Revision:2015 Course Code:6046

Course Title:TELEVISION ENGINEERING

PART A

I 1) Efficiency, S/N ratio, frequency response, directivity, distortion, impedance etc.

2) Primary colours — red, green, blue
Secondary colours — Yellow,Magenta,Green.

3) To regenerate the colour sub carrier in the receiver with same frequency, and phase of the transmission side colour sub carrier.

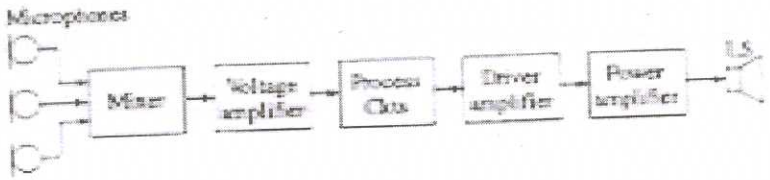
4) JPEG, MPEG, IPTV, IPMP etc...

5) Security system, bank hospitals, festivals, stadium, etc..

PART – B

II 1) Fig ---1

BLOCK DIAGRAM OF PA SYSTEM



3

When a large gathering is to be addressed, sound needs to be amplified so that people at a distance from the stage may receive good intensity of sound. The system used for this function is called public address system. 3

Microphone picks up sound waves and converts them into electrical signal. Provision of 2 or more microphones. Output of microphones is fed to mixer stage

	function of mixer stage is to effectively isolate different channels from each other before feeding to the main amplifier. Voltage amplifier amplifies the output of the mixer. Processing circuits have master gain control and tone control. Driver amplifier gives voltage amplification to the signal and fed to power amplifier stage. Power amplifier gives desired power amplification to the signal. The output of power amplifier is connected to the loudspeaker, which converts electrical signal to sound signal.				
2.					
		PAL	NTSC	SECAM	
	Lines/frame	625	525	625	
	Frames/second	25	30	25	
	Line frequency	15625	15750	15625	
	Channel bandwidth	7Mhz.	6Mhz	8Mhz	
	Picture modulation	AM	AM	AM	
	Sound modulation	FM	FM	FM	
				(ANY 3)	
3.	In digital Tv transmission, the analog video and audio signals are first quantized and get transmitted. The quantization is done at such a fast rate that the reassembled signals at the receiver almost resemble the sent signals. Thus formation of digital TV signal involves various processes as below. 1. Sampling. 2.quantization. 3.encoding. 4. Data compression. 5.modulation (describe briefly each term) --- 3 marks				3

4.

Working

- The single gun consists of a long-necked tube with a single electrode at its base, flaring out into a horizontally-aligned rectangular shape with three vertically-aligned rectangular cathodes inside
- Each cathode is fed the amplified signal from one of the decoded RGB signals.
- The electrons from the cathodes are all aimed toward a single point at the back of the screen where they hit the aperture grille, a steel sheet with vertical slots cut in it.

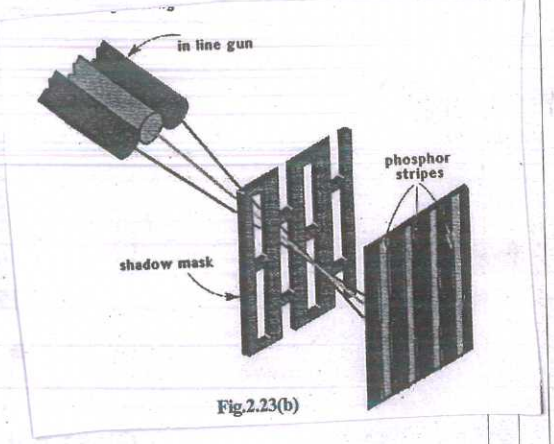


Fig.2.23(b)

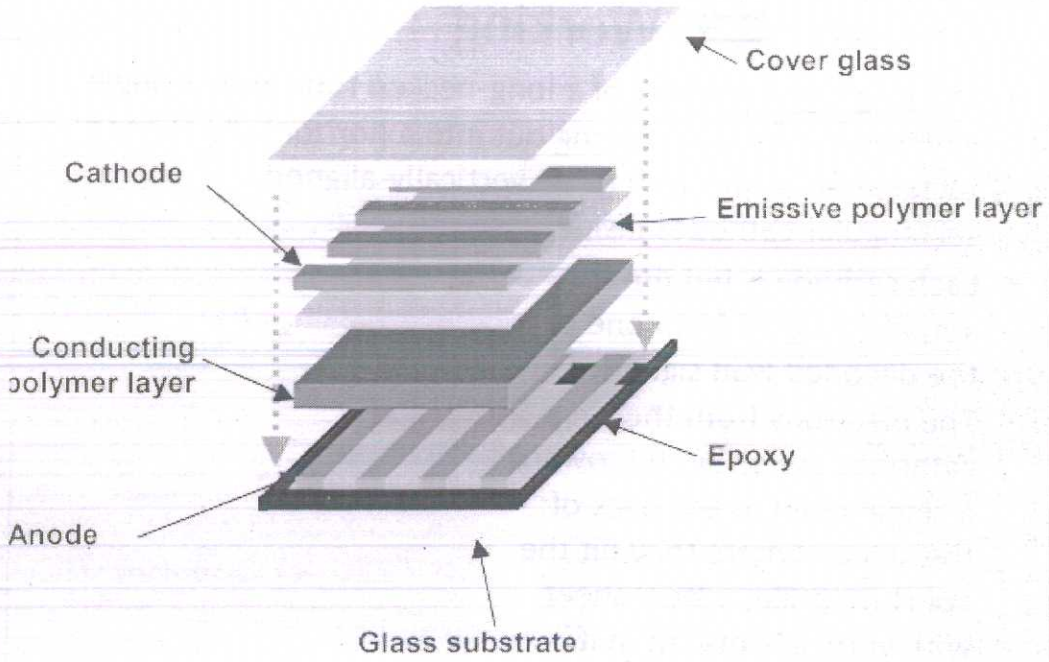
The precision- in- line(PIL) picture tube has 3 guns which are aligned in a horizontal line. Colour phosphors are deposited on the screen in the form of vertical stripes in triads(R,G,B). The aperture mask has vertical slots corresponding to colour phosphor stripes. The slots in the mask are so designed that each beam strikes its own phosphor. The P.I.L. picture tube is more efficient. 3

