# AUDIO VIDEO SYSTEMS (e-content)

5TH SEMESTER ECE

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By

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# AUDIO SYSTEM

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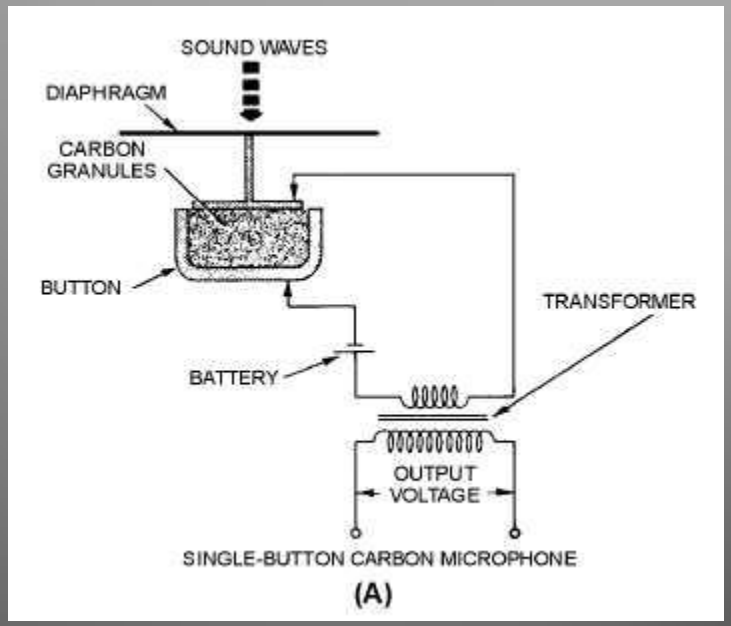
MICROPHONES AND LOUDSPEAKERS

# MICROPHONES

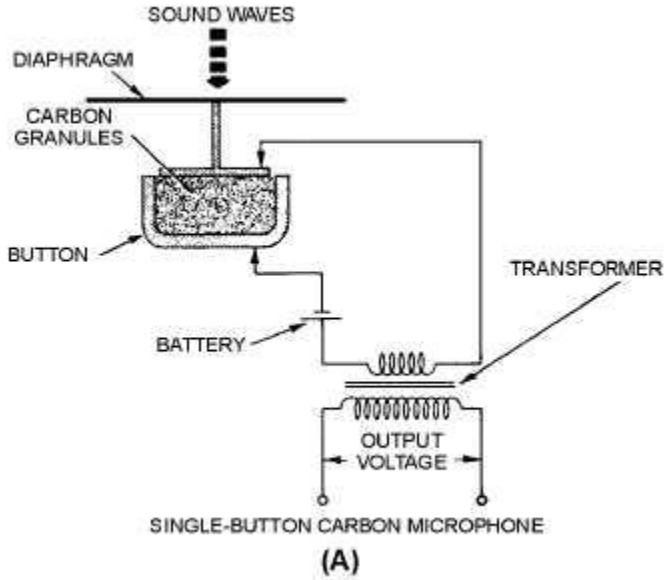
- A microphone, colloquially named mic or mike.
- It is an  electro-acoustic transducer or device – that converts acoustic energy into an electrical energy . In other word
- Microphone detects sound signal and produce an electrical signal

# CARBON MICROPHONE

- Early microphones were invented for communication purposes.
- The first microphone was Carbon Microphone which was invented in 1876 and was independently developed by David Edward Hughes in England and Emile Burner and Thomas Alva Edison in the US.
- Later modifications were made to design as the microphone was used more in entertainment industry.



# DIAGRAM OF CARBON MICROPHONE



# Construction

- The basic concept behind the carbon microphone is the fact that when carbon granules are compressed their resistance decreases. This occurs because the granules come into better contact with each other when they are pushed together by the higher pressure.
- The carbon microphone comprises carbon granules that are contained within a small contained that is covered with a thin metal diaphragm. A battery is also required to cause a current to flow through the microphone.

# Construction

- When sound waves strike the carbon microphone diaphragm it vibrates, exerting a varying pressure onto the carbon. These varying pressure levels are translated into varying levels of resistance, which in turn vary the current passing through the microphone.
- The varying current can be passed through a transformer or a capacitor to enable it to be used within a telephone, or by some form of amplifier. The frequency response of the carbon microphone, however, is limited to a narrow range, and the device produces significant electrical noise. Often the microphone would produce a form of crackling noise which could be eliminated by shaking it or giving it a small sharp knock. This would shake the carbon granules and enable them to produce a more steady current.

# Dynamic Microphone (Moving Coil Microphone)

- The dynamic microphone consists of a magnet, and a diaphragm to which a coil is attached. The assembly is held in place by an outer casing and the coil can move freely over the magnet. As sound waves hit the diaphragm, this causes the coil to move backwards and forwards within the magnetic field and as a result an electric current is induced in line with the incoming sound vibrations.

# Moving Coil Microphone Adv. & Disadv.

Advantages:

- Durable design and versatile use.
- A reverse of a loudspeaker.
- No need of power.
- High output
- Simple principle & construction
- Cheap and simple to manufacture

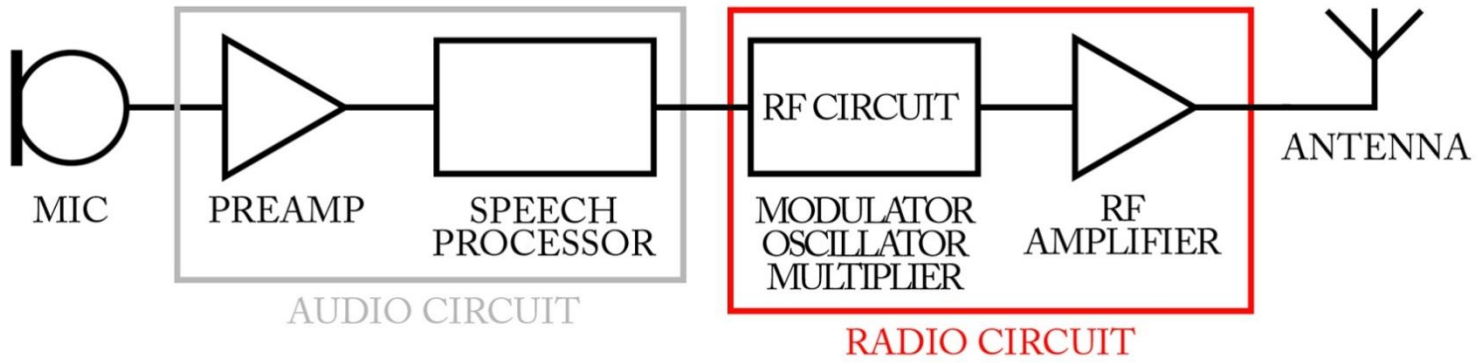
Disadvantages

- Very noisy
- Poor frequency response
- Requires battery or other supply for operation

# WIRELESS MICROPHONE

- A **wireless microphone**, or **cordless microphone**, is a microphone without a physical cable connecting it directly to the sound recording or amplifying equipment with which it is associated. Also known as a **radio microphone**, it has a small, battery-powered radio transmitter in the microphone body, which transmits the audio signal from the microphone by radio waves to a nearby receiver unit, which recovers the audio. The other audio equipment is connected to the receiver unit by cable.
- Wireless microphones usually use VHF or UHF frequency bands

# WIRELESS MICROPHONE TRANSMITTER BLOCK DIAGRAM



# CORDLESS MICROPHONE (advantages & disadvantages

**Advantages** are:

- Greater freedom of movement for the artist or speaker.
- Avoidance of cabling problems common with wired microphones, caused by constant moving and stressing the cables.
- Reduction of cable "trip hazards" in the performance space
- Galvanic isolation of microphone, avoiding ground loops between microphone and other electrical instruments on stage

**Disadvantages** are:

- Sometimes limited range (a wired balanced XLR microphone can run up to 300 ft or 100 meters).
- Possible interference with or, more often, from other radio equipment or other radio microphones.
- Operation time is limited relative to battery life
- Noise or dead spots (places where it doesn't work, especially in non-diversity systems)
- Limited number of operating microphones at the same time and place, due to the limited number of radio channels (frequencies).
- Higher cost in proportion to fewer other features
- Lower sound quality

# LOUDSPEAKERS

Loudspeaker, is an electro-mechnical device used to convert electrical signal into sound signal.

Loudspeaker is another very important device present in any audio and video system such as public address systems, radios, televisions etc. This will convert back the electrical signal into acoustic signal which is the original signal and the required signal after necessary amplification and signal processing.

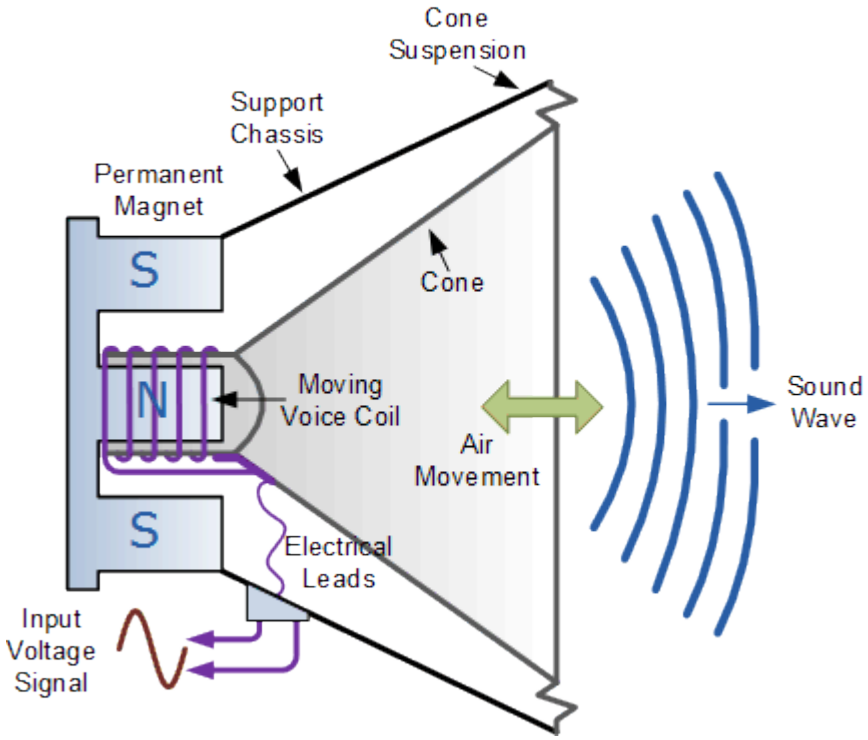
# Characteristics of Loudspeakers:

- Efficiency
- Noise
- Frequency response
- Distortion
- Directivity
- Impedance
- Power handling capacity

# MOVING COIL Loudspeaker or Direct Radiating Type Loudspeaker

- It is also known as Cone Type L.S. or Direct Radiating Type L.S.
- Works on principle of interaction between magnetic field and current.
- A coil placed in uniform magnetic field and audio current passes through it, resulting in force.
- Generated force is proportional to the audio current and hence causes vibratory motion in the coil, which makes conical diaphragm to vibrate resulting in sound waves.

