MODEL ANSWER

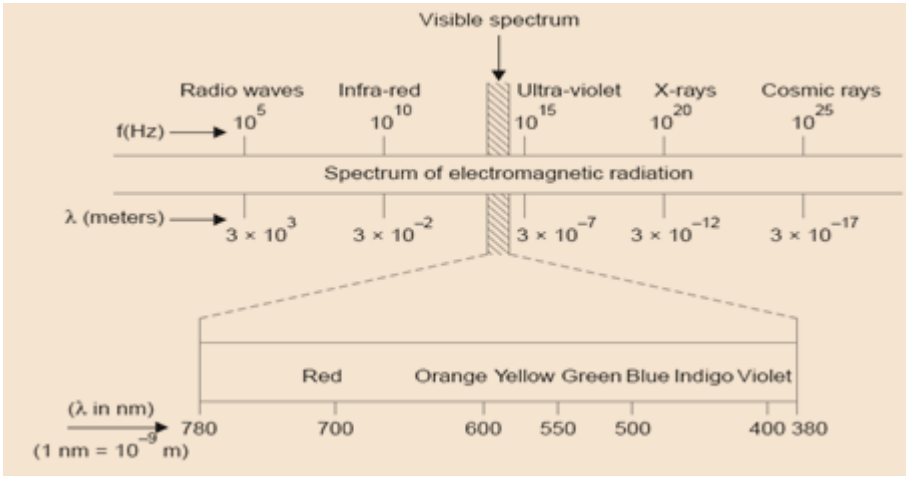
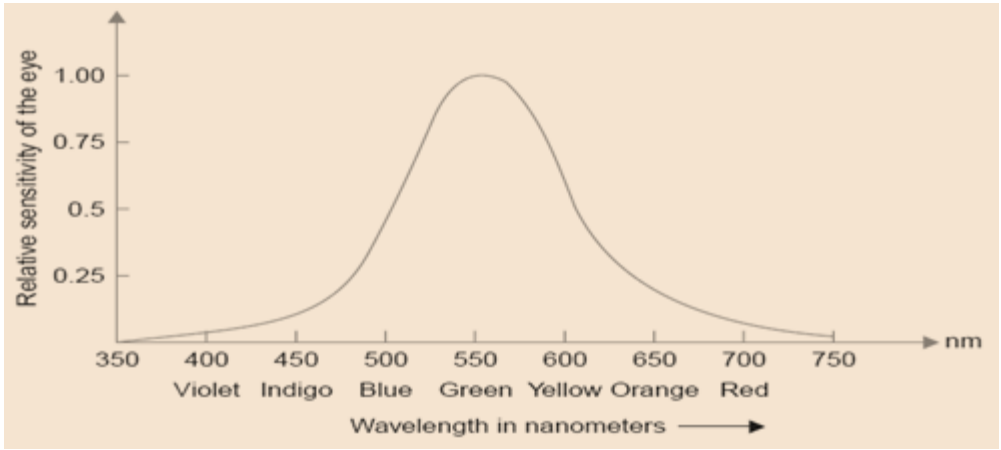
SUMMER– 17 EXAMINATION

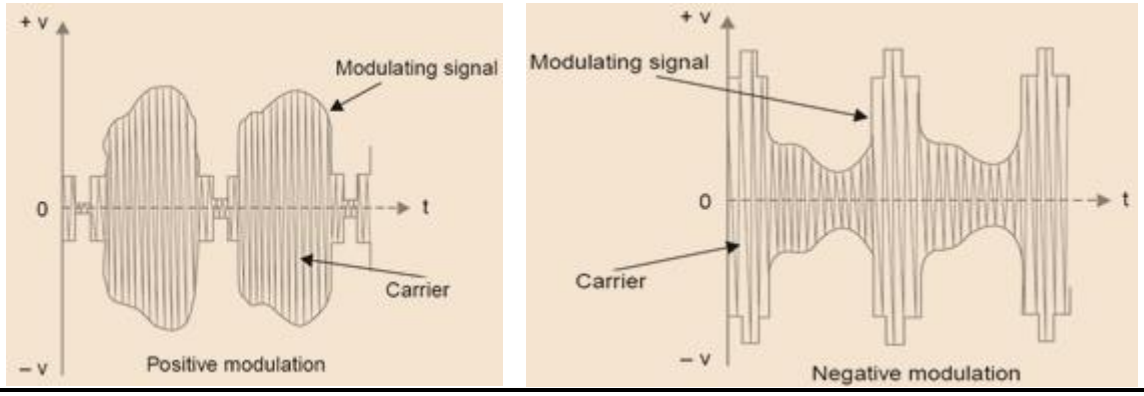
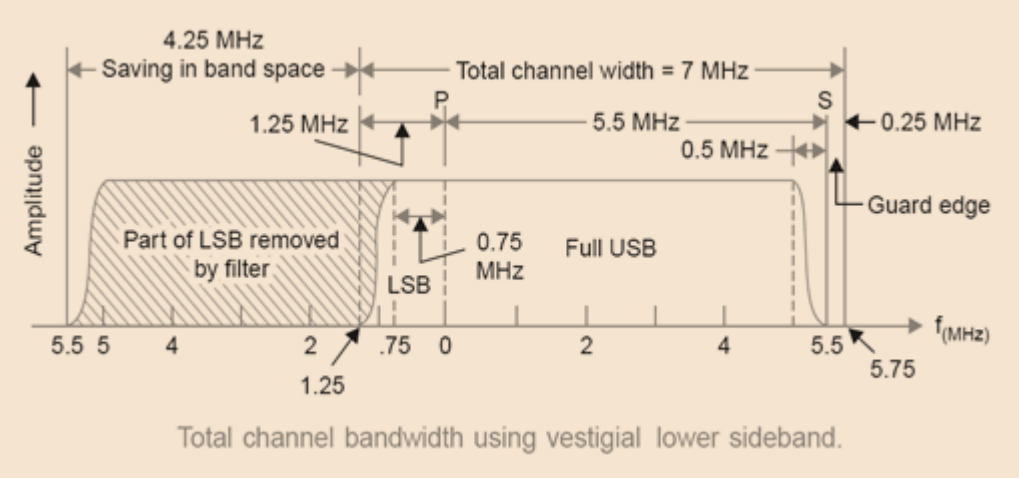
Subject Title: TV Signal transmission System Subject Code: 17441

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1	a)	**Attempt any: SIX of the following**	**12-Total Marks**
	(i)	**Define aspect ratio and kell factor.**	**2M**
	Ans:	**Aspect Ratio:** The width to height ratio of the picture frame is called the aspect ratio. The standardized aspect ratio is 4:3 **Kell factor:** It is the measure of effective resolution of an interlaced scanning system. The effective resolution is always less than the number of scan lines because of the random nature of subject details. The value of kell factor lies in the range between 0.64 to 0.85	**(Each-1M)**
	(ii)	**What is persistence of vision?**	**2M**
	Ans:	• While televising picture elements of the frame by means of the scanning process, it is necessary to present the picture to the eye in such a way that an illusion of continuity is created and any motion in the scene appears on the picture tube screen as a smooth and continuous change. • To achieve this, advantage is taken of 'persistence of vision' or storage characteristics of the human eye. • This is came from the fact that the sensation produced when the light is incident on eye's retina, it does not disappear immediately after the light is removed but persists (stays) for about 1/16th of a second.	**2M**
	(iii)	**State Which band is not used for TV signal transmission. Why?**	**2M**

	Ans:	***(Note: Other Valid reason can be considered)*** In TV signal transmission band 2 is not used. **Reason:** Band 2 is used for FM broadcasting, and as there is no more space available to transmit TV signal (7MHz). Band 2 is not used for TV signal transmission	**(State- 1M, Reason - 1M)**
	(iv)	**Define Colour brust signal in colour TV signal.**	**2M**
	Ans:	The transmitted signal does not contain the subcarrier frequency but it is necessary to generate it in the receiver with correct frequency and phase relationship for proper detection of the colour sidebands. To ensure this, a short sample of the subcarrier oscillator, (8 to 11 cycles) called the "colour burst" is sent to the receiver along with sync signals. Subcarrier frequency is 4.43MHz.	**2M**
	(v)	**Draw Visible light spectrum.**	**2M**
	Ans:	 **OR** 	**2M**

(vi)	**State the role of blanking pulses in CCV signal.**	**2M**
Ans:	• The composite video signal contains blanking pulses to make retrace line invisible. • This is done by increasing the signal amplitude slightly more than the black level during retrace period • Composite video signal contains horizontal and vertical blanking pulses.	**2M(Any Two Roles)**
(vii)	**State Grassman's law of colour mixing.**	**2M**
Ans:	Property of the eye of producing a response which depends on the algebraic sum of the red, green and blue inputs is known as Grassman's Law.	**2M**
(viii)	**Draw the waveform for positive and negative modulation.**	**2M**
Ans:		**(1M each diagram)**
b)	**Attempt any <u>Two</u> of the following:**	**8M**
(i)	**Draw the frequency response of VSB. Why it used in TV transmission?**	**4M**
Ans:	 Total channel bandwidth using vestigial lower sideband. • **Reason:** In the video signal very low frequency modulating components exist along with the rest of the signal. These components give rise to sidebands very close to the carrier frequency which are difficult to remove by physically realizable filters. • Thus it is not possible to go to the extreme and fully suppress one complete sideband in the case of television signals. The low video frequencies contain the most	**(Diagram-2M ,Reason-2M)**

important information of the picture and any effort to completely suppress the lower sideband would result in objectionable phase distortion at these frequencies.

