# Government Science College, Valod

Computer Science    Computer Graphics    Art
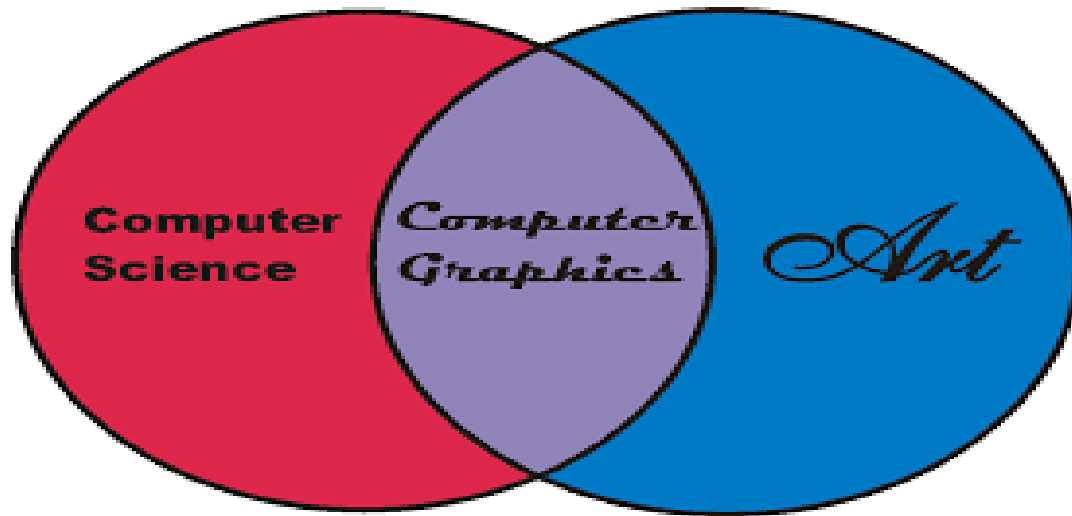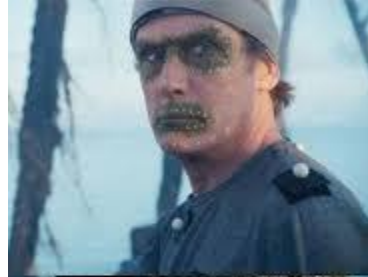
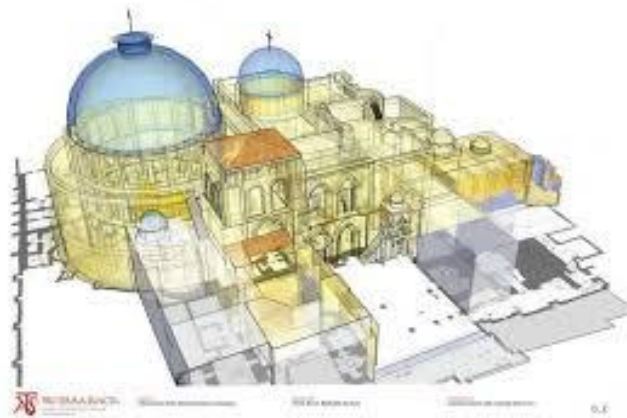Computer Graphics

