Pixel addressing and object geometry, filled area primitives

PART-A

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**down any two line attributes** **NOV/DEC 2011,NOV/DEC 2014].** **Line type** setLinetype(lt) **Line width** setLinewidthScaleFactor(lw)	C305.1	**BTL1**
2	**entiate window and viewport [NOV/DEC 2011].** A world coordinate area selected for display is called a window. An area on a display device to which a window is mapped is called a viewport.	C305.1	**BTL2**
3	**is the major difference between symmetrical DDA and simple DDA [MAY/JUNE 2012].** The DDA (Digital Differential Analyzer) algorithm is used to find out interpolating points between any given two points, linearly (i.e. straight line). Now since this is to be done on a digital computer - speed is an important factor. The equation of a straight line is given by m=Δx/Δy eq(i), where Δx = x(2)-x(1) & Δy = y(2)-y(1), now using this equation we could compute successive points that lie on the line. But then this is the discrete world of raster graphics - so we require integral coordinates. In simple DDA eq(i) is transformed to m=eΔx/eΔy where **e**, call it the increment factor, is a positive real number. since putting the same number in numerator and denominator does not change anything - but if suitably chosen - it can help us in generating discrete points thereby reducing the overload of having to round off the resultant points.	C305.1	**BTL1**

	Basically what we need to do is: increment the coordinates by a fixed small amount, beginning from the starting point, and each time we have a new point progressing towards the end point. In simple DDA - *e* is chosen as 1/max(|Δx|,|Δy|) such that one of the coordinate is integral and only the other coordinate has to be rounded. i.e. P(i+1) = P(i)+(1,Round(e*Δy)) here one coordinate is being incremented by 1 and the other by e*Δy In symmetric DDA - *e* is chosen such that *though* both the co-ordinates of the resultant points has to be rounded off, it can be done so very efficiently, thus quickly.		
4	**is the rule of clipping** **[MAY/JUNE 2012,MAY/JUNE 2014].** Any procedure which identifies that portion of a picture which is either inside or outside a region is referred to as a **clipping algorithm** or **clipping**. The region against which an object is to be clipped is called clipping window.	C305.1	**BTL1**
5	**text clipping** **NOV/DEC 2012, NOV/DEC 2014].** ng the text against the clip window is known as text clipping. TYPES All or none string clipping All or none character clipping Individual character clipping	C305.1	**BTL1**
6	**Aspect Ratio. [MAY/JUNE 2013]** It is a property of video monitors. This number gives the ratio of vertical points to horizontal points necessary to produce equal-length lines in both directions on the screen.	C305.1	**BTL1**
7	**ill you clip a point**? **[MAY/JUNE 2013]** If the x coordinate boundaries of the clipping rectangle are Xmin and Xmax, and the y coordinate boundaries are Ymin and Ymax, then the following inequalities must be satisfied for a point at (X,Y) to be inside the clipping rectangle: Xmin < X < Xmax and Ymin < Y < Ymax If any of the four inequalities does not hold, the point is outside the clipping rectangle.	C305.1	**BTL1**
8	**ze a line from (10, 12) to (15, 15) on a raster screen using Bresenhams straight line algorithm.** **[NOV/DEC 2013]** 1. Input the two line endpoints and store the left end point in (x0,y0) 2. load (x0,y0) into frame buffer, ie. Plot the first point. 3. Calculate the constants Δx, Δy, 2Δy and obtain the starting value for the decision parameter as P0 = 2Δy-Δx	C305.1	**BTL2**

	4. At each xkalong the line, starting at k=0 perform the following test If Pk< 0, the next point to plot is(xk+1,yk) and Pk+1 = Pk+ 2Δy Otherwise, the next point to plot is (xk+1,yk+1) and Pk+1 = Pk+ 2Δy - 2Δx 5. Perform step4 Δx times.		
9	**e different types of text clipping methods available.** **[NOV/DEC 2013]** **All-or-none string clipping** -if all of the string is inside a clip window, keep it otherwise discards. **All-or-none character clipping** – discard only those characters that are not completely inside the window. Any character that either overlaps or is outside a window boundary is clipped. **dual characters** – if an individual character overlaps a clip window boundary, clip off the parts of the character that are outside the window.	C305.1	**BTL2**
10	**is Output Primitive [MAY/JUNE 2014]?** Basic geometric structures that describe a scene are referred to as Output Primitives. Points and straight lines segments are the simplest geometric components of pictures. Additional output primitives that can be used to construct a picture include circles and other conic sections, quadric surfaces, spline curves and surfaces, polygon, color areas, and character strings.	C305.1	**BTL1**
11	**What is DDA?** The Digital Differential Analyzer is a scan-conversion line algorithm based oncalculating either difference in y-coordinate (dy) or difference in x-coordinate. We sample the line at unit intervals in one coordinate and determine corresponding integer values nearest the line path for the other coordinate.	C305.1	**BTL1**
12	**are the disadvantages of DDA algorithm?** • Round-off error in successive additions of the floating-point increment can cause the calculated pixel positions to drift away from the true line path for long line segments. Rounding operations and floating-point arithmetic in procedure are still time consuming.	C305.1	**BTL1**
13	**is attribute parameter?** Any parameter that affects the way a primitive is to be displayed is referred to as an attribute parameter	C305.1	**BTL1**
14	**are the basic line attributes?** Basic attributes of a straight line segment are its type, its width, and its color.	C305.1	**BTL1**

15	**fy the contrast between Raster and Vector graphics. [MAY/JUNE 2015]** A raster image is made of up pixels, each a different color, arranged to display an image. A vector image is made up of paths, each with a mathematical formula (vector) that tells the path how it is shaped and what color it is bordered with or filled by. The major difference is that raster image pixels do not retain their appearance as size increases – when you blow a photograph up, it becomes blurry for this reason. Vector images do retain appearance regardless of size, since the mathematical formulas dictate how the image is rendered	C305.1	**BTL3**
16	**ute the resolution of a 2*2 inch image that has 512 * 512 pixels. [NOV /DEC 2015]** The maximum number of points that can be displayed without an overlap on a CRT is called as resolution. Measured by pixels per inch. Resolution of the given image is 256 pixel.	C305.1	**BTL2**
17	**he contents of the display file. [NOV /DEC 2015]** Display file contains function definitions of graphic primitives that are updated as per the need to the application program and generated by graphics software. A display list (or display file) is a series of graphics commands that define an output image. The image is created (rendered) by executing the commands to combine various primitives. This activity is most often performed by specialized display or processing hardware partly or completely independent of the system's CPU for the purpose of freeing the CPU from the overhead of maintaining the display, and may provide output features or speed beyond the CPU's capability.	C305.1	**BTL1**
18	**Computer Graphics.** Computer graphics remains one of the most existing and rapidly growing computer fields. Computer graphics may be defined as a pictorial representation or graphical representation of objects in a computer	C305.1	**BTL1**
19	**is meant by scan code?** When a key is pressed on the keyboard, the keyboard controller places a code carry to the key pressed into a part of the memory called as the keyboard buffer. This code is called as the scan code.	C305.1	**BTL1**
20	**is meant by refreshing of the screen?** Some method is needed for maintaining the picture on the screen. Refreshing of screen is done by keeping the phosphorus glowing to redraw the picture repeatedly. (i.e.) By quickly directing the electronic	C305.1	**BTL1**

	beam back to the same points.		
21	**: Random scan/Raster scan displays.** Random scan is a method in which the display is made by the electronic beam which is directed only to the points or part of the screen where the picture is to be drawn. The Raster scan system is a scanning technique in which the electrons sweep from top to bottom and from left to right. The intensity is turned on or off to light and unlight the pixel.	C305.1	**BTL1**
22	**ıt the merits and demerits of Penetration techniques.** The merits and demerits of the Penetration techniques are as follows ● It is an inexpensive technique ● It has only four colors ● The quality of the picture is not good when it is compared to other techniques ● It can display color scans in monitors ● Poor limitation etc.	C305.1	**BTL1**
23	**ıt the merits and demerits of DVST.** The merits and demerits of direct view storage tubes [DVST] are as follows ● It has a flat screen ● Refreshing of screen is not required ● Selective or part erasing of screen is not possible :RITS ● It has poor contrast ● Performance is inferior to the refresh CRT.	C305.1	**BTL1**
24	**do you mean by emissive and non-emissive displays?** The emissive display converts electrical energy into light energy. The plasma panels, thin film electro- luminescent displays are the examples. The Non emissive are optical effects to convert the sunlight or light from any other source to graphic form. Liquid crystal display is an example.	C305.1	**BTL1**
26	**is persistence?** The time it takes the emitted light from the screen to decay one tenth of its original intensity is called as persistence.	C305.1	**BTL1**
27	**is resolution? <u>APRIL/MAY 2017</u>** The maximum number of points that can be displayed without an overlap on a CRT is called as resolution.	C305.1	**BTL1**
28	**is Aspect ratio?** The ratio of vertical points to the horizontal points necessary to produce length of lines in both directions of the screen is called the Aspect ratio. Usually the aspect ratio is ¾.	C305.1	**BTL1**
29	**is meant by Addressability?** The Addressability is the number of individual dots per inch (d.p.i) that can be created. If the address of the current dot is (x, y) then the next dot will be (x+y), (x+y+1) etc.	C305.1	**BTL1**