# Direct Radiating Type Loudspeaker



# Direct Radiating Type Loudspeaker

- Force on coil due to interaction current and magnetic field is given by

$$F = B * L * I * \sin\alpha$$

Where as F = Force in newton
B = Flux density in tesla
L = length of coil wire in m
α = Angle between coil and field
Normally, $\alpha = 90^\circ$ and hence,

$$F = B * L * I$$

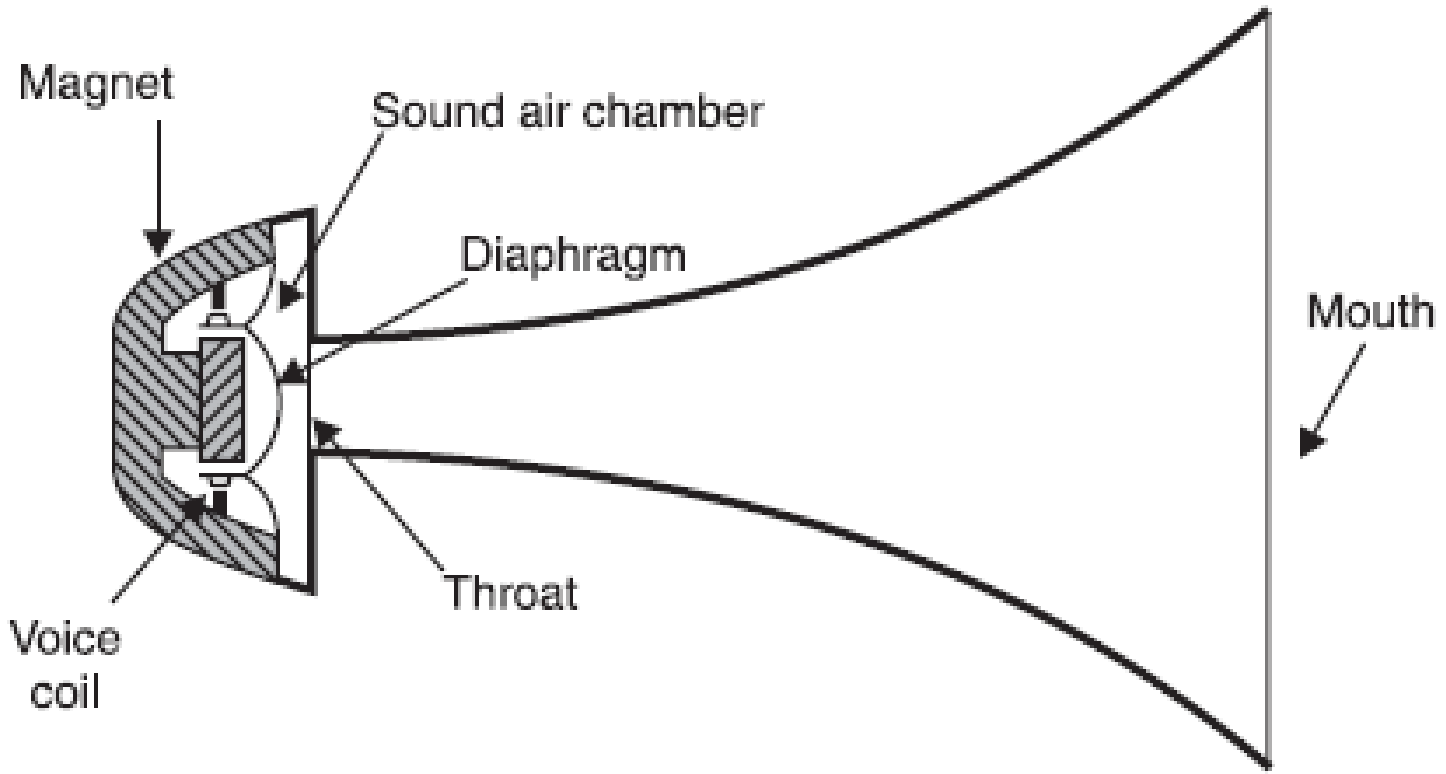
# CHARACTERISTICS

- **Efficiency** : Quite low – due to fact that it acts as a direct radiator – complete mismatch between the low acoustic load of large volume of air and high mechanical load of coil and cone assembly
- **SNR** : 30 dB (approx.)
- **Frequency Response.** : Restricted to mid frequency only – 200 Hz to 5000 Hz – woofer (up to 40 Hz), tweeter (up to 10 kHz)
- **Distortion** : Non-linear due to non-uniformity of magnetic field – about 10%
- **Directivity** : Basically Omni-directional – less behind baffles and enclosures
- **Impedance and Power** : Varies from 2 to 32 ohm about 25 watt

# HORN TYPE LOUDSPEAKER

- Instead of radiating acoustic power directly in open space of listeners area, power is first delivered to the air trapped in fixed non-vibrating tapered or flared horn and from here to the air in the listeners area.
- Indirect Radiating Loudspeaker.
- Horn does acoustically what the cone does mechanically
- Horn acts as an acoustic transformer.
- Allows better impedance matching.
- Results in increased efficiency – 30-50%.

# HORN TYPE LOUDSPEAKER



# HORN TYPE LOUDSPEAKER

- Air chamber is lined with sound absorbing material
- Cross sectional area increases logarithmically
- Horn acts as a high pass filter
- Cut-off Frequency

$$fc = CA\ 2\pi V$$

- Where as

C = velocity of sound

A= Area of cross section of throat

V = Volume of air chamber

In terms of diameter of mouth, lowest frequency can be produced by horn is

f = (170/d) , d = diameter of mouth in meter

# HORN TYPE LOUDSPEAKER

- Low freq. response is improved by wide mouth and high freq. response is improved by small throat.
- To improve low freq. response – large size horn – unwieldy
- Horn structure is folded back in itself to conserve physical space.
- Contains cone loudspeaker with a horn.
- Horn for high fidelity

# CHARACTERISTICS

- Efficiency : 30-50%
- SNR : 40 dB
- Freq. Response : 30-10KHz
- Distortion : low, less than 5%
- Directivity : about 90o – differs from low freq to high freq (concentrated in a narrow cone about axis of the horn)
- Impedance : 16 ohms
- Power : about 100 watts

# Multi-way speaker system (woofers and tweeters)

- A single loudspeaker can not have flat response for the whole audio frequency range from 16 Hz – 20000Hz, and not even for the practical Hi-Fi range of 40 Hz to Hz.
- Low frequencies are weakened by the back sound waves of reverse phase in open speaker.
- In closed box (enclose), the compliance(capacitive effect) of the entrapped air comes in series with the compliance of the cone system and hence increases the resonance frequency of the loudspeaker.
- The loss at high frequencies is due to mass (or inductive effect) of the diaphragm (including cone).

- Thus, a single speaker can not produce both, the good solid bass and the smooth crisp treble.
- The best of them can only produce just acceptable bass and treble which will not satisfy the Hi-Fi requirements.
- To solve the problem, the audio frequency spectrum is divided into at least 2 and preferably 3 parts.
- Separate speakers are designed for each part, so that each speaker has to cover only a small range of frequency.
- The speakers which cover low frequencies from 16 Hz to 1000 Hz are called ‘woofers’.

- The speakers which cover higher audio frequencies are called ‘tweeters’.
- Many a time, a third speaker, called ‘squawker’ is used for mid frequency range from Hz and in that case woofer works up to 500 Hz and tweeter from 5000 Hz onwards.

# CROSS-OVER NETWORKS

- When a multi-way loudspeaker system is used to get flat frequency response for the entire range of audio frequencies, it is essential to have a cross-over network to divide the incoming signal into separate frequency ranges for each speaker .
- In the absence of cross-over networks, the speakers will suffer overheating and the output will be distorted when full power at frequencies outside their range is fed to them.
- Over efficiency will be much reduced in the absence of cross-over networks.

- A basic cross-over network is illustrated in figure.
- Cross-over networks make use of the fact that the capacitive reactance decreases with increase in frequency

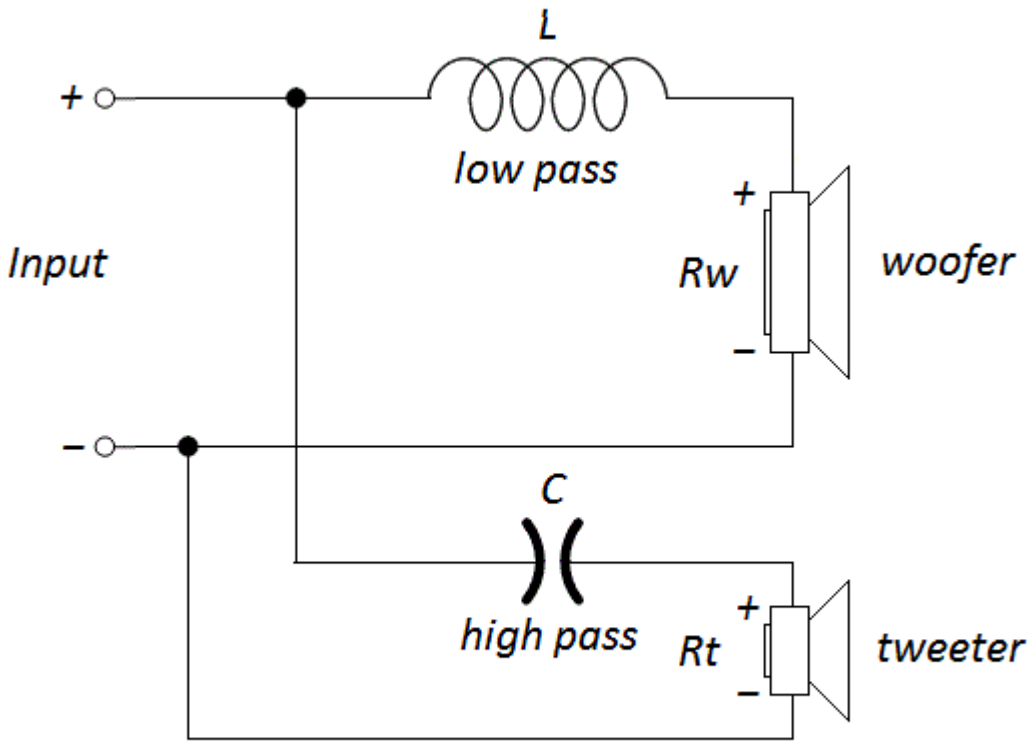
$$\mathrm{Xc} = \frac{1}{(2\pi fc)}$$

and the inductive reactance increases with increase in frequency

$\mathrm{Xi} = 2\pi \mathrm{fi}$

- A basic cross-over network is illustrated in figure
- The circuit consists of a low-pass LC filter across the woofer and a high-pass LC filter across the tweeter.
- The low-pass filter permits only low audio frequencies (16 Hz to 1000 Hz) to go to the woofer.