By

Mayurkumar Marolia
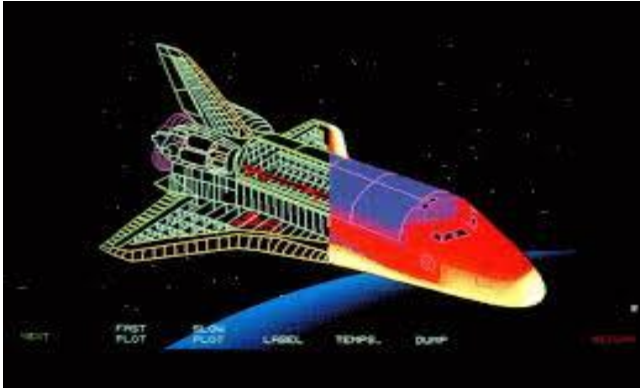
# Applications

- Games

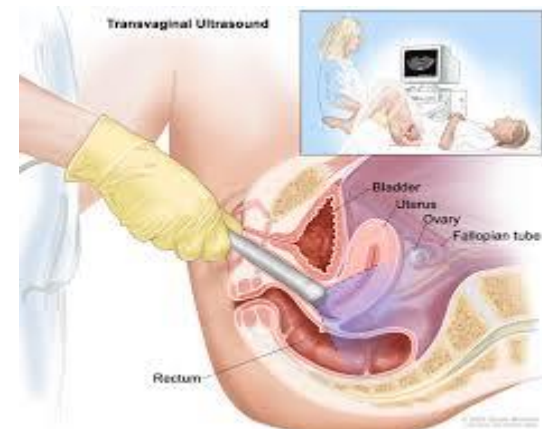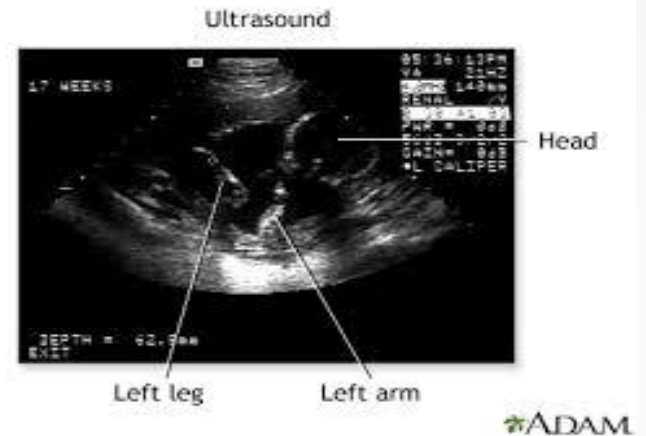# Application

- Movies

# Application

- Engineering

# Application

- Medical Technology

# Application

- Simulation
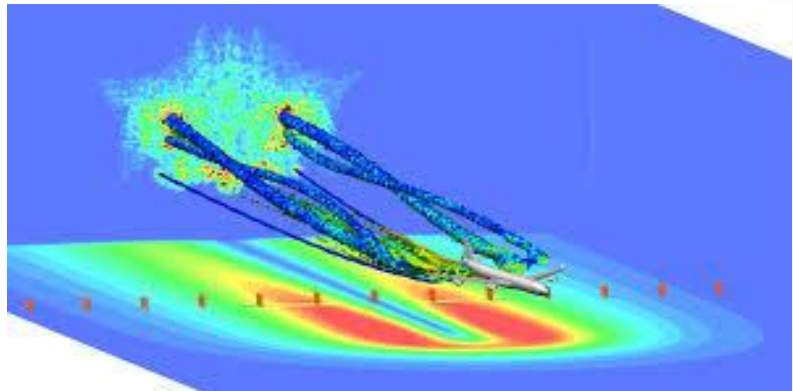
# Raster Image (Bitmap/Pixel)

- They are pixel based, means that location and color information about the image is stored in individual pixels within grid.

- Each pixel has an assigned a color.

- Raster images are edited at the pixel level that allows the color of any one pixel to change.

- Created & edited by Adobe Photoshop, etc.

- The size of an image are based on image's resolution

- Raster images are not easily scalable.

- Used for Photorealistic images and have complex color variations

# Raster (Bitmap/Pixel) Image
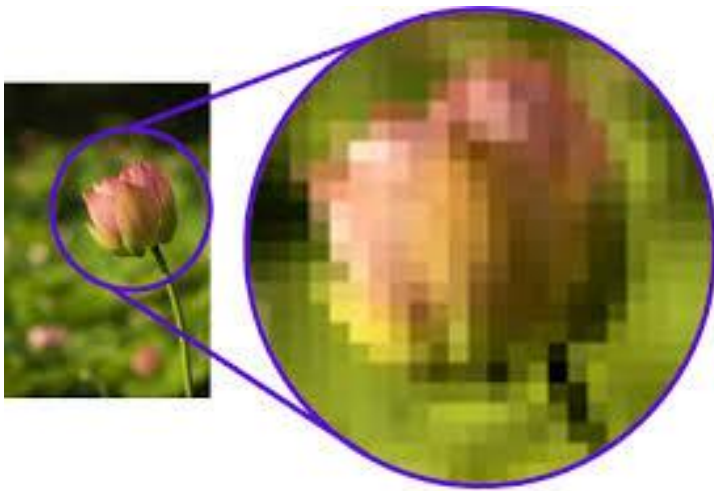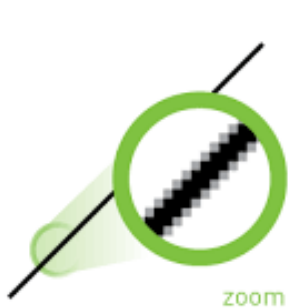
# Raster Image Vs Vector Image
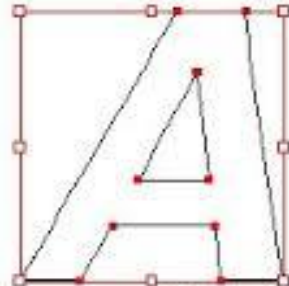
# Vector Image

- They are mathematically based image
- All lines, shapes, etc. of a vector based image are independent of each other
- Created and edited in CorelDraw and Adobe Illustrator
- Have smooth edges
- Not good for photorealistic image.
- Easily scalable due to their mathematics formula.

