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 judgment 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 1

a) Attempt any SIX of the following **12M**

i. Give the significance of kell factor with its value.

Ans:

Significance of Kell:- **02M**

The Kell factor is used in estimating the actual resolution achieved in TV pictures i.e. to estimate actual no. of horizontal and vertical lines are resolved by human eye. Kell factor can be used to determine the horizontal resolution that is required to match the vertical resolution attained by a given number of scan lines.

The value of Kell factor is from 0.65 to 0.75.the typical value is 0.69.

ii. Define :

1) **Aspect ratio**
2) **Image continuity**

Ans:

Aspect ratio: **01M**

The width to height ratio of a TV screen or picture frame is called as aspect ratio. It is fixed at 4:3 that is

Width =4 and height = 3.

Image continuity: **01M**

- The picture information is transmitted line by line, but we get impression of continuity due to a phenomenon called "persistence of vision" of the human eye.
- Persistence of vision is a property of the retina of human eye that any impression produced on the retina will persist for $1/16^{th}$ of second.
- If within the short interval of persistence of vision, a series of images are presented to the eye, eye will see all images without break called Image continuity.

iii. Band II is not use for TV signal Transmission. Justify

Ans: **02M**

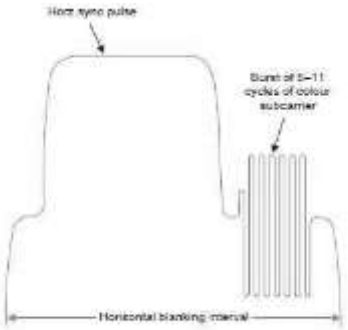
Band II (88 -108 MHz) is used for FM broadcasting that is for sound signal transmission.

iv. Define colour burst signal in colour TV signal.

Ans:

Colour Burst Signal in colour TV signal:- **02M**

Colour burst signal is 8 to 11 cycles of colour subcarrier signal placed at back porch of horizontal blanking period. And it is sent to the receiver along with sync signals. Subcarrier frequency is 4.43MHz.



Location of colour burst on the back porch of each horizontal sync pulse

v. Write Grass-Man's law of additive colour mixing.

Ans:

Grass-Man's law of additive colour mixing: **02M**

The algebraic sum of Red Blue and Green colour lights falling on white screen keeping brightness constant is called Grass-Man's law. It is represented by below equation for 100% white light.

$$Y = 0.59(G) + 0.30(R) + 0.11(B)$$

Where G, R and B are the intensities of green, red and blue lights.

vi. State the role of blanking pulses in CCV signal.

Ans:

Role of Blanking pulses in CCV Signal:- **02M**

Blanking pulses are added to make the retrace lines invisible. These are added by raising the signal amplitude slightly above the black level (75 %) during the time the scanning circuits produce retraces.

vii. Define compatibility and reverse compatibility of colour TV signal transmission.

Ans:

Compatibility: **01M**

The colour television signal must produce a normal black and white picture on a monochrome receiver without any modification of the receiver circuitry.

Reverse compatibility: **01M**

A colour receiver must be able to produce a black and white from a normal monochrome signal.

viii. Why FM signal is preferred for sound and AM for picture transmission.

Ans:

Suitability of FM for sound signal transmission: **01M**

- 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: **01M**

- 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: **01M**

Frequency modulation provides almost noise free and high fidelity output needs a wider swing in frequency on either side of the carrier. This can be easily allowed in a TV channel, where, because of

- Very high video frequencies a channel bandwidth of 7 MHz is allotted. In FM, where 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: **01M**

- 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 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.

b) Attempt any TWO of the following: **08M**

i) Define:-

1) Brightness

2) Contrast

3) Viewing distance

4) Luminance

Ans: -

Brightness:- **01M**

Brightness is the overall or average intensity of illumination and it determines background light level in the reproduced picture.

Contrast: - **01M**

This is the difference in light intensity between black and white parts of the picture over the average brightness level.

Viewing distance:- **01M**

This 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.

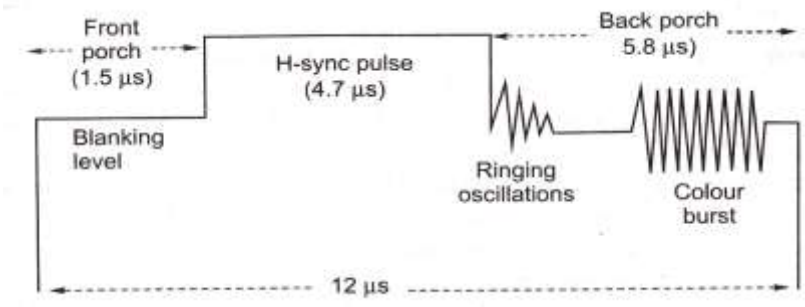
Luminance or brightness:- **01M**

This 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.

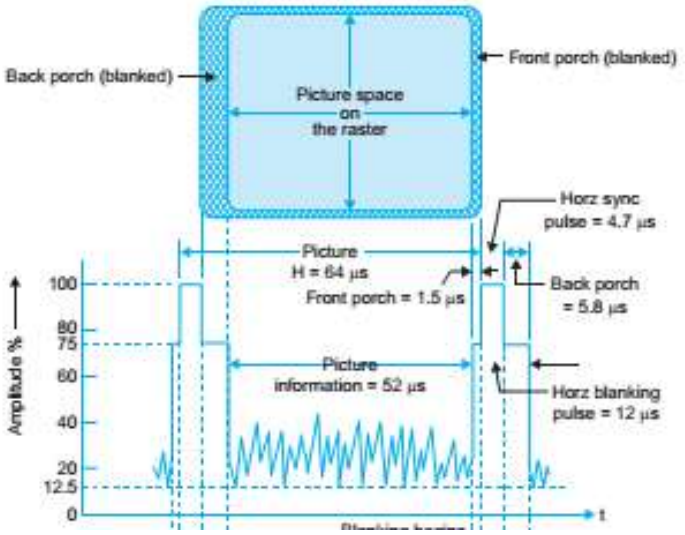
ii) Give the function of back porch and draw well labeled horizontal blanking details of one horizontal line.

Ans:

Diagram: **02M**



OR



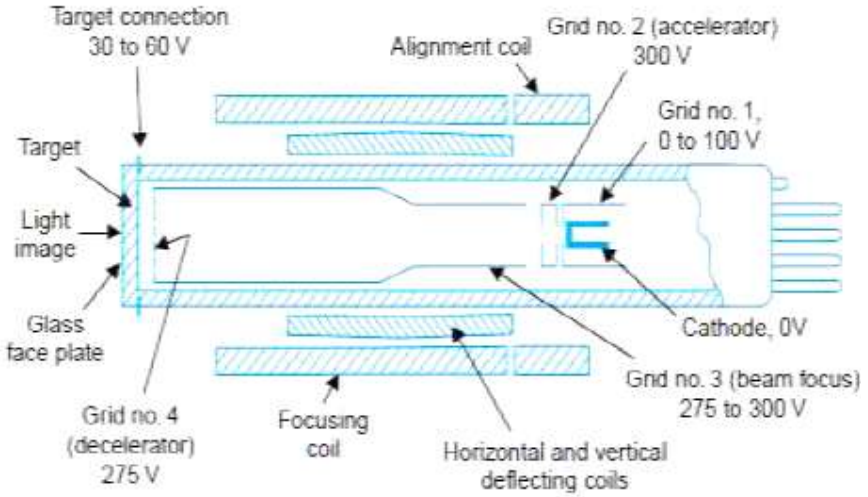
Function of Back Porch: **02M**

It is 5.8 µs wide. Its function is to absorb the ringing oscillations as shown in fig. which are cause during sudden fall of voltage from sync top during flyback. In the absence of back porch this ringing oscillations would have corrupted signals. The back porch also provides necessary amplitudes equal to the banking level and enables to preserve the DC content of the picture information at the transmitter.

iii) Draw neat label schematic diagram of Videocon Camera tube and state its working.