- This distortion will be seen by the eye as 'smear' (spreaded) in the reproduced picture. Therefore, as a compromise, only a part of the lower sideband is suppressed, and the radiated signal then consists of a full upper sideband together with the carrier, and the vestige (remaining part) of the partially suppressed lower sideband. This pattern of transmission of the modulated signal is known as vestigial sideband or A5C transmission. In the 625 line system, frequencies up to 0.75 MHz in the lower sideband are fully radiated.

(ii)	**Give the function of back porch and draw the well labelled diagram of horizontal blanking details of one horizontal line.**	**4M**
Ans:	**Diagram:**	**2M.**

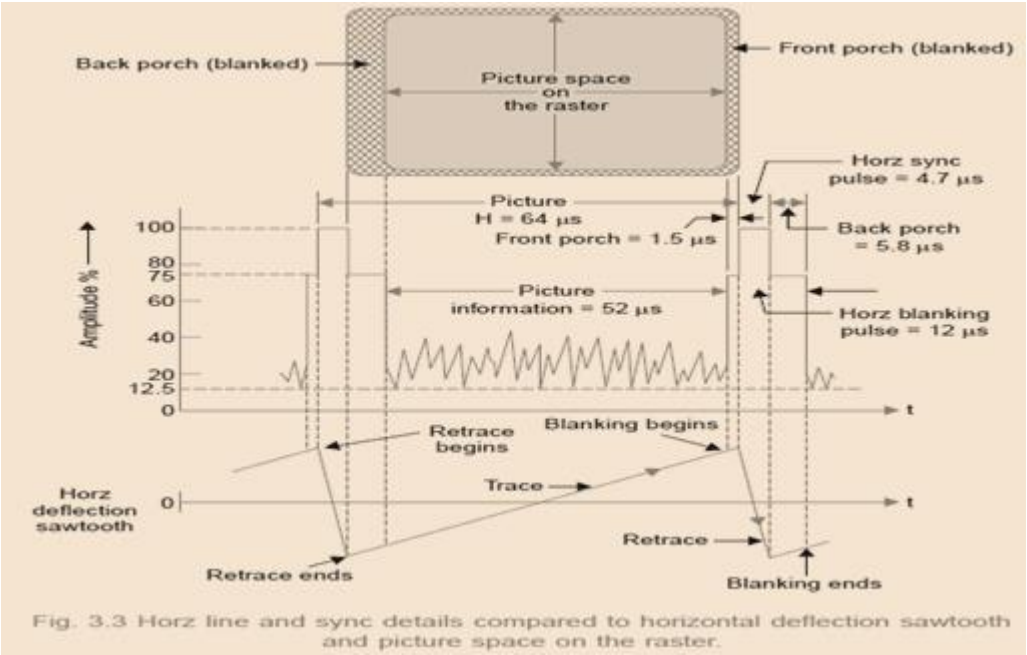
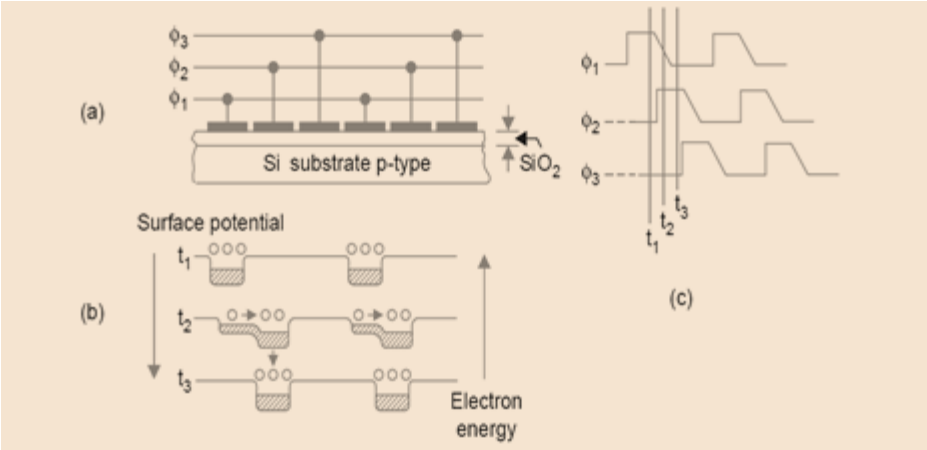


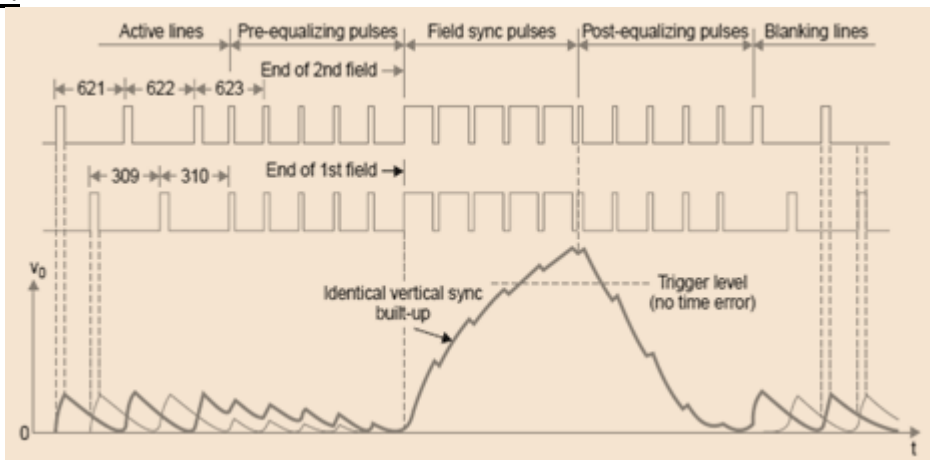
Fig. 3.3 Horz line and sync details compared to horizontal deflection sawtooth and picture space on the raster.

Function: **2M**

- This period of 5.8 µs at the blanking level allows plenty of time for line flyback to be completed.
- It also permits time for the horizontal time-base circuit to reverse direction of current for the initiation of the scanning of next line.
- The back porch also provides the necessary amplitude equal to the blanking level (reference level) and enables to preserve the dc content of the picture information at the transmitter.

(iii)	**Draw schematic diagram of CCD camera tube and state its working.**	**4M**

	Ans:	**Diagram:**  A three phase n-channel MOS charge coupled device. (a) construction (b) transfer of electrons between potential wells (c) different phases of clocking voltage waveform.	**2M**
		Working: • The CCD is a string of very closely spaced MOS capacitors. It can store and transfer analog charge signals either electrons or holes that may be introduced electrically or optically. • The chip consists of a p-type substrate, the one side of which is oxidized to form a film of silicon dioxide, which is an insulator. • Then by photolithographic processes, an array of metal electrodes known as gates is deposited on the insulator film. This results in the creation of a very large number of tiny MOS capacitors on the entire surface of the chip. • The application of small positive potentials to the gate electrodes results the depletion regions just below them. These are called potential wells. • The depth of each well (depletion region) varies with the magnitude of the applied potential. As shown in Fig. (a), the gate electrodes operate in groups of three, with every third electrode connected to a common conductor. The spots under them serve as light sensitive elements. • When an image is focused onto the silicon chip, electrons are generated within it. The number of electrons depends on the intensity of incident light. The electrons produced collect in the potential wells. As a result the pattern of collected charges represents the optical image.	**2M**
Q 2		**Attempt any two FOUR of the following:**	**16M**
	(a)	**What is interlaced scanning?How hikers are eliminated using it.**	**4M**

	Ans:	***(Note: Question Should be "What is interlaced scanning? How Flicker are eliminated using it.")*** • In television pictures an effective rate of 50 vertical scans per second is utilized to reduce the flicker. This is accomplished by increasing the downward rate of travel of the scanning electron beam, so that every alternate line gets scanned instead of successive line. • Then when the beam reaches the bottom of the picture frame it quickly returns to the top to scan those lines that were missed in the previous scanning. • Thus, the total numbers of lines are divided into two groups called 'fields'. Each field is scanned alternately. This method of scanning is called 'interlaced scanning'. **Eliminate flicker: (any other reasons can be considered)** • In interlaced scanning each frame is divided into two fields. • Each field is obtained by interlacing the horizontal scanning lines into the group fields. One with odd numbered lines & one with even numbered lines. They are called odd and even fields respectively. • The reception rate is so per second. As two fields are scanned during one frame period of 1/25 second. • Thus 50 views of picture are shown during one section. • This fast repetition rate reduces flickers.	**(what is Interlace scanning-2M, How to eliminate flicker-2M)**
	(b)	**Draw pre and post equilizing pulses transmission during vertical blanking period and state their significence.**	**4M**
	Ans:	**Diagram:**  **Significance:** • To take care of this drawback which occurs on account of the half line discrepancy five narrow pulses are added on either side of the vertical sync pulses. These are known as pre-equalizing and post-equalizing pulses.	**2M**