# Display Devices

- It is a device for presentation of information, such as image or a text, for visual and tectile reception, acquired, stored ore transmitted in various forms.

- The **cathode ray tube** (**CRT**) is a vacuum **tube** containing one or more electron guns, and a fluorescent screen used to view images. It has a means to accelerate and deflect the electron beam(s) onto the screen to create the images.

# Cathode Ray Tube (CRT)

Anode

Deflecting coils

Control Grid

Heater

Cathode

Electron beam

Focusing coil

Fluorescent screen
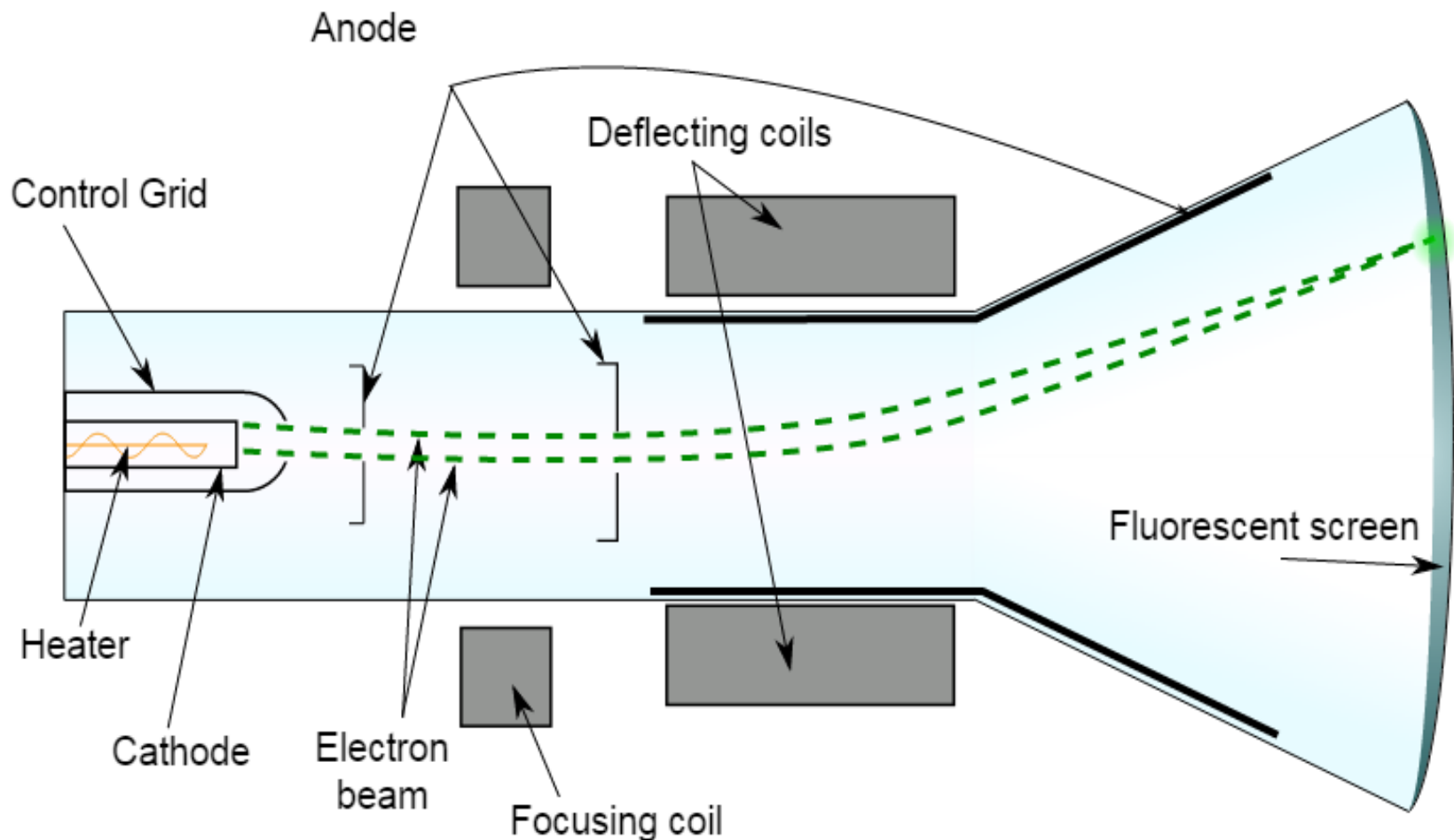