# CROSS-OVER NETWORKS




*2-Way First Order Speaker Crossover*

# CROSS-OVER NETWORKS

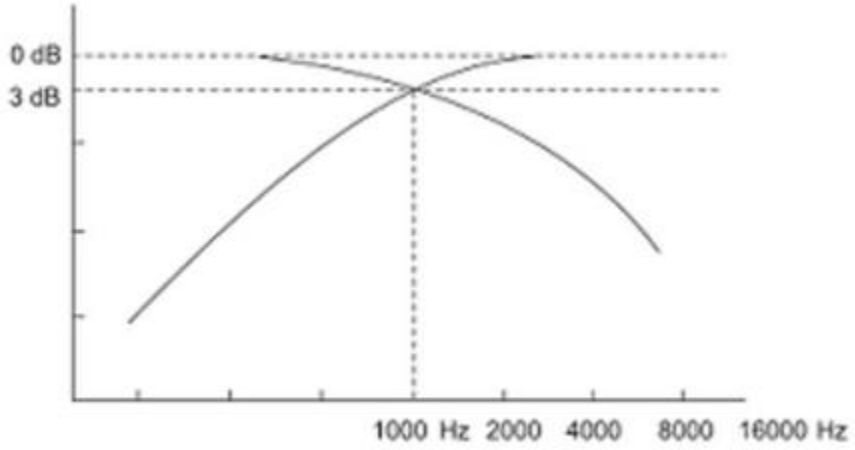



**Fig.** *Response curve of basic crossover network*

# CROSS-OVER NETWORKS

- The series reactance of L and shunt reactance of C for high audio frequencies prevents these frequencies from going to the woofer .
- The high-pass filter consisting of C in series and L in shunt allows the high audio frequencies to pass to the tweeter and blocks the low frequencies .
- The response curve of a typical cross-over network (of figure) is shown in fig It gives attenuation of 12 dB per octave.

- Considerations for designing cross over networks:
- The cross over frequency for woofer tweeter circuit is where the woofer output curve crosses the tweeter output curve. This is normally 1000 hz. Hence woofer gives output between hz and tweeter from hz for 2 speaker system.
- Attenuation beyond the cut-off frequency for woofer and before the cut-off frequency for tweeter should preferably be 12 db per octave although 6 db per octave is acceptable for economy models.

- For a three way speaker system, frequency coverage to the cross-over point is as given below:
- Woofer: 16 hz to 500 hz.
- Squawker: 500 hz to 5000 hz
- Tweeter: 5000 hz to hz
- While for two way speaker system, it is as follows:
- Woofer: 16 hz to 1000 hz.
- Tweeter: 1000 hz to hz
- Inductors and capacitances should be calculated correctly.
- Electrolytic capacitors cannot be used as there is no polarisation DC current.

# OPTICAL SOUND RECORDING

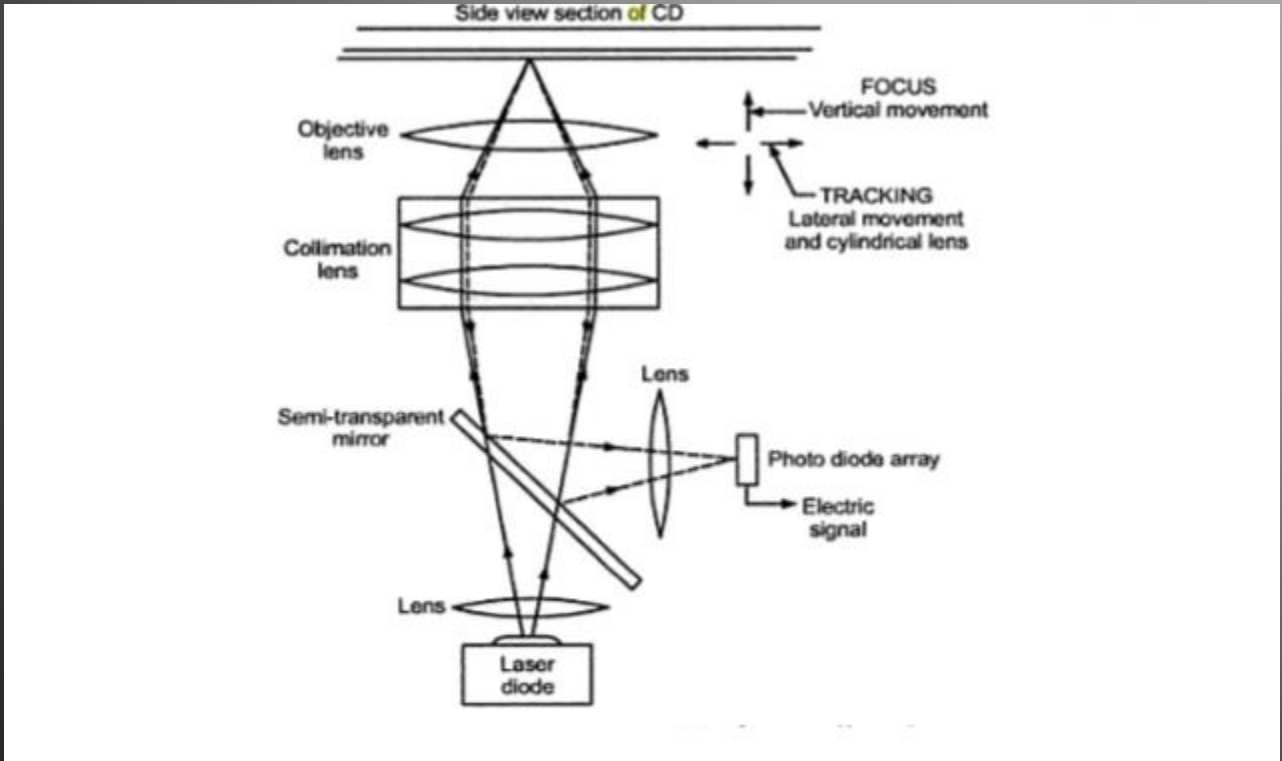
Optical sound recording is done by converting audio signals into variations of light intensity falling on the film. Intensity of light from a slit is made to vary in accordance with the sound pressure variations. When this light falls on edge of main film, sound is recorded.

Recording on Compact Discs: This is done with the help of laser beams, made ON and OFF by digitized audio signals. These beams fall on a photo resist material on a rotating disc and cause pits of varying width & fixed depth and thus record signals in binary form, flats and pits making 1s and 0s.

# OPTICAL SOUND RECORDING

- Reproduction of sound from films A sharply focused narrow beam of light is made to fall on the soundtrack of the film. As the film moves, light passing through bright and grey shaded portions in case of variable-density record & through bright portions of n variable area in case of a variable-area record, falls on a photocell which converts this light into electrical signals.in both types of recording, The quantity of light falling on the photocell will depend on the strength of the recorded audio signal. The output of the photocell will, therefore, be an audio voltage which can be amplified and fed to a loudspeaker which finally converts it into sound.

# Diagram of Playback Process



# TELEVISION

# BASICS OF TELEVISION

- Television – to see from a distance Or T.V. is the Transmission of Picture information over an electric channel.
- Real breakthrough – invention of CRT
- First Camera tube – iconoscope
- 1935 – TV broadcasting started
- 1959 – in India

# ELEMENTS OF A TELEVISION SYSTEM

Fundamental aim :

To extent the sense of sight beyond its natural limit along the sound associated with the scene

In 625 line monochrome system:

Picture signal :amplitude modulated

Sound signal – frequency modulated

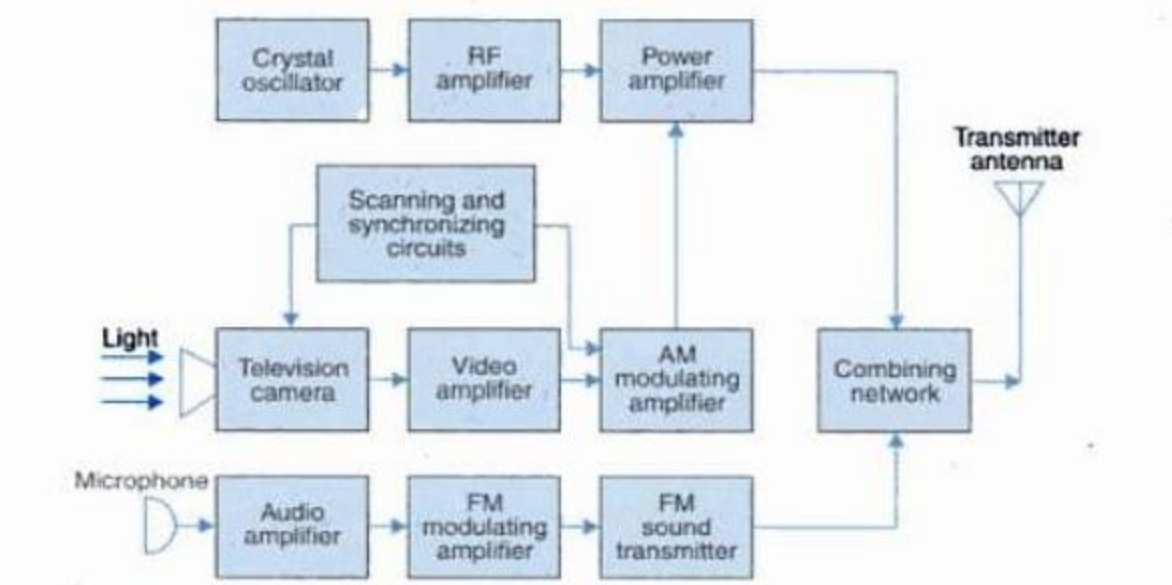
Carrier frequencies are suitably spaced and modulated outputs radiated through a common antenna

# ELEMENTS OF A TELEVISION SYSTEM

- Picture Transmission
- Picture information – optical in character – assembly of a large number of bright and dark areas, each representing a picture element
- infinite number of pieces – existing simultaneously
- Information is a function of two variables: Time and Space
- Instead of using infinite number of channels simultaneously, we use Scanning
- Scanning: Optical information is converted into electrical form and transmitted element by element, one at a time in a sequential manner to cover the entire scene to be televised
- done at very fast rate
- repeated a number of times per second to create an illusion of simultaneous pick-up

# Basic Monochrome Television Transmitter

- It consists of Television Camera, Video amplifier, AM Modulating amplifier, Audio amplifier, FM Modulating amplifier, FM sound transmitter, Crystal oscillator, RF amplifier, Power amplifier, Scanning and Synchronizing Circuits, Combining network, Transmitting antenna and Microphone.