- Each set consists of five narrow pulses occupying 2.5 lines period on either side of the vertical sync pulses. Pre-equalizing and post equalizing pulse details with line numbers occupied by them in each field are given in Fig.
- The effect of these pulses is to shift the half-line discrepancy away both from the beginning and end of vertical sync pulses.
- Pre-equalizing pulses being of 2.3 μs duration result in the discharge of the capacitor to essentially zero voltage in both the fields, despite the half-line discrepancy before the voltage buildup starts with the arrival of vertical sync pulses.
- Post-equalizing pulses are necessary for a fast discharge of the capacitor to ensure triggering of the vertical oscillator at proper time. If the decay of voltage across the capacitor is slow as would happen in the absence of post-equalizing pulses, the oscillator may trigger at the trailing edge which may be far-away from the leading edge and this could lead to an error in triggering.

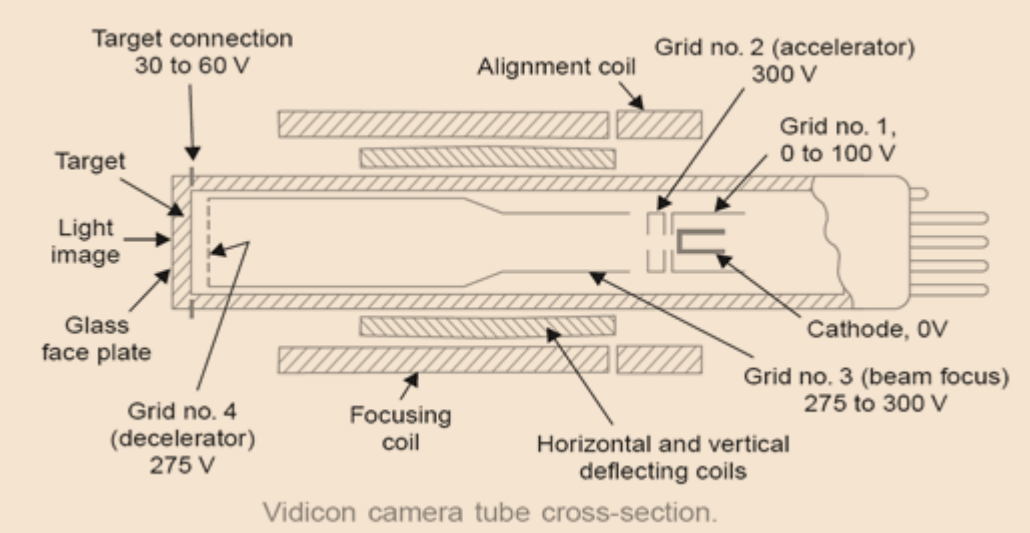
2M

(c) **Draw the neat diagram of vidicon camera tube and explain its working.** **4M**

Ans: **2M**

Diagram:

- It functions on the principle of photoconductivity, where the resistance of the target material shows a marked decrease when exposed to light.
- Fig. illustrates the structural configuration of a typical vidicon.



Vidicon camera tube cross-section.

Working:

- As shown in figure, the target consists of a thin photoconductive layer of either selenium or antimony compounds. This is deposited on a transparent conducting film, coated on the inner surface of the face plate.
- This conductive coating is known as signal electrode or plate. Image side of the photo

2M

layer, which is in contact with the signal electrode, is connected to DC supply through the load resistance RL.

- The beam that emerges from the electron gun is focused on surface of the photoconductive layer by combined action of uniform magnetic field of an external coil and electrostatic field of grid No 3. Grid No. 4 provides a uniform decelerating field between itself, and the photoconductive layer, so that the electron beam approaches the layer with a low velocity to prevent any secondary emission.
- Deflection of the beam, for scanning the target, is obtained by vertical and horizontal deflecting coils, placed around the tube.

(d) **Calculate phase and magnitude of weighted primary colours with neat phasor diagram.** **4M**

Ans: **Calculation for phase and magnitude:-**

The amplitude and phase angle of primary colour can be found out from weighted value of (B-Y) and (R-Y).

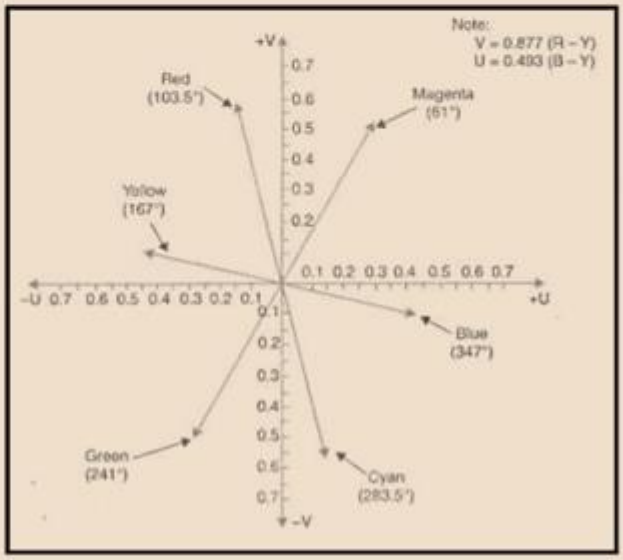
$$U = 0.493\ (B - Y)\ \text{unweighted}$$

$$V = 0.877\ (R - Y)\ \text{unweighted}$$ **1M**

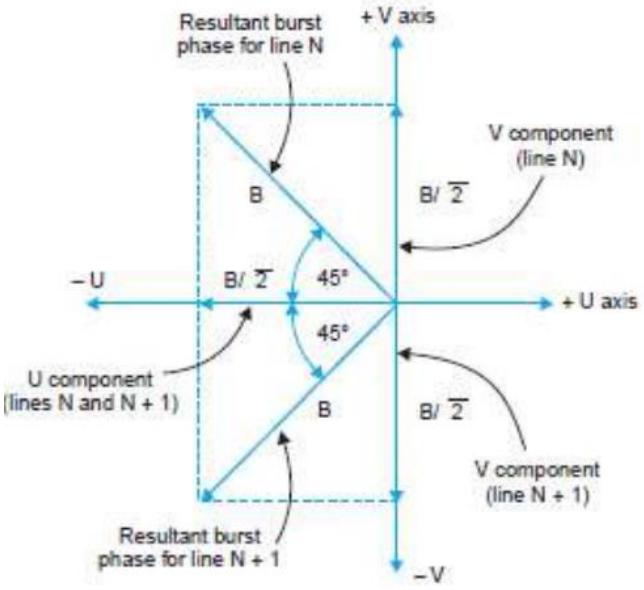
COLOUR	Y	U	V	'C'	ϕ
White	1	0	0	0	0°
Yellow	0.89	– 0.4385	+ 0.0965	0.44	167°
Cyan	0.70	+ 0.148	– 0.614	0.63	283°
Green	0.59	–0.29	– 0.5174	0.59	241°
Magenta	0.41	+ 0.29	+ 0.5174	0.59	61°
Red	0.31	– 0.148	+ 0.614	0.63	103°
Blue	0.11	+ 0.4385	– 0.0965	0.44	347°
Black	0	0	0	0	0°

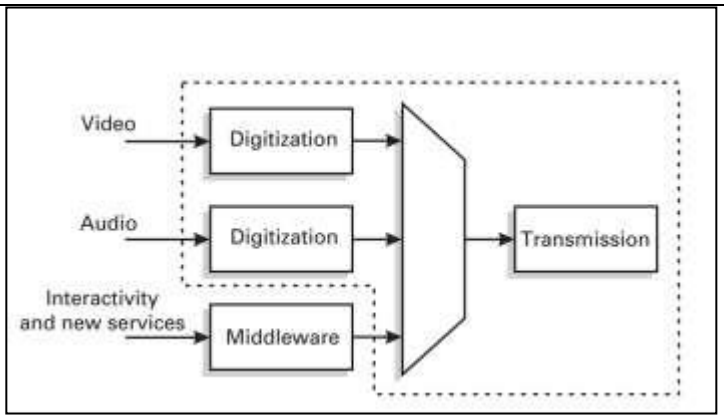
1M

Phasor Diagram:-



2M

	(e)	**Describe concept of PAL-V switching and its purpose with the help of phasor diagram.**	**4M**
	Ans:	 • If the PAL signal were applied to an NTSC type decoder, the (B – Y) output would be U as required but the (R – Y) output would alternate as + V and – V from line to line. • Therefore, the V demodulator must be switched at half the horizontal (line) frequency rate to give + V only on all successive lines. • The PAL receiver must be told how to achieve the correct switching mode. A colour burst (10 cycles at 4.43 MHz) is sent out at the start of each line. • Its function is to synchronize the receiver colour oscillator for reinsertion of the correct carrier into the U and V demodulators. • The burst phase swings 45° about the - (B – Y) axis from line to line. However the sign of (R – Y) burst component indicates the same sign as that of the (R – Y) picture signal. • Thus the necessary switching mode information is always available. Since the colour burst shifts on alternate lines by ± 45° about the zero reference phase it is often called the swinging burst.	**(2M Concept & Purpose, 2M diagram)**
	(f)	**Draw the block diagram of digital TV transmission and explain its working.**	**4M**
	Ans:	**<u>Diagram:</u>**	**2M**



2M

Working:

•A digital television system is made up of a set of standards, as presented in Figure, which identifies the basic components: video and audio represent the services that are essential to the broadcasting of digital television; interactivity and the new services (e-commerce, Internet access) are added to the system by the middleware.