Ans:-

Diagram: **02M**



Vidicon camera tube cross-section

Working: - **02M**

- Light from the scene is focused by an optical lens on to vidicon target. Light passes through the glass face place and internal conductive surface to photoconductive image plate that is scanned by electron beam. The resulting camera signal is taken from the target ring image end of photo conductive target is connected to DC supply (40V).
- In absence of light, the photo conductive layers behave as an insulator. When light falls on it, electrons from Conduction level of atoms becomes free. Therefore change image is formed.
- When low energy electron beam sweeps past each picture element of target plate, it deposits just enough electrons on target plate to discharge each point to zero potential. Therefore discharge current flows through R_L. This is camera output signal.

Q.2 Attempt any FOUR of the following : **16M**

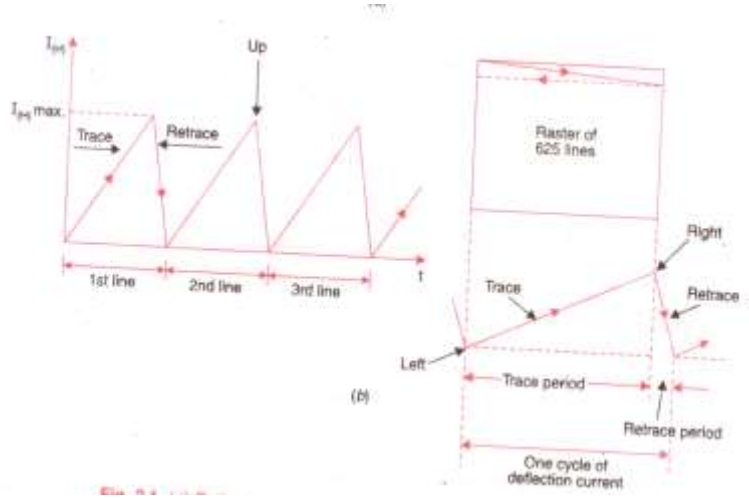
a) Describe the process used to create motion picture using principle of persistence of vision. Draw appropriate diagram of the same.

Ans:-

Explanation:- **02M**

- 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.

Diagram:- **02M**



b) Why are equalizing pulses transmitted during vertical synchronous pulses?

Ans:-

Explanation:- **02M**

- There is a ½ line difference just prior to the start of serrated vertical pulse.
- This ½ line difference does not affect the horizontal deflection synchronization but it does affect the vertical synchronization and the interlaced scanning. So to avoid this effect of uneven line period can be reduced by increasing the interval between the preceding line pulse and the field sync pulses.
- To ensure that the vertical deflection oscillator receives the necessary triggering voltage at the same time after every field, a series of five narrow pulses 2.3μs each, occurring at half line rhythm, are inserted before the field sync pulse.
- These are called pre equalizing pulses .The width of equalizing pulse are normally half the width of sync pulses, roughly half of 4.7μs or (2.3μs) each as mentioned before.
- The equalizing pulses inserted after the vertical synchronizing pulses are post equalizing pulses. These equalizing pulses do not disturb the operation of either oscillator, yet they permit the vertical sync pulse to occur at the correct time after every field.
- We have seen that the vertical slots of 4.7μs duration that are inserted in the vertical sync period to achieve horizontal synchronization are called serrated pulses.
- The pre-equalizing, post equalizing and serrated pulses are necessary to correct interlaced scanning.
- The field sync pulses give triggering pulse to the vertical oscillator (field oscillator) Horizontal oscillator receives triggering pulses even during the vertical blanking due to the presence of serrated pulses.

- Vertical sync pulses are available at the end of the line of second field and at the middle of the line at the end of first field.
- The equalizing pulses are provided to avoid timing error at vertical oscillator. The shape of the vertical trigger pulse is maintained at both even and odd fields.

Diagram:- **02M**

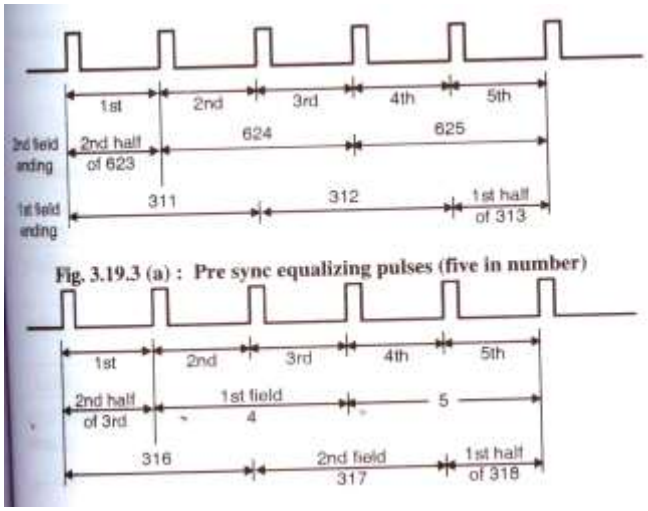


Fig. 3.19.3 (a) : Pre sync equalizing pulses (five in number)

c) Draw & describe the working of colour camera giving o/p (R-Y), (B-Y) & Y signal.

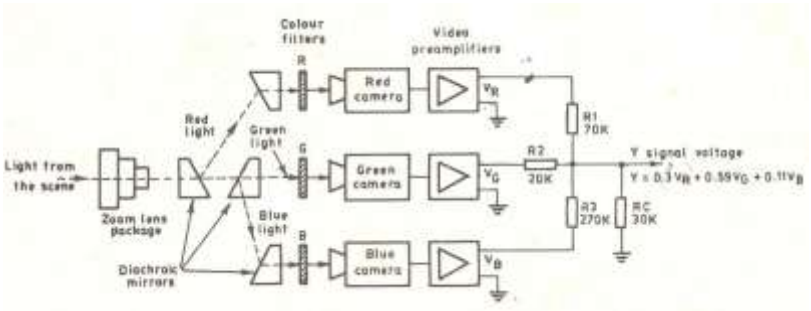
Ans:-

Explanation:- **02M**

- Fig shows a simple block schematic of colour TV camera. It essentially consists of three camera tubes in which each tube receives selectively filtered primary colours.
- Each camera tube develops a signal voltage proportional to the respective colour intensity (luminance) received by it. Light from the scene is processed by the objective lens system.
- The image formed by the lens is split into three images by means of glass prisms. These prisms are designed as diachroic mirrors. A diachroic mirror passes one wavelength and rejects other wavelength (colours of light).Thus red, green and blue colour images are formed.
- The rays from each of the splitters also pass through colour filters called trimming filters. These filters provide highly precise primary colour images which are converted into video signals by image-orthicon or vidicon camera tubes.
- Thus the three colour signals are generated. These are called Red(R), Green (G) and Blue (B) signals.
- The voltage Vy as obtained from the resistance matrix is low because Rc is chosen to be small to avoid crosstalk. Hence it is simplified before it leaves the camera sub-chassis. Also, the amplified Y signal is inverted to obtain –Y as the output. This is passed on to the two adder circuits.

