

Part A**Answer any ten questions****Each question carries 2 marks**

1. Create motion pictures , music video , cartoon animation films -viewing films and television shows– Utility in the movie industry and game industry.
2. Memory area that stores picture definition – holds the set of intensity values for all the screen points.
3. Impact printers utilize hammers, pins or wheels to hit against an inked ribbon to print on paper whereas non-impact printers use a spray of ink , laser or heat and pressure to execute printing.
4. A circle is the set of all points in a plane situated at a fixed distance from a fixed point in the plane- $(x-a)^2 + (y-b)^2 = r^2$ where r is the radius , a and b are the coordinates of the center (a,b) .
5. A serif is a small line or stroke regularly attached to the end of a larger stroke in a letter or symbol.
6. Reflection is the minor image of original object – it is a rotation operation with 180 degree- in reflection transformation , the size of object does not change.
7. The area chosen for this display is called window- an area in object space.- what is to be displayed
Viewport :An area on display device to which a window is mapped – where to be displaced
8. All or none string clipping - all or none character clipping – text clipping.
9. In perspective projection , the distance from the centre of projection plane is finite and the size of the object varies inversely with distance which looks more realistic.
10. A quadtree is a spatial data structure which has 4 branches attached to node where as an octree has 8 branches attached to node.
11. Animation is the process of creating a scene through the rapid display of pictures and motions.
12. Computer animation function includes object manipulation and rendering camera motions, the generation of in-betweens.

Part B**Answer any six questions****Each question carries 5 marks**

13. Beam penetration method – used in random-scan monitors- two layers of phosphor(red and green) fig.- advantages (inexpensive) – disadvantage (only four colour are possible, quality of picture is not good) -2.5 marks

Shadow- Mark method- used in raster scan system – produce wide range of colours – used in the majority of televisions sets and monitors-fig.- advantages (realistic , million colours ,shadow scenes) – disadvantages (convergence problem, relatively poor resolution , relatively expensive) -2.5 marks

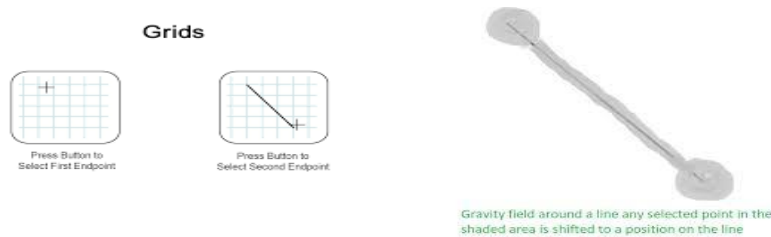
14. DDA – Digital Differential Analysis – a scan conversion line algorithm based on calculation dx or dy using $dy = m * dx$, $dx = dy/m$ – $dx = x_2 - x_1$, $dy = y_2 - y_1$, $m = (y_2 - y_1)/(x_2 - x_1)$ – fig. – explanation -5 marks

15.

K	P_k	(X_{k+1}, Y_{k+1})	K	P_k	(X_{k+1}, Y_{k+1})
0	6	(21,11)	5	6	(26,15)
1	2	(22,12)	6	2	(27,16)
2	-2	(23,12)	7	-2	(28,16)
3	14	(24,13)	8	14	(29,17)
4	10	(25,14)	9	10	(30,18)

16. Translation – the straight line movement of an object from one position to another – $x_1 = x + t_x$, $y_1 = y + t_y$ where t_x and t_y are translation distances along x and y axis – fig – matrix representation - 2.5 Marks
Rotation : It is a process of changing the angle of the object with angle of rotation and rotation point - fig - matrix representation – 2.5 marks

17. Grids:- When a grid is used, any input coordinate position is rounded to the nearest intersection of two grid lines. Grids facilitate object constructions, because a new line can be joined easily to a previously drawn line by selecting any position near the endpoint grid intersection of one end of the displayed line. Spacing between grid line is often an option that can be set by the user. -2.5 marks