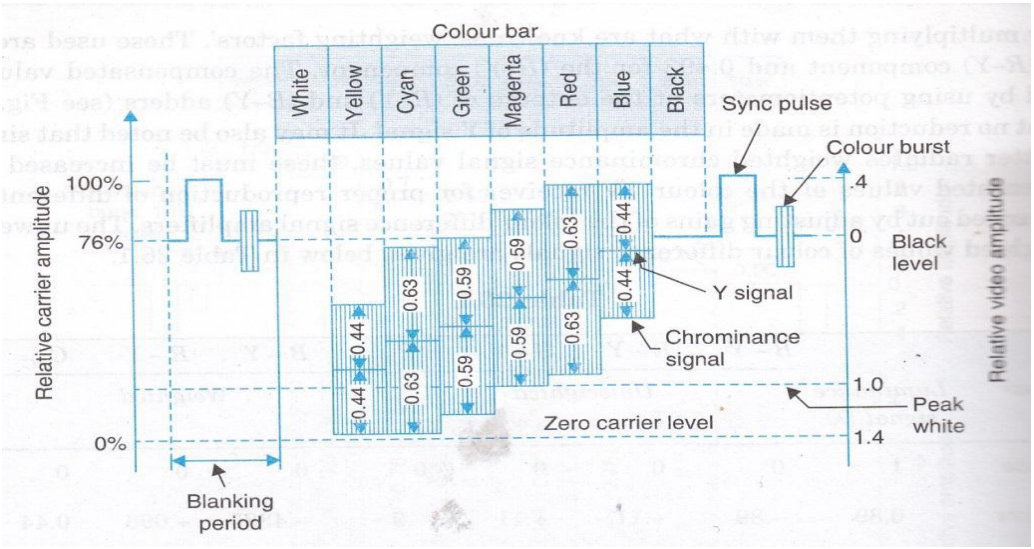
•These new services, introduced by digital television, originated from data transmission with video and audio.

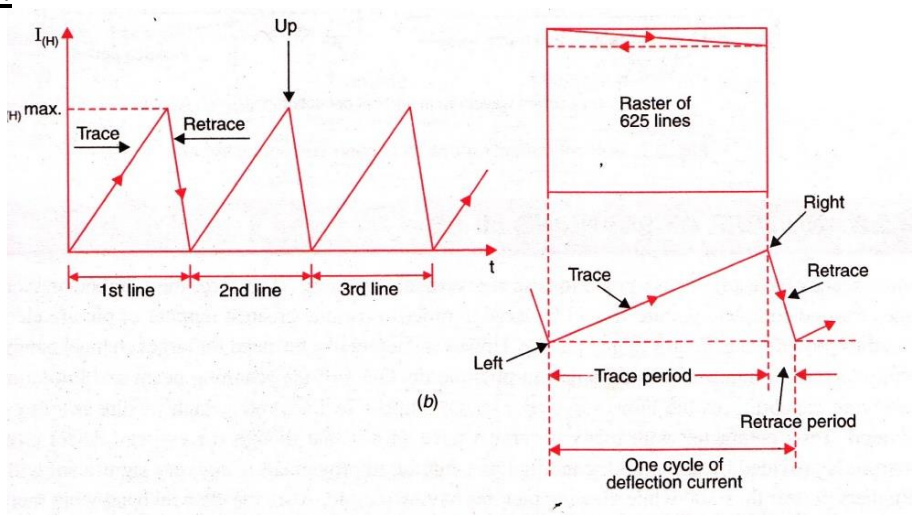
•They may be used to offer new concepts in the broadcasting of TV programs to the users, or even to send data for applications that do not have a direct connection with television programming.

•With digital television, the viewers will be renamed users, as they participate in interaction with the TV stations and the companies that supply services.

Q. 3		**Attempt any FOUR of the following:**	**16M**
	a)	**Explain the term horizontal and vertical resolution.**	**4M**
	Ans:	**Vertical Resolution:** The ability of the system to resolve vertical details is called vertical resolution. **OR** The number of pixels on a vertical line on the screen is called vertical resolution. The vertical resolution $R_V = (N_T - N_L) * K = N_A K$ Where N_T = Total number of lines on screen N_L = Lines lost in vertical blanking period K = Kell factor **For 625 lines: Rv = (625 – 40) * 0.7 = 409.5 (approximately 409)** **Horizontal resolution:** The ability of the system to resolve horizontal details is called horizontal resolution. **OR** The number of pixels on horizontal line is called horizontal resolution. $R_H = R_V * A$ Where A is aspect ratio= 4/3 **For 625 lines: R_H = 409.5 * 4/3 = 546**	**1M** **1M** **1M** **1M**
	b)	**Define:** **1.Brightness** **2.Contrast** **3.Viewing distance** **4.Luminance**	**4M**

	Ans:	**Brightness:-** It is the overall or average intensity of illumination and it determines background light level in the reproduced picture. **Contrast: -** It is the difference in light intensity between black and white parts of the picture over the average brightness level. **Viewing distance:-** The viewing distance from screen of TV receiver should not be large or too small. The distance varies from person to person and lies between 3 to 8 times the picture heights. The preferable distance is close to 5 times the picture height. **Luminance or brightness:-** It is the amount of light intensity as perceived by the eye regardless of the colour. In black and white picture, better lighted parts have more luminance than dark areas.	**(Each-1M)**
	c)	**Why FM is used for sound signal and AM for picture signal.**	**4M**
	Ans:	**Suitability of FM for sound signal transmission:** • FM is capable of providing almost noise free and high fidelity output. • S/N ratio is high in FM system. Random changes in amplitude are greatly suppressed in FM. • Due to capture effect in FM system, weak interfering stations are fully suppressed. **Suitability of AM for picture signal transmission:** • Detection of baseband signal from the modulated wave is very easy using a single diode rectifier and a simple LPF circuit which is low price makes it popular. • AM detector does not detect changes in phases but detects the changes in amplitude. Hence output of the detector is free of phase noise. As eyes are sensitive to phase noise, its absence in the output makes AM suitable for picture. FM can detect changes in phase and hence it is unsuitable for video **OR** **Preference of FM for Sound Transmission:** • Frequency modulation provides almost noise free and high fidelity output • In FM, highest audio frequency allowed is 15 kHz, the sideband frequencies do not extend too far and can be easily accommodated around the sound carrier that lies 5.5 MHz away from the picture carrier. • The bandwidth assigned to the FM sound signal is about 200 kHz of which not more than 100 kHz is occupied by sidebands of significant amplitude. **Preference of AM for Picture Signal Transmission:** • At the VHF and UHF carrier frequencies, there is a displacement in time between the direct and reflected signals. The distortion which arises due to interference between multiple signals is more objectionable in FM than AM because the frequency of the FM signal continuously changes. • If FM were used for picture transmission, the changing best frequency between the multiple paths, delayed with respect to each other, would produce a bar interference pattern in the image with a shimmering effect, since the bars continuously change as the beat frequency changes. Hence, hardly any steady picture is produced. Alternatively if	**2M** **2M** **2M** **2M**

	AM were used, the multiple signal paths can at most produce a ghost image which is steady. • Circuit complexity and bandwidth requirements are much less in AM than FM. Hence AM is preferred to FM for broadcasting the picture signal.	
d)	**State two advantage and two disadvantage of digital TV transmission.**	**4M**
Ans:	**Advantages: (Any two)** • Reduction of 50Hz flicker. • High resolution pictures. • Slow motion action. • Easy adoption to additional displays. • Reduced operational instability. **Disadvantages: (Any two)** • The biggest disadvantage of the digital TV is the fact that you will need special equipment called digital converter box. • In digital broadcast there is the loss of signals because of bad weather. • It can be quite difficult to adjust the antenna (without special equipment e.g. signal level meter). • Switching channels is slower because of the time delays in decoding digital signals	**2M** **2M**
e)	**Draw CCVS and label it.**	**4M**
Ans:		**Diagram- 2M** **Labeling - 2M**
f)	**Give the characteristics of digital TV transmission(any four points).**	**4M**
Ans:	**Characteristic of Digital TV transmission:** • T.V scanning Line :1250 • Aspect ratio : 16:9 • Interlace ratio: 1: 1 progressive • Active lines: 1152 • Field frequency: 40Hz • Line frequency: 62.5KHz	**(Any four) 1M each**