5. OLED – Organic Light Emitting Diode is a type of display that makes it possible to reach dark blacks and build ultra-thin tv., while making them more efficient and eco-friendly

OLEDs work in similar way to conventional diodes and LEDs, but instead of using layers of n-type and p-type semiconductors, they use organic molecules to produce their electrons and holes.

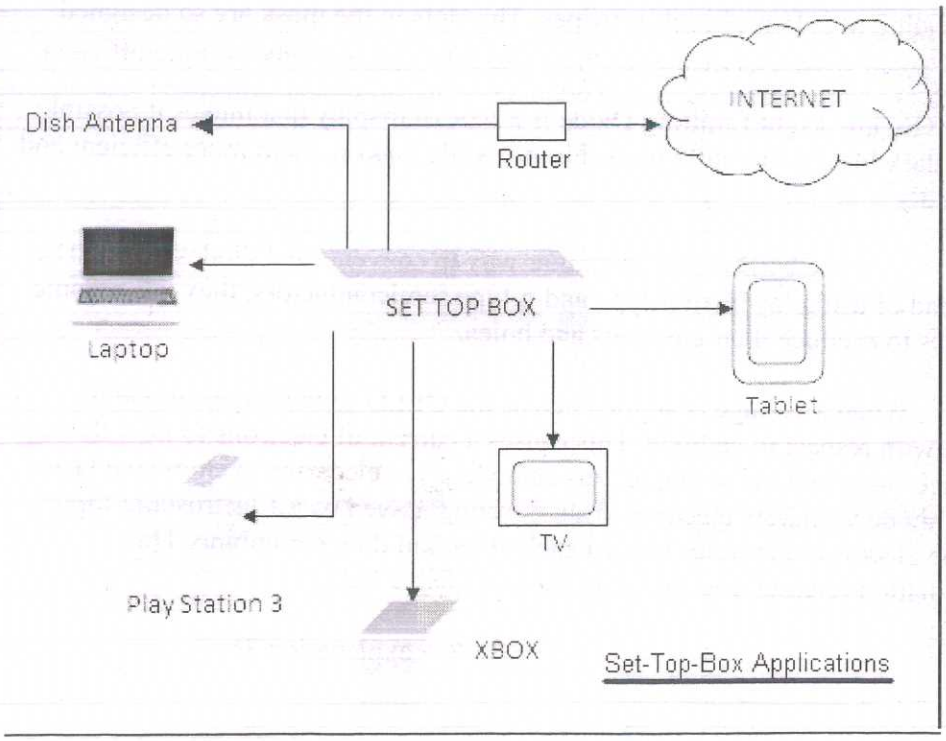
When a voltage is applied across the OLED such that the anode is positive with respect to cathode. This causes a current of electrons to flow through the device from cathode to anode.thus cathode gives electrons to emmisive layer and the anode withdraw electrons from the conductive layer..Electrostatic forces bring the electrons and holes toward each other and they recombine. This recombination releases energy in the form of visible light.

(fig. 3 + explanation 3)



6.

Fig 4 set top box



3

	A general definition of set top-boxes is: A STB is an appliance for the reception, decoding, processing and local networking of digital broadcasting and related services. Additional functionalities implemented in a STB could be: • Conditional Access (CA) • Networking: examples of networking functions are VoIP and the provision of principal signals for other products • Recording • Interfacing • Return channel (allowing unique user interaction with broadcast content) • Picture and sound processing The digital device which connects between dish antenna and television set and used to select different TV channels as per the choice is called set top box. It selects one channel among different channel received by dish antenna. Set top box includes digital satellite receiver, digital cable receiver etc.	3		
7.	**1 Sensitivity**. Defined as output in mill volt for the sound pressure of 1 microbar at 1000hz. 2. **signal to noise rato** - : it is defined to be the ratio of DB of the output to the output in the absence of sound. **3.Frequency response**. Defined as the bandwidth of audio frequencies in the output of microphone within +/- 1 DB of the output at 1000hz. **4.Distortion, 5. Output impedance**...(explain any 3)			
III. a.	Main parts.-permanent magnet and ribbon conductor. The ribbon is light aluminium foil, which is suspended in the magnetic field of per. Magnet. When the ribbon is moved by the force of sound pressure, there is a change of magnetic flux through conductor. Due to this change of magnetic flux, an emf is induced across the ribbon. This emf is proportional to the rate of change of magnetic flux which is proportional to the force of sound waves striking the ribbon. It is also called pressure gradient microphone or velocity microphone.	3		