- First Adder circuit adds the red camera output –Y to obtain (R-Y) signal. Similarly the second adder combines blue camera output to –Y and delivers (B-Y) as its output. This is illustrated in below fig.
- The difference signals thus obtained bear information both about the hue and saturation of different colours.

Diagram:- **02M**



OR

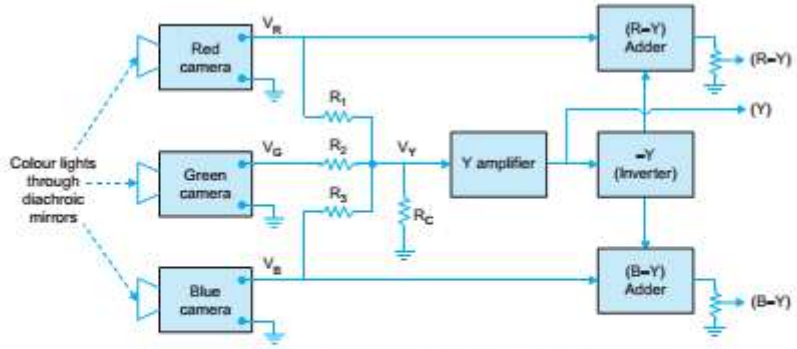


Fig. 25.9. Production of luminance and colour-difference signals.
Note that Y = 0.3R + 0.59G + 0.11B
(R – Y) = 0.7R – 0.59G – 0.11B
and (B – Y) = 0.89B – 0.59G – 0.3R.

d) Draw phasor diagram for weighted primary colours& calculate their phase & magnitude.

Ans:- **(Calculation 02M, Phasor Diagram 02M)**

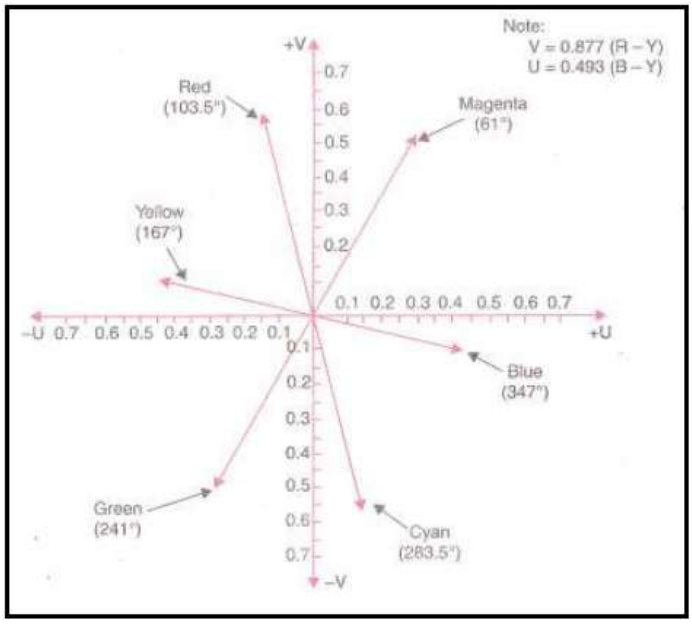
Calculation for phase and magnitude:-

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

$$(B-Y)\text{ weighted} = 0.493\,(B-Y)\text{ unweighted}$$
$$(R-Y)\text{ weighted} = 0.877\,(R-Y)\text{ unweighted}$$

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°

Phasor Diagram:-



e) List the advantages of PAL TV system (any four).

Ans:-

Advantages (Any Four point):- **01M each**

- PAL TV systems, hue errors are automatically removed with the utilization of phase alternation of colour signals it receives.
- No need of tint control
- With the help of a 1H delay line that produces lower saturation, the chrominance phase errors that may occur in the PAL system are cancelled out.
- The greatest advantage of the PAL TV system over the NTSC system is that it avoids the NTSC system's sensitivity to phase changes through minor modifications where high colour fidelity is achieved.

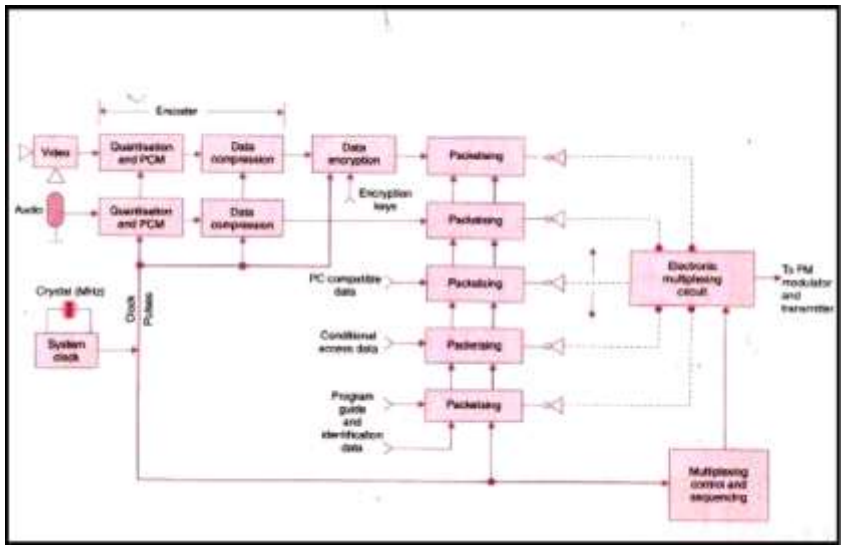
- With the help of a delay line and two adders, the PAL decoder adds colour signals of successive lines while cancelling out phase errors.
- Excellent colour stability

f) State the principle of digital TV transmission with labeled block diagram.

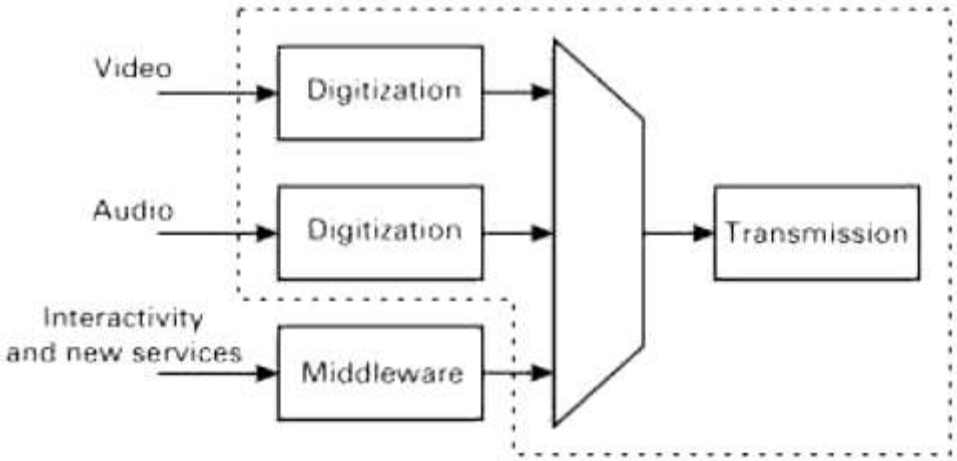
Ans:-

NOTE:- Any other relevant diagram can be considered

Diagram:- **02M**



OR



Principle: **02M**

- 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

Q3 Attempt any FOUR of the following: **16M**

a) What are the applications of progressive scanning (any four). And also list the advantages of interlaced scanning.