		• Luminance signal Y = 20MHz • Sample per active line: 1920 • Wide band colour signal: 7Mhz • Narrow band colour signal: 5.5MHz	
Q. 4		**Attempt any <u>FOUR</u> of the following:**	**16M**
	a)	**Describe the process used to create motion picture using principle of persistence of vision. Draw appropriate diagram for the same.**	**4M**
	Ans:	**<u>Explanation:-</u>** • While televising picture elements of the frame by means of the scanning process, It is necessary to present the picture to the eye in such a way that an illusion of continuity is created and any motion in the scene appears on the picture tube screen as a smooth and continuous change. This arises from the fact that the sensation produced when nerves of the eye's retina are stimulated by incident light does not cease immediately after the light is removed but persists for about $1/16^{th}$ of a second. • Thus if the scanning rate per second is made greater than sixteen, or the number of pictures shown per second is more than sixteen, the eye is able to integrate the changing levels of brightness in the scene. • So when the picture elements are scanned rapidly, they appear to the eye as a complete picture unit, with none of the elements visible separately. • A similar process is carried out in the television system. The scene is scanned rapidly both in the horizontal and vertical directions simultaneously to provide sufficient number of complete pictures or frames per second to give the illusion of continuous motion. **<u>Diagram:</u>**  	**2M** **2M**
	b)	**State the importance of DC level in composite video signal.**	**4M**
	Ans:	**<u>Importance of DC Level</u>** • In addition to continuous amplitude variations for individual picture elements, the video signal has an average value or dc component corresponding to the average brightness of the scene. • DC level is the level between Avg. brightness information & 0 level. • In the absence of dc component the receiver cannot follow changes in brightness, as the ac camera signal, say for grey picture elements on a black background will then be the same as a signal for white area on a grey back-ground.	**4M**

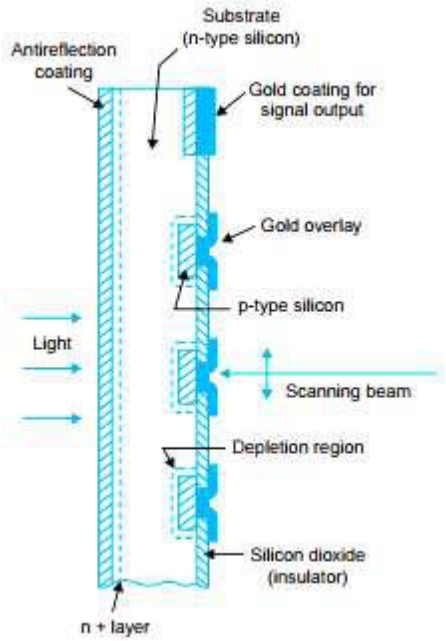
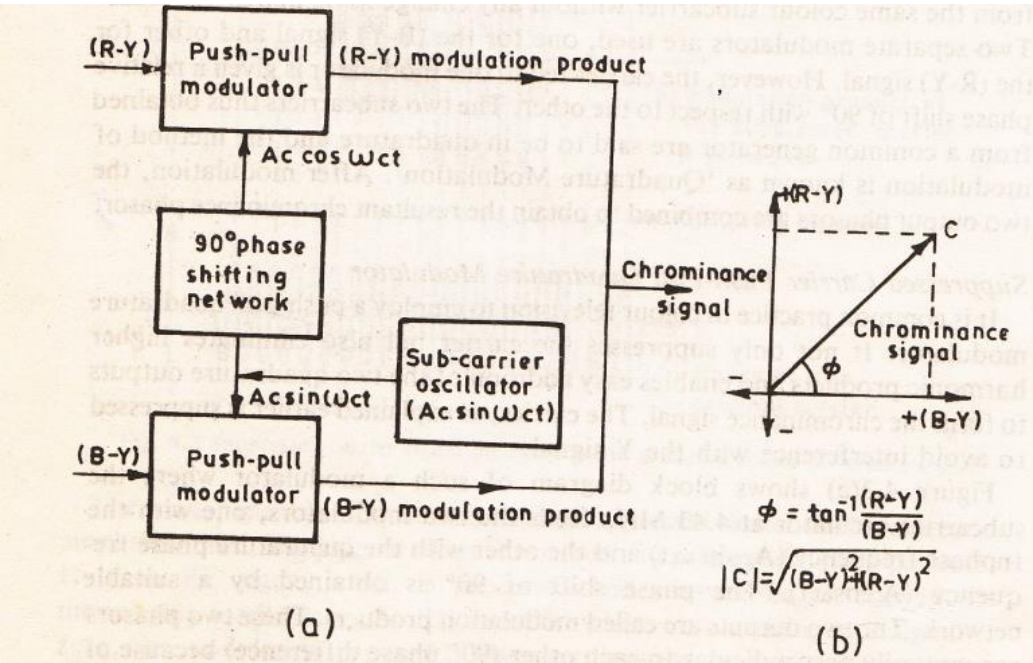
		• DC components of the signal for three lines have been identified, each representing a different level of average brightness in the scene.	
	c)	**Draw the schematic diagram of silicon diode array camera tube and explain its working.**	**4M**
	Ans:	**Operation:-** • The photodiodes are reverse biased by applying +10 V or to the n + layer on the substrate. The n+ layer side is illuminated by the light focused on to it from the image. The incidence of light generates electron-hole pairs in the substrate. Under influence of the applied electric field, holes are swept over to the p- side of the depletion region thus reducing reverse bias on the diodes. • This process continues to produce storage action till the scanning beam of electron gun scans the photodiode side of the substrate. • The scanning beam deposits electrons on the p-side thus returning the diodes to their original reverse bias. The consequent sudden increase in current across each diode caused by the scanning beam represents the video signal. • The current flows through a load resistance in the battery circuit and develop a video signal proportional to the intensity of light falling on the array of photodiodes • The vidicon employing such a multi diode silicon target is less susceptible to damage or burns due to excessive high lights. **Diagram:**  	**2M** **2M**
	d)	**Draw block diagram of QAM for PAL system and explain its working**	**4M**
	Ans:		

		Diagram:  **Explanation:** In colour television two colour- difference signals need two carrier frequencies for their transmission but only one carrier (colour subcarrier) is available for this purpose. This problem is solved by creating two carrier frequencies from the same colour subcarrier without any change in its numerical value. Two separate modulators are used, one for the (B-Y) signal and other for the (R-Y) signal. However, the carrier fed to one modulator is given a relative phase shift of 90^0 with respect to the other. The two subcarriers thus obtained from a common generator are said to be in quadrature and the method of modulation is known as 'Quadrature Modulation'. After modulation, the two output phasors are combined to obtain the resultant chrominance phasor.	**2M** **2M**
e)		**State the advantages of PAL system (any four).**	**4M**
Ans:		1) Phase noise causing error in the reproduction of colors is atomically eliminated hence separate hue or tint control is not required. 2) Bandwidth for both U and V signals are the same (1.3 MHz for LSB and 0.5 MHz for USB) which simplifies filtering action. 3) Use of delay lines before demodulators isolates U and V signals from each other which reduce the crosstalk type interference in the colors. 4) Studio mixing is easy 5) The problem of differential phase errors has been successfully over comes in the PAL system.	**Any 4** **1M each**
f)		**Draw the block diagram of PAL encoder and state the function of each block**	**4M**
Ans:		**Generation of U and V signals:-** • The gamma corrected R, G and B signals are matrixes to form the Y and the weighted colour difference signals. • The low pass filters are used to restrict the bandwidths of both (B – Y) and (R – Y) video signals to about 1.3 MHz by appropriate. • In this process these signals suffer a small delay relative to the Y signal. In order to	**2M**

compensate for this delay, a delay line is inserted in the path of Y signal.

- The weighted colour difference video signals from the filters are fed to corresponding balanced modulators. The sinusoidal sub-carrier is fed directly to the U modulator but passes through a ± 90° phase switching circuit on alternate lines before entering the V modulator.