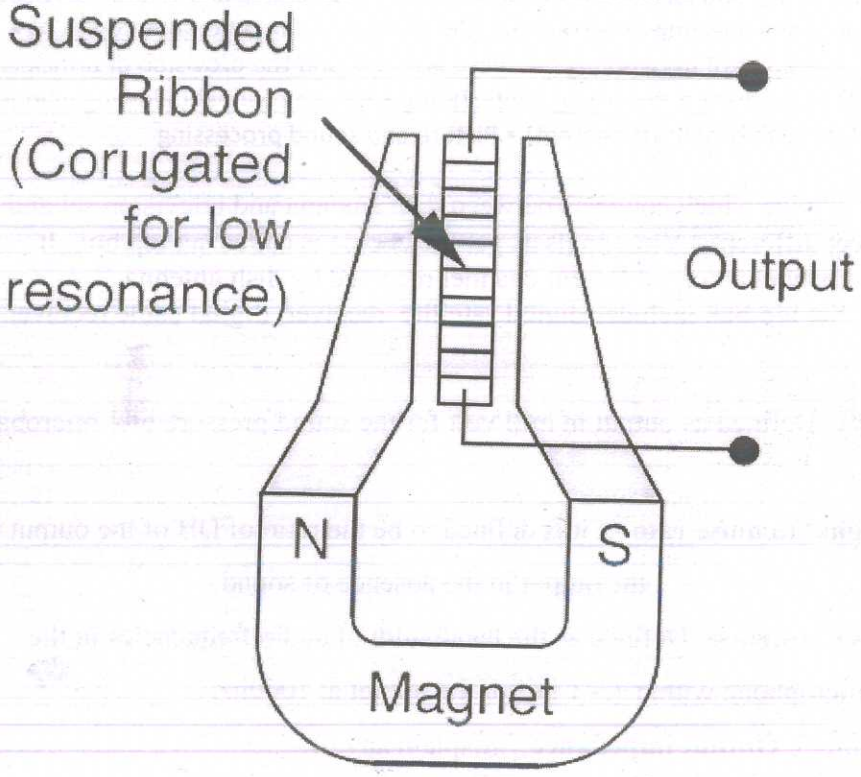


Fig1: Ribbon and Magnet Arrangement

4

III. b.

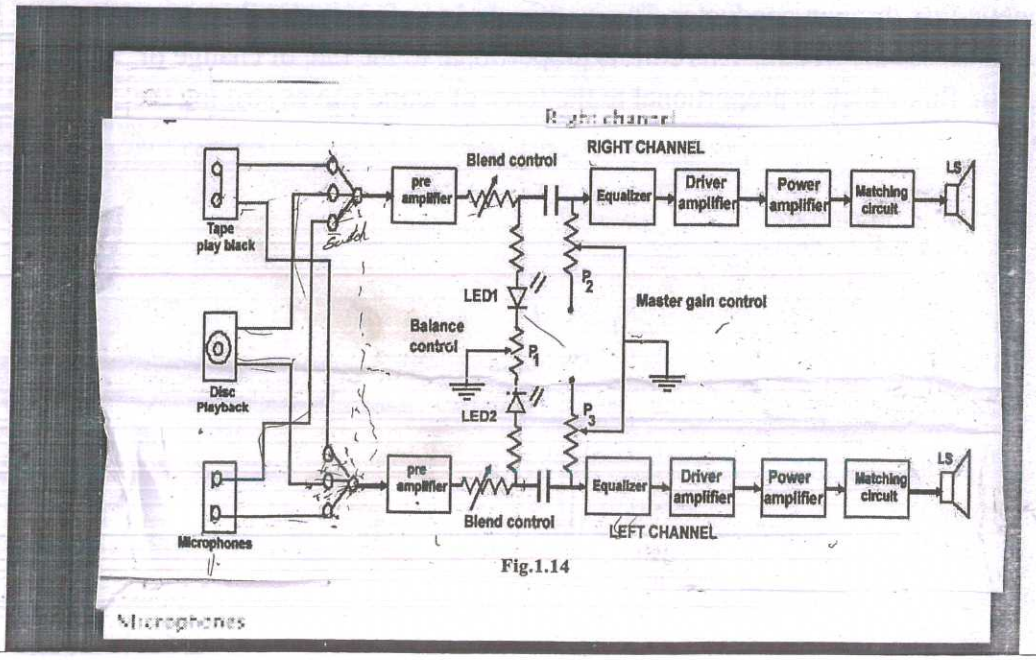
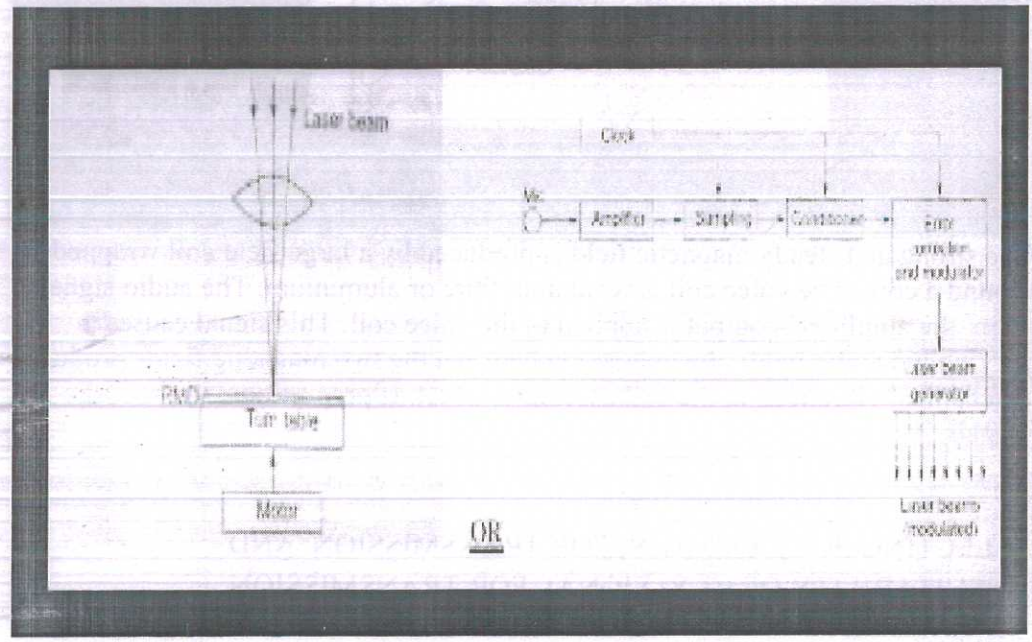
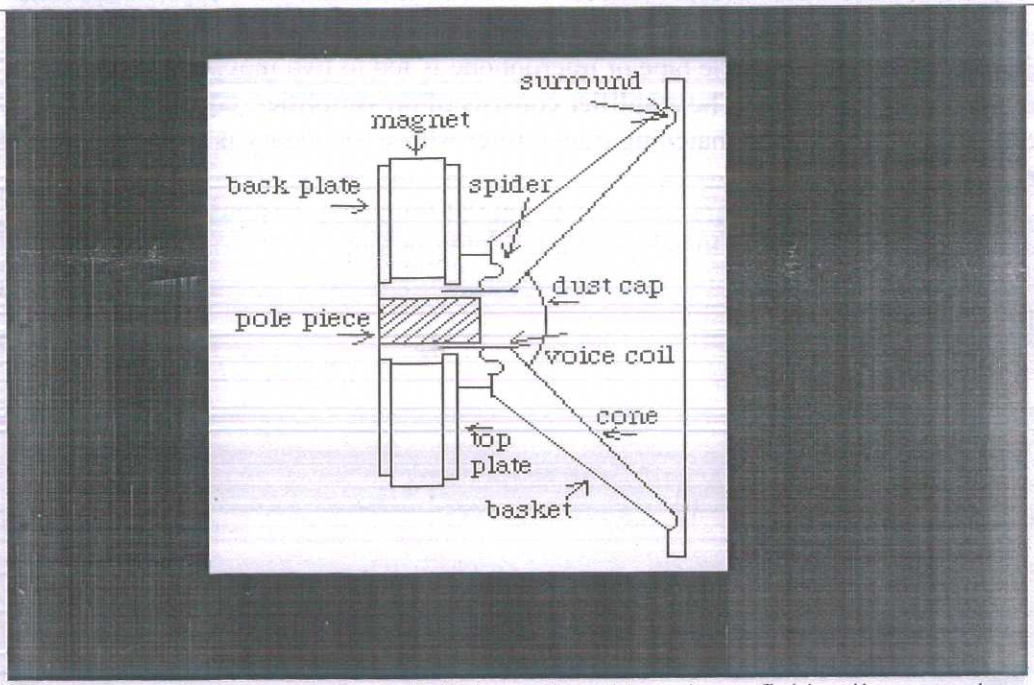


Fig.1.14

4

	The sterio signal from the tape or microphone is fed to two independent amplification channels. The amplifier consists of pre-amplifier, equalizer, well designed amplifier, and matching transformer whose secondary is connected to the respective loud speaker. All the blocks are designed to get flat frequency response, little distortion, high s/n ratio, to achieve high fidelity output. Explanation 4.	4	
IV (a)	 Fig . optical recording. A CD contains record of digital audio signals in the form of pits of 1 micrometer depth and 0.5 micrometer width but of variable length. Pitch of tracks is 1.6 micrometer. Recording is done on a resist master disc with the help of powerful laser beam as shown in fig. The laser beam is modulated by digitized audio signal. The audio signal is sampled and quantized . these bits are added with error correction bits and modulate the laser beam. When laser beam is on a pit is formed and when off, a flat is formed. (fig 4, expln.-4)		
IV (b)			



4

The strong and steady magnetic field is produced by a large field coil wrapped around a core. The voice coil is wound on fibre or aluminium. The audio signal from the amplifier's output is applied to the voice coil. This signal causes a varying magnetic field . the interaction between the two magnetic fields produces mechanical vibrations in the coil assemply, which is proportional to the audio signals.

3

V.a. SELECTING (R-Y) AND (G-Y) FOR TRANSMISSION AND UNSUITABILITY OF (G-Y) SIGNAL FOR TRANSMISSION.