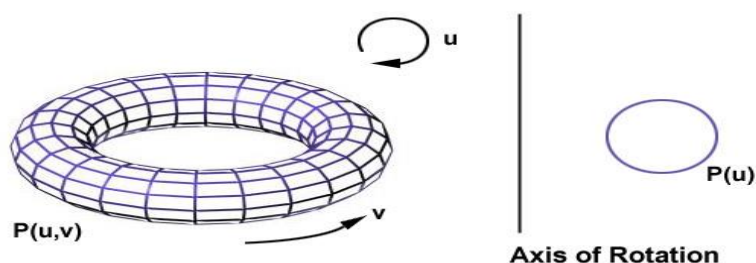
Gravity field:- When it is needed to connect lines at positions between endpoints, the graphics packages convert any input position near a line to a position on the line. The conversion is accomplished by creating a gravity area around the line. Any related position within the gravity field of line is moved to the nearest position on the line. It illustrated with a shaded boundary around the line. -2.5 marks

18. Sweep representations are useful in creating two and a half dimensional solid models and it look like 3d objects. In the direction of movement, consider only the thickness of objects cross section -Two categories of solids are considered of this kind: solid of uniform thickness and axisymmetric solids (solids of revolution). We have a profile like(point, circle etc) and a path, it may be a straight line or curve-Linear sweep is divided into translational sweep (straight line) and rotational sweep.

Figure below illustrates a translational sweep. The periodic spline curve in Figure (a) defines the object cross section.



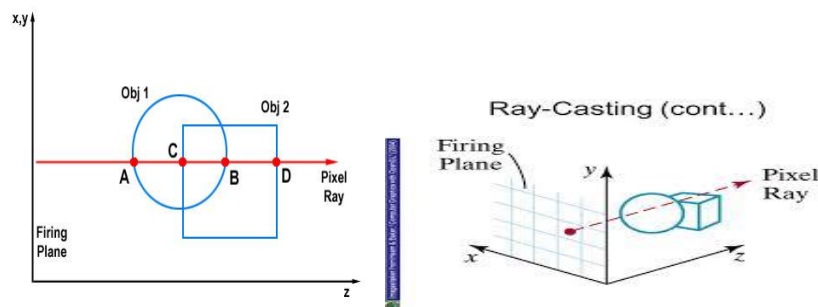
Constructing a solid with a translational sweep. Translating the control points of the periodic spline curve in (a) generates the solid shown in (b), whose surface can be described with point function $P(u, v)$.



Example of torus designed using a rotational sweep. The periodic spline cross section is rotated about an axis of rotation specified in the plane of the cross section.

19. Modelling technique to combine the volumes occupied by overlapping three dimensional objects using the set operations is known as CSG. It creates a new volume by applying union, intersection and difference operations to two specified volumes. This method is also known as building block approach -fig. -2.5 marks

Ray Casting method is often used to implement CSG operation when objects are described with boundary representations.



Operation	Surface Limit
Union	A, D
Intersection	C, B
Difference ($\text{Obj}_2 - \text{Obj}_1$)	B, D

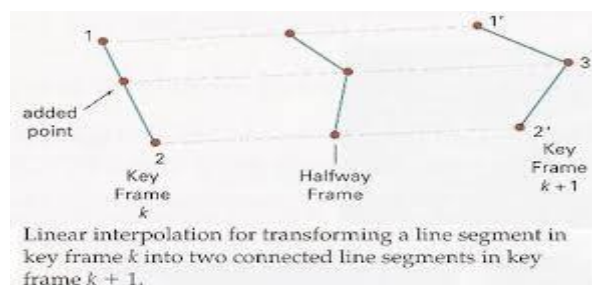
-2.5 marks

20. A general-purpose language, such as C, Lisp, Pascal, or FORTRAN, is often used to program the animation functions, but several specialized animation languages have been developed. Animation functions include a graphics editor, a key-frame generator, an in-between generator, and standard graphics routines.