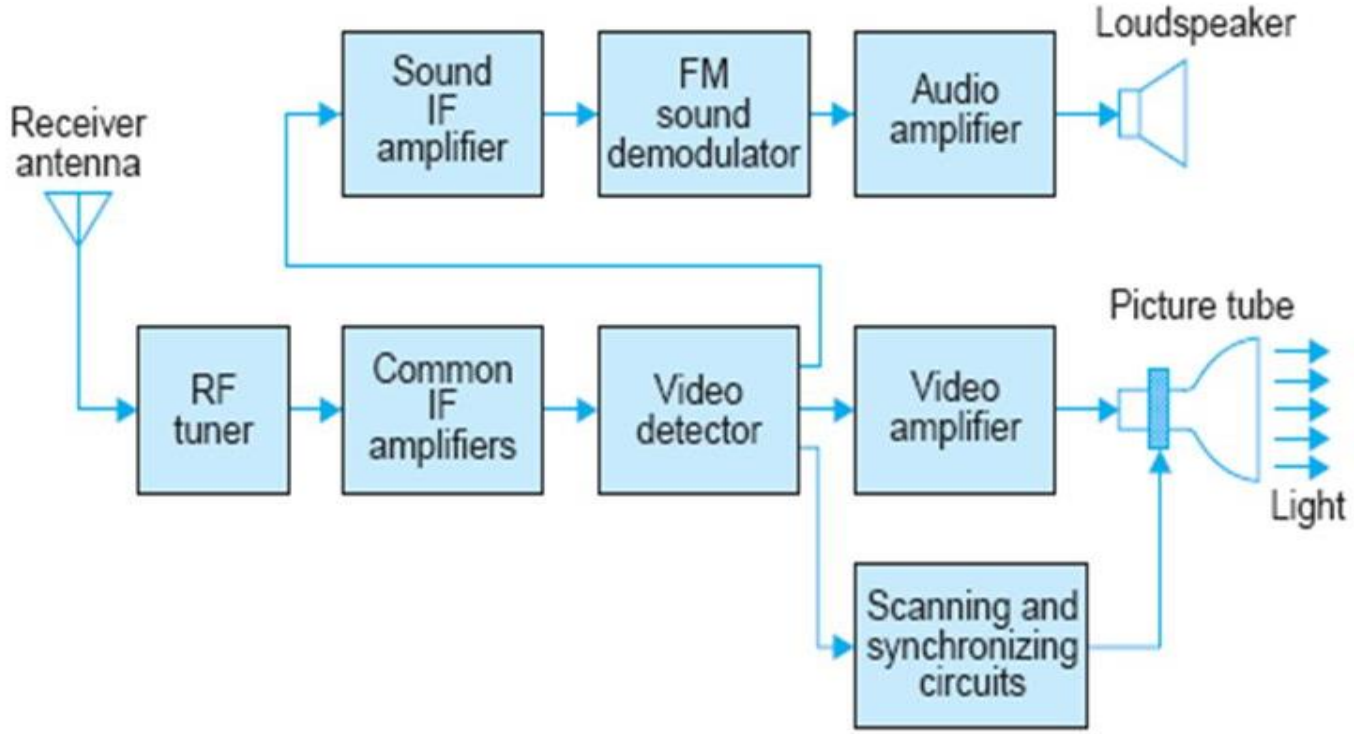
# Basic Monochrome Television Transmitter

- TELEVISION CAMERA: Its function is to convert optical image of television scene into electrical signal by the scanning process.
- VIDEO AMPLIFIER: Video amplifier amplifies the video signal.
- AM MODULATING AMPLIFIER: The video signals are amplified by the modulating amplifier to get the modulated signal.
- AUDIO AMPLIFIER: Audio amplifier amplifies the electrical form of audio signal from the microphone.
- FM MODULATING AMPLIFIER: Sound signal from audio amplifier is frequency modulated by FM Modulating amplifier.
- FM SOUND TRANSMITTER: FM modulated amplified signal is transmitted through this FM sound transmitter to transmitting antenna through the combining network.

# CONT…

- CRYSTAL OSCILLATOR: Crystal Oscillator generates the allotted picture carrier frequency.
- RF AMPLIFIER:RF amplifier amplifies the picture carrier frequency generated by crystal oscillator to required level.
- POWER AMPLIFIER: Power amplifier varies according to the modulating signal from AM modulating amplifier
- SCANNING AND SYNCHRONIZING CIRCUITS Scanning is the process where picture elements are converted into corresponding varying electrical signal
- COMBINING NETWORK Combining network is used to isolate the AM picture and FM sound signal during network is used to isolate the AM picture and FM sound signal during transmission
- TRANSMITTING ANTENNA: Transmitting antenna receives the AM picture signal and FM sound signal from combining network for radiation as electromagnetic waves.
- MICROPHONE: Converts sound associated with picture being televised into proportionate electrical signal.

# BASIC MONOCHROME TELEVISION RECEIVER






- RECEIVER Block diagram of a monochrome TV receiver is shown. It consists of RF Tuner, Receiver antenna, common IF amplifier, video detector, video amplifier, scanning and synchronizing circuits, sound IF amplifier, FM Sound demodulator, Audio amplifier, Loud Speaker, Picture tube

# BASIC MONOCHROME TELEVISION RECEIVER

- RF TUNER: RF Tuner selects the desired channel frequency band from the receiving antenna.
- RECEIVER ANTENNA: Receiver antenna intercepts the radiated RF signals and sends it to RF Tuner
- COMMON IF AMPLIFIER: There are 2 or 3 stages of IF amplifiers.
- VIDEO DETECTOR: Used to detect video signals coming from last stage of IF amplifiers.
- VIDEO AMPLIFIER: It amplifies the detected video signal to the level required.
- SCANNING AND SYNCHRONIZING CIRCUITS: Scanning is the process where picture elements are converted into corresponding varying electrical signals.

# BASIC MONOCHROME TELEVISION RECEIVER

- SOUND IF AMPLIFIER: Detected audio signal is separated and selected for its IF range and amplified.
- FM SOUND DEMODULATOR: FM Sound signal is demodulated in this stage.
- AUDIO AMPLIFIER: FM demodulated audio signal is amplified to the required level to feed into the loud speaker.
- LOUD SPEAKER: Loud Speaker converts FM demodulated amplifier signal associated with picture being televised into proportionate sound signal.
- PICTURE TUBE: In picture tube the amplified video signal is converted back into picture elements.

# SCANNING AND ITS NEED

- SCANNING: Scanning is the process used to convert the optical into electrical signal. Fastest movement of electron beam on the image is called scanning.

- SCANNING PROCESS: Scanning process is a technique similar to reading of written information on a page starting at the top left and processing line by line downwards to the end at the bottom right. Scanning is done frame by frame. Each frame consists of 625 horizontal lines. Each frame is scanned at a rate of 25 frames / sec.