# Cathode Ray Tube (CRT)
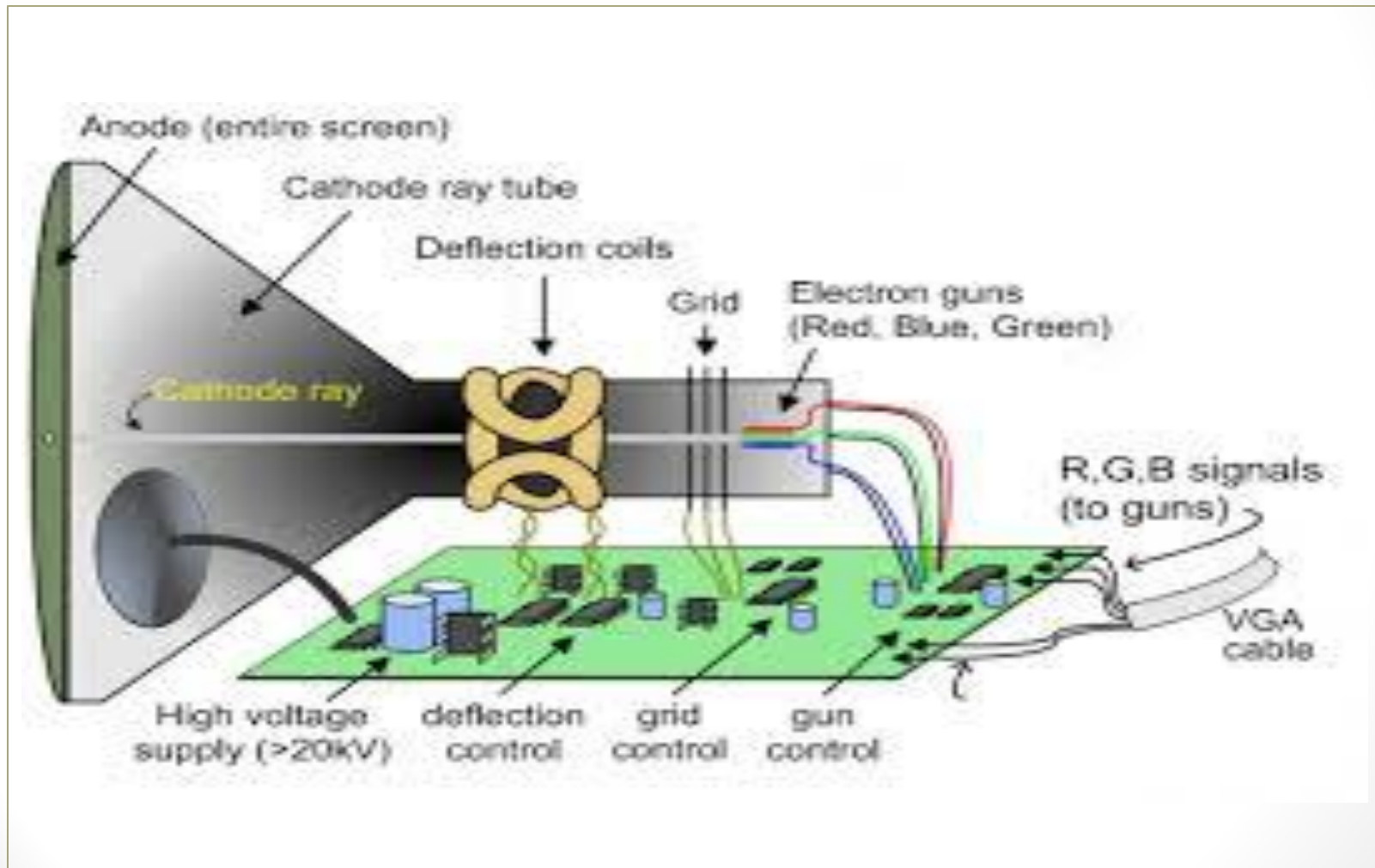
# CRT Working

- Heat is supplied to cathode( rich in electrons )
- Control Grid covers the cathode leaving small opening
- Intensity is controlled by setting voltage levels on grid.
- Anode accelerates the electrons towards phosphar screen
- Focusing and deflection coils (Horizontal & Vertical ) are needed to force the electron beam to converge into small spot
- Deflecting coils produce low magnetic field for constant adjustment of the direction of electron beam.
- Electron beam collide with Phosphar coating screen and screen display image.