Ans:-

Application (any four):- **½ M each**

- Progressive scanning is used for displaying, storing, or transmitting moving images in which all the lines of each frame are drawn in sequence.
- It is used for cathode ray tube (CRT).
- It is used for CRT computer monitors.
- It is used for LCD computer monitors.
- It is used for HDTV's as the display resolution
- It is also used in other CRT-type displays such as SDTVs.

Advantages of interlaced scanning: **2M**

I. It reduces the video BW because the total number of lines scanned/sec. remains unchanged.

II. It also avoids the problem of flicker since scanning rate is doubled i.e. 50 frames/sec.

b) Give BW of colour signal. Why it is lesser than luminance signal.

Ans:- **(Explanation 3M and Bandwidth 1M)**

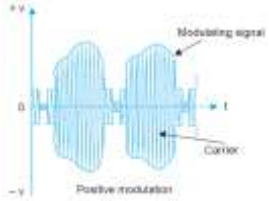
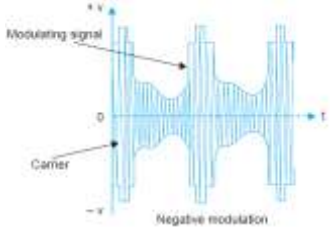
Bandwidth of colour signal is 1.3MHz to 1.5 MHz

- The colour video signals do not require a large bandwidth like Y signal which is transmitted with full frequency bandwidth of 5MHz for maximum horizontal details in monochrome.
- If the object is very small then eye cannot recognize the colour but sees only the brightness.
- The luminance signal Y carries all the fine details of the picture.
- For colours formed by two primaries, the video spectrum lies between 0.5MHz and 1.3MHz.
- For colours formed by all the three primaries, video frequencies are below 0.5MHz; therefore in colour transmission it is not necessary to send colour information beyond 1.5MHz.

c) Differentiate between positive and negative modulation (any four points)

Ans:- Any four points **(Each difference 1M)**

Sr.No	Positive modulation	Negative modulation
1	When increase in brightness of that picture results in an increase of the amplitude of modulated envelope.it is called positive modulation.	When increase in brightness reduces amplitude of the modulated envelope, it is called negative modulation.
2	White level of video signal corresponds to 100% total magnitude.	White level of video signal correspondence to 12.5% of the total amplitude.
3	Noise pulses do not effect synchronization but cause white spot in the picture	Noise pulses are seen as less annoying black spot.
4	More power is required with less efficiency	If peak power available from transmitter is considered them less power is required for more efficiency.
5	Black level of video signal correspondence to 25% of total magnitude.	Blanking level starts at 75%

6		

d) List characteristics of digital TV transmission (any four).

Ans:-

Characteristic of Digital TV transmission: (Any four) **01M each**

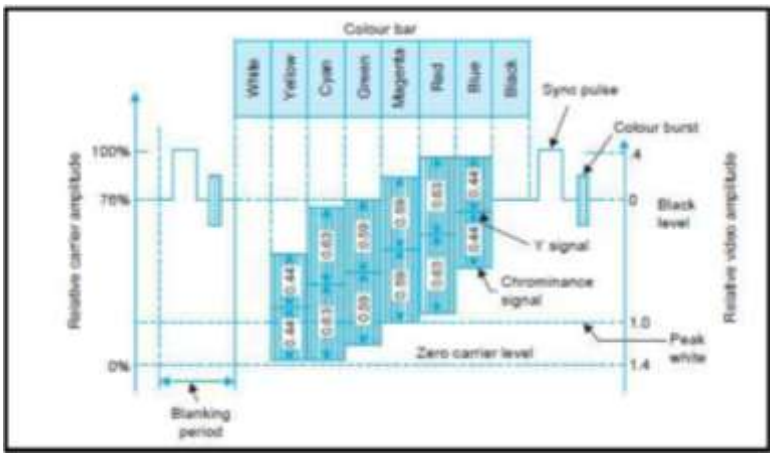
- T.V scanning Line :1250
- Aspect ratio : 16:9
- Interlace ratio: 1: 1 progressive
- Active lines: 1152
- Field frequency: 40Hz
- Line frequency: 62.5KHz
- Luminance signal Y = 20MHz
- Sample per active line: 1920
- Wide band colour signal: 7Mhz
- Narrow band colour signal: 5.5MHz

e) Draw neat labeled of CCVS for two horizontal lines.

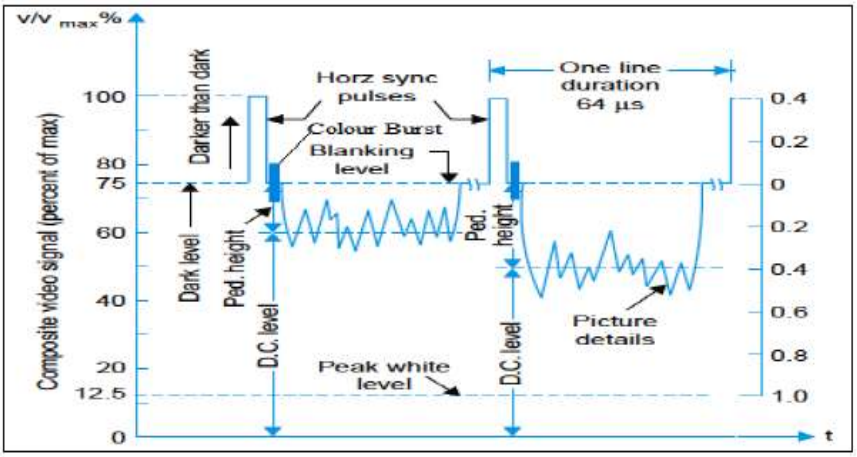
Ans:-

NOTE:- Any other relevant diagram can be considered

Diagram:- **04M**



OR



f) List two advantages & two disadvantages of digital TV transmission system.

Ans:

Advantages: (Any two) **02M**

- Reduction of 50Hz flicker.
- High resolution pictures.
- Slow motion action.
- Easy adoption to additional displays.
- Reduced operational instability.

Disadvantages: (Any two) **02M**

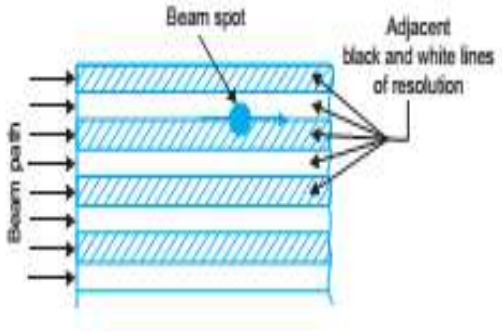
- The biggest disadvantage of the digital TV is the fact that you will need special equipment called digital converter box.
- In digital broadcast there is the loss of signals because of bad weather.
- It can be quite difficult to adjust the antenna (without special equipment e.g. signal level meter).
- Switching channels is slower because of the time delays in decoding digital signals

Q4. Attempt any Four of the following: **16M**

a) Illustrate operation of vertical resolution with neat diagram

Ans: -

Diagram:- **02M**



Explanation:- **02M**

The ability of the scanning system to resolve picture details in vertical direction is known as vertical resolution.