30	**is a dot size?** Dot size may be defined as the diameter of a single dot on the devices output. Dot size is also called as the Spot size.	C305.1	**BTL1**
31	***What is interdot distance?*** Interdot distance is the reciprocal of addressability. If the addressability is large, the interdot distance will be less. The interdot distance should be less to get smooth shapes.	C305.1	**BTL1**
32	***What is the difference between impact and non-impact printers?*** Impact printer press formed character faces against an inked ribbon on to the paper. A line printer and dot-matrix printer are examples. Non-impact printer and plotters use Laser techniques, inkjet sprays, Xerographic process, electrostatic methods and electro thermal methods to get images onto the papers. Examples are: Inkjet/Laser printers.	C305.1	**BTL1**

PART – B

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**Write down and explain the midpoint circle drawing algorithm. Assume 10 cm as the radius and co-ordinate origin as the centre of the circle<u>[NOV/DEC 2011, NOV/DEC 2014,MAY/JUNE 2014]. APRIL/MAY 2017</u>** Refer page no. : 118-121	C305.1	**BTL2**
2	**in about Bresenham's circle generating algorithm <u>[MAY/JUNE 2012].</u>** Refer page no. : 117-118	C305.1	**BTL2**
3	**in the Bresenham's Line drawing algorithm and trace the algorithm for the given points(2,1)to (10,12).List the advantages of Bresenham's Line drawing algorithm over DDA algorithm. <u>[NOV/DEC 2012],</u> NOV/DEC 2016** Refer page no. : 106-110	C305.1	**BTL2**
4	**Explain the basic concept of Midpoint ellipse drawing algorithm. Derive the decision parameter for the algorithm and write down the algorithm steps. <u>[MAY/JUNE 2013,MAY/JUNE 2014]</u>** Refer Page No:122-124	C305.1	**BTL2**

5	**Explain the basic concept of Midpoint ellipse drawing algorithm. Derive the decision parameter for the algorithm and write down the algorithm steps. [MAY/JUNE 2013,MAY/JUNE 2014]** Refer Page No:122-124	C305.1	**BTL2**
6	**(i)Summarize Midpoint circle drawing procedure.** **(ii)Use the above procedure to compute points on a circle with centre at (5,5) and radius of 8 units. [MAY/JUNE 2015]** Refer Notes.	C305.1	**BTL2**
7	**(i) Define and differentiate random scan and raster scan devices. [NOV /DEC 2015] NOV /DEC 2016** **(ii) Using Bresenhams circle drawing algorithm plot one quadrant circle of radius 7 pixels with origin as centre. [NOV /DEC 2015]** Refer Notes.	C305.1	**BTL4**
8	**(i) How are event driven input devices handled by the hardware? Explain. [NOV /DEC 2015]** **(ii)Discuss the primitives used for filtering. [NOV /DEC 2015]** Refer Class notes	C305.1	**BTL6**
9	**Explain the working principle of CRT with neat diagram. NOV /DEC 2016** Refer page no :35-37	C305.1	**BTL2**

UNIT II

TWO DIMENSIONAL GRAPHICS

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

PART - A

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**down the shear transformation matrix [NOV/DEC 2012, MAY/JUNE 2015].** Shear along any pair of axes is proportional to the third axis. For instance, to shear along **z** in 3D, **x** and **y** values are altered by an amount proportional to the value of **z**, leaving **z** unchanged. Let Sh_{zx}, Sh_{zy} is the shear due to **z** along **x** and Shear along any pair of axes is proportional to the third axis. For instance, to shear along **z** in 3D, **x** and **y** values are altered by an amount proportional to the value of **z**, leaving **z** unchanged. Let Sh_{zx}, Sh_{zy} is the shear due to **z** along **x** and **y** directions respectively and are real values. Then the matrix representation is $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ Sh_{zx} & Sh_{zy} & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$	C305.2	BTL1

	Shear for **x** , **y** axis is similar to that of **z**. The general form of shear is given by $$\begin{bmatrix} 1 & Sh_{xy} & Sh_{xz} & 0 \\ Sh_{yx} & 1 & Sh_{yz} & 0 \\ Sh_{zx} & Sh_{zy} & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$		
2	**: viewing** **[MAY/JUNE 2012, MAY/JUNE 2014].** pecify a rectangular area in the modeling coordinates (world coordinates) and a viewport in the device coordinates on the display window defines what to appear viewport defines where to display	C305.2	**BTL1**
3	**entiate oblique and orthogonal projections [NOV/DEC 2012]. APRIL/MAY2017** **ue projection** is a simple type of graphical projection used for producing pictorial, two-dimensional images of three-dimensional objects **hographic projection** (or **orthogonal projection**) is a means of representing a three-dimensional object in two dimensions. It is a form of parallel projection, where the view direction is orthogonal to the projection plane, resulting in every plane of the scene appearing in affine transformation on the viewing surface. It is further divided into *multiview orthographic projections* and *axonometric pictorials*.	C305.2	**BTL2**
4	**is Critical Fusion Frequency? [MAY/JUNE 2013]** lowest refresh rate at which flicker disappears. Depends on persistence, intensity, ambient lighting, phosphor color, and the observer.	C305.2	**BTL1**
5	**the single point perspective projection transformation matrix when projectors are placed on the z-axis. [NOV/DEC 2013]**	C305.2	**BTL1**

	A Single Point Perspective A single point perspective transformation with respect to z-axis $[x\ y\ z\ 1]\begin{bmatrix}1&0&0&0\\0&1&0&0\\0&0&1&r\\0&0&0&1\end{bmatrix}=[x\ y\ z\ (rz+1)]$ $[x^{*}\ y^{*}\ z^{*}\ 1]=\left[\frac{x}{rz+1}\ \frac{y}{rz+1}\ \frac{z}{rz+1}\ 1\right]$ Now the perspective projection is obtained by concatenating the orthographic projection matrix $[T]=[P_r][P_z]=\begin{bmatrix}1&0&0&0\\0&1&0&0\\0&0&1&r\\0&0&0&1\end{bmatrix}\begin{bmatrix}1&0&0&0\\0&1&0&0\\0&0&0&0\\0&0&0&1\end{bmatrix}=\begin{bmatrix}1&0&0&0\\0&1&0&0\\0&0&0&r\\0&0&0&1\end{bmatrix}$ $[x^{*}\ y^{*}\ z^{*}\ 1]=\left[\frac{x}{rz+1}\ \frac{y}{rz+1}\ 0\ 1\right]$		
6	**entiate parallel and perspective projection. [NOV/DEC 2014]** 1. Perspective projection is representing or drawing objects which resemble the real thing while parallel projection is used in drawing objects when perspective projection cannot be used. 2. Parallel projection is much like seeing objects through a telescope, letting parallel light rays into the eyes which produce visual representations without depth while perspective projection represents objects in a three-dimensional way. 3. In perspective projection, objects that are far away appear smaller, and objects that are near appear bigger while parallel projection does not create this effect. 4. While parallel projection may be best for architectural drawings, in cases wherein measurements are necessary, it is better to use perspective projection.	C305.2	**BTL2**
7	**e the general form of scaling matrix about a fixed point (Xf, Yf). [NOV /DEC 2015]** a. Many graphics applications involve sequences of geometric transformations. b. Hence we consider how the matrix representations can be reformulated so that such transformation sequence can be efficiently processed. c. Each of three basic two-dimensional transformations (translation, rotation and scaling) can be expressed in the general matrix form $\mathbf{P' = M_{1}.P + M_2}$ d. P and P ' = column vectors, coordinate position	C305.2	**BTL2**