# Raster Scan Display
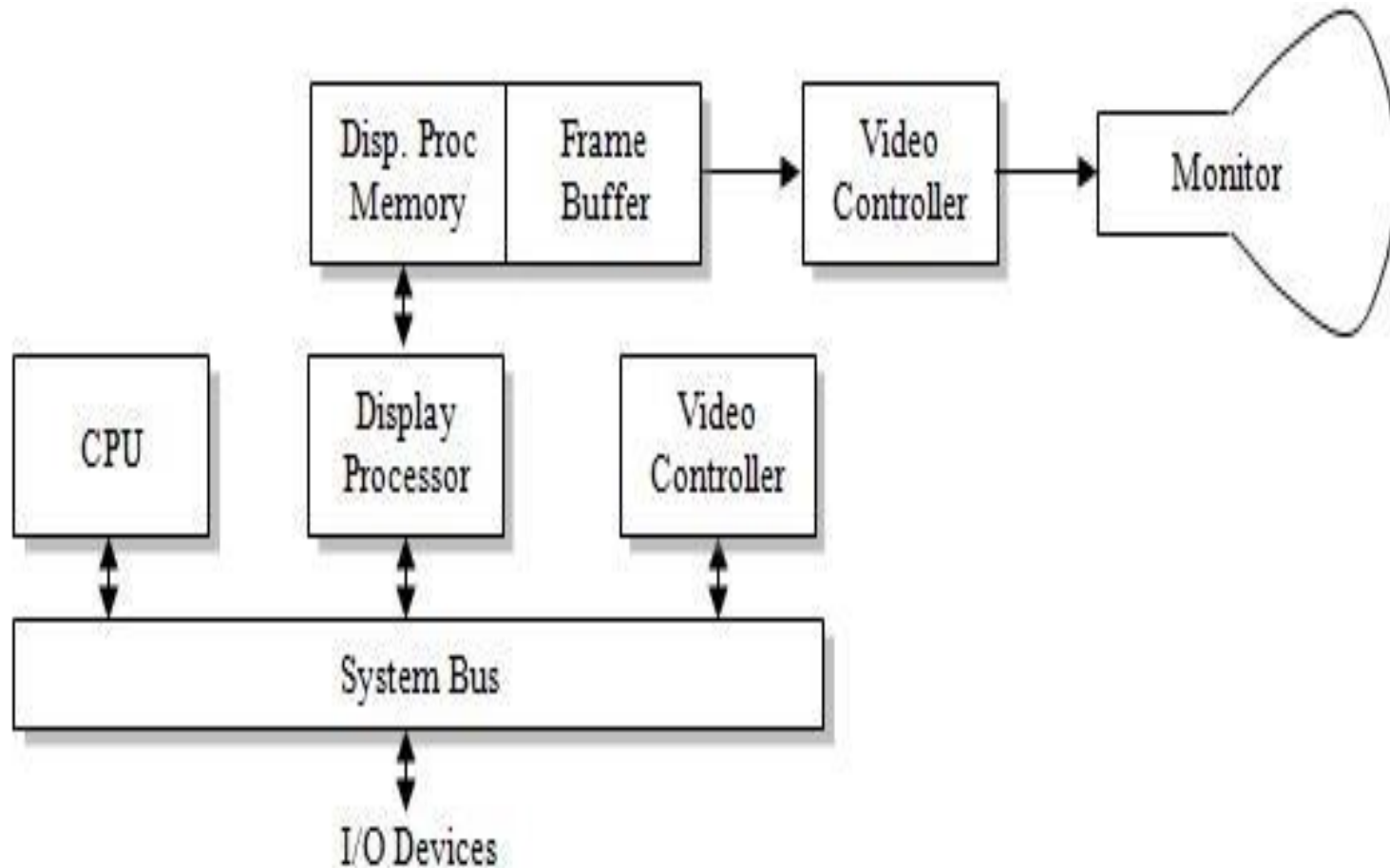
# Raster Scan Display

- Graphics display consist of three components
- (1) Frame Buffer (2) Display Controller (3) TV Screen
- Frame Buffer (Graphics Card) act as an interface between slow graphics computation and high data rate video image display
- stores image as matrix of intensity values ( 0s and 1s )
- Stored instensity values are retrieved from frame buffer and displayed on screen a row at a time.
- Video Controller has DMA in Frame Buffer and retrive data from it to display devices.
- It reads bytes of data from frame buffer and converts 0s and 1s to line of video signals ( Scan line )
- Display controller repeat cycle for 60 time per second.