Vertical resolution is a function of scanning lines into which the picture is divided in the vertical plane.

The maximum number of dark and white elements which can be resolved by the human eye in the vertical direction in a screen of height H decided by the number of horizontal lines into which picture is split while scanning.

Thus, vertical resolution can be expressed as,

$$Vr = Na * K$$

Vr = Vertical resolution

Na = Active number of lines.

K-kell factor or resolution factor Assuming a reasonable value of k = 0.69,

Vr = 585 × 0.69 = 400 lines

It is of interest to note that the corresponding resolution of 35 mm motion pictures is about 515 lines and thus produces greater details as compared to television pictures.

b) Explain the significance of sync, blanking, equalizing pulses.

Ans: -

Blanking pulses: **01M**

- 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.
- Repetition of rate of horizontal blanking pulses per frame is 15625 Hz (line frequency)
- Vertical blanking pulse frequency is 50Hz (field frequency)

Sync Pulses:- **02M**

Sync pulses are having amplitude in upper 25 percent of video signal.

Horizontal sync details:

- Out of a total line period of 64 μs, the line blanking period is 12 μs. During this interval a line synchronizing pulse is inserted.
- The line blanking period is divided into three sections. These are the 'front porch' (1.5 μs), the 'line sync' pulse (4.7 μs) and the 'back porch' (5.8 μs).

Vertical sync details:

- The basic vertical sync added at the end of both even and odd fields Its width has to be kept much larger than the horizontal sync pulse, in order to drive a suitable field sync pulse at the receiver to trigger the field sweep oscillator.
- The standards specify that the vertical sync period should be 2.5 to 3 times the horizontal line period.
- In the 625 line system 2.5 line period ($2.5 \times 64 = 160$ μs) has been allotted for the vertical sync pulses.

Equalizing pulses:- **01M**

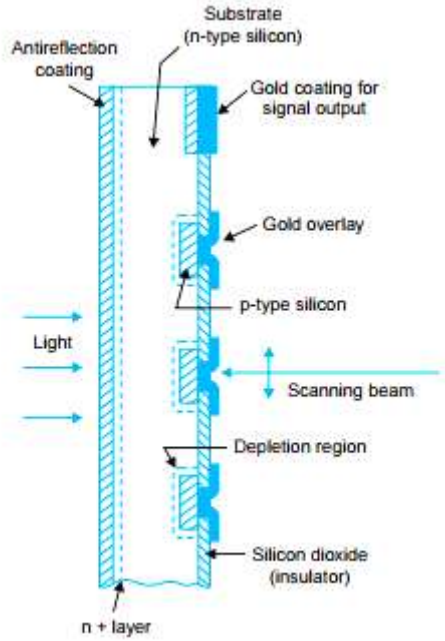
- To take care of this drawback which occurs on account of the half line discrepancy five narrow pulses are added on either side of the vertical sync pulses. These are known as pre-equalizing and post-equalizing pulses.
- Each set consists of **five narrow pulses occupying 2.5 lines period** on either side of the vertical sync pulses. Pre-equalizing and post equalizing pulse details with line numbers occupied by them in each field.

- 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**.

c) Draw the schematic of silicon diode array camera tube. Describe its operation.

Ans:-

Schematic:- **02M**



Operation:- **02M**

- The photodiodes are reverse biased by applying +10 V or so to the n + layer on the substrate. This 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. A typical value of peak signal current is 7 µA for bright white light.
- The vidicon employing such a multi diode silicon target is less susceptible to damage or burns due to excessive high lights. It also has low lag time and high sensitivity to visible light which can be extended to the infrared region

d) List factor influencing the choice of colour sub carrier frequency in colour TV

Ans:-

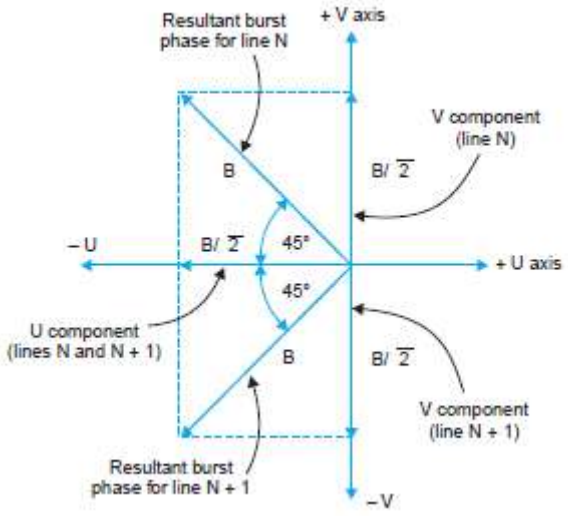
Factor influencing the choice of colour sub carrier frequency in colour TV:- (Any 4) 01M each

- The picture carrier and the colour subcarrier should be located quite apart from each other to avoid any beat interference between the two signals due to some overlaps and imperfect frequency interleaving. It can be minimized by placing the chroma signal near high frequency end of the Y signal spectrum.
- The chroma signal lies in the pass-band of luminance signal and can thus reach the picture tube input of a B & W receiver.
- Some dot pattering may appear on the colour subcarrier along with the Y signal. This effect can again be reduced by choosing a higher subcarrier frequency.
- fsc cannot be chosen for the following reasons:
    i. Keeping the subcarrier very high would mean single sideband transmission of the chroma signal with the consequent increase in receiver design complexity. The chroma signal requires at least a bandwidth of 2 MHz centered on the subcarrier. Thus, if both the sidebands are to be fully accommodated, the highest possible value of fsc is around 4 MHz
    ii. A very high subcarrier will bring it too close to the sound signal spectrum and cause another type of interference due to mutual interference.
    iii. It is technically difficult to obtain reasonably linear phase characteristics near the cut-off point of the video bandwidth. A higher value of fsc would place the complex chroma signal in this region causing its distortion. Any phase shift of the chroma signal affects hues and hence too high a value of fsc is not desirable.

e) Describe concept of PAL – V switching and its purpose with the help of Phasor diagram.