Y = 0.3R+0.59G+0.11B

Also (0.3+0.59+0.11)Y = 0.3R+0.59G+0.11B

Rearranging the above equations we get :

$$(G - Y) = -0.51(R - Y) - 0.186\,(B - Y).$$

Since the required amplitudes of both $(R - Y)$ and $(B - Y)$ are less than unity, they may be derived using simple resistor attenuators across the respective signal paths. However, if $(G - Y)$ is to be one of the two transmitted signals then

(i) if $(R - Y)$ s the missing signal, its matrix would have to be based on the expression:

$$(R - Y) = \square\ (0.59/03)\,(G - Y) - (0.11/0.3)\,(B - Y)$$

The factor (0.59/0.3)= 1.97 implies gain in the matrix and thus would need an extra amplifier.

(*ii*) Similarly if $(B - Y)$ is not transmitted, the matrix formula would be:

$$(B - Y) = (0.59/0.11)\,(G\text{-}Y) - (0.3/0.11)\,(R\text{-}Y)$$

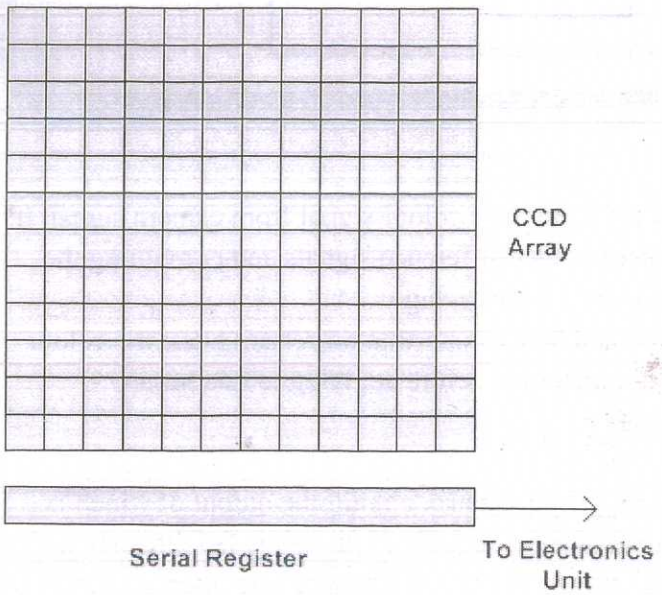
The factor 0.59/0.11 = 5.4 and 0.3/0.11 = 2.7, both imply gain and two extra amplifiers would be necessary in the matrices. This shows that it would be technically less convenient and uneconomical to use $(G - Y)$ as one of the colour difference signals for transmission.

In addition, since the proportion of G in Y is relatively large in most cases, the amplitude of $(G - Y)$ is small. It is either the smallest of the three colour difference signals, or is atmost equal to the smaller of the other two. The smaller amplitude together with the need for gain in the matrix would make S/N ratio problems more difficult then when $(R - Y)$ and $(B - Y)$ are chosen for transmission.

V.b. The photo electric effect is fundamental to the operation of a CCD camera. Atoms in a silicon crystal have electrons arranged in discrete energy bands. Most of the electrons occupy the valance band. But can be excited into the conduction by heating or absorption of a photon.

CCD (charge-coupled device) is an electronic instrument for detecting light. In the case of an astronomical CCD camera, this light is very dim. We will see that this has certain implications for how the CCD operates.

A CCD uses a thin silicon wafer chip. The chip is divided into thousands or millions of tiny light sensitive squares (or sometimes rectangles) called photosites. Each photosite corresponds to an individual pixel . In the final image and photosites are often referred to simply as pixels. For clarity in this discussion, "photosites" will refer to the CCD chip and "pixels" will refer to an image. Each photosite is surrounded by a non-conductive boundary which contains the charge that is collected during an exposure within the photosite. 4



3

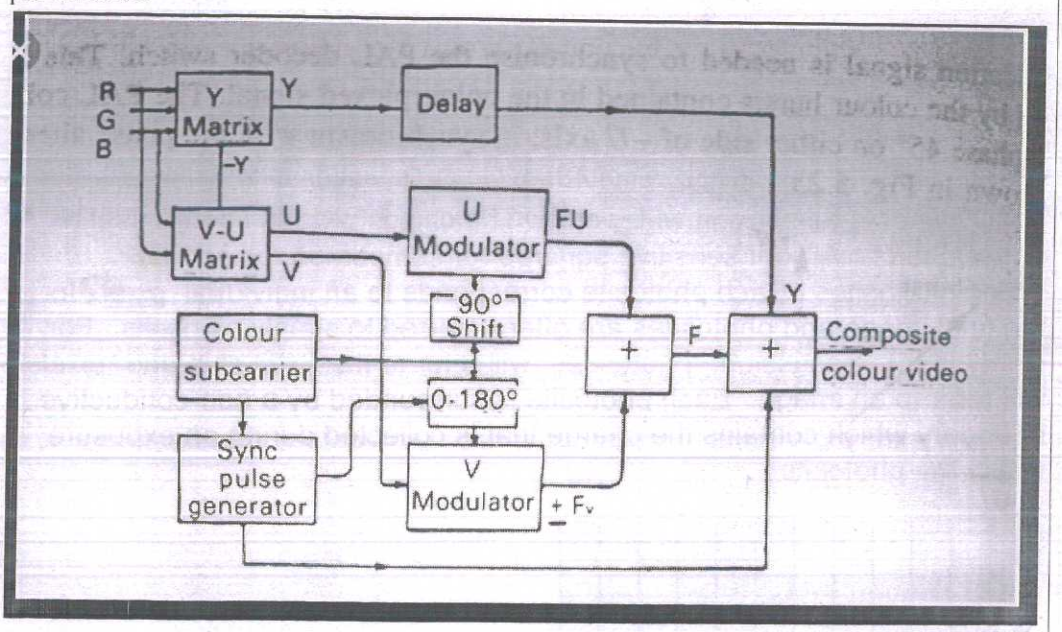
A CCD chip consists of an array of photosites(squares) and a serial register for reading out the image data.