# Types of Scanning:

1. Horizontal Scanning
2. Vertical Scanning
3. Sequential (or) Progressive Scanning
4. Interlaced Scanning.

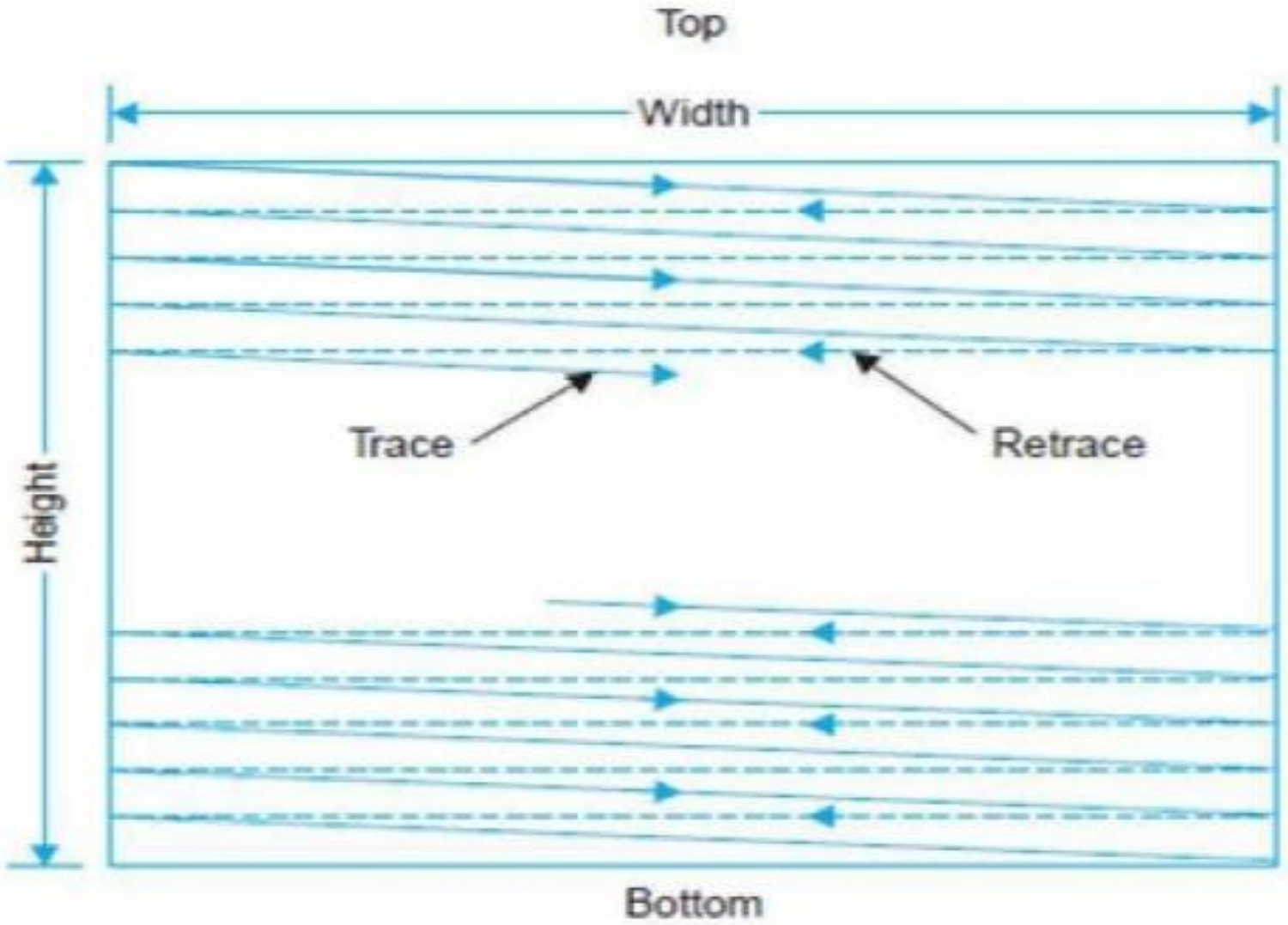
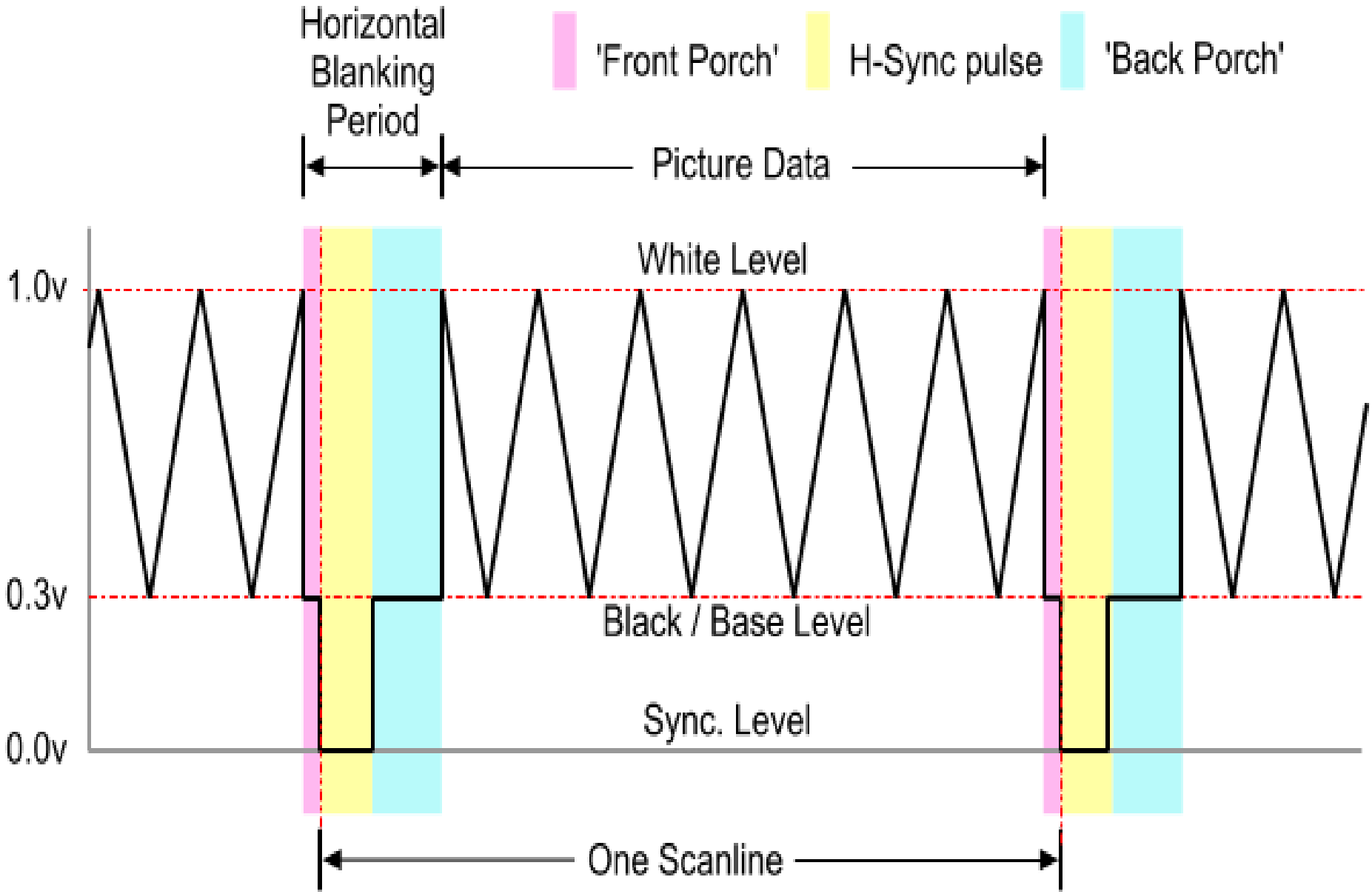



**Figure. Path of scanning beam in covering picture area**

# NEED FOR SYNCHRONIZING AND BLANKING PULSES

- At any time the same co-ordinate will be scanned by the electron beam in both the camera tube and picture tube. Otherwise distorted picture will be seen on the screen. So synchronization between the transmitter and receiver is needed. For that we are using Sync pulses.
- At the receiver side these pulses are identified, separated and used for triggering the oscillator circuit.
- Horizontal Sync pulse time period = 4.7 μSec.
- Horizontal Sync pulse Frequency =15,625 Hz.
- Vertical Sync pulse time period = 160 μSec.
- Vertical Sync pulse frequency = 50 Hz.


Horizontal Blanking Period
'Front Porch'
H-Sync pulse
'Back Porch'
Picture Data
White Level
1.0v
0.3v
Black / Base Level
Sync. Level
0.0v
One Scanline

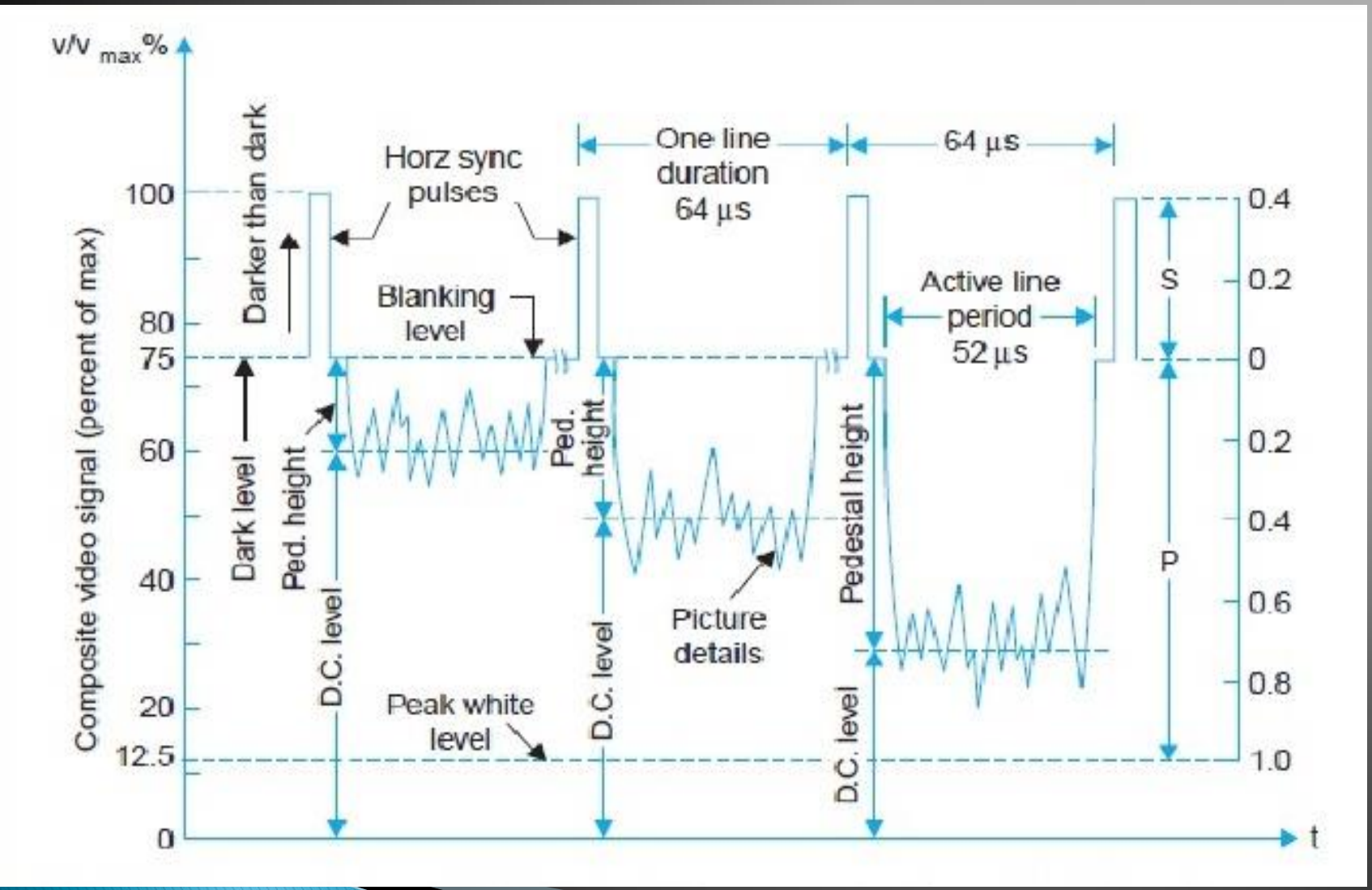
# BLANKING PULSES

- BLANKING PULSES : The video signal obtained during the horizontal and vertical retrace are not useful one. So there is no need to transmit them. So to make the retrace signal invisible we are using blanking pulses. During horizontal blanking, horizontal retrace is blanked.
- For a single line one blanking pulse is needed. So for 1 sec, 15,625 blanking pulses are needed.
- In vertical retrace, for one frame two vertical blanking pulse is needed. So in 1 sec, 25 frames are scanned.