Generation of QAM & CCVS:-

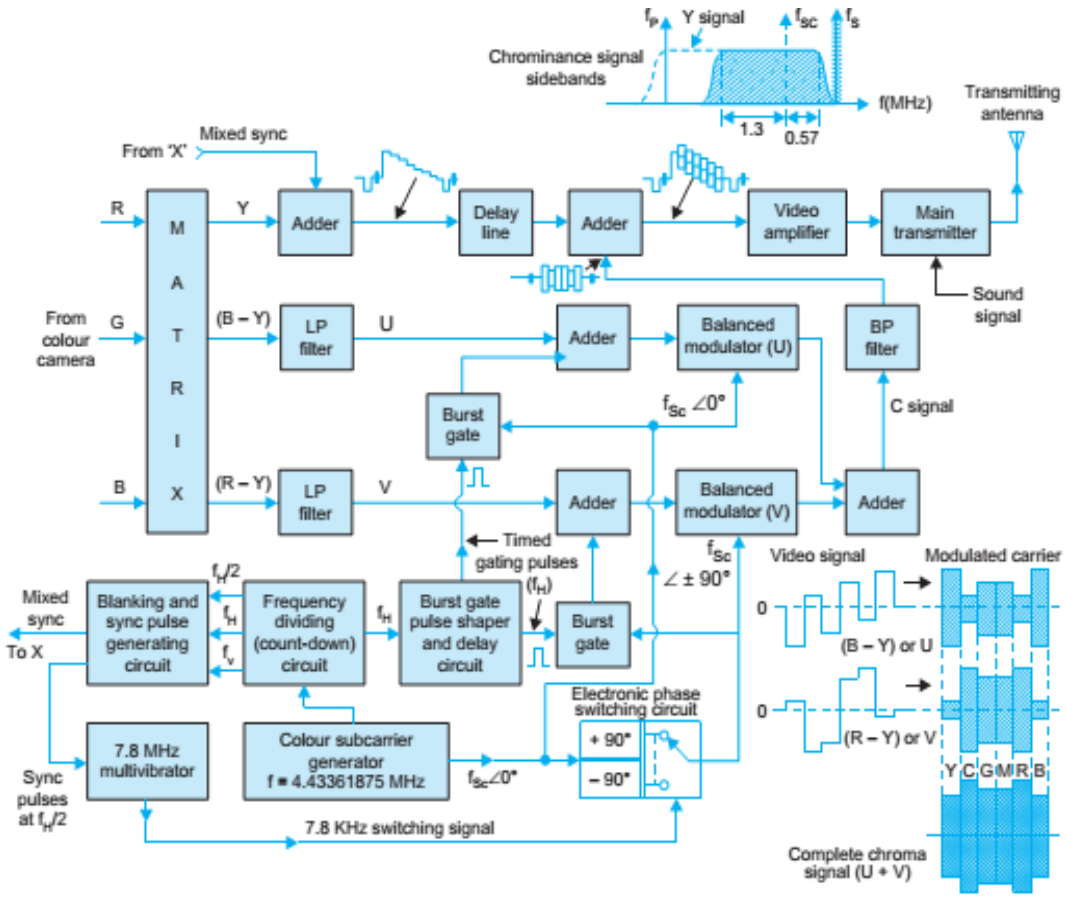
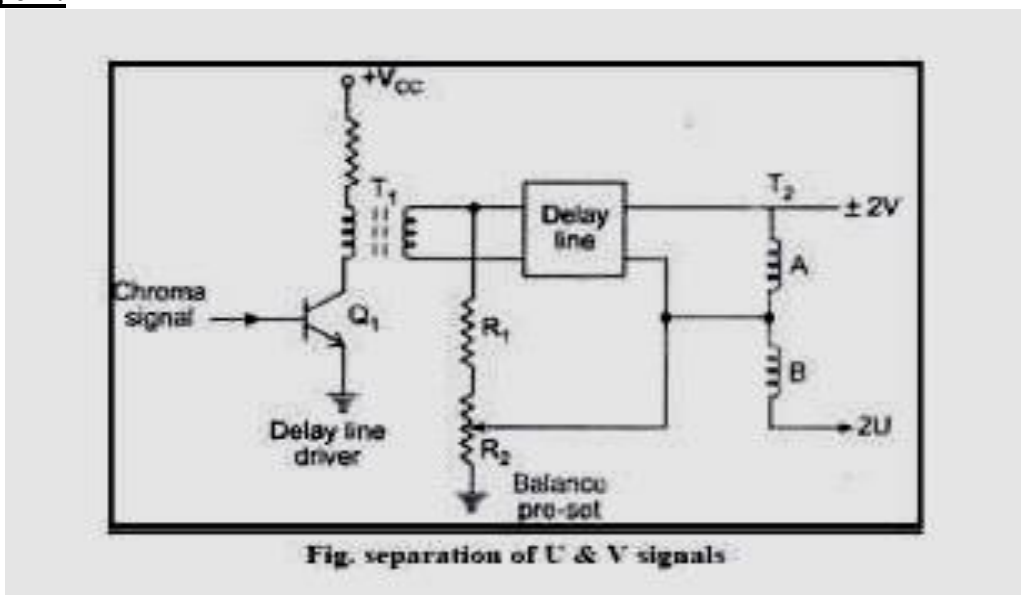
- The double sideband suppressed carrier signals from the modulators are added to get the quadrature amplitude modulated (Q.A.M.) chrominance (C) signal. This passes through a filter which removes harmonics of the subcarrier frequency and restricts the upper and lower sidebands to appropriate values.
- The output of the filter feeds into an adder circuit where it is combined with the luminance and sync signals to form a composite colour video signal.

Insertion of colour burst:-

- The colour burst signal is also fed to the modulators along with the U and V signals through the adders. The burst signals are obtained from the circuits that feed the colour subcarrier signal to the two modulators.
- However, before feeding the burst signals to the U and V adders these are passed through separate burst gates. Each burst gate is controlled by delayed pulses at fH rate obtained from the frequency dividing circuit.
- At the outputs of the two modulators, the two burst components combine in the adder to yield an output which is the vector sum of the two burst inputs. This is a subcarrier sine wave (≈10 cycles) at + 45° on one line and – 45° on the next line with reference to – U phasor.

Final transmission:-

- The colour composite signal thus formed is fed to the main transmitter to modulate the station channel picture carrier in the normal way.
- The sound signal after being frequency modulated with the channel sound carrier frequency forms the RF signal that is finally radiated through the transmitter antenna system.

			**2M**
Q.5		**Attempt any <u>FOUR</u> of the following:**	**16M**
	a)	**Explain how U and V signals are obtained from colour difference signal.**	**4M**
	Ans:	**<u>Diagram:</u>**  **Fig. separation of U & V signals**	**2M**

Working: -

- The basic principle of U & V signal separation by transformer action is shown in fig. It consists of transistor Q_1, Transformer T_1, PAL delay line & a center tapped transformer T_2. The delay line driver transistor Q_1 feeds the amplified Chroma signal through transformer T1 into the delay line.
- The signal after passing through the delay line appears across "A" winding of the transformer T_2. Chroma signal is also fed directly at the center tap of transformer T_2 through the potentiometer R_2. As T_2 is center tapped with equal no. of turns in "A" & "B" the voltage induced by the signal from delay line will be equal in amplitude but out of phase in winding A & B.