# Raster Scan Display

- Deflection signals move a beam all over the screen in pattern for displaying any image.
- The electron beam is swept across the screen one row at a time ((1) Scan line)

    from top to bottom.
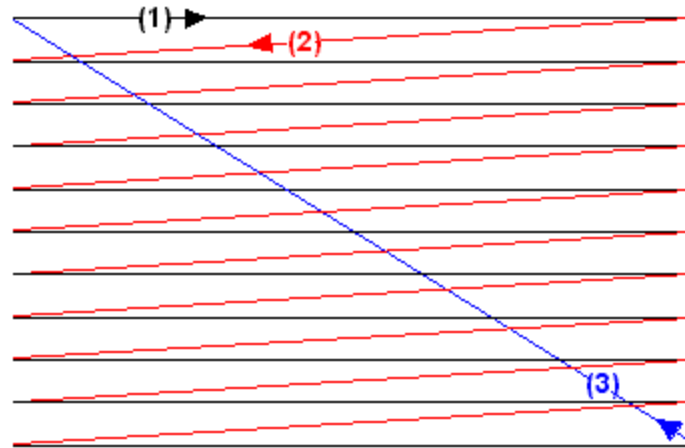


- The beam is on, while it moves from left to right, off while it moves from right to left. ( (2)Horizontal Retrace – dotted lines)
- When beam reaches to bottom of screen, it is off and move back to top of screen. ( (3)Vertical Retrace )
- It maintain steady image on the screen by repeating scanning of the same image. ( Refreshing of the screen )

# Raster Scan Display



(a)    (b)

(c)    (d)
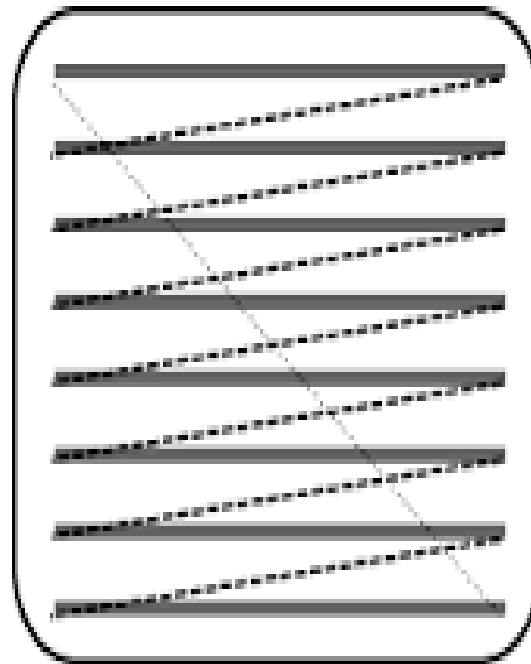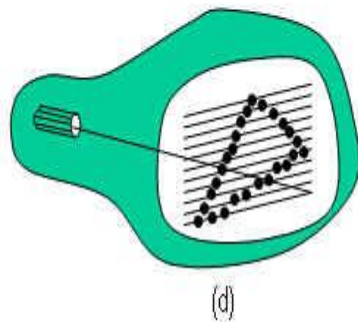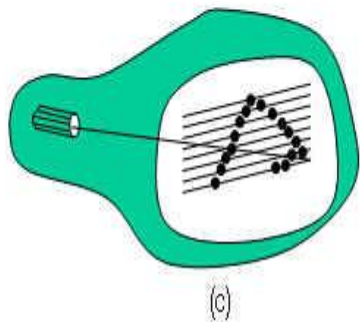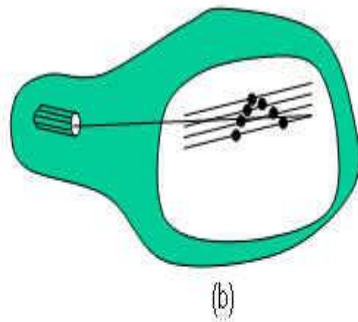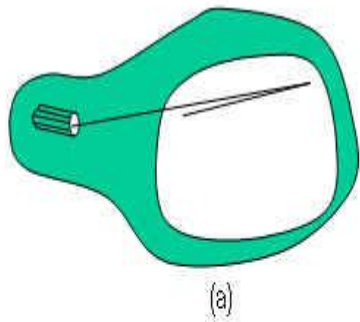
Scanline