21. Morphing: Transformation of object shapes from one form to another is called Morphing.

Morphing is an effect that can be used to manipulate still images or to create interesting animated transformations.

Morphing allows you to smoothly blend two images so that one image seems to melt into the next often producing some amusing results- Given two key frames for an object transformation, we first adjust the object specification in one of the frames so that the number of polygon edges (or the number of vertices) is the same for the two frames.



Part C

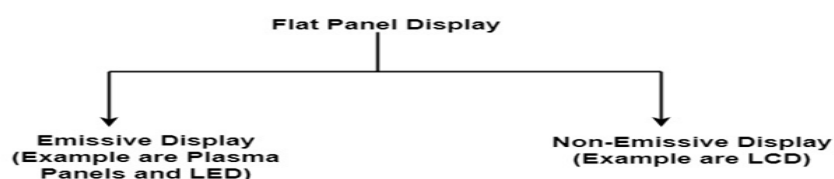
Answer any two questions

Each question carries 15 marks

22.

The Flat-Panel display refers to a class of video devices that have reduced volume, weight and power requirement compare to CRT.

Example: Small T.V. monitor, calculator, pocket video games, laptop computers, an advertisement board in elevator. (3 Marks)



a. Emissive Display: The emissive displays are devices that convert electrical energy into light. Examples are Plasma Panel, thin film electroluminescent display and LED (Light Emitting Diodes). (3 Marks)

b. Non-Emissive Display: The Non-Emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. Examples are LCD (Liquid Crystal Device). (3 Marks)

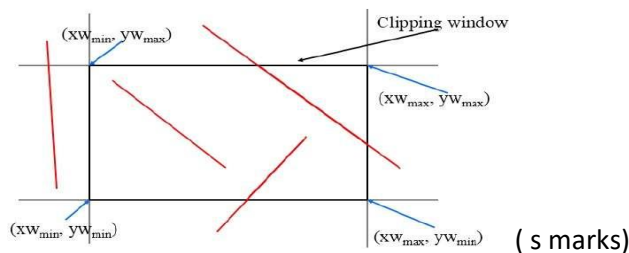
In an LED, a matrix of diodes is organized to form the pixel positions in the display and picture definition is stored in a refresh buffer. Data is read from the refresh buffer and converted to voltage levels that are applied to the diodes to produce the light pattern in the display (2 Marks)

Liquid Crystal Displays are the devices that produce a picture by passing polarized light from the surroundings or from an internal light source through a liquid-crystal material that transmits the light.

Fig- advantages – disadvantages (4 Marks)

23. Cohen-Sutherland Line Clippings

This algorithm uses the clipping window as shown in the following figure. The minimum coordinate for the clipping region is (XW_min, YW_min) and the maximum coordinate for the clipping region is (XW_max, YW_max) .



We will use 4-bits to divide the entire region. These 4 bits represent the Top, Bottom, Right, and Left of the region as shown in the following figure. Here, the **TOP** and **LEFT** bit is set to 1 because it is the **TOP-LEFT** corner.

	RIGHT	LEFT
TOP	1001	1010
BOTTOM	0001	0010
	0101	0110

There are 3 possibilities for the line –

- Line can be completely inside the window (This line should be accepted).
- Line can be completely outside of the window (This line will be completely removed from the region).
- Line can be partially inside the window (We will find intersection point and draw only that portion of line that is inside region). (5 Marks)

Algorithm

Step 1 – Assign a region code for each endpoints.

Step 2 – If both endpoints have a region code **0000** then accept this line.

Step 3 – Else, perform the logical **AND** operation for both region codes.

Step 3.1 – If the result is not **0000**, then reject the line.

Step 3.2 – Else you need clipping.

Step 3.2.1 – Choose an endpoint of the line that is outside the window.