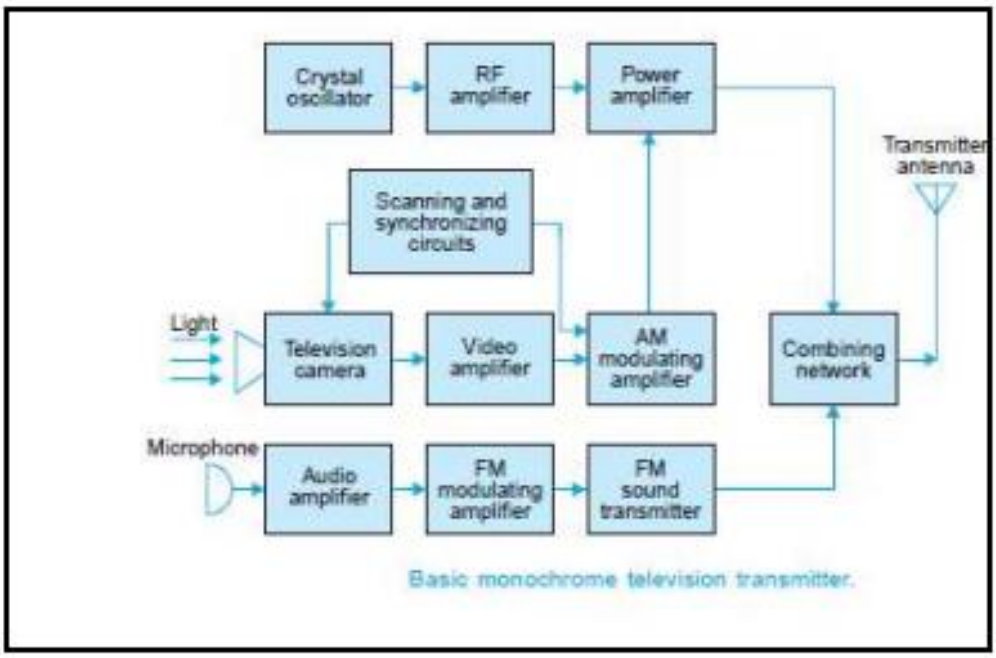
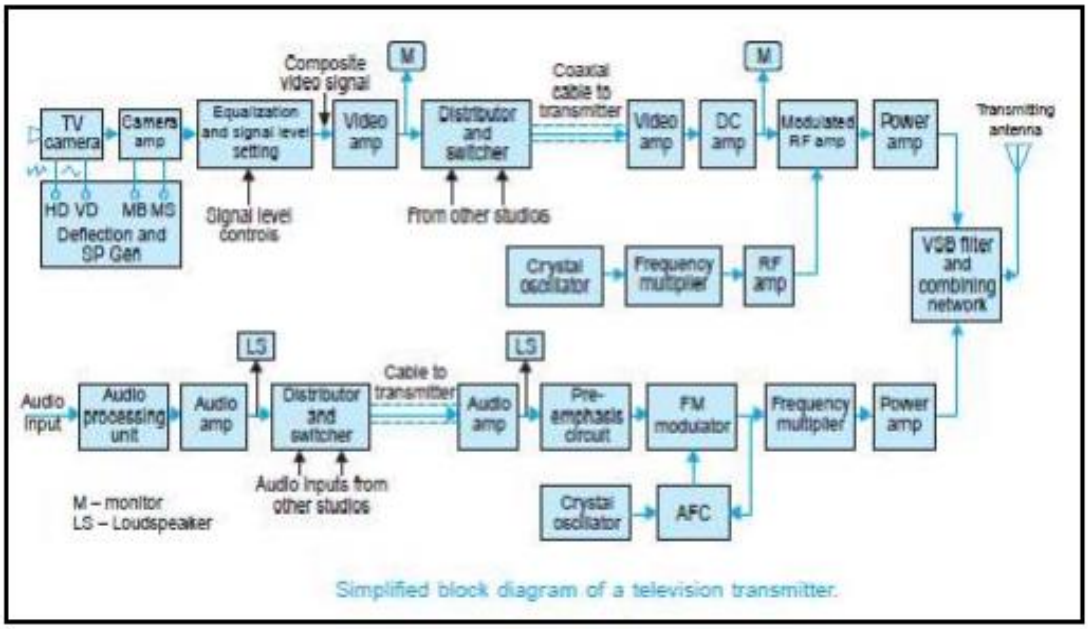
2M

b) List CCIR-B stands for PAL colour TV (any eight). **4M**

Ans: **(Each-1M)**

Parameter	CCIR standard
Lines/picture	625
Frames/second	25
Fields/second	50
Line frequency	15,625
Colour system	PAL/Secam
Video bandwidth	5/6 MHz
Channel bandwidth	7 or 8 MHz
Colour sub-carrier	4.43 MHz
Video modulation	Negative
Picture modulation	AM
Sound modulation	FM

c) Draw block diagram of monochrome TV transmitter. **4M**

	Ans:	 Basic monochrome television transmitter. **OR**  Simplified block diagram of a television transmitter. **Block diagram of monochrome TV transmitter**	**(Block Diagram:4 M)**
	d)	**Describe T.V. channel allocation for band I and band III.**	**4M**
	Ans:	**<u>TV channel allocation for Band I and Band –III:</u>**	

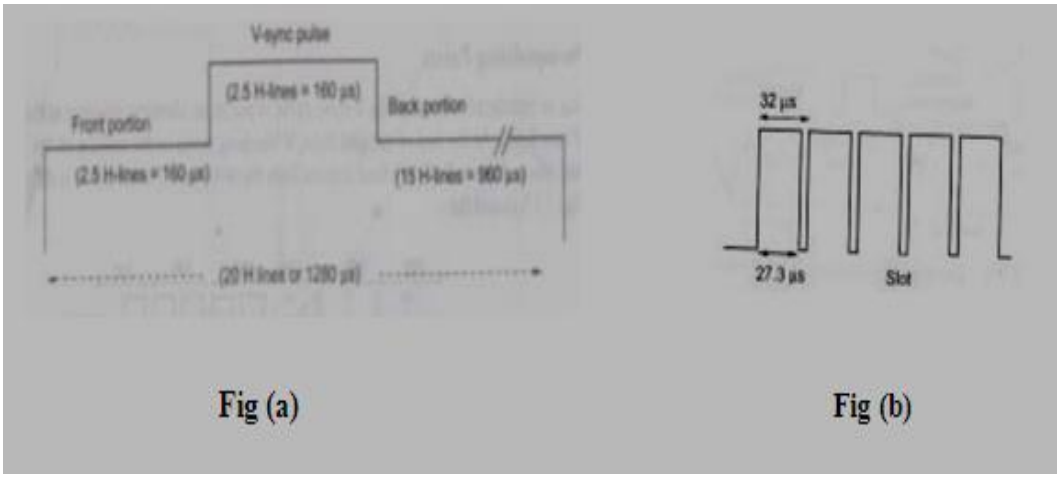
				2M

Band	*Channel No.*	*Frequency range*	*Picture carrier Frequency (MHz)*	*Sound carrier Frequency (MHz)*
BAND I (41-68 MHz)	1	41–47 (not used)		
	2	47–54	48.25	53.75
	3	54–61	55.25	60.75
	4	61–68	62.25	67.75

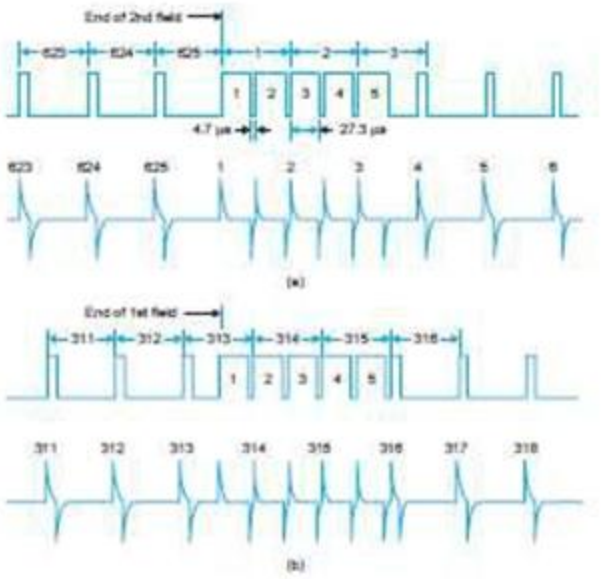
2M

BAND III (174-230 MHz)	5	174–181	175.25	180.75
	6	181–188	182.25	187.75
	7	188–195	189.25	194.75
	8	195–202	196.25	201.75
	9	202–209	203.25	208.75
	10	209–216	210.25	215.75
	11	216–223	217.25	222.75
	12	223–230	224.25	229.75

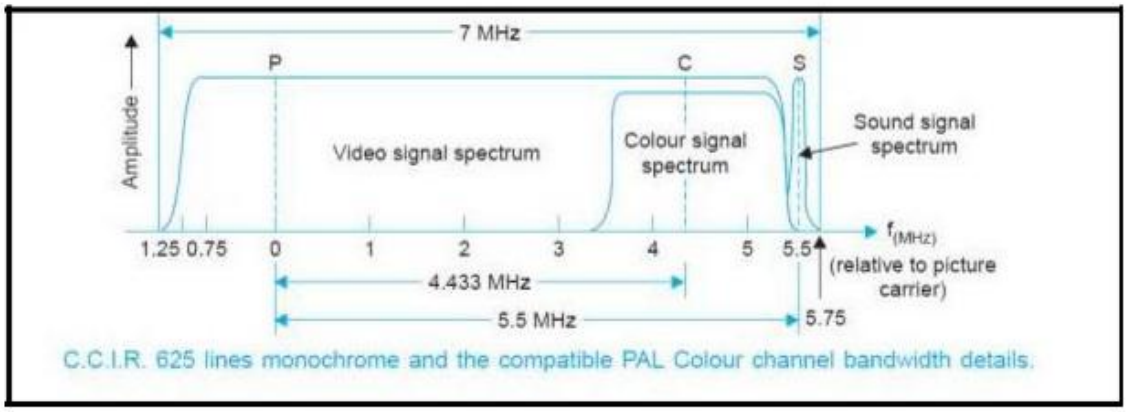
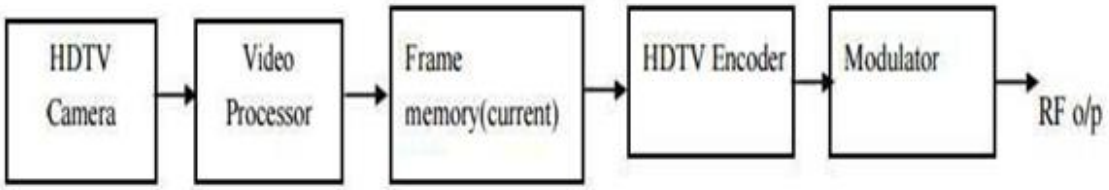
e)	**Define:** **(i) Hue** **(ii) Saturation** **(iii) Chrominance** **(iv) Additive mixing**	**4M**
Ans:	**Hue:** Hue or tint can be defined as the predominant spectral colour of the received light. The colour of any object is distinguished by its hue or tint. **Saturation:** Saturation refers to the spectral purity of the colour light. It indicates the degree by which the colour is diluted by white. **Chrominance:** Chrominance (*chroma* or C for short) is the signal used in video systems to convey the colour information of the picture, separately from the accompanying luminance signal (or Y for short). **Additive mixing:** All light sensations to the eye are splitted in to three main colour groups namely red, blue and green. The optic nerve system integrates the different colour impressions in	**(Each-1M)**