HBlank

VBlank

# Random Scan Display



Vector

Raster
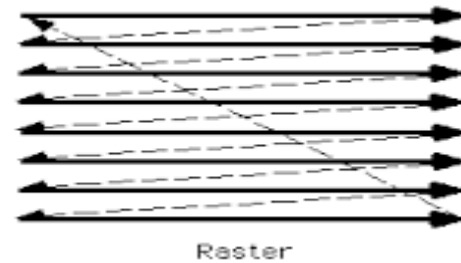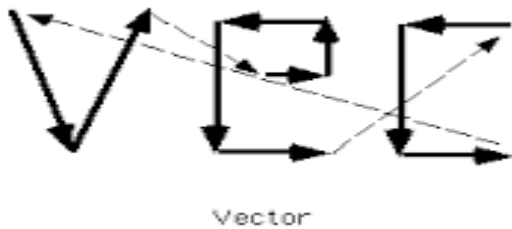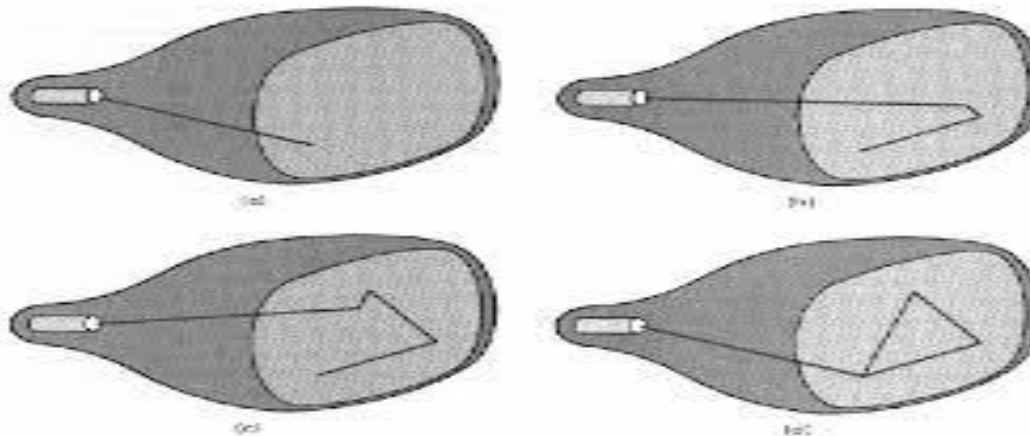
# Random Scan Display

- The electron beam directed to only the parts of the screen where a picture is to be drawn.

- It draw a picture one line at a time.

- Known as Vector Display, Stroke-write Display or calligraphic displays.

- Picture can be drawn at any specified order.

- Refresh Rate depends on no. of lines to be displayed. A picture definition is stored as a set of line drawing commands in an area of memory ( Refresh Display File or Refresh Buffer) .

- To display specified picture, the system cycles through the set of commands in display file, drawing each componenet line one by one.

# Random Scan Display

- After all line-drawing commands have been processed, system cycles back to the first line of command in the list and repeats the procedure of scan, display and retrace.

- It handles 100000 lines at refresh rate that burn out display.

- It avoids refresh for drawing small lines.

- Refresh Rates are 60 frames per second.

| Vector Scan Display | Raster Scan Display |
|---|---|
| 1. In vector scan display the beam is moved between the end points of the graphics primitives. | 1. In raster scan display the beam is moved all over the screen one scan line at a time, from top to bottom and then back to top. |
| 2. Vector display flickers when the number of primitives in the buffer becomes too large. | 2. In raster display, the refresh process is independent of the complexity of the image. |
| 3. Scan conversion is not required. | 3. Graphics primities are specified in terms of their endpoints and must be scan converted into their corresponding pixels in the frame buffer. |
| 4. Scan conversion hardware is not required. | 4. Because each primitive must be scan-converted, real time dynamics is far more computational and requires seperate scan conversion hardware. |
| 5. Vector display draws a continuous and smooth lines. | 5. Raster display can display mathematically smooth lines, polygons, and boundaries of curved primitives only by approximating them with pixels on the raster grid. |
| 6. Cost is more. | 6. Cost is low. |
| 7. Vector display only draws lines and characters. | 7. Raster display has ability to display areas filled with solid colours or patterns. |

# Next….

- Various Types of Displays and Printers

# Hard Copy Graphics Devices

- Computer Printers are commonly used as hard copy graphics devices.

- Hard copy is a permanent reproduction of displayed or transmitted data.

- There are many different types of printers and printing technology available.