Ans:-

Diagram:- **02M**



Explanation:- **02M**

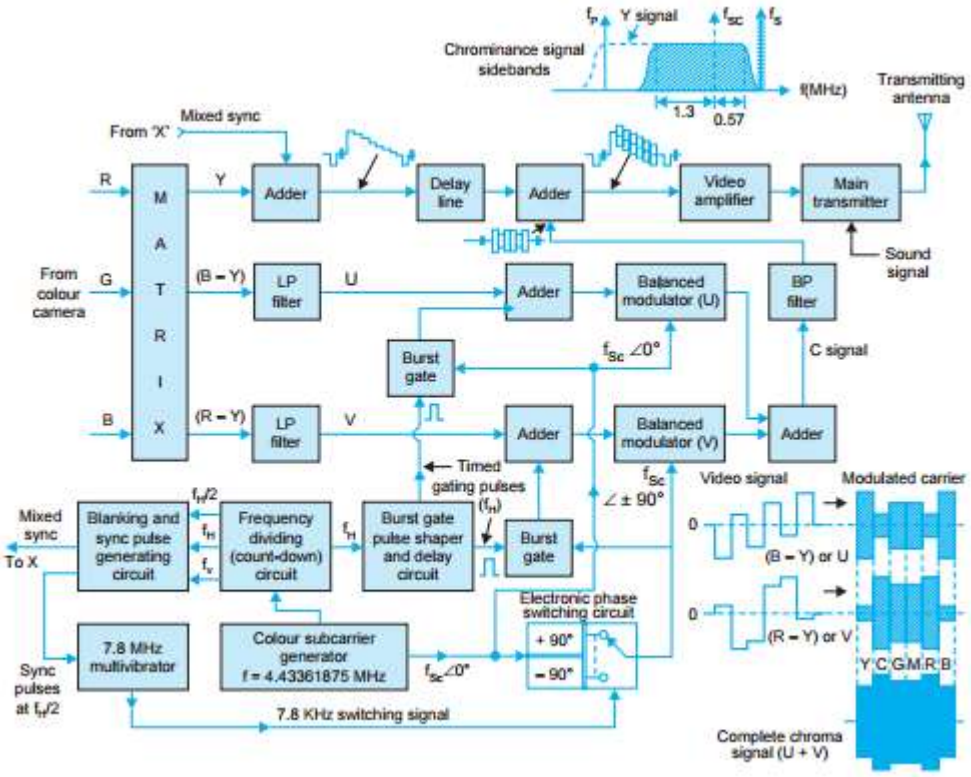
- If the PAL signal were applied to an NTSC type decoder, the (B – Y) output would be U as required but the (R – Y) output would alternate as + V and – V from line to line.
- Therefore, the V demodulator must be switched at half the horizontal (line) frequency rate to give '+ V ' only on all successive lines.
- Clearly 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.
- Note that the burst phase actually swings $\pm$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.

f) Draw the block diagram of PAL encoder with output waveform.

Ans:- **(Diagram 03M, Waveform 01M)**

NOTE:- Any other relevant diagram can be considered

Diagram:-



Q5) Attempt any FOUR of the following **16M**

a) Write the process of separation of U and V with neat diagram.

Ans:-

Diagram:- **02M**

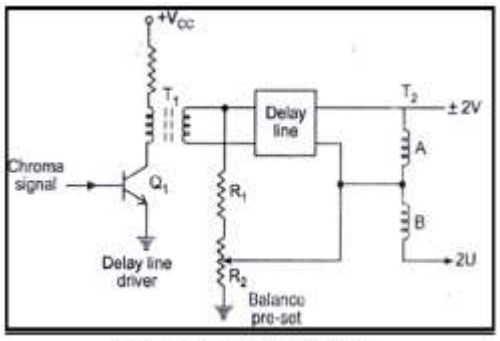


Fig. separation of U & V signals

OR

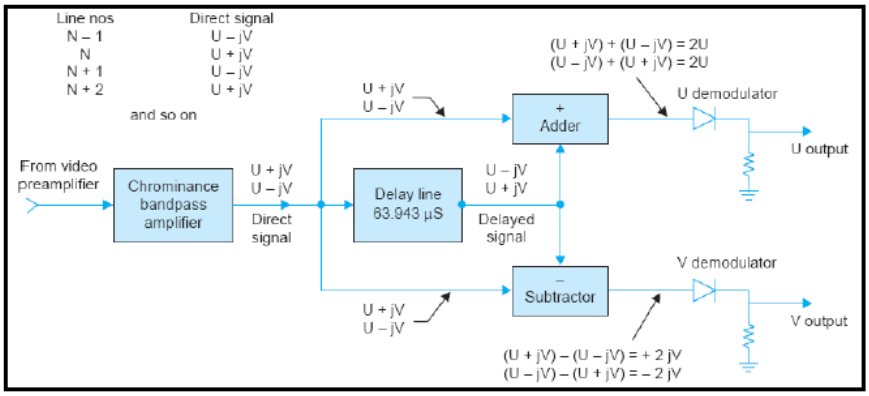


Fig. separation of U & V signals

Working: - **02M**

- The basic principle of U & V signal separation by transformer action is shown in fig. It consists of transistor Q1, Transformer T1, PAL delay line & a center tapped transformer T2. The delay line driver transistor Q1 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 T2. Chroma signal is also fed directly at the center tap of transformer T2 through the potentiometer R2. As T2 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.

b) Why vertical sync pulses are serrated during T.V. signals transmission.

Ans:-

Explanation:- **02M**

- 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.

Diagram: - **2M**

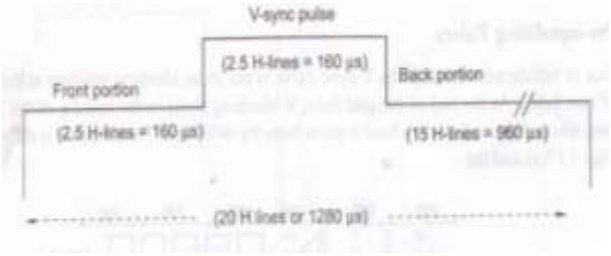


Fig (a)

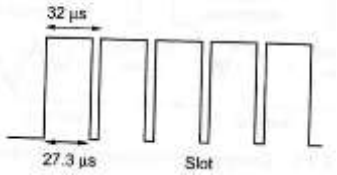
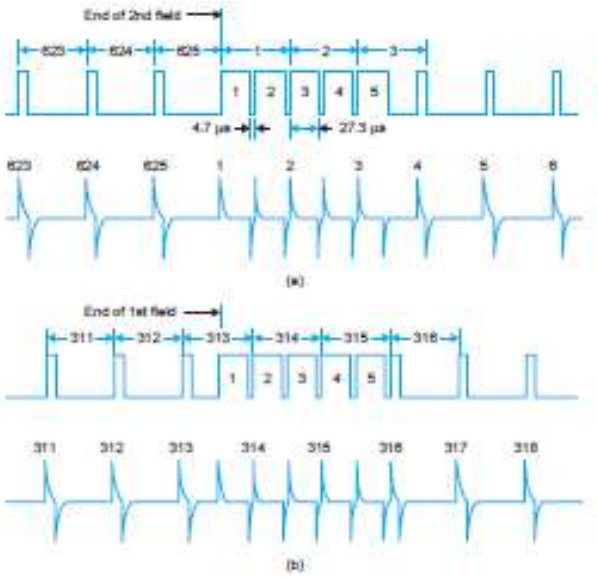


Fig (b)

OR

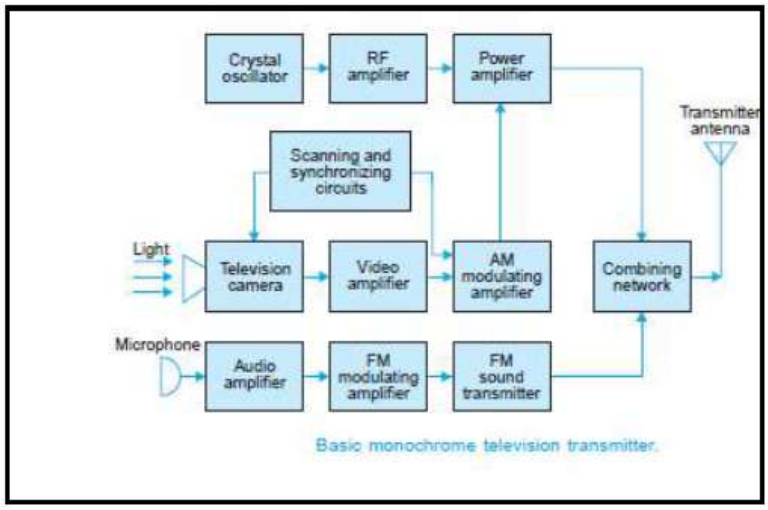


- The front portion of the V-blanking pulses is of 160 micro second and V- sync pulse is also 160 micro second which is equal to two and half H-Lines .This back portion is of 960 micro second equal to 15 H-Lines. Vertical deflection is very slow as compare to the horizontal deflection. And therefore 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.