VI.a. Encoder in colour TV generate the composite colour signal from camera signal. It is done by quarature modulation of colour difference signals and combining the modulation products before frequency interleaving

To prevent over modulation and hence distortion on certain hues, the colour difference signals are reduced in magnitude before applying to quadrature modulator.The scaling factors are

U = 0.493 (B_Y) and V = 0.877(R_Y)

pal encoder



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R,G,B signals from camera are given to matrix circuit, the output of which is U,Vand Y signal.The subcarrier oscillator frequency (fm<0^0) is fed directrly to the U modulator , but given a phase shift of +/- 90^0 on alternate line intervals before feeding to V modulator. This amounts to 180^0 phase difference with respect to u on alternate lines.Thus phase shift errors cancelled due to reversal of V signal.

The Y signal obtained at the output of matrix circuit is

	combined with line and frame sync pulseses and fed to a delay lineto maintain time characteristics of Y and C signals.			
(b)	Luminance-This is the amount of light intensity as perceived by the eye regardless of the colour. In black and white pictures,better lighted parts have more luminance than dark areas. Hue- This is the predominant spectral colour of the received light. Thus the colour of any object is distinguished by its hue or tint. The green leaves has green hue Saturation- This is the spectral purity of the colour light.Saturation may be taken as an indication of how little the colour is diluted by white. A fully saturated colour has no white. The hue and saturation of a colour put together is known as chrominance.			
VII. a.	The R.f signal from antenna is demodulated and amplified in the tuner in the conventional way to obtain IF output. The aseperated video and audio IF signals are digitized and presented to digital signal processing circuits with the aid of a micro computer. Video codec –it takes signal from the IF stage, coverts in to 8 bit digital signal. Video processor. It seperates the signal into two channels luminance and chrominance and given to picture tube through R G B m,atrix. Deflection processing circuit – it senses the TV signal and synchronises the vertical and horizontal sweep . Audio codec – it samples the input signal and converts into 16 bit data stream. Audio processor. – The audio processor takes the signal from the convertor and splits it into two channels. CCU – It is a control computer that controls other chips and translates the users instructions.	5		

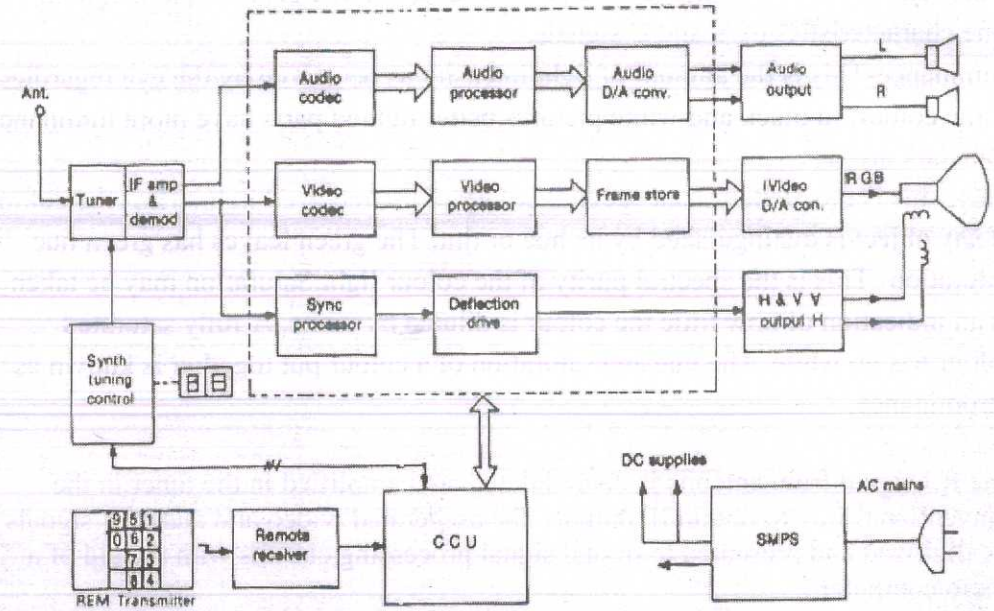


Fig. Functional block diagram of digital TV receiver

5

(*figure :5 + Explanation :5*)

VII b. In the conventional PAL/NTSC systems the luminance and chrominance information is transmitted simultaneously for each line in interleaved form. For sound information, there is an additional carrier. This creates problems of interference beats called cross luminance and cross colour effects

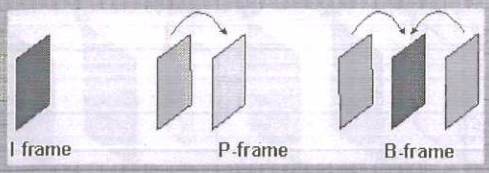
To solve this problem, a new encoding system called Multiplexed Analog Components, (MAC) is proposed. In MAC coding luminance and chrominance signals are time division multiplexed. ie sent in time sequence as separate components in the time of a normal horizontal line. And not simultaneously. 5

VIII a) Raw video contains an immence amount of data. Video compression reduces the bit rate of data and hence reduce the bandwidth.