Step 3.2.2 – Find the intersection point at the window boundary (base on region code).

Step 3.2.3 – Replace endpoint with the intersection point and update the region code.

Step 3.2.4 – Repeat step 2 until we find a clipped line either trivially accepted or trivially rejected.

Step 4 – Repeat step 1 for other lines. (5 marks)

24. The most commonly used boundary representation for a 3D **graphics** object is a set of **surface polygons** that enclose the object interior. ... The **polygon surfaces** are common in design and solid-modelling applications, since their wireframe display can be done quickly to give general indication of **surface** structure- As information for each polygon is input, the data are placed into tables that are to be used in the subsequent' processing, display, and manipulation of the objects in a scene.(3 marks)

Polygon data tables can be organized into two groups:

Geometric tables - attribute tables.

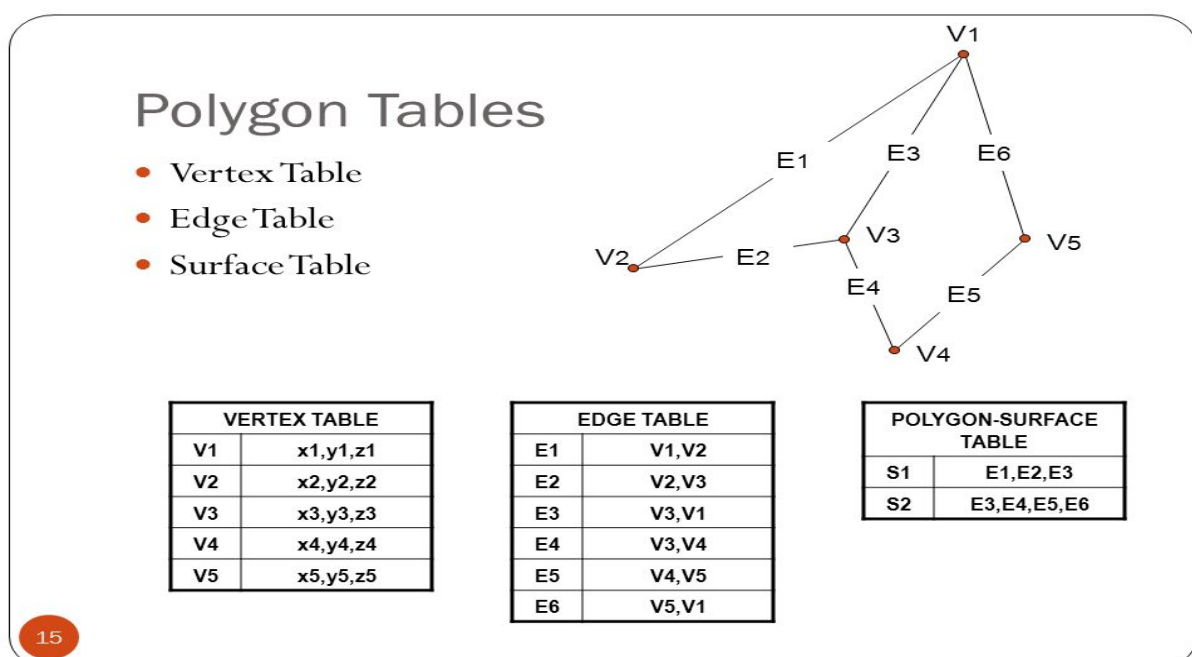
Geometric data tables contain vertex coordinates and parameters to identify the spatial orientation of the polygon surfaces. -Attribute information for an object includes parameters specifying the degree of transparency of the object and its surface reflectivity and texture characteristics. (2 marks)

A convenient organization for storing geometric data is to create three lists: **a vertex table, an edge table, and a polygon table.**

In this method, the surface is specified by the set of vertex coordinates and associated attributes. As shown in the following figure, there are five vertices, from v_1 to v_5 .