	e. M1 = 2 by 2 array containing multiplicative factors, for translation M1 is the identity matrix M2 = two-element column matrix containing translational terms, for rotation or scaling M2 contains the translational terms associated with the pivot point or scaling fixed point f. To produce a sequence of transformations such as scaling followed by rotation then translation, we could calculate the transformed coordinate's $$P' = M_1 \cdot P + M_2$$ $$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix} \quad \text{Translation}$$ $$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x - x_r \\ y - y_r \end{bmatrix} + \begin{bmatrix} x_r \\ y_r \end{bmatrix} \quad \text{Rotation}$$ $$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} - \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x_r \\ y_r \end{bmatrix} + \begin{bmatrix} x_r \\ y_r \end{bmatrix}$$ $$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} s_x & 0 \\ 0 & s_y \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 1-s_x & 0 \\ 0 & 1-s_y \end{bmatrix} \begin{bmatrix} x_f \\ y_f \end{bmatrix} \quad \text{Scaling}$$ g. A more efficient approach is to combine the transformations so that the final coordinate positions are obtained directly from the initial coordinates, without calculating intermediate coordinate values. <u>General Form Scaling matrix about a fixed point</u> Sx 0 0 0 Sy 0 xf(1-Sx) yf(1-Sy) 1		
8	**down the conditions for point clipping in window. [NOV /DEC 2015]** **<u>Point Clipping:</u>** 1. Assuming that the clip window is a rectangle in standard position 2. Saving a point P=(x, y) for display $\mathbf{xw_{min} <= x <= xw_{max}}$ $\mathbf{yw_{min} <= y <= yw_{max}}$ 3. Appling Fields - Particles (explosion, sea foam)	C305.2	**BTL1**

9	**is Transformation?** Transformation is the process of introducing changes in the shape size and orientation of the object using scaling rotation reflection shearing & translation etc.	C305.2	**BTL1**
10	**short notes on active and passive transformations.** In the **active transformation** the points x and y represent different coordinates of the same coordinate system. Here all the points are acted upon by the same transformation and hence the shape of the object is not distorted. In a **passive transformation** the points x and y represent same points in the space but in a different coordinate system. Here the change in the coordinates is merely due to the change in the type of the user coordinate system.	C305.2	**BTL1**
12	***What is rotation?*** A 2-D rotation is done by repositioning the coordinates along a circular path, in X = rcos (q + f) and Y = r sin (q + f).	C305.2	**BTL1**
13	***What is scaling?*** The scaling transformations changes the shape of an object and can be carried out by multiplying each vertex (x,y) by scaling factor Sx,Sy where Sx is the scaling factor of x and Sy is the scaling factor of y.	C305.2	**BTL1**
14	***What is shearing?*** The shearing transformation actually slants the object along the X direction or the Y direction as required.ie; this transformation slants the shape of an object along a required plane.	C305.2	**BTL1**
15	***Distinguish between window port & view port?*** A portion of a picture that is to be displayed by a window is known as window port. The display area of the part selected or the form in which the selected part is viewed is known as view port.	C305.2	**BTL2**
16	***Define clipping? And types of clipping.*** Clipping is the method of cutting a graphics display to neatly fit a predefined graphics region or the view port. • Point clipping • Line clipping • Area clipping • Curve clipping • Text clipping	C305.2	**BTL1**
17	***What is covering (exterior clipping)? APRIL/MAY2017*** This is just opposite to clipping. This removes the lines coming inside the windows and displays the remaining. Covering is mainly used to make labels on the complex pictures.	C305.2	**BTL1**
18	***What is the need of homogeneous coordinates?***	C305.2	**BTL1**

	To perform more than one transformation at a time, use homogeneous coordinates or matrixes. They reduce unwanted calculations intermediate steps saves time and memory and produce a sequence of transformations		
19	***Distinguish between uniform scaling and differential scaling.*** When the scaling factors sx and sy are assigned to the same value, a uniform scaling is produced that maintains relative object proportions. Unequal values for sx and sy result in a differential scaling that is often used in design application	C305.2	**BTL2**
20	***What is fixed point scaling?*** The location of a scaled object can be controlled by a position called the fixed point that is to remain unchanged after the scaling transformation	C305.2	**BTL1**
21	***Define Affine transformation.*** A coordinate transformation of the form X= axxx +axyy+bx, y ‟ayxx+ayy y+by is called a two-dimensional affine transformation. Each of the transformed coordinates x „and y „is a linear function of the original coordinates x and y, and parameters aij and bk are constants determined by the transformation type.	C305.2	**BTL1**
22	***Distinguish between bitBlt and pixBlt.*** Raster functions that manipulate rectangular pixel arrays are generally referred to as raster ops. Moving a block of pixels from one location to another is also called a block transfer of pixel values. On a bilevel system, this operation is called a bitBlt (bit-block transfer), on multilevel system t is called pixBlt.	C305.2	**BTL2**
23	***List out the various Text clipping.*** • All-or-none string clipping -if all of the string is inside a clip window, keep it otherwise discards. • All-or-none character clipping – discard only those characters that are not completely inside the window. Any character that either overlaps or is outside a window boundary is clipped. • Individual characters – if an individual character overlaps a clip window boundary, clip off the parts of the	C305.2	**BTL1**

	character that are outside the window.		
24	***What is fixed point scaling?*** The location of a scaled object can be controlled by a position called the fixed point that is to remain unchanged after the scaling transformation	C305.2	**BTL1**
25	***List out the various Text clipping.*** • All-or-none string clipping - if all of the string is inside a clip window, keep it otherwise discards. • All-or-none character clipping – discard only those characters that are not completely inside the window. Any character that either overlaps or is outside a window boundary is clipped. • Individual characters – if an individual character overlaps a clip window boundary, clip off the parts of the character that are outside the window.	C305.2	**BTL1**
26	***Write down the shear transformation matrix. (nov/dec 2012)*** A transformation that distorts the shape of an object such that the transformed shape appears as if the object were composed of internal layers that had been caused to slide over each other is called a shear.	C305.2	**BTL1**
27	***What is the use of clipping?(may/june 2012)*** Clipping in computer graphics is to remove objects, lines or line segments that are outside the viewing volume.	C305.2	**BTL1**
28	***How will you clip a point?(may/june 2013)*** Assuming that the clip window is a rectangle in standard position, we save a point P=(x,y) for display if the following inequalities are satisfied: xwmin ≤ x≤ xwmax ywmin ≤ y≤ ywmax where the edges of the clip window (xwmin ,xwmax, ywmin, ywmax) can be either the world-coordinate window boundaries or viewport boundaries. If any one of these inequalities is not satisfied, the points are clipped (not saved for display).	C305.2	**BTL1**
29	***Define viewing transformation.*** The mapping of a part of world coordinate scene to device coordinates are called viewing transformation. Two dimensional viewing transformations is simply referred to as window to viewport transformation or the windowing transformation.	C305.2	**BTL1**

30.	on window to viewpoint coordinate transformation**. NOV /DEC 2016, APRIL/MAY2017** **ow-to-Viewport mapping** is the process of mapping or transforming a two-dimensional, world-coordinate scene to device coordinates. In particular, objects inside the world or clipping window are mapped to the viewport. The viewport is displayed in the interface window on the screen. In other words, the clipping window is used to select the part of the scene that is to be displayed. The viewport then positions the scene on the output device.	C305.2	**BTL1**