  - **1. Dot Matrix Printers**

  - **2. Inkjet Printers**

  - **3. Laser Printers**

  - **4. Thermal Printers**

  - **5. Plotters**

# Dot Matrix (Impact) Printers

- Produce Characters or graphics by Striking pins on the ink ribbon to print Dots on paper.
- A Print-head runs backward and forward to print the image.
- Draws characters or shapes by putting many dots.
- Each of these dots is made of a very tiny metal rod or a pin.
- The print-head holds these pins.
- Higher no of pins on printer-head, the better quality of image.
- Printer head contain 9-24 pins.
- Speed is measured by CPS.
- Costly compared to other printers.
- Low resolution printing devices.

# Inkjet Printers

- Widely used by domestic and small-scale users.
- Low Printing cost and high quality printing with multicolors.
- Head moves forward and backward from which electrically controlled and operated tiny droplets drop on the paper in the form of dots.
- These dots are few hundreds per inch.
- Printing head comprise channels containing printing ink that moves forward and backward.
- Good Quality printers with Photograph printing Quality.
- Inkjet printer takes less warm up time compare to laser printer.
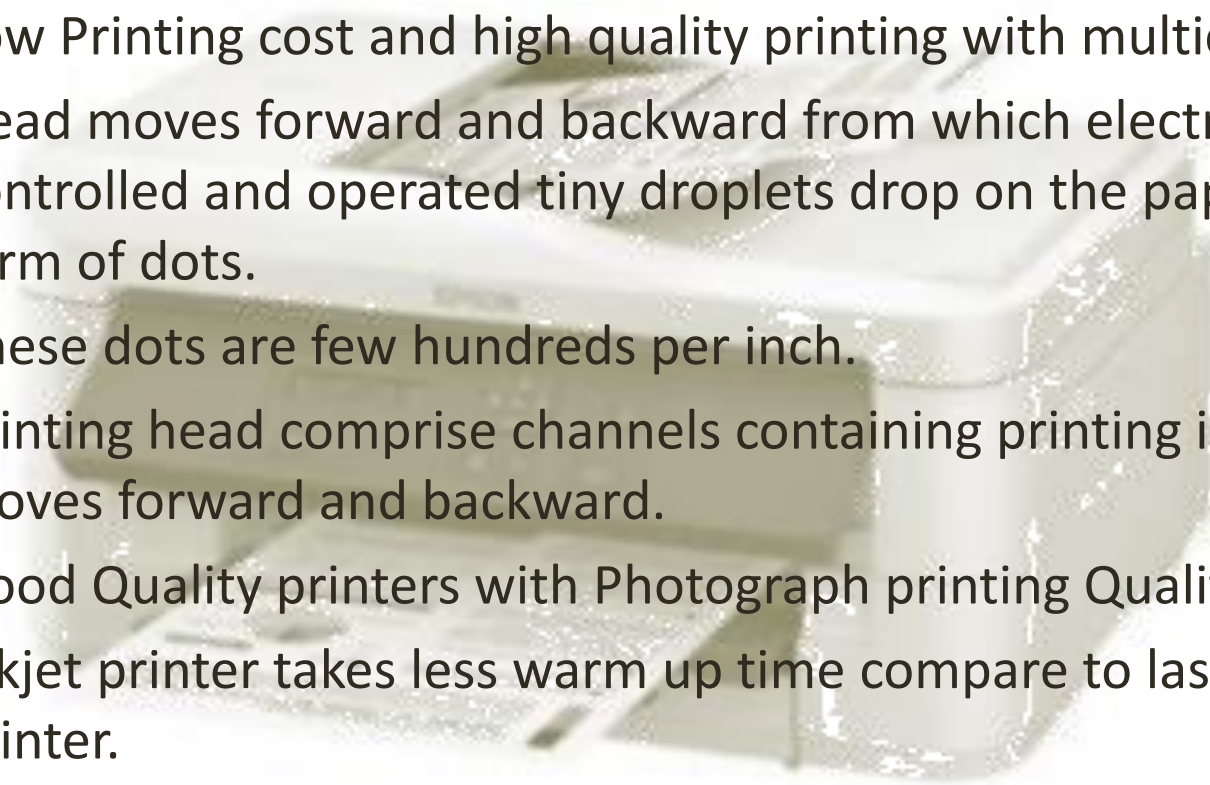
# Laser Printer

- Use toner instead of ink as in inkjet printers.
- Speed is much higher as the entire page image is taken at once.
- Some printer prints 200 PPM.
- Printing process comprise six steps:
  - 1. Charging
  - 2. Writing
  - 3. Developing
  - 4. Transferring
  - 5. Fusing
  - 6. Cleaning

# Laser Printer



Basic Laser Printer Components