- Each vertex stores x, y, and z coordinate information which is represented in the table as $v_1: x_1, y_1, z_1$.
- The Edge table is used to store the edge information of polygon. In the following figure, edge E_1 lies between vertex v_1 and v_2 which is represented in the table as $E_1: v_1, v_2$.
- Polygon surface table stores the number of surfaces present in the polygon. From the following figure, surface S_1 is covered by edges E_1, E_2 and E_3 which can be represented in the polygon surface table as $S_1: E_1, E_2, \text{ and } E_3$.

Coordinate values for each vertex in the object are stored in the vertex table. The edge table contains pointers back into the vertex table to identify the vertices for each polygon edge. And the polygon table contains pointers back into the edge table to identify the edges for each polygon. (5 marks)



15

Some tests that could be performed by the graphics packages are (1) that every vertex is listed as an endpoint for at least two edges, (2) that every edge is part of at least one polygon and (3) that every polygon is closed, (4) that each polygon has at least one shared edge and (5) that if the edge table contains pointers to polygons ,every edge referenced by a polygon pointer has a reciprocal pointer back to the polygon. $E1:V1,V2,S1$

$E2:V2,V3.S1. E3: V3,V1,S1,S2 E4:V3,V4,S2 E5:V4,V5,S2 E6:V5,V1,S2$ (5 marks)

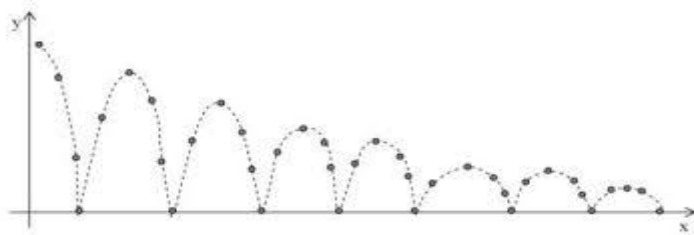
25. Various ways in which motions of objects can be specified as: •Direct Motion Specification. •Goal-Directed Systems. •Kinematics and Dynamics

Direct Motion Specification:

Straight forward method for defining a motion sequence is direct specification of motion. We explicitly give the rotation angles and translation vectors. The geometric transformations are applied to transform coordinate positions.

- Explicit parameters are provided
- Explicit rotation angles are given to object in any frame.
- Explicit translation vectors are given
- Geometric transformation is applied to transform coordinate position.

Eg. Bouncing Ball.



Approximating the motion of a bouncing ball with a damped sine function.

Advantages are 1. Parameters are provided to any object easily and explicitly. 2. Coordinate positions are easily applied to transform the object.

Disadvantage: 1. No implicit parameter can be transform. 2. Acceleration of any object is possible.

(5 marks)

Goal directed systems

These systems are referred to as goal directed because they determine specific motion parameters given the goals of the animation. For example, We could specify that we want an object to "walk " or to "run" to a particular destination. Or We could state that we want an object to "pick up " some other specified object. Input directives are then interpreted in terms of component motions that will accomplish the task.

- Provide general term specification of the motion.
- Abstractly describing the action(expressing a quality or characteristic apart from any specific object)
- These are referred as goal directed because they provide specific motion of the object.

Eg. Walk, to run etc.

(5 marks)

Kinematics

With a kinetic description , we specify the animation by giving motion parameters(position, velocity, acceleration) without reference to the forces that cause the motion.

- Specification or study of motion independent of the underlying forces that produce the motion (position ,velocity and acceleration)
- Consider only motion (movement of object from one position to another)
- Time intervals are measured in min., sec. ,and hours. These time intervals are observed between relation position and reference point.

Dynamics

Dynamic require the specification of the forces that produce the velocities and accelerations.

Object motions are obtained from the force equations describing the physical laws such as Newton's law of motions etc.

$$F = d(mv)/dt,$$

If mass is constant $F = ma$.

(5 marks)