PART - B

S.NO	**QUESTIONS**	**CO**	**BLOOM'S LEVEL**
1	**i)Explain two dimenstional translation and scaling with an example.** **ii)Obtain a transformation matrix for rotating an object and scaling about a specified the pivot point. [MAY/JUNE 2013] NOV /DEC 2016 APRIL/MAY 2017** Refer Notes.	C305.2	**BTL2**
2	**Differentiate parallel and perspective projections and derive their projection matrices. [NOV/DEC 2011,MAY/JUNE 2014].** Refer page no. : 459-466	C305.2	**BTL4**
3	**Differentiate parallel and perspective projections 8 mark [NOV/DEC 2012].** Refer page no. : 459-466	C305.2	**BTL4**
4	**(i) Flip the given quadrilateral A(10,8) , B (22,8) , C (34,17) , D(10,27) about the origin and then zoom it to twice its size. Find the new positions of the quadrilateral [NOV /DEC 2015]** **(ii)Derive the viewing pipeline and transformation matrix [NOV /DEC 2015] NOV /DEC 2016** Refer Notes.	C305.2	**BTL2**
5	**(i) Clip the given line A(1,3), B(4,1) against a window P(2,2), Q(5,2), R(5,4), S(2,4) using Liang Barsky line clipping algorithm [NOV /DEC 2015]** **(ii)Explain two dimensional viewing pipeline in detail [NOV /DEC 2015] APRIL/MAY 2017**	C305.2	**BTL2**

	Refer Notes.		
6	**Explain in detail the Cohen-Sutherland line clipping algorithm with an example** **[NOV/DEC 2011, MAY/JUNE 2012,MAY/JUNE 2014, NOV/DEC 2014].** Refer page no. : 246-248	C305.2	**BTL2**
7	**The reflection along the line y = x is equivalent to the reflection along the X axis followed by counter clockwise rotation by O degrees. Find the value of Theta.** **[NOV/DEC 2013]** Refer Notes	C305.2	**BTL2**
8	**(i)Rotate a triangle [(4,6),(2,2),(6,2)] about the vertex (4,6) by 180º CCW and find the new vertices** **ove that Reflection is equal to Rotation by 180º.** **[MAY/JUNE 2015]** Refer Notes.	C305.2	**BTL2**
9	**With suitable examples, explain the following** **) successive Rotation ,translation and scaling transformation** Refer page no. : 206-208 **NOV /DEC 2016** **ve clipping algorithm.** **[NOV/DEC 2012].** Refer page no. : 264	C305.2	**BTL2**
10	**Explain in detail the Sutherland Hodgeman polygon clipping algorithm with an example 8 Mark** **[NOV/DEC 2016].** Refer page no :225-226	C305.2	**BTL2**

UNIT III

THREE DIMENSIONAL GRAPHICS

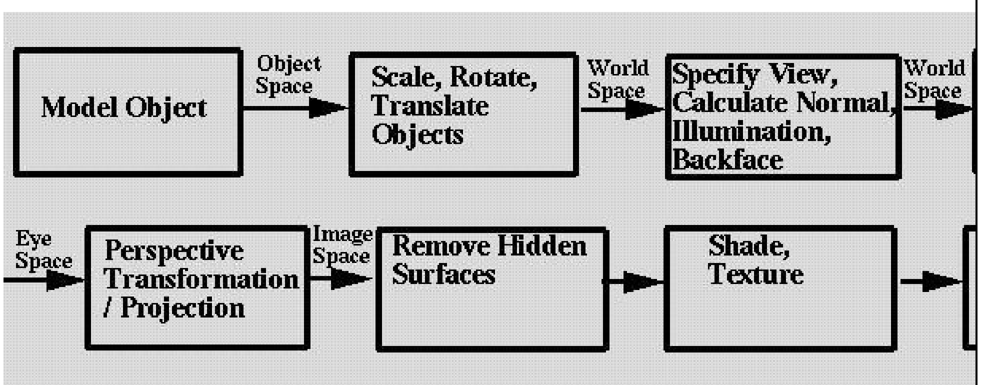
Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces -B-Spline curves and surfaces.

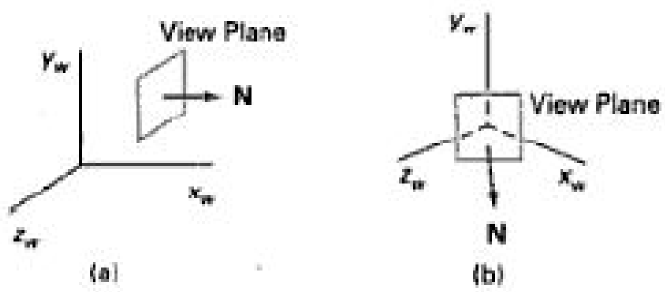
TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping; Visible surface detection methods.

PART - A

S.NO	QUESTIONS	CO	BLOOM'S LEVEL

1	**he general expression of Bezier Bernstein polynomial.** **[NOV/DEC 2013]** The $n + 1$ **Bernstein basis polynomials** of degree n are defined as $$b_{\nu,n}(x) = \binom{n}{\nu} x^{\nu} (1-x)^{n-\nu}, \quad \nu = 0, \ldots, n.$$ Where $\binom{n}{\nu}$ is a binomial coefficient. The Bernstein basis polynomials of degree n form a basis for the vector space Π_n of polynomials of degree at most n. A linear combination of Bernstein basis polynomials $$B_n(x) = \sum_{\nu=0}^{n} \beta_{\nu} b_{\nu,n}(x)$$ is called a **Bernstein polynomial** or **polynomial in Bernstein form** of degree n. The coefficients β_{ν} are called **Bernstein coefficients** or **Bézier coefficients**.	C305.3	**BTL1**
2	**are the advantages of B spline over Bezier curve?** **[MAY/JUNE 2013]** B-spline curves require more information (*i.e.*, the degree of the curve and a knot vector) and a more complex theory than Bézier curves. But, it has more advantages to offset this shortcoming. First, a B-spline curve can be a Bézier curve. Second, B-spline curves satisfy all important properties that Bézier curves have. Third, B-spline curves provide more control flexibility than Bézier curves can do. For example, the degree of a B-spline curve is separated from the number of control points. More precisely, we can use lower degree curves and still maintain a large number of control points. We can change the position of a control point without globally changing the shape of the whole curve (local modification property). Since B-spline curves satisfy the strong convex hull property, they have a finer shape control. Moreover, there are other techniques for designing and editing the shape of a curve such as changing knots.	C305.3	**BTL1**
3	**are spline curves?** **[NOV/DEC 2011, NOV/DEC 2012, NOV/DEC 2014, MAY/JUNE 2014].** ne curve is a flexible strip used to produce a smooth curve through a designated set of points. The spline curve refers to any section curve formed with polynomial sections satisfying specified conditions at the boundary of the pieces	C305.3	**BTL1**
4	**quadric surfaces.** **[NOV/DEC 2011].** es described with second degree equations are known as quadric surfaces. They include spheres, ellipsoids, tori, parabolids and hyperbolids.	C305.3	**BTL1**
5	**entiate parallel projection from perspective projection** **[MAY/JUNE 2012].**	C305.3	**BTL2**

	ctive projection is defined by straight rays of projection drawn from object to the centre of projection and image is drawn where these rays untersect with the viewplane...while parallel projection is defined by parallel lines drawn from object in fixed direction towards the viewplane In perspective projection centre of projection is at finite distance from viewplane and in parallel projection centre of projection lies at infinite distance. Prespective projection form realistic picture of object but parallel projection do not form realistic view of object.		
6	**is Mesh Modeling ? [MAY/JUNE 2015]** A polygon mesh is a collection of vertices, edges and faces that defines the shape of a polyhedral object in 3D computer graphics and solid modeling. The faces usually consist of triangles (triangle mesh), quadrilaterals, or other simple convex polygons, since this simplifies rendering, but may also be composed of more general concave polygons, or polygons with holes.	C305.3	**BTL1**
7	the 3D Viewing **pipeline** **[MAY/JUNE 2014, MAY/JUNE 2015]**  	C305.3	**BTL1**
8	**sent the parametric representation of a cubic Bezier curve. [NOV /DEC 2015]** ; a spline approximation method. A beizer curve section can be fitted to any number of control points. The number of control points to be approximated and their relative position determine the degreeof the Beizer polynomial. As with the interpolation splines, a beizer curve can be specified with boundary conditions, with a characterization matrix, or with blending functions.	C305.3	**BTL1**