# COMPOSITE VIDEO SIGNAL (CVS)

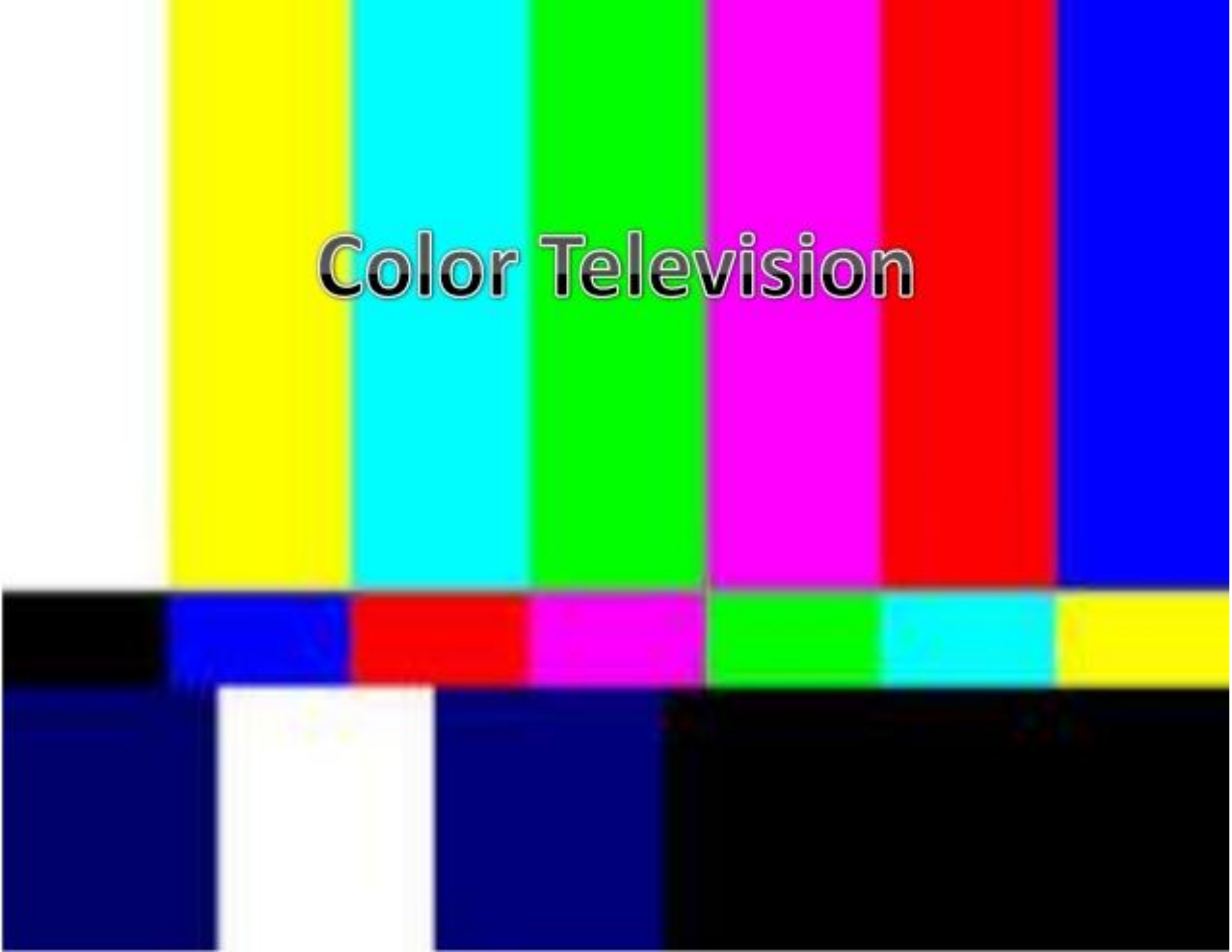
- CVS consists of
- Camera signal corresponding to the picture to be transmitted.
- Blanking pulses to made the retrace invisible.
- Sync pulse to synchronize the transmitter and receiver.

# COMPOSITE VIDEO SIGNAL (CVS)



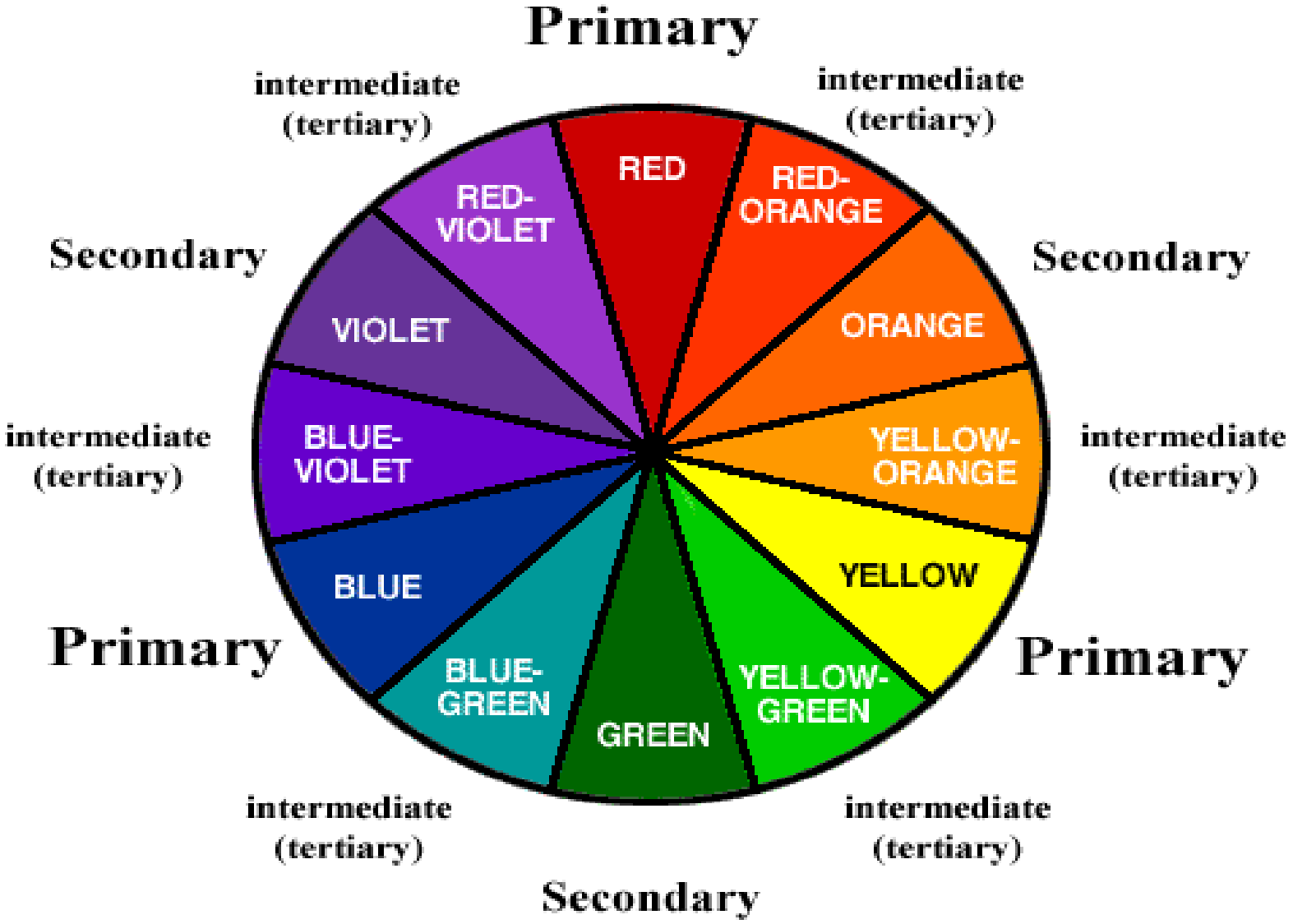
# COMPOSITE VIDEO SIGNAL (CVS)

- Video signal varies between certain limits
- Peak white level: 10 to 12.5%
- Black level : 72%
- Blanking level : Sync pulses added – 75%level
- Pedestal : difference between black level and blanking level – tend to merge
- Pedestal height : distance between the pedestal level and the dc level – indicates the average brightness
- Picture information : 10% – 75%
- Darker the picture – higher will be the voltage within those limits


Color Television

# PRIMARY AND SECONDARY COLOUR

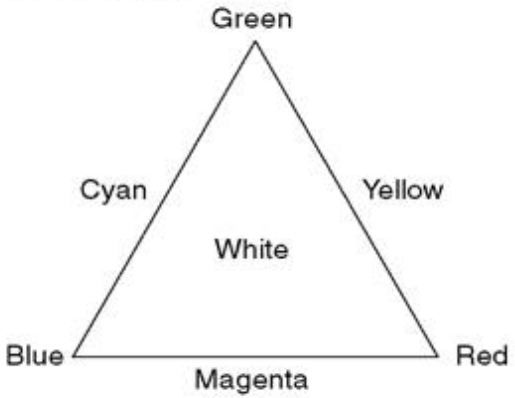
- **Primary colours**: are sets of colours that can be combined to make a useful range of colours. The primary colours are those which cannot be created by mixing other colour in a given colour space. Red, green and blue are TV's primary colours.
- **Secondary colours**: A secondary colour is formed by the sum of two primary colours of equal intensity. Every secondary colour is the complement of one primary colour: cyan complements red, magenta complements green and yellow complements blue.
- Cyan is green + blue,
- magenta is blue + red, and red,
- Yellow + cyan is light green, and
- Cyan + magenta is light blue.


Primary
intermediate (tertiary)
intermediate (tertiary)
Secondary
Secondary
intermediate (tertiary)
intermediate (tertiary)
Primary
Primary
intermediate (tertiary)
intermediate (tertiary)
Secondary
RED
RED-ORANGE
ORANGE
YELLOW-ORANGE
YELLOW
YELLOW-GREEN
GREEN
BLUE-GREEN
BLUE
BLUE-VIOLET
VIOLET
RED-VIOLET

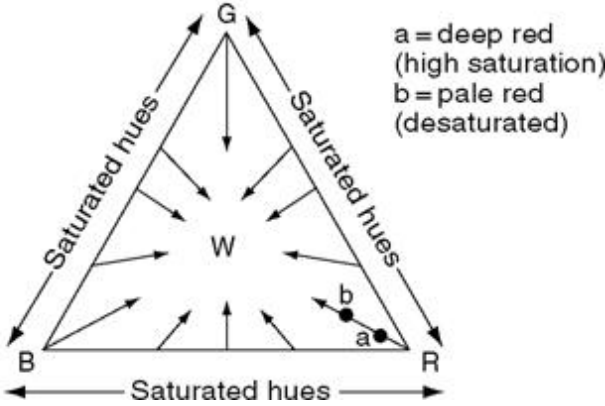
# COLOUR TRIANGLE

- Colour television is based on the principle of **additive** colour mixing in which three suitable primaries (red, green and blue) can be mixed together to produce white and a wide range of colours. The colour seen is dependent on the relative amounts of red, green and blue light.
- Mixtures between two of the primary colours can be plotted as points on the line joining the two primaries, e.g. a mixture of red and green produces yellow. When the three primary colours are mixed together the resultant colour 'mix' can be plotted inside the triangle.

