SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore-35

Affiliated to The Dr.M.G.R Medical University, Chennai

DEPARTMENT OF CARDIAC TECHNOLOGY - I YEAR

SUBJECT : MEDICAL PHYSICS

TOPIC : CATHODE RAY TUBE (CRT)

Introduction

- CRT is a vacuum tube used for displaying images.
- It operates by controlling electron beams directed at a phosphorescent screen.
- Widely used in older medical imaging systems and television displays.

Components of CRT

1.Electron Gun: Emits electron (Thermionic Emission)

2. Control Grid: Regulates beam intensity.

3. Focusing System: Focuses the electron beam.

4. Deflection System: Guides the beam to the desired location. (Electrostatic force & Motor Effect)

5. Fluorescent Screen: Produces visible light. (Zinc sulfide & Phosphorus)

6. Glass Tube & Base : Provides a vacuum environment.

Working Principle of CRT

1. Electrons are emitted by the cathode (electron gun).

2. The control grid adjusts the electron flow.

3. The focusing and deflection systems guide the beam.

4. The beam strikes the phosphorescent screen, creating light and images.

Applications of CRT

- Medical Imaging: Used in fluoroscopy and ECG monitors.
- Television and Video Displays: Early technology for image visualization.
- Oscilloscopes: For wave analysis in labs and diagnostics.
- Radar Displays: For navigation and monitoring.

Transition to Modern Technologies

- CRTs have been replaced by LCD, LED, and OLED technologies.
- Modern systems offer:
  - Higher resolution and sharper images.
  - Lightweight and compact designs.
  - Energy efficiency and safety.

Cathode Ray Oscilloscope (CRO)

The Cathode Ray Oscilloscope (CRO) is an electronic test instrument that uses a CRT to visualize electrical signals as waveforms. It is commonly used in electronics to display voltage vs. Time..

Deflection System:

Moves the electron beam both horizontally and vertically.

The horizontal movement represents time, while the vertical represents the voltage of the signal.

Working Principle of CRO

- Time Base: Controls the horizontal deflection to represent the time axis, allowing the visualization of signal timing.
- Vertical Deflection: Controls the vertical movement of the beam, corresponding to the voltage of the signal being analyzed.

Applications of CRO

- Signal Analysis: Used for analyzing the waveform of electrical signals, such as voltage changes in circuits.
- Troubleshooting: Helps detect faults or irregularities in electronic circuits by visualizing the signals.
- Medical Diagnostics: CROs are used to display medical signals, such as ECG (electrocardiogram) waveforms, for cardiac monitoring.
- Electronics Research: Used to visualize the behavior of electrical signals in research labs.

Advantages of CRT & CRO

CRT:

High brightness and real-time display.

Suitable for continuous image display.

CRO:

Provides real-time waveform visualization.

Helps analyze and troubleshoot electronic circuits.

Accurate voltage and time measurements.

Limitations of CRT & CRO

CRT:

Large, bulky, and power-consuming.

Low resolution compared to modern displays.

CRO:

Requires calibration for accurate measurements.

Limited portability and can be fragile.

Only suitable for analog signals.

Transition from CRO to DSO

- Higher Bandwidth and Sampling Rates for accurate high-speed measurements.
- Digital Storage allows waveform capture and advanced analysis.
- Multiple Channels for simultaneous signal analysis. Compact and Portable design for easier handling. Advanced Features like automatic measurements, FFT, and signal averaging. Increased Precision with high-resolution displays and digital processing.

CONCLUSION

- CRT was an essential technology for early imaging systems and displays.
- CRO remains a crucial tool for visualizing electrical signals, particularly in medical diagnostics and signal analysis.
- Both devices laid the groundwork for the development of modern diagnostic technologies..