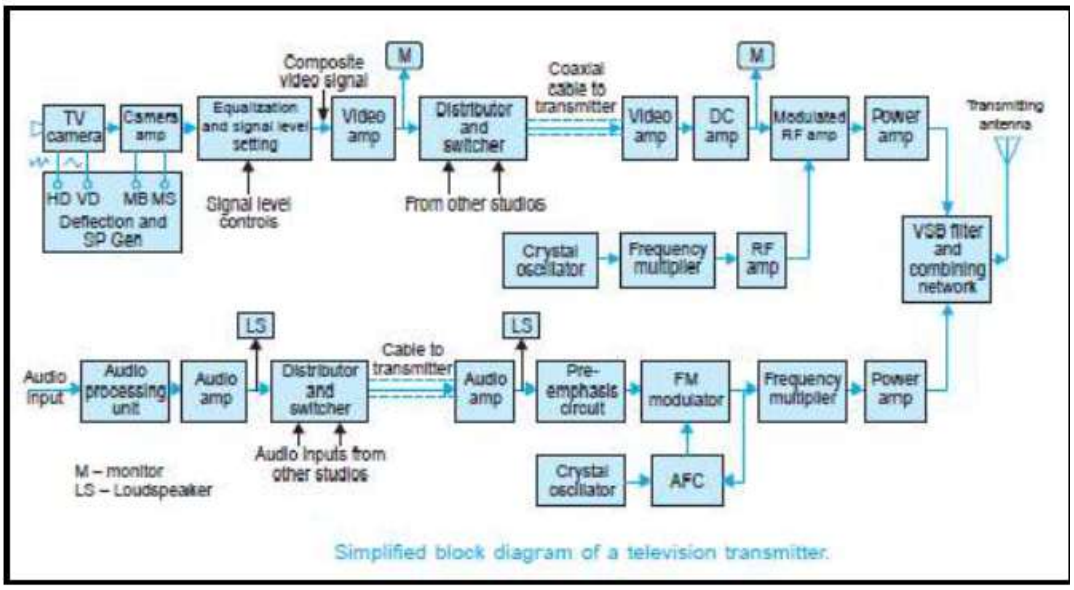
c) Draw basic block diagram and write working of monochrome TV transmitter.

Ans:

Diagram: **02M**



OR



Working: - **02M**

- **TV camera**: The heart of which is a camera tube, is used to convert the optical information into a corresponding electrical signal, the amplitude of which varies in accordance with the variations of brightness.
- **Microphone:** It converts the sound associated with the picture being televised into proportionate electrical signal, which is normally a voltage.

- **Sync and scanning circuits:** It is use to extract the electrical current from the photosensitive target of the camera tube with the help of a scanning beam which is produced by saw tooth current through horizontal and vertical deflection coils.
- **Video amplifiers:** Videos signals along with blanking and sync pulses called composites video signals are amplified by using video amplifier.
- **Audio Amplifier :** Which amplifies with audio signals
- **Combining Bridge or Combining Network:** Video modulated and audio modulated signals are passing through this network to go a common transmitting antenna. This bridge prevents audio modulated signals from going to video section and vice versa to avoid overloading.
- **Transmitting antenna:** Video modulated and audio modulated signals are fade to common transmitting antenna which radiates this signals into the space on the form of EM

d) State the main characteristic of the CCIR -B System for monochrome T.V

Ans:

Characteristics of CCIR-B system:- Any 8) **½ M each**

- Number of scanning lines/frame =625
- Field (vertical) frequency =50Hz
- Line(horizontal) frequency= 15625Hz
- Aspect ratio(width/height) =4:3
- Horizontal trace time =52μs
- Horizontal retrace time= 12μs
- Total scanning line lost in vertical retrace= 64μs
- Front porch= 1.5μs
- Back porch= 5.8μs
- Horizontal sync pulse= 4.7μs
- Colour sub carrier frequency= 4.43MHz
- Colour system Phase Alteration by Line –Delay (PAL-D)
- U signal(weighted B-Y) U=0.493 (B-Y)
- V signal(weighted R-Y) V=0.877(R-Y)
- Total vertical blanking duration 1280μs or 1.280ms
- Vertical sync pulse =160μs
- Pre and post equalizing pulse 5 pulse each

- Sync pulse top 100%
- Blanking/pedestal level 75%
- Black level 72-75%
- White level 10-12.5%
- Width of video signal =5MHz
- Chroma signal bandwidth -1.3MHz to +1.57MHz
- Video IF =38.9MHz
- Audio IF= 33.4MHz
- Inter carrier frequency= 5.5MHz
- Audio modulation Frequency Modulation(FM)
- Video modulation Amplitude Modulation (AM)
- Total channel width in VHF= 7MHz
- Total channel width in UHF= 8MHz

e) Describe additive and subtractive mixing of colours

Ans:

***Note:** If student has explain the separation without diagram, then also marks should be given*

Additive mixing: **02M**

In this type of mixing light from two or more colours obtained either from independent sources or through filters can create a combines sensation of a different colour. Secondary colours result when two primary colours of equal magnitude are additively mixed. By pair wise additive mixing of colours the following complementary colours are produced.

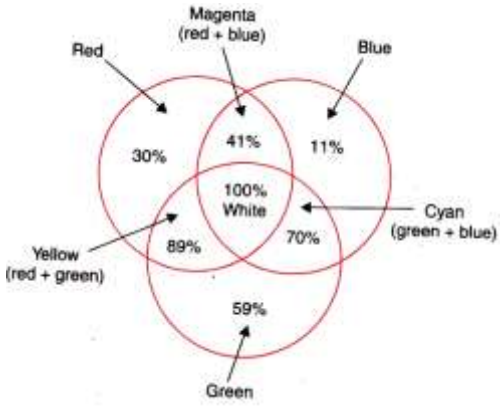
Red (30%) + Green (59%) =Yellow (89%)

Red (30%) + Blue (11%) = Magenta (41%) (Purplish blue)

Blue (11%) + Green (59%) = Cyan (70%) (Greenish blue)

Red (30%) + Green (59%) + Blue (11%) = White (100%) (Luminance)

Additive mixing occurs when we see the light emitted by the sources



Venn diagram of Additive mixing

Subtractive mixing: **02M**

- Secondary Colours (cyan, magenta, and yellow) of additive mixing are called primary colours of subtractive mixing.
- Result of subtractive mixing is shown in Venn diagram for e.g. [white-red = cyan]
- The three basic primary colours R, G, B can be written with minus sign in front of them.

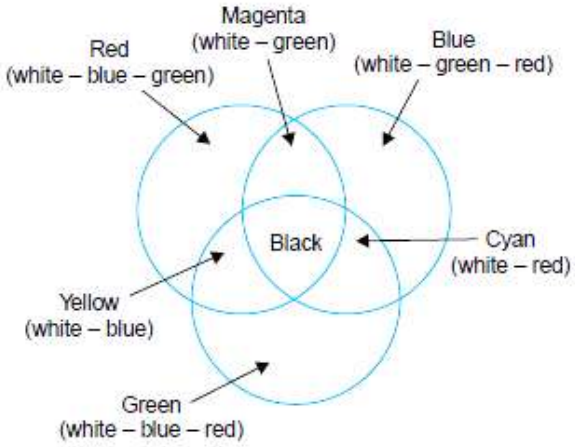
  For e.g.