		accordance with the curve to perceive the actual colour of the object.	
	f)	**Why vertical sync pulses are serrated during TV signal transmission.**	**4M**
	Ans:	• When the vertical scanning beam reaches from the bottom-most line to the top, the next field starts. The retrace of the beam from bottom to top is covered by blanking pulse, called vertical blanking (or V-blanking) pulse as shown in fig. (a). • During blanking the video signal remains cut-off making the retrace invisible on the screen. The V-blanking pulse carries V-sync pulse which triggers the V-sweep oscillator for synchronization. V-blanking pulse along with V-sync pulse is added to the video signal and appears at an interval of every 20ms. • The front portion of the V-blanking pulses is of 160 micro second and V- sync pulse is also 160 micro second which is equal to two and half H-Lines .This back portion is of 960 micro second equal to 15 H-Lines. Vertical deflection is very slow as compare to the horizontal deflection. And therefore the time interval of V blanking pulse and its various components are white wide. Due to wide interval serrations are introduce in V sync pulse. The serration or slots of 32 micro second intervals is as shown in above fig. (b) The width of each slot is equal to 4.7 micro second and this slot is made after every 27.3 micro second.  Fig (a) Fig (b)	

OR



Q.6		Attempt any FOUR of the following:	16M
	a)	**Define compatibility and reverse compatibility of colour TV signal.**	**4M**
	Ans:	In monochrome *reception* of natural daylight scenes and pictures taken in black and white are called Compatibility. The *colour television signal* must produce a normal black and white is referred to as reverse compatibility.	**(Each -2M)**
	b)	**Colour signal is suppressed before transmission of TV signal. Give reason.**	**4M**
	Ans:	• In TV transmitter, the colour difference signals (R-Y) and (B-Y) are weighted down & then modulated by colour subcarrier frequency 4.45MHz to obtain chrominance signal.(by using QAM) • This signal is transmitted with a suppressed subcarrier because amplitudes of the two carrier components are large compared to the sidebands products and if it is not suppressed, it will cause interference with Y signal when combined with it. • Due to suppressed colour carrier, we do not get any interference in the monochrome receiver when they are receiving colour information and also in the colour receiver when they receive monochrome information. • Also carrier is the large amplitude of carrier as compared to sideband frequency component. If carrier is remain as part of modulated signal it can cause serious interference and dot patterning in colour reception.	**(For concept - 4M)**

		Thus the colour carrier is suppressed before transmission and again regenerated at the receiver for demodulating for colour signal.	
	c)	**Differentiate between bandwidth of colour signal over luminance signal.**	**4M**
	Ans:	**Diagram:**  C.C.I.R. 625 lines monochrome and the compatible PAL Colour channel bandwidth details. **Explanation:** In the PAL colour system which is compatible with the C.C.I.R. 625 line monochrome system, the colour subcarrier frequency is located 4.433 MH_Z away from the picture carrier. The bandwidth of colour signals is restricted to about = 1.2 MH_Z around the subcarrier. Fig gives necessary details of the location of monochrome (picture), colour & sound signal spectrums, all within the same channel bandwidth of 7 MH_Z The luminance signal is transmitted with full frequency bandwidth of 5MH_Z for maximum horizontal details in monochrome. Whereas such large bandwidth is not necessary for colour signals; as for very small details human eye perceive only brightness but not the colour. For small colour areas video frequencies does not exceed 0.5 MH_Z, for medium size areas frequency spectrum between 0.5 MH_Z to 1.5 MH_Z and only two primary colours are needed. Therefore, for finer colour details human eye cannot distinguish between green and yellow colours. Thus maximum bandwidth necessary for colour signal transmission is around 3 MH_Z, (+/-1.5 MH_Z).	**2M** **2M**
	d)	**Draw block diagram of HDTV transmitter and state its working.**	**4M**
	Ans:	**Block diagram of HDTV transmitter:**  **OR** **Other Equivalent**	**2M**

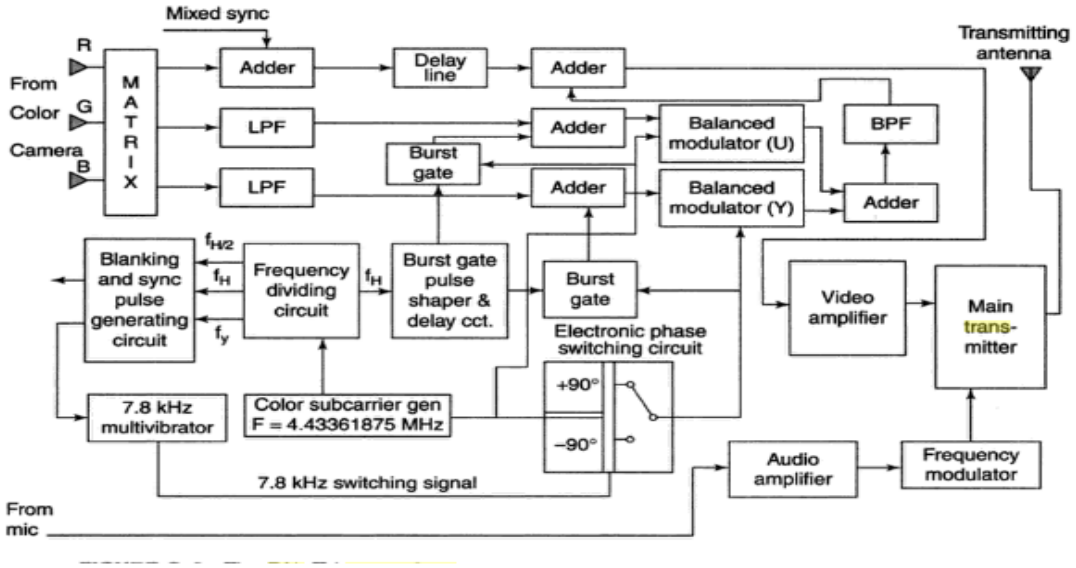
Working:

- A frame of the input video signal (output stored of the HDTV camera) after being suitably processed is in the frame memory (current) and referred to as new frame.
- A predicted frame is generated by past frames accumulated in the frame memory (previous).
- A difference frame is obtained by subtracting the predicted frame from the new frame. since the predicted frame closely represents the new frame, there is little information left to be transmitted in the difference frame.
- This is the first step in video compression. Further compression, of the video signal is achieved by using: o a transform coder o Entropy encoding which takes advantage of redundancy in the signal obtained at the output of the transform coder.
- The coded signals along with the digital audio & control signals are multiplexed. To take care of error during transmission the output of the multiplexer is passed through the channel encoder. This is the final signal which feeds the modulator.

2M

e) Draw block diagram of PAL transmitter and give the function of each block. **4M**

Ans: **Block Diagram:** **2M**



Block diagram of PAL TV Transmitter.

2M

Explanation:

- The colour components R, G, B are processed in a matrix processor circuit which modulates a color subcarrier at 4.433 MHz.
- The audio from the microphone is frequency modulated and fed to the main transmitter.
- The color subcarrier frequency is generated with a crystal control oscillator.
- The gamma connected R, G, B color signal are matrix to form Y and weighted color difference signal.
- The color burst signal is also fed to the modulator along with the U and V signal

		through the adder. • The burst signal is obtained from the circuit that feed color subcarrier to the two modulator. • The sound signal after frequency modulation with the channel sound carrier frequency also forms the part of the RF signal that is finally radiated through transmitter antenna system.	
	f)	**List features and characteristics of HDTV signal.**	**4M**
	Ans:	1. Improvement in both vertical and horizontal resolution of the reproduced picture by approximately 2:1 over existing standards much improved colour rendition (reproduction). 2. Higher aspect ratio of at least 5:3. 3. Stereophonic sound. 4. Their implementation results in a picture quality as clear as obtained from 35 mm cine films and sound as good as from digital audio discs. 5. 1125 scanning lines per frame. 6. 60 fields per second. 7. 2:1 interlace scan. 8. Aspect ratio 16:9. 9. Bandwidth 10MHz 10. Luminance signal Y = 20MHz 11. Sample per active line: 1920 12. Wide band colour signal: 7Mhz 13. Narrow band colour signal: 5.5MHz	**½ marks each. (Any eight)**