A video compression system consists of the following.

1. An encoder. 2. Compressed bit streams. 3. A decoder.

- Main addition over image compression
  - Exploit the temporal redundancy
- Predict current frame based on previously coded frames
- Types of coded frames:
  - I-frame – Intra-coded frame, coded independently of all other frames
  - P-frame – Predictively coded frame, coded based on previously coded frame
  - B-frame – Bi-directionally predicted frame, coded based on both previous and future coded frames



MPEG is an acronym for moving pictures Expert Group. MPEG is a method for video compression, which involves the compression of digital images and sound, as well as synchronization of the two.

MPEG STANDARDS

1. MPEG-1 IS INTENDED FOR INTERMEDIATE DATA RATES ON THE ORDER OF 1.5M bit/second
2. Mpeg -2 is intended to high data rates of 10Mbit/sec.
3. Mpeg-3 was intended for HDTV compression and merged with mpeg-2
4. Mpeg-4 is intended for very low data rates of less than 64 k bit/sec.

MPEG FRAMES

I frame :An intracoded frame (I-frame) is an independent frame that is not related to any other frame. They are present at regular intervals. An I frame must appear periodically to handle some sudden change in the frame.

p-frame. A predicted frame (p frame) is related to the preceding I-frame or p-frame. Each p-frame contains only the changes from the preceding frame.

B-frame : A bidirectional frame (B-frame) is related to I-frame or P-frame. Each B-frame is related to the past and future.

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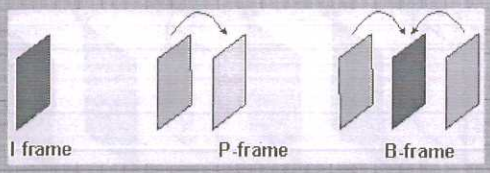

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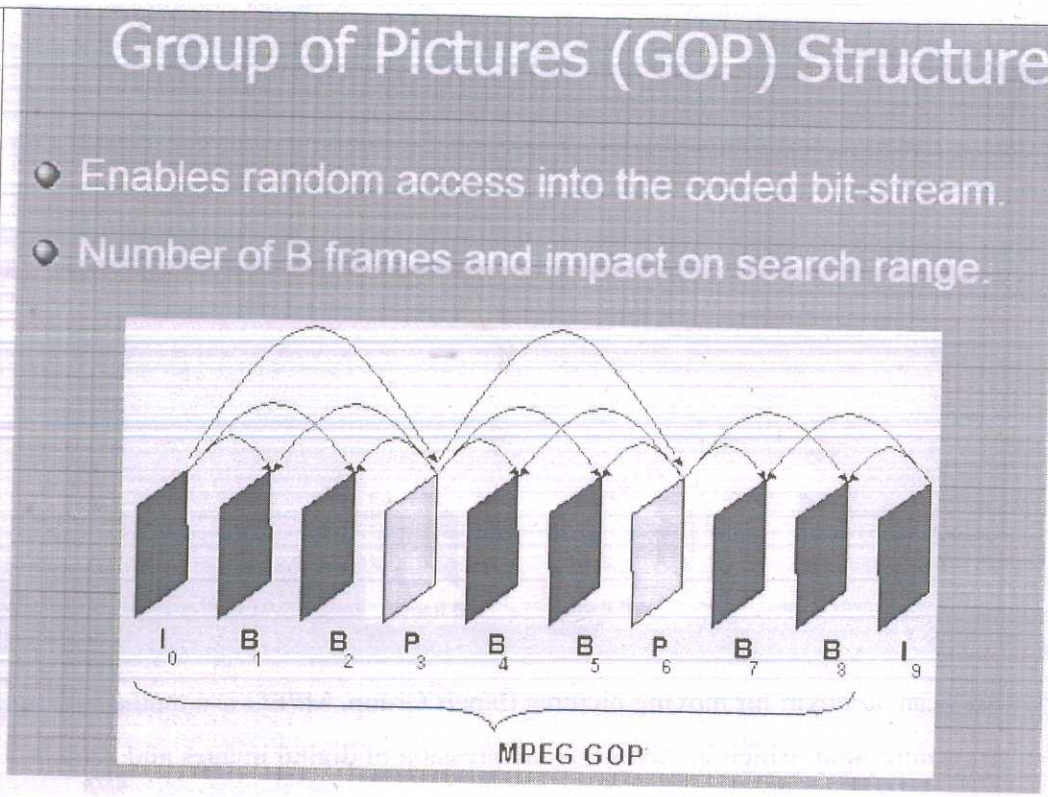