(a) Colour triangle



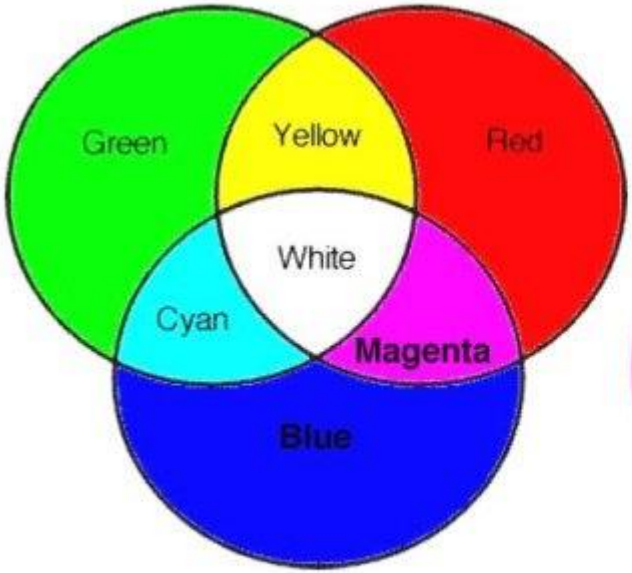

(b) Illustrating hue and saturation



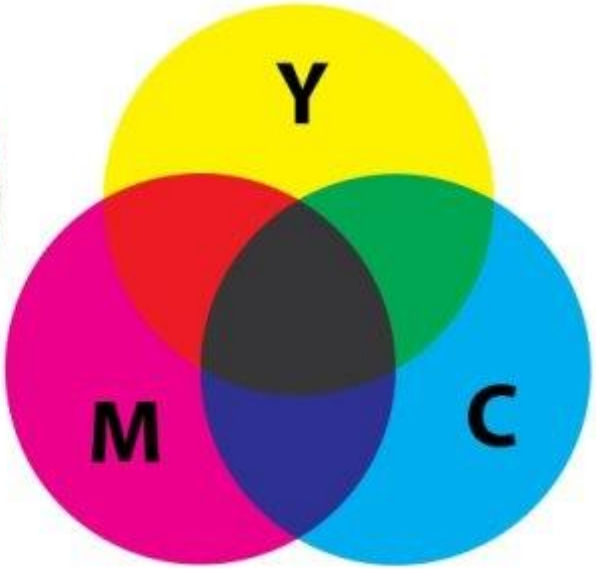
# MIXING OF COLOUR

- Mixing of colours can take place in two ways:
- Additive mixing
- Subtractive mixing
- Additive color mixing is the process of combining light of two different colors.
- By pairwise additive mixing of the primary colour the following complementary colour are produced:
- Red + Green = Yellow
- Red + Blue = Magenta
- Blue + Green = Cyan

# MIXING OF COLOUR



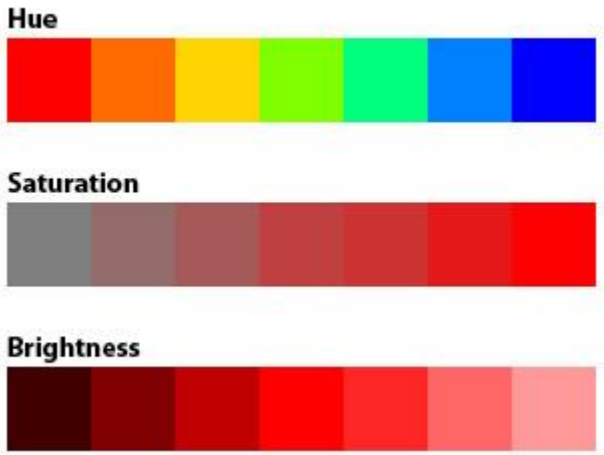

*Additive colour mixture of Red, Green and Blue to produce Yellow, Cyan, Magenta and White*



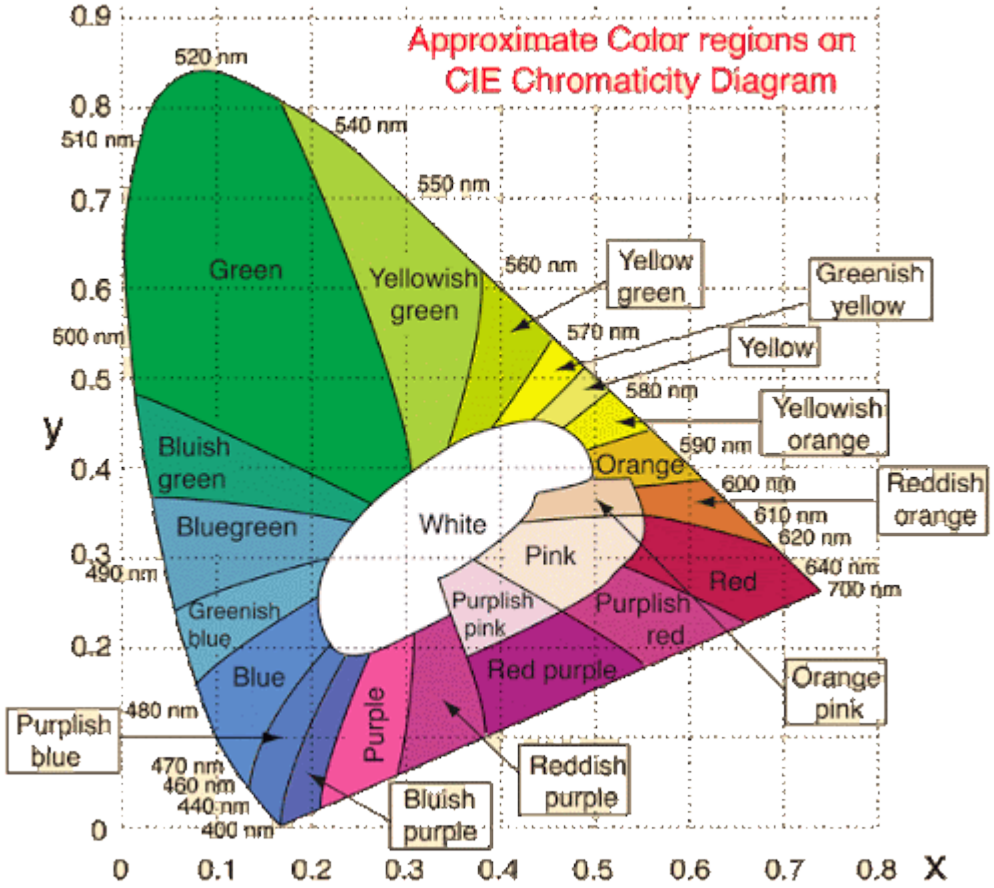

*Subtractive colour mixture of Yellow, Cyan and Magenta to produce Red, Green, Blue and Black*

# Hue, Saturation and Luminance

- Saturation – Saturation describes how much the signal appears to be a single wavelength. If it is a single wavelength, then there will be a very particular set of RGB signals that can come out of it. Our brain perceives this as saturation. On the other hand, if the light does not have one wavelength that stands out above the rest, we will perceive it as desaturated.
- Hue – If the color is saturated, then hue represents what wavelength the eye perceives as being the only wavelength. This, of course, can be fooled by having 3 wavelengths carefully tuned to the colors our eyes are most sensitive to, which is how monitors work.
- Luminance – The strength of the overall response. The more photons that hit the eye, the stronger the signal from the cones in our eyes, so the brighter we perceive it.



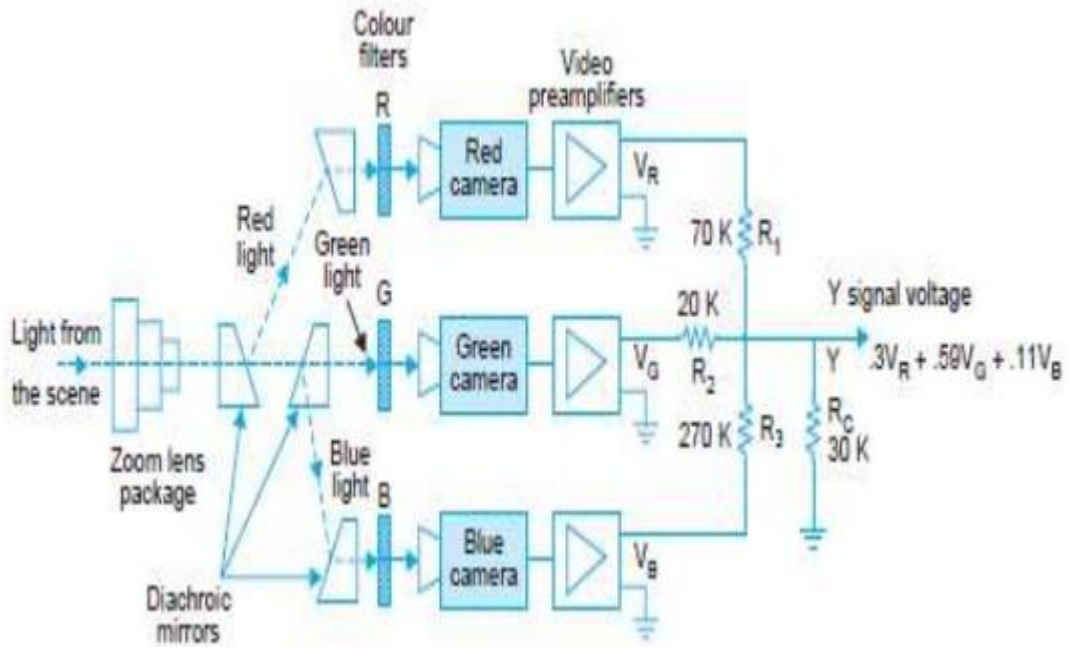
# CHROMATICITY DIGRAM



# TELEVISION CAMERA TUBES

- An electron tube use a light-sensitive material/receptor that converts an optical image into an electrical television video signal.
- The tube is used in a television camera to generate a train of electrical pulses representing the light intensities present in an optical image focused on the tube.
- Each point of this image is interrogated in its proper turn by the beam in tube , and an electrical signal corresponding to the amount of light at that point of the optical image is generated by the tube. This signal represents the video or picture portion of a television signal.