	$$P(u)=\sum_{k=0}^{n} p_k BEZ_{k,n}(u), \qquad 0 \le u \le 1$$ $$BEZ_{k,n}(u)=\binom{n}{k}u^k(1-u)^{n-k}, \qquad \binom{n}{k}=\frac{n!}{k!(n-k)!}$$ e coordinates of the control points are blended using Bézier ending functions $BEZ_{k,n}(u)$ lynomial degree of a Bézier curve is one less than the number of ntrol points. points : parabola points : cubic curve points : fourth order curve		
9	**projecting plane and center of projection. [NOV /DEC 2015]** **tion Plane** - The plane on which projection of object is formed A view plane or projection plane is set-up perpendicular to the viewing Zv axis. view reference point is a world coordinate position, which is the origin of the viewing coordinate system. It is chosen to be close to or on the surface of some object in a scene.  projection is 'formed' on the **view plane** (planar geometric projection) rays (projectors) projected from the **center of projection** pass through each point of the models and intersect projection plane. Since everything is synthetic, the projection plane can be in front of the models, inside the models, or behind the models. - Coordinate position (xprojRef, yprojRdf, zprojRef) sets the projection reference point. This point is used as the center of projection if	C305.3	**BTL1**

	projType is set to perspective; otherwise, this point and the center of the viewplane window define the parallel projection vector.		
10	**are the various representation schemes used in three dimensional objects?** ● Boundary representation (B-res) – describe the 3 dimensional object as a set of surfaces that separate the object interior from the environment. ● Space-portioning representation – describe interior properties, by partitioning the spatial region containing an object into a set of small, no overlapping, contiguous solids.	C305.3	**BTL1**
11	***What is Polygon mesh?*** Polygon mesh is a method to represent the polygon, when the object surfaces are tiled, it is more convenient to specify the surface facets with a mesh function. The various meshes are ● Triangle strip – (n-2) connected triangles ● Quadrilateral mesh – generates (n-1)(m-1) Quadrilateral	C305.3	**BTL1**
12	***What is Bezier Basis Function?*** Bezier Basis functions are a set of polynomials, which can be used instead of the primitive polynomial basis, and have some useful properties for interactive curve design.	C305.3	**BTL1**
13	***What is surface patch?*** A single surface element can be defined as the surface traced out as two parameters (u, v) take all possible values between 0 and 1 in a two-parameter representation. Such a single surface element is known as a surface patch.	C305.3	**BTL1**
14	***Write short notes on rendering bi-cubic surface patches of constant u and v method.*** The simple way is to draw the iso-parmetric lines of the surface. Discrete approximations to curves on the surface are produced by holding one parameter constant and allowing the other to vary at discrete intervals over its whole range. This produce curves of constant u and constant v.	C305.3	**BTL1**
15	***What are the advantages of rendering polygons by scan line method?*** i. The max and min values of the scan were easily found. ii. The intersection of scan lines with edges is easily calculated by a simple incremental method. iii. The depth of the polygon at each pixel is easily calculated by an incremental method.	C305.3	**BTL1**
16	***What are the advantages of rendering by patch splitting?*** ● It is fast-especially on workstations with a hardware polygon-rendering pipeline. ● It‟s speed can be varied by altering the depth of sub-division.	C305.3	**BTL1**
17	***Define B-Spline curve.***	C305.3	**BTL1**

	A B-Spline curve is a set of piecewise(usually cubic) polynomial segments that pass close to a set of control points. However the curve does not pass through these control points, it only passes close to them		
18	***What is a spline?*** To produce a smooth curve through a designed set of points, a flexible strip called spline is used. Such a spline curve can be mathematically described with a piecewise cubic polynomial function whose first and second derivatives are continuous across various curve section.	C305.3	**BTL1**
19	***What is the use of control points?*** Spline curve can be specified by giving a set of coordinate positions called control points, which indicates the general shape of the curve, can specify spline curve.	C305.3	**BTL1**
20	***What are the different ways of specifying spline curve?*** ● Using a set of boundary conditions that are imposed on the spline. ● Using the state matrix that characteristics the spline ● Using a set of blending functions that calculate the positions along the curve path by specifying combination of geometric constraints on the curve.	C305.3	**BTL1**
21	***What are the important properties of Bezier Curve?***. • It needs only four control points • It always passes through the first and last control points • The curve lies entirely within the convex half formed by four control points.	C305.3	**BTL1**
22	***Differentiate between interpolation spline and approximation spline.*** When the spline curve passes through all the control points then it is called interpolate. When the curve is not passing through all the control points then that curve is called approximation spline.	C305.3	**BTL2**
23	***What do you mean by parabolic splines?*** For parabolic splines a parabola is fitted through the first three points p1,p2,p3 of the data array of k points. Then a second parabolic arc is found to fit the sequence of points p2, p3, p4. This continues in this way until a parabolic arc is found to fit through points pn-2, pn-1 and pn. The final plotted curve is a meshing together of all these parabolic arcs.	C305.3	**BTL1**
24	***What is cubic spline?*** Cubic splines are a straight forward extension of the concepts underlying parabolic spline. The total curve in this case is a sequence of arcs of cubic rather than parabolic curves. Each cubic satisfies :ax+ bx + cx + d	C305.3	**BTL1**
25	***What is a Blobby object?Give two examples NOV/DEC 2016*** Some objects do not maintain a fixed shape, but change their surface characteristics in certain motions or when in proximity to other objects. That is known as blobby objects. Example – molecular structures, water droplets.	C305.3	**BTL1**

26	***Define Octrees.*** Hierarchical tree structures called octrees, are used to represent solid objects in some graphics systems. Medical imaging and other applications that require displays of object cross sections commonly use octree representation	C305.3	**BTL1**
27	***Define Projection.*** The process of displaying 3D into a 2D display unit is known as projection. The projection transforms 3D objects into a 2D projection plane. The process of converting the description of objects from world coordinates to viewing coordinates is known as projection	C305.3	**BTL1**
28	***What are the steps involved in 3D transformation?*** • Modeling Transformation • Viewing Transformation • Projection Transformation • Workstation Transformation	C305.3	**BTL1**
29	***What do you mean by view plane?*** A view plane is nothing but the film plane in camera which is positioned and oriented for a particular shot of the scene.	C305.3	**BTL1**
30	***What is view-plane normal vector?*** This normal vector is the direction perpendicular to the view plane and it is called as [DXN DYN DZN	C305.3	**BTL1**
31	***What is view distance?*** The view plane normal vector is a directed line segment from the view plane to the view reference point. The length of this directed line segment is referred to as view distance.	C305.3	**BTL1**

PART – B

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**(a) (i) A cube has. its vertices located at A(0, 0, 10), B(10, 0,10), C(10, 10, 10), D (0, 10,10), E(0, 0, 0), F(10, 0, 0), G(10, 10, 0), 11(0, 10, 0). The Y axis is vertical and Z axis is oriented towards**	C305.3	**BTL2**

	the viewer. The cube is being viewed from point (0, 20.80).Calculate the perspective view of the cube on XY plane. **(ii) Discuss on the various visualization techniques in detail. <u>[NOV/DEC 2013]</u>** ReferNotes		
2	**(i) Calculate the new coordinates of a block rotated about x axis by an angle of = 30 degrees. The original coordinates of the block are given relative to the global xyz axis system. A(1, 1, 2) B(2, I, 2) C(2, 2, 2) D(1, 2, 2) E(1, 1, 1) F(2, 1, 1) G(2, 2,1) 11(1, 2, 1).** **(ii) Discuss on Area subdivision method of hidden surface identification** **algorithm.** **<u>[NOV/DEC 2013]</u>** Refer Notes	C305.3	**BTL2**
3	**(i)With suitable examples, explain the 3D transformations.** Refer page no. : 428-443 **<u>[NOV/DEC 2011, MAY/JUNE 2012,MAY/JUNE 2014, MAY/JUNE 2015]</u>** **ite notes on quadric surfaces <u>NOV/DEC 2012]. NOV/DEC 2016 APRIL/MAY 2017</u>** Refer page no. : 330-335	C305.3	**BTL2**
4	**i) Determine the blending function for uniform periodic Bspline curve for n=4,d = 4. <u>[MAY/JUNE 2013]</u>** **ii)Explain any one visible surface identification algorithm. <u>[MAY/JUNE 2013,MAY/JUNE 2014]</u>** Refer Notes	C305.3	**BTL2**
5	**suitable examples, explain all 3D transformations**. **<u>[NOV/DEC 2011, MAY/JUNE 2012].</u>** Refer page no. : 428-443	C305.3	**BTL2**
6	**in about 3D object representations**. **<u>[MAY/JUNE 2012 NOV/DEC 2014].</u>** Refer page no. : 325-340	C305.3	**BTL2**
7	**Discuss the visible surface detection methods in detail ? <u>[NOV/DEC 2014,MAY/JUNE 2015]</u>** Refer page no. : 490-498	C305.3	**BTL6**
8	**s parallel projection and perspective projection in detail. <u>[MAY/JUNE 2014,MAY/JUNE 2015].</u> NOV/DEC 2016** Refer Notes	C305.3	**BTL6**