  -Green, - blue, - red (Minus sign indicates the colour absorbed from the incident light.)

  -green = white – green {magenta}

  -Blue = white – blue {yellow}

  - Red = white – red {cyan}



Venn diagram of subtractive mixing

f) Write the frequency ranges of T.V Channel allocation for Band I and Band III.

Ans:

TV channel allocation for band I & band III:- **(Band I 01M, Band III 03M)**

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
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

Q6 Attempt any four of the following: **16M**

a) Explain how colour TV system maintains compatibility with monochrome TV system.

Ans:- **(Any four points 01M each)**

Compatibility implies that:-

- The colour television signal must produce a normal black and white picture on a monochrome receiver without any modification of the receiver circuitry.

To achieve this, that is to make the system fully compatible the composite colour signal must meet the following requirements:

- It should occupy the same bandwidth as the corresponding monochrome signal.
- The location and spacing of picture and sound carrier frequencies should remain the same.

- The colour signal should have the same luminance (brightness) information as would a monochrome signal, transmitting the same scene.
- The composite colour signal should contain colour information together with the ancillary signals needed to allow this to be decoded.
- The colour information should be carried in such a way that it does not affect the picture reproduced on the screen of a monochrome receiver.
- The system must employ the same deflection frequencies and sync signals as used for monochrome transmission and reception.

b) Colour signal is suppressed before transmission of TV signal, give reason.

Ans:-

Explanation:- **04M**

- 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.
- Thus the colour carrier is suppressed before transmission and again regenerated at the receiver for demodulating for colour signal.

c) State the reason of delaying luminance signal by one H-line period before mixing with colour signal.

Ans:-

Explanation:- **04M**

- The gamma corrected *R, G* and *B* signals are matrixed to form the *Y* and the weighted colour difference signals.
- The bandwidths of both (*B* – *Y*) and (*R* – *Y*) video signals are restricted to about 1.3 MHz by appropriate low pass filters. In this process these signals suffer a small delay relative to the *Y* signal.

- In order to compensate for this delay, a delay line is inserted in the path of *Y* signal.
- The video amplifier in the luminance channel is dc coupled and has the same bandwidth as in the monochrome receiver.
- It is followed by a delay line to compensate for the additional delay the colour signal suffers because of limited band pass of the chrominance.

d) Describe the features and characteristics of HD signal transmission.

Ans:-

Features and characteristics of HD signal transmission: (Any 8) **½ M each**

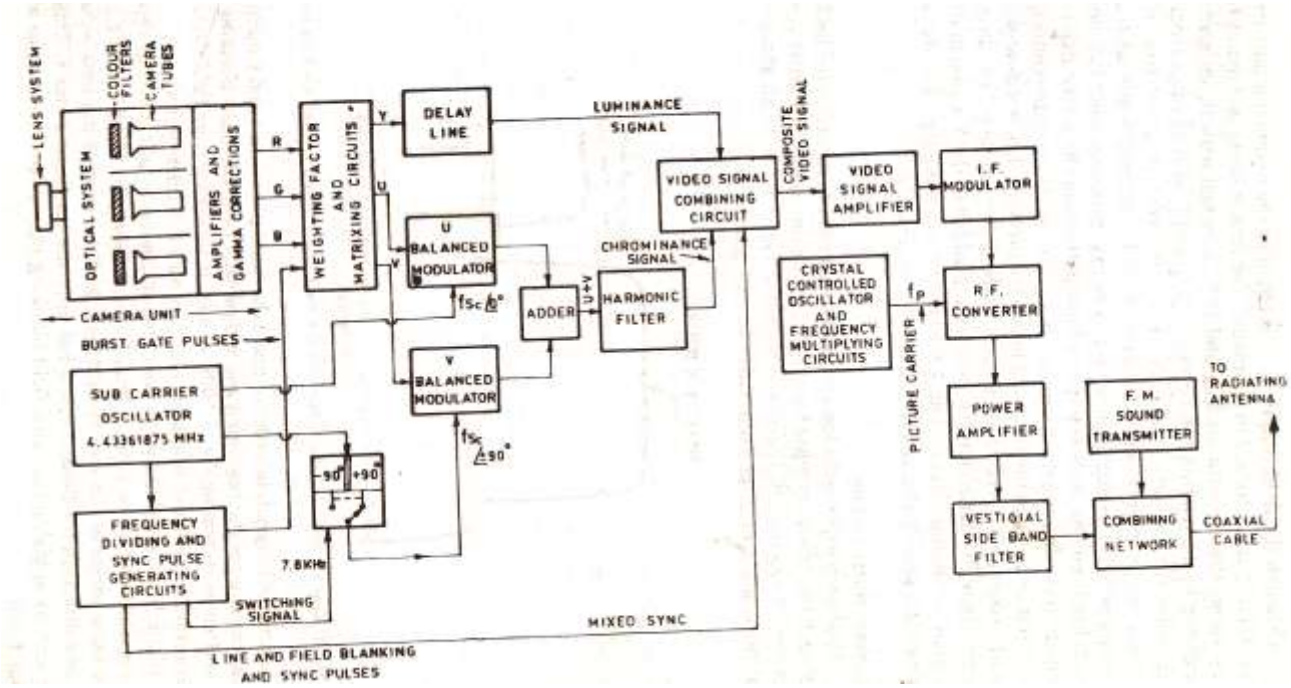
- Improvement in both vertical and horizontal resolution of the reproduced picture by approximately 2:1 over existing standards much improved colour rendition (reproduction).
- Higher aspect ratio of at least 5:3.
- Stereophonic sound.
- Their implementation results in a picture quality as clear as obtained from 35 mm cine films and sound as good as from digital audio discs.
- 1125 scanning lines per frame.
- 60 fields per second.
- 2:1 interlace scan.
- Aspect ratio 16:9.
- Bandwidth 10MHz
- Luminance signal Y = 20MHz
- Sample per active line: 1920
- Wide band colour signal: 7Mhz
- Narrow band colour signal: 5.5MHz

e) Draw block diagram of PAL TV transmitter.

Ans:-

NOTE:- Any other relevant diagram can be considered

Diagram:- **04M**



f) Write working of HDTV transmitter with neat block diagram.

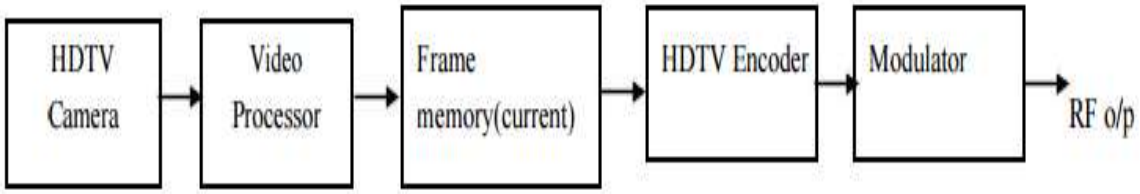
Ans:-

Working:- **02M**

- 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.

Note:- Video information typically remains un changes from frame to frame, except for some displacement owing

Block Diagram:- **02M**



OR