# COLOUR TV CAMERA



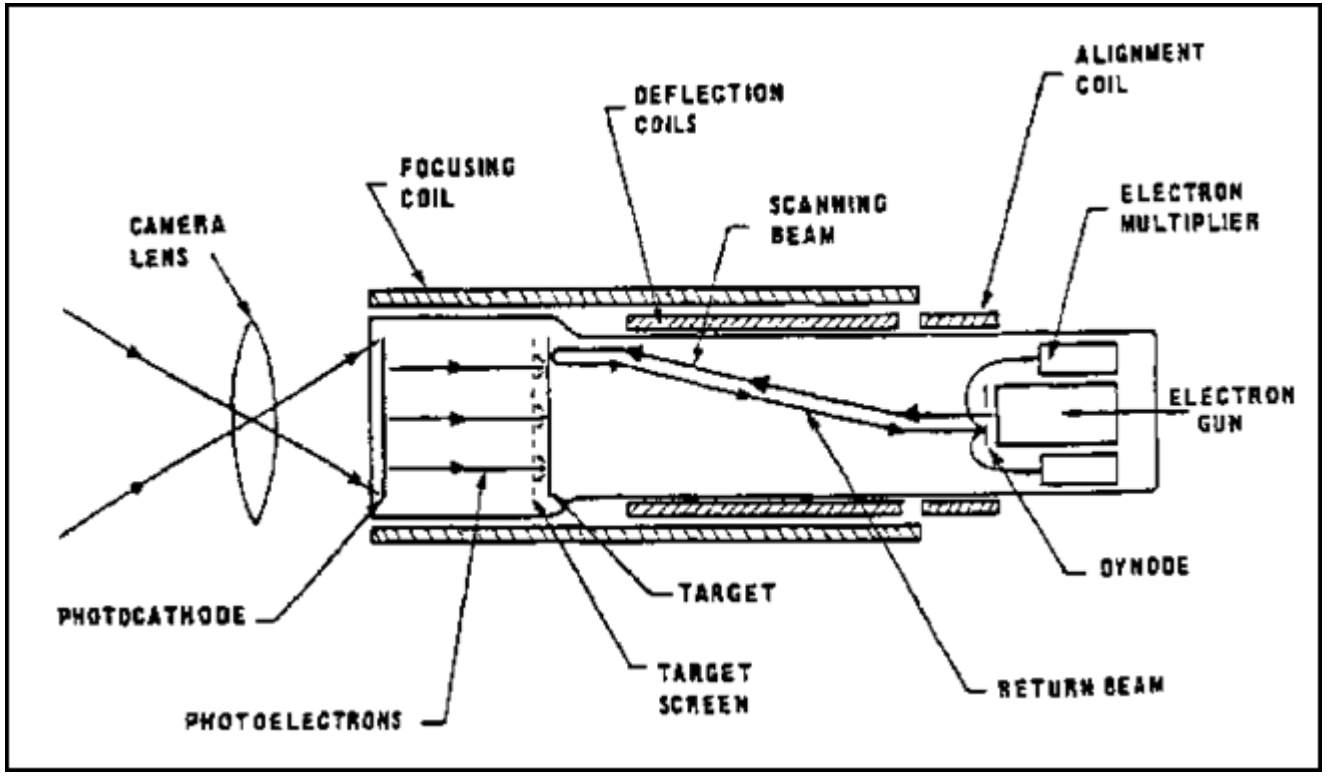
# BASIC PRINCIPLE

- Photoconductive effect
- Photoemission effect

# Types of Camera Tubes

- Image Orthicon tube
- Vidicon
- Plumbicon

# Image Orthicon tube



# Image Orthicon tube

Principle : Photoemissive

It has three section:

- Image section
- Scanning section
- Electron gun –cum–multiplier section

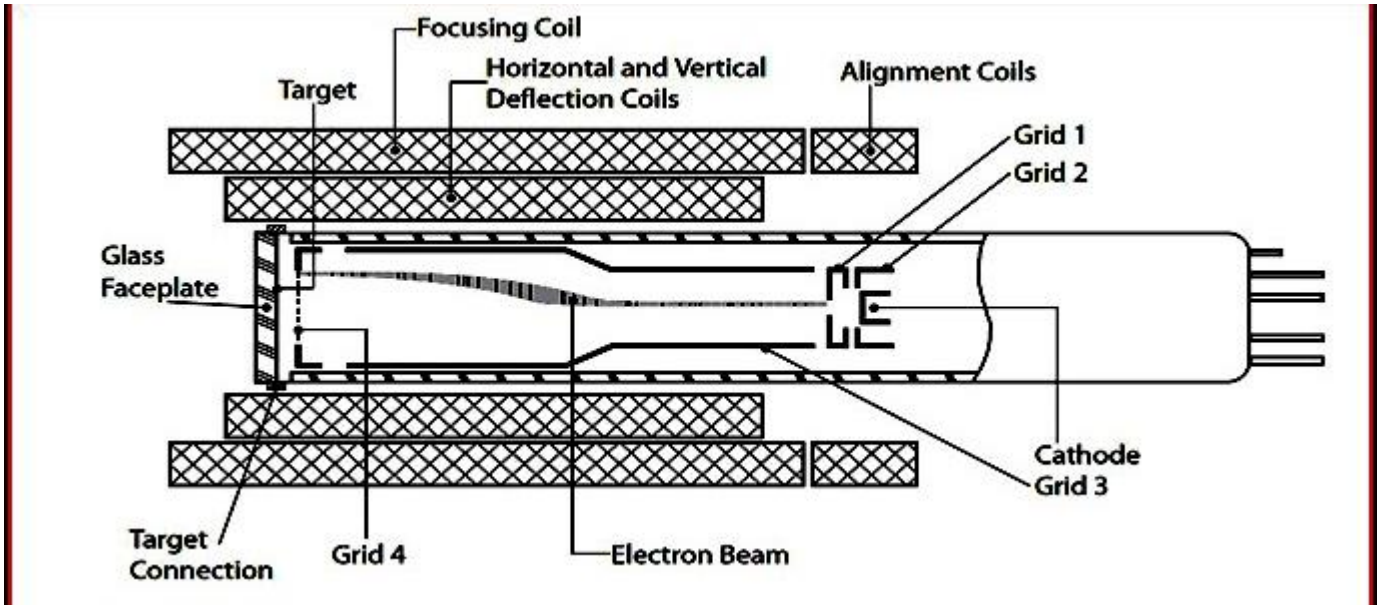
# Vidicon

Principle : Photoconductive

It has three section:

- Target section
- Scanning section
- Electron gun

# Vidicon


Focusing Coil
Target
Horizontal and Vertical
Deflection Coils
Alignment Coils
Grid 1
Grid 2
Glass
Faceplate
Cathode
Grid 3
Target
Connection
Grid 4
Electron Beam

# Plumbicon Camera Tube

- Principle : Photoconductive
- It has fast response and produce high quality pictures at low light level.
- It has small size and light weight and has low power operating characteristics .
- It is similar to vidicon tube except small change in target plate

# PAL TV COLOUR RECEIVER

The colour TV receiver is similar to the monochrome system expect that here we have a colour demodulator section

The sections of the PAL colour receiver are

1. Colour chroma section
2. Colour band pass amplifier
3. Burst gate
4. Colour killer circuit
5. Colour subcarrier oscillator
6. PAL delay line and discrimination
7. Matrix network

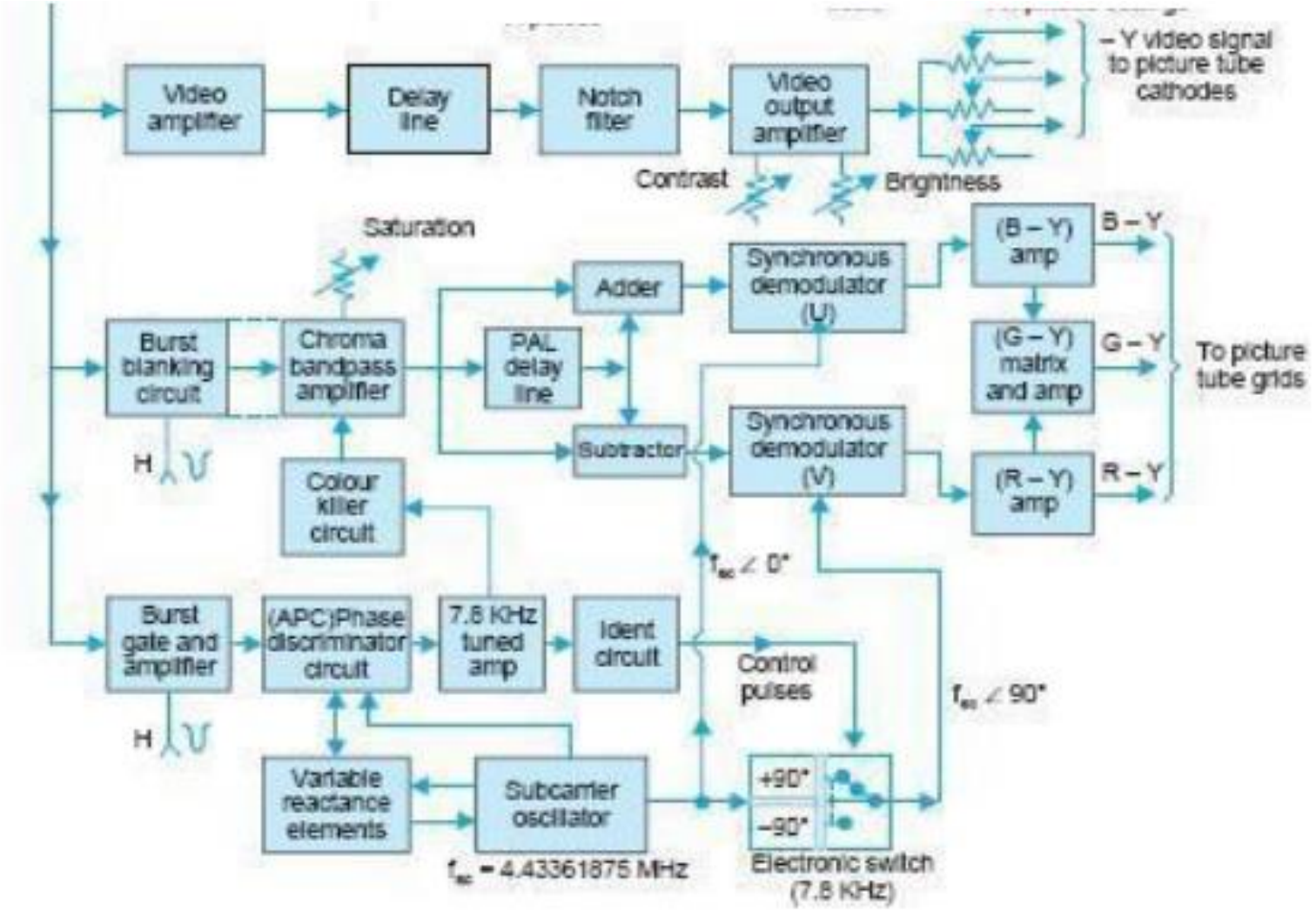



**Figure. Block diagram of a PAL-D colour receiver.**

# PAL TV RECEIVER

- Signal from antenna is selected by the tuner and converted to video and sound IF. It is amplified by the IF amplifier and detected by video amplifier. Inter carrier sound IF is sent to sound IF section and audio signal is produced. Video is amplified and sent to CRT and vertical & horizontal sync pulses are separated and transmitted to respective sections.
- The RF tuner is used to select the RF signal for different channel from the antenna.
- The sync pulses for horizontal and vertical oscillator are separated by the sync separator and its associated circuit
- Chrome band pass amplifier:
- This section consists of a chroma filter and two stage chroma amplifiers. In this section we have a color control. This control adjusts the gain of the band pass amplifier

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# NTSC,SECAM AND PAL SYSTEM

- **NTSC** is an abbreviation for National Television Standards Committee, named for the group that originally developed the black & white and subsequently color television system that is used in the United States, Japan and many other countries. An NTSC picture is made up of 525 interlaced lines and is displayed at a rate of 29.97 frames per second.
- **PAL** is an abbreviation for Phase Alternate Line. This is the video format standard used in many European countries. A PAL picture is made up of 625 interlaced lines and is displayed at a rate of 25 frames per second.
- **SECAM** is an abbreviation for Sequential Color and Memory. This video format is used in many Eastern countries such as the USSR, China, Pakistan, France, and a few others. Like PAL, a SECAM picture is also made up of 625 interlaced lines and is displayed at a rate of 25 frames per second. However, the way SECAM processes the color information, it is not compatible with the PAL video format standard.

# THANK YOU