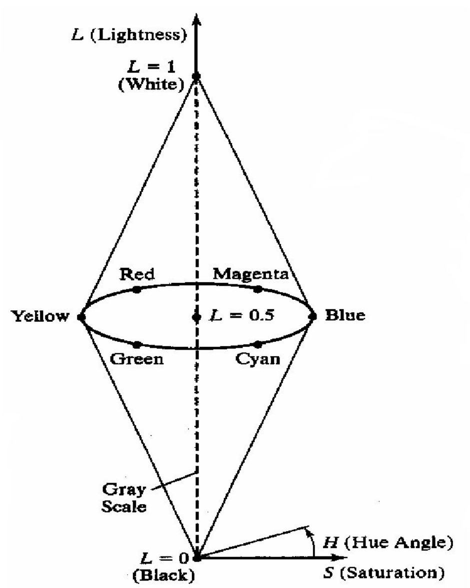
9	**(i)Derive the parametric equation for a cubic Bezier curve [NOV /DEC 2015] <u>APRIL/MAY 2017</u>** **(ii)Compare and contrast orthographic, Axonometric and Oblique projections [NOV /DEC 2015]** Refer Notes.	C305.3	**BTL2**
10	**(i)Write down the Back face detection algorithm [NOV /DEC 2015]** **w will you perform three dimensional rotation about any arbitrary axis , arbitrary plane? [NOV /DEC 2015] NOV /DEC 2016]** Notes.	C305.3	**BTL2**
11	**notes on viewing coordinates 8 mark <u>[NOV/DEC 2016].</u>** Refer page no. : 452-458	C305.3	**BTL2**
12	**notes on viewing coordinates 8 mark <u>[NOV/DEC 2016].</u>** Refer page no. : 452-458	C305.3	**BTL2**
13	**lygon has four vertices located at A(20, 10) B(60, 10) C(60, 30) D(20, 30). Calculate the vertices after applying a transformation matrix to double the size of polygon with point A located on the same place. (8) <u>[NOV/DEC 2013]</u>** **f on polygon meshes NOV /DEC 2016.** Refer Notes.	C305.3	**BTL2**
14	**s about 3Dimentional display methods. NOV/DEC2016** Refer page no. : 428-443	C305.3	**BTL6**

UNIT IV

ILLUMINATION AND COLOUR MODELS

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model -YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection

PART – A

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**the Color Model HLS double cone.** **[MAY/JUNE 2013]** The **HLS** color space, also called **HSL**, stands for "Hue, Saturation, Lightness." While the HSV (Hue Saturation Value) can be viewed graphically as a color cone or hexcone, HSL is drawn as a double cone or double hexcone. Both systems are deformed versions of the RGB colour cube. The two apexes of the HLS double hexcone correspond to black and white. The angular parameter corresponds to hue, distance from the axis corresponds to saturation, and distance along the black-white axis corresponds to lightness. 	C305.4	BTL1
2	**is dithering. When does this occur? [NOV /DEC 2015] NOV /DEC 2016** ing is color approximation. It occurs when an image is opened In a different machine using different applications. ing is the attempt by a computer program to approximate a color from a mixture of other colors when the required color is not available. For example, dithering occurs when a color is specified for a Web page that a browser on a particular operating system can't support. The browser will then attempt to replace the requested color with an approximation composed of two or more other colors it can produce. The result may or may not be acceptable to the graphic designer. It may also appear somewhat grainy since it's	C305.4	BTL1

<table>
<tr><td></td><td>composed of different pixel intensities rather than a single intensity over the colored space.</td><td></td><td></td></tr>
<tr><td>3</td><td>are subtractive colors [MAY/JUNE 2012].
btractive color model explains the mixing of a limited set of dyes, inks, paint pigments or natural colorants to create a wider range of colors, each the result of partially or completely subtracting (that is, absorbing) some wavelengths of light and not others. The color that a surface displays depends on which parts of the visible spectrum are not absorbed and therefore remain visible.</td><td>C305.4</td><td>BTL1</td></tr>
<tr><td>4</td><td>lo you mean by temporal aliasing [MAY/JUNE 2012].
oral anti-aliasing seeks to reduce or remove the effects of temporal aliasing. Temporal aliasing is caused by the sampling rate (i.e. number of frames per second) of a scene being too low compared to the transformation speed of objects inside of the scene; this causes objects to appear to jump or appear at a location instead of giving the impression of smoothly moving towards them. To avoid aliasing artifacts altogether, the sampling rate of a scene must be at least twice as high as the fastest moving object.</td><td>C305.4</td><td>BTL1</td></tr>
<tr><td>5</td><td>he difference between CMY and HSV color model
[NOV/DEC 2012,NOV/DEC 2014].
Magenta, Yellow (Black) – CMY(K) • A subtractive color model
<table>
<tr><th>COLOR</th><th>RBS</th><th>ECTS</th></tr>
<tr><td></td><td></td><td>nd green</td></tr>
<tr><td>ta</td><td></td><td>nd red</td></tr>
<tr><td>v</td><td></td><td>d green</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
olor model is based on polar coordinates, not Cartesian coordinates.
s a non-linearly transformed (skewed) version of RGB cube
quantity that distinguishes color family, say red from yellow, green from blue (what color?)
tion (Chroma): color intensity (strong to weak). Intensity of distinctive hue, or degree of color sensation from that of white or grey (what purity?) Value (luminance): light color or dark color (what strength?)</td><td>C305.4</td><td>BTL1</td></tr>
<tr><td>6</td><td>on the uses of Chromaticity diagram.
<u>[MAY/JUNE 2015] APRIL/MAY 2017</u>
Chromaticity is an objective specification of the quality of a color regardless of its luminance. Chromaticity consists of two independent parameters, often specified as hue (h) and colorfulness (s), where the latter is alternatively called saturation, chroma, intensity, or excitation purity. This number of parameters follows from trichromacy of vision of most humans, which is assumed by most models in color science.</td><td>C305.4</td><td>BTL1</td></tr>
</table>