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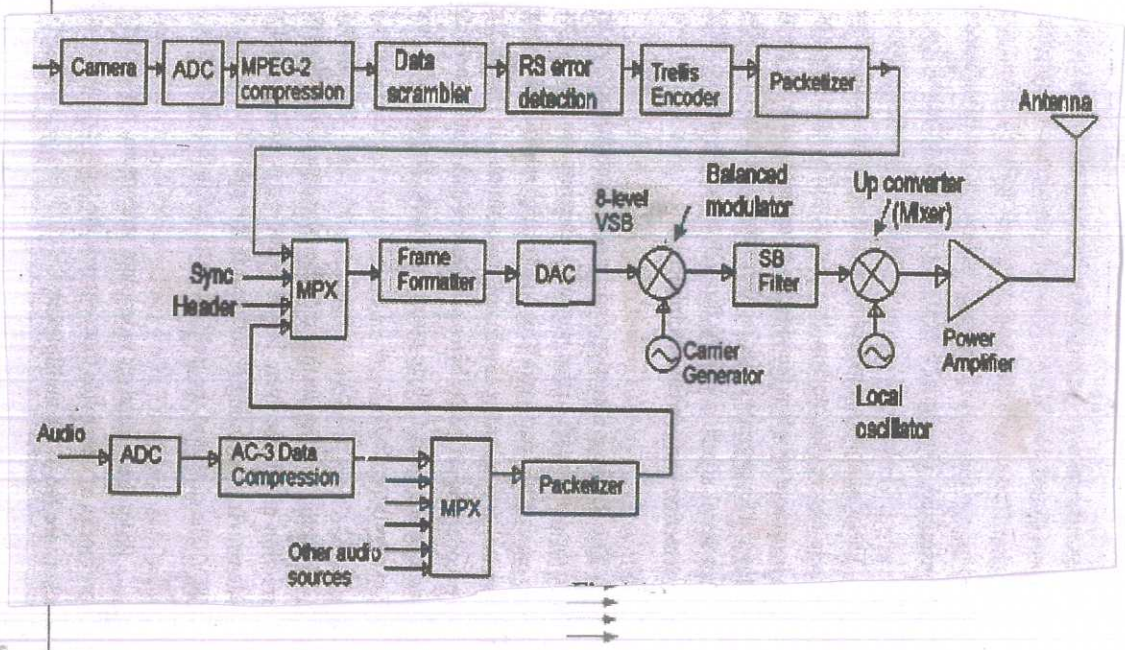
B-frame : A bidirectional frame (B-frame) is related to I-frame or P-frame. Each B-frame is related to the past and future. (fig.7. + exp. 8)

IX a)	HIGH DEFINITION TELEVISION aims at 1. Improvement in vertical and horizontal resolution of the reproduced picture. 2. Much improved colour reproduction, 3. Higher aspect ratio of at least 5 : 3. 4. Stereophonic sound. This implementation results in a picture quality as clear as obtained from 35mm cine films. Video from RGB are converted to chrominance and luminance signals.. It is digitized by A/D converters. Data compression is used to reduce the number of bits needed to represent the video data. MPEG-2 is used in HDTV. The scrambler scrambles the signal. Rs error detection and correction circuit adds extra bits to the data stream so that transmission errors can be detected. At the receiver. Packetizer converts video data streams into short blocks of data bytes that segment the video signal. The packets from video and audio section are multiplexed along with synchronizing signals. Frame formatter assembles the bit packets into frames DAC each sequential 3-bit group is converted to a dscrete voltage level. This	4

signal is used to modulate the carrier.
The side band filter removes one side band and mixer up converts this signal. The signal is boosted and transmitted by the antenna.



IX b)

LCD : consumes less power compared to led, it requires additional light source. Low relaiability. Low speed.

LED : provide better contrast ratio. ,long lasting, no additional light source required.

OLED :improved image quality, better contrast and brightness,less lfe time, it has poor reading effect in bright light surroundings.

\

X a)

DTH : DTH technology enables a broadcasting company to directly beam the signal to your TV set through a receiver installed in the house. There is no need for a separate cable connection. The disadvg. is the capital cost that has to be borne initially.

DTH broadcasting refers to the distribution of multi channel TV programmes in Ku band by using a satellite system by providing TV signals direct to subscribers premises. For DTH connection, the broadcasting company provides a set that comprises the dish and a receiving set.

b)	CAS – CONDITIONAL ACCESS SYSTEM. : CAS is a technology used to control access to digital television services to authorised users by encrypting the transmission. CAS is used for pay tv services. The CA System provider provides the equipment and software to the broadcaster who then integrates the CAS into his equipment. A typical CA process involves 3 basic elements. 1. Broad cast equipment. 2. Set-top box. 3. Security module. Broad cast equipment generates the encrypted programs that are transmitted to the subscriber. When these are transmitted , the set top box filters out the signals and passes them to the security module.	5
c).	CATV (originally community antenna TV, now often community access TV) is more commonly known as "cable TV". In addition to bringing TV programs to those millions of people throught the world who connected to a community antenna. Cable TV is a system of delivering television program to consumers via RF signal transmitter through coaxial cables. The abbreviation CATV is often used for cable television. It originally stand for community acess television or community antenna TV. IN areas where over the air TV reception was limited by distance from transmitter or mountains, large community antennas were constructed, and cable was run from them to individual homes..	5