	The chromaticity diagram is also used to define *color gamuts*, or color ranges, that show the effect of adding colors together. Color gamuts are simple polygons positioned on the diagram		
7	**rt the given color value to CMY color mode where R=0.23 , G=0.57, B=0.11. [NOV /DEC 2015]** C= 1-R , M= 1-G , Y= 1- B C=1-0.23=0.77 M=1-0.57=0.43 Y=1-0.11=0.89	C305.4	**BTL2**
8	**the difference between CMY and HSV color models.(nov/dec 2012)** The HSV (Hue, Saturation, Value) model is a color model which uses color descriptions that have a more intuitive appeal to a user. To give a color specification, a user selects a spectral color and the amounts of white and black that is to be added to obtain different shades, tint, and tones. A color model defined with the primary colors cyan, magenta, and yellow is useful for describing color output to hard-copy devices.	C305.4	**BTL2**
9	**are subtractive colors?(may/june 2012)** **RGB** model is an additive system, the Cyan-Magenta-Yellow (CMY) model is a subtractive color model. In a subtractive model, the more that an element is added, the more that it subtracts from white. So, if none of these are present the result is white, and when all are fully present the result is black.	C305.4	**BTL1**
10	**YIQ color model** In the YIQ color model, luminance (brightness) information in contained in the Y parameter, chromaticity information (hue and purity) is contained into the I and Q parameters. A combination of red, green and blue intensities are chosen for the Y parameter to yield the standard luminosity curve. Since Y contains the luminance information, black and white TV monitors use only the Y signal.	C305.4	**BTL1**
11	**What do you mean by shading of objects?(nov/dec 2011)** A shading model dictates how light is scattered or reflected from a surface. The shading models described here focuses on achromatic light. **Achromatic light** has brightness and no color; it is a shade of gray so it is described by a single value its intensity. A shading model uses two types of light source to illuminate the objects in a scene : **point light sources** and **ambient light**.	C305.4	**BTL1**
12	**is texture?(nov/dec 2011)** The realism of an image is greatly enhanced by adding surface texture to various faces of a mesh object. The basic technique begins with some texture function, **texture(s,t)** in **texture space** , which has two parameters s and t. The function texture(s,t)	C305.4	**BTL1**

	produces a color or intensity value for each value of s and t between 0(dark)and 1(light).		
13	**are the types of reflection of incident light?(nov/dec 2013)** There are two different types of reflection of incident light Diffuse scattering. Specular reflections.	C305.4	**BTL1**
14	**: rendering (may/june 2013)** **Rendering** is the process of generating an image from a model (or models in what collectively could be called a *scene*file), by means of computer programs. Also, the results of such a model can be called a rendering	C305.4	**BTL1**
15	**entiate flat and smooth shading (may/june 2013)** The main distinction is between a shading method that accentuates the individual polygons (**flat shading**) and a method that blends the faces to de-emphasize the edges between them (**smooth shading**).	C305.4	**BTL2**
16	**: shading (may/june 2012)** **Shading** is a process used in drawing for depicting levels of darkness on paper by applying media more densely or with a darker shade for darker areas, and less densely or with a lighter shade for lighter areas.	C305.4	**BTL1**
17	**is a shadow? (nov/dec 2012)** Shadows make an image more realistic. The way one object casts a shadow on another object gives important visual clues as to how the two objects are positioned with respect to each other. Shadows conveys lot of information as such, you are getting a second look at the object from the view point of the light source	C305.4	**BTL1**
18	**are two methods for computing shadows?** Shadows as Texture. Creating shadows with the use of a shadow buffer.	C305.4	**BTL1**
19	**any two Drawbacks of Phong Shading** Relatively slow in speed. More computation is required per pixel.	C305.4	**BTL1**
20	**are the two common sources of textures?** Bitmap Textures. Procedural Textures.	C305.4	**BTL1**
21	**two types of smooth shading.** Gouraud shading. Phong shading.	C305.4	**BTL1**

22	***What is a color model?*** A color model is a method for explaining the properties or behavior of color within some particular context. Example: XYZ model, RGB model.	C305.4	**BTL1**
23	***Define intensity of light.*** Intensity is the radiant energy emitted per unit time, per unit solid angle, and per unit projected area of source.	C305.4	**BTL1**
24	***What is hue?*** The perceived light has a dominant frequency (or dominant wavelength). The dominant frequency is also called as hue or simply as color.	C305.4	**BTL1**
25	***What is purity of light?*** Purity describes how washed out or how "pure" the c olor of the light appears. pastels and pale colors are described as less pure	C305.4	**BTL1**
26	***Define the term chromacity.*** The term chromacity is used to refer collectively to the two properties describing color characteristics: purity and dominant frequency	C305.4	**BTL1**
27	***How is the color of an object determined?*** When white light is incident upon an object, some frequencies are reflected and some are absorbed by the object. The combination of frequencies present in the reflected light determines what we perceive as the color of the object	C305.4	**BTL1**
28	***Define purity or saturation.*** Purity describes how washed out or how "pure" the color of the light appears	C305.4	**BTL1**
29	***Define complementary colors.*** If the two color sources combine to produce white light, they are referred to as 'complementary colors. Examples of complementary color pairs are red and cyan, green and magenta, and blue and yellow.	C305.4	**BTL1**
30	***Define primary colors.*** The two or three colors used to produce other colors in a color model are referred to as primary colors.	C305.4	**BTL1**
31	***State the use of chromaticity diagram.*** Comparing color gamuts for different sets of primaries.Identifying complementary colors. Determining	C305.4	**BTL1**

	dominant wavelength and purity of a given color.		
32	***What is Color Look up table?*** In color displays, 24 bits per pixel are commonly used, where 8 bits represent 256 level for each color. It is necessary to read 24- bit for each pixel from frame buffer. This is very time consuming. To avoid this video controller uses look up table to store many entries to pixel values in RGB format. This look up table is commonly known as colour table	C305.4	**BTL1**

PART - B

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**Briefly explain different color models in detail. [MAY/JUNE 2013, MAY/JUNE 2014, MAY/JUNE 2015] APRIL/MAY 2017** Refer page no. : 592, 595-597	C305.4	**BTL2**
2	**Discuss on the various colour models in detail. [NOV/DEC2013]** Refer page no. : 592, 595-597	C305.4	**BTL2**
3	**Write notes on YIQ and HSV color model. [NOV/DEC 2016].** Refer page no. : 592, 595-597	C305.4	**BTL1**
4	**are and contrast between RGB and CMY color models [MAY/JUNE 2012].** Refer page no. : 592,595	C305.4	**BTL4**
5	**in RGB color model in detail [NOV/DEC 2014]. [NOV/DEC 2016].** Refer page no. : 592-593	C305.4	**BTL2**
6	Discuss the color spectrum, color concepts and color models in detail. **[NOV /DEC 2015]** Refer page no. : 592, 595-597	C305.4	**BTL6**

7	Explain the illumination models in detail **[NOV /DEC 2015]** Refer page no. : 495-497	C305.4	**BTL2**
8	Explain about Halftone approximation and Dithering techniques in detail.**NOV/DEC 2016 APRIL/MAY 2017** Refer page no. : 610-613	C305.4	**BTL2**

UNIT V

ANIMATIONS & REALISM

ANIMATION GRAPHICS: Design of Animation sequences – animation function – raster animation –key frame systems – motion specification –morphing – tweening.

COMPUTER GRAPHICS REALISM: Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons –space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

PART - A

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**are keyframe systems** **[NOV/DEC 2012].** ıme systems are specialized animation languages designed simply to generate the in-betweensfrom the user specified keyframes.	C305.5	**BTL1**
2	**is animation? [NOV/DEC 2011]. / Give the basic principle of animation [NOV /DEC 2015]** ɔuter animation refers to any time sequence of visual changes in a scene. Computer animations can be generated by changing camera parameters such as position, orientation and focal length. Persistence of vision is the basic principle of animation.	C305.5	**BTL1**
3	**keyframes** **[NOV/DEC 2011, MAY/JUNE 2014].** frame is detailed drawing of the sceneat a certain time in the animation sequence. Within each keyframe each object is positioned according to the time for that frame.	C305.5	**BTL1**
4	**fractals_** **[NOV/DEC 2011, MAY/JUNE 2012]. [MAY/JUNE 2013]** **ctal** is a mathematical set that has a fractal dimension that usually exceeds its and may fall between the integers. Many of the curves and pictures have a particularly important property called self-similar. This means that they appear the same at every scale: No matter how much one enlarges a picture of the curve, it has the same level of detail.	C305.5	**BTL1**
5	**down the different types of animation.[NOV/DEC 2013, NOV/DEC 2014]** are various types of animation techniques practiced by film makers all over the world. Classical and digital 2D animation, digital 3D Animation, stop-motion, clay animation, cut-out animation, paint-on-glass animation, drawn-on-film animation, and experimental animation are just a few among the many existing forms of animation	C305.5	**BTL1**
6	**ıe attributes of turtle in graphics. [NOV /DEC 2015]** The turtle program is a Robert that can move in 2 dimensions and it has a pencil for drawing. The turtle is defined by the following parameters. • Position of the turtle (x, y)	C305.5	**BTL1**

	• Heading of the turtle 0 the angle from the x axis. Attributes : Location, Orientation, and Pen		
7	**computer graphics animation.** Computer graphics animation is the use of computer graphics equipment where the graphics output presentation dynamically changes in real time. This is often also called real time animation	C305.5	**BTL1**
8	***What is tweening?*** It is the process, which is applicable to animation objects defined by a sequence of points, and that change shape from frame to frame	C305.5	**BTL1**
9	***Define frame.*** One of the shape photographs that a film or video is made of is known as frame.	C305.5	**BTL1**
10	***What is the normal speed of a visual animation?*** Visual animation requires a playback of at least 25 frames per second.	C305.5	**BTL1**
11	***What are the different tricks used in computer graphics animation?*** a. Color look Up Table manipulation b. Bit plane manipulation c. Use of UDCS d. Special drawing modes e. Sprites f. Bit blitting	C305.5	**BTL1**
12	***What is solid modeling?*** The construction of 3 dimensional objects for graphics display is often referred to as solid modeling.	C305.5	**BTL1**
13	***What is an intuitive interface?*** The intuitive interface is one, which simulates the way a person would perform a corresponding operation on real object rather than have menu command.	C305.5	**BTL1**
14	***What is Sprite?*** A Sprite is graphics shape in animation and games programs. Each sprite provided in the system has its own memory area similar to but smaller than pixel	C305.5	**BTL1**
15	***What is the UDC technique?*** UDC stands for User Defined Character set. It is graphics animation trick, which is used in early microcomputer system.	C305.5	**BTL1**
16	***What is computer graphics realism?*** The creation of realistic picture in computer graphics is known as realism.It is important in fields such as simulation, design, entertainments, advertising, research, education, command, and control.	C305.5	**BTL1**

17	***How realistic pictures are created in computer graphics?*** To create a realistic picture, it must be process the scene or picture through viewing-coordinate transformations and projection that transform three-dimensional viewing coordinates onto two-dimensional device coordinates	C305.5	**BTL1**
18	***What is a Fractal Dimension?*** Fractal has infinite detail and fractal dimension. A fractal imbedded in n-dimensional space could have any fractional dimension between 0 and n. The Fractal Dimension D= LogN / Log S Where N is the No of Pieces and S is the Scaling Factor	C305.5	**BTL1**
19	***What is random fractal?*** The patterns in the random fractals are no longer perfect and the random defects at all scale.	C305.5	**BTL1**
20	***What is geometric fractal?*** A geometric fractal is a fractal that repeats self-similar patterns over all scales.	C305.5	**BTL1**
21	***What is Koch curve?*** The Koch curve can be drawn by dividing line into 4 equal segments with scaling factor 1/3. and middle 2 segments are so adjusted that they form adjustment sides of an equilateral triangle.	C305.5	**BTL1**
22	***What is turtle graphics program?*** • The turtle program is a Robert that can move in 2 dimensions and it has a pencil for drawing. The turtle is defined by the following parameters Position of the turtle (x, y) • Heading of the turtle 0 the angle from the x axis.	C305.5	**BTL1**
23	***What is graftals?*** Graftals are applicable to represent realistic rendering plants and trees. A tree is represented by a String of symbols 0, 1.	C305.5	**BTL1**
24	***What is a Particle system?*** A particle system is a method for modeling natural objects, or other irregularly shaped objects, that exhibit “fluid- like” properties. Particle systems are suitable for realistic rendering of fuzzy objects, smoke, sea and grass	C305.5	**BTL1**

25	***Give some examples for computer graphics standards*.** ● CORE – The Core graphics standard ● GKS -- The Graphics Kernel system ● PHIGS – The Programmers Hierarchical Interactive Graphics System. ● GSX – The Graphics system extension ● NAPLPS – The North American presentation level protocol syntax.	C305.5	**BTL1**
26	**is raster animation?** **<u>Raster Animations</u>** **1.** On raster systems, real-time animation in limited applications can be generated using raster operations. **2.** Sequence of raster operations can be executed to produce real time animation of either 2D or 3D objects. **3.** We can animate objects along 2D motion paths using the color-table transformations. **a.** Predefine the object as successive positions along the motion path, set the successive blocks of pixel values to color table entries. **b.** Set the pixels at the first position of the object to „on‟ values, and set the pixels at the other object positions to the background color. **c.** The animation is accomplished by changing the color table values so that the object is „on‟ at successive positions along the animation path as the preceding position is set to the background intensity.	C305.5	**BTL1**
27	**is morphing?NOV/DEC 2016** Transformation of object shapes from one form to another is called Morphing. Morphing methods can be applied to any motion or transition involving a change in shape. Morphing is a special effect in motion pictures and animations that changes (or morphs) one image or shape into another through a seamless transition. Most often it is used to depict one person turning into another through technological means or as part of a fantasy or surreal sequence	C305.5	**BTL1**
28	**short notes about successive refinement curves.** By repeatedly refining a simple curve very complex curves can be fashioned Ex. Koch curve - Produces an infinitely long line within a region of finite area . *<u>Approach:</u>*	C305.5	**BTL1**

	1. To form K_{n+1} from K_n , subdivide each segment of K_n into 3 equal parts and replace the middle part with a bump in the shape of an equilateral triangle. 2. Each generation of the Koch curve consists of four version of the previous generation		
29	**is ray tracing?** R**ay tracing** is a technique for generating an image by **tracing**the path of light through pixels in an image plane and simulating the effects of its encounters with virtual objects. Ray Tracing or Ray Casting - Provides a related , powerful approach to render scenes. Used for 3D image generation.	C305.5	**BTL1**
30	**ie different ways of adding surface texture.** Texture Mapping, Procedural Texturing Methods, Frame Mapping, Solid Texture, Wood grain texture, 3D Noise and Marble Texture.	C305.5	**BTL1**
31	**Differentiate key frame systems from parameterized systems.NOV/DEC 2016** Parameterized systems are systems that involve numerous instantiations of the same finite-state module, and depend on a parameter which defines their size. Examples of parameterized systems include sensor systems, telecommunication protocols, bus protocols, cache coherence protocols, and many other protocols that underly current state-of-the-art systems. A **key frame** in animation and filmmaking is a drawing that defines the starting and ending points of any smooth transition. The drawings are called "**frames**" because their position in time is measured in frames on a strip of film. A sequence of key frames defines which movement the viewer will see, whereas the position of the key frames on the film, video, or animation defines the timing of the movement.	C305.5	**BTL2**
32	**Write the importance of morphing.NOV/DEC 2016** **Morphing** is a special effect in motion pictures and animations that changes (or morphs) one image or shape into another through a seamless transition. Most often it is used to depict one person turning into another through technological means or as part of a fantasy or surreal sequence. Traditionally such a depiction would be achieved through cross-fading techniques on film	C305.5	**BTL1**

PART -B

S.NO	QUESTIONS	CO	BLOOM'S LEVEL
1	**Briefly explain different types of fractals with neat diagram and also explain how to construct fractals and the uses of fractals in computer graphics.** **[MAY/JUNE 2013] NOV/DEC 2016** Refer page no. : 384-389	C305.5	**BTL2**
2	**Mention the salient features of Animation. [NOV/DEC 2014]** Refer page no. : 592-593	C305.5	**BTL**
3	**Write short notes on techniques for Computer Animation. [MAY/JUNE 2015]** Refer Notes	C305.5	**BTL1**
4	**(i) Distinguish between raster animation and key frame animation in detail [NOV /DEC 2015] APRIL/MAY 2017** **(ii) How will you generate grammar based model? Explain [NOV /DEC 2015] APRIL/MAY 2017** Refer page no. : 592-593	C305.5	**BTL4**
5	**Write Short Notes on [NOV /DEC 2015] APRIL/MAY 2017** **(i) Ray tracing (6) NOV/DEC 2016** **(ii) Koch curves (5)** **(iii) Morphing (5)** Refer Notes	C305.5	**BTL1**
6	**in the different methods of motion specification? NOV/DEC 2016** Refer Notes	C305.5	**BTL2**
7	**on the forces affecting object motion. NOV/DEC 2016** **1. gravitational** **2. electromagnetic** **3. friction** Refer Notes	C305.5	**BTL1**