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 anyn 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) Define aspect ratio. Give its value.

Ans: **[01M for definition, 01M for value]**

Aspect ratio:

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.

ii) Explain interlace error.

Ans: **[01M for Explanation, 01M for Diagram]**

Any error in interlace scanning timings and sequence would leave a large number of picture elements unresolved and thus the quality of the reproduced picture gets impaired. Interlace error occurs due to the time difference in starting the second field.

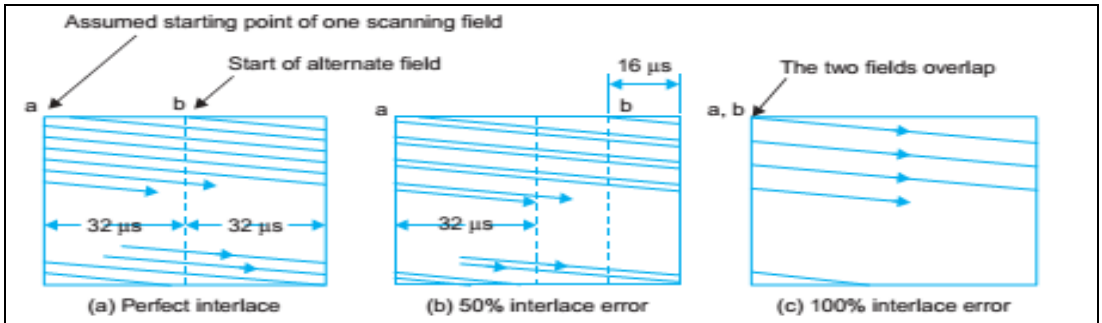


Fig. 2.9 Examples of interlace error.

iii) List channel allocation for Band I. for TV.

Ans: **[½ M for each Channel]**

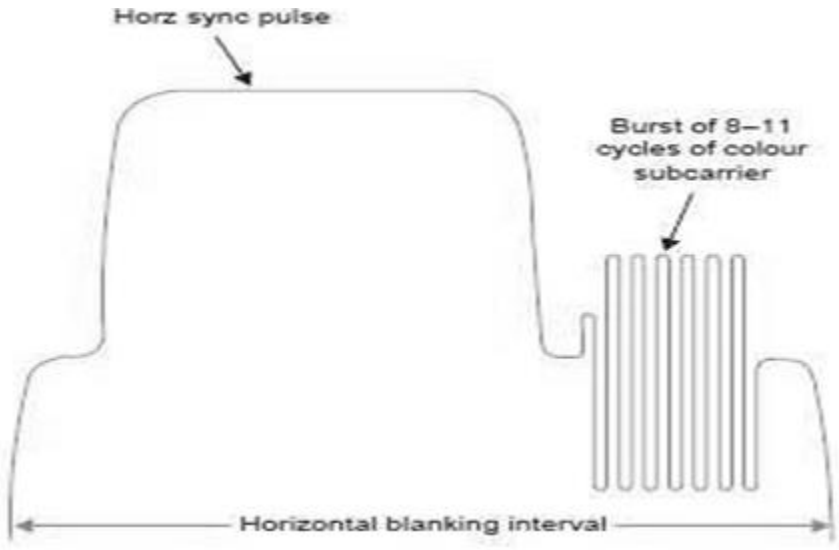
BAND	CHANNEL NO.	FREQUENCY RANGE
BAND I (41-68 MHz)	1	41–47 (not used)
	2	47–54
	3	54–61
	4	61–68

iv) Define colour burst signal.

Ans: **[1M for Explanation, 1 M for Diagram]**

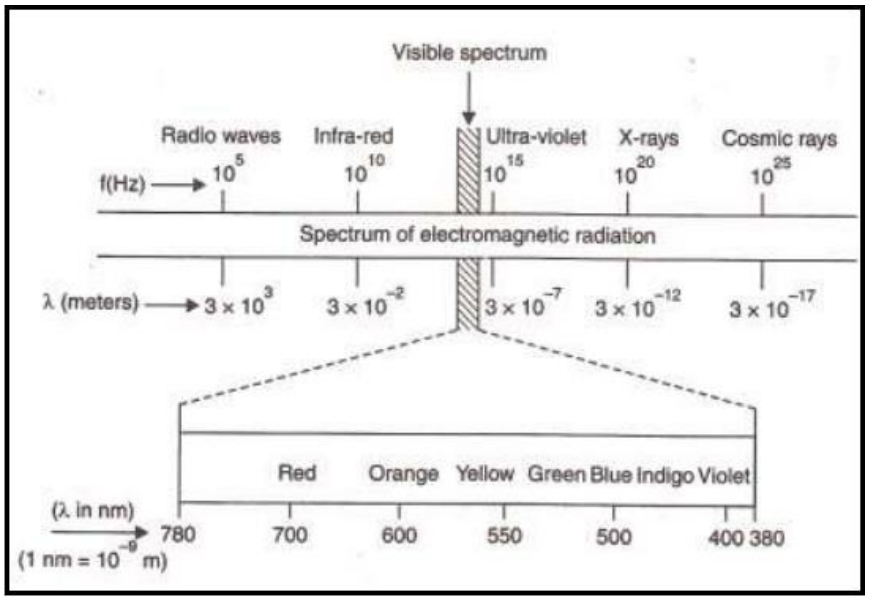
Colour Burst signal:-

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.



v) Draw well labeled visible sight spectrum with wavelength and frequency.

Ans: **[02M]**



vi) Give the function of combining network in PAL signal transmission

Ans: [**02M**]

Combining network in PAL signal transmitter combines the modulated CCVS signal with sound signal before feeding to the final transmitter section.

vii) Draw human eye response curve and state the function of cones in human eye structure.

Ans: **[01M diagram,01M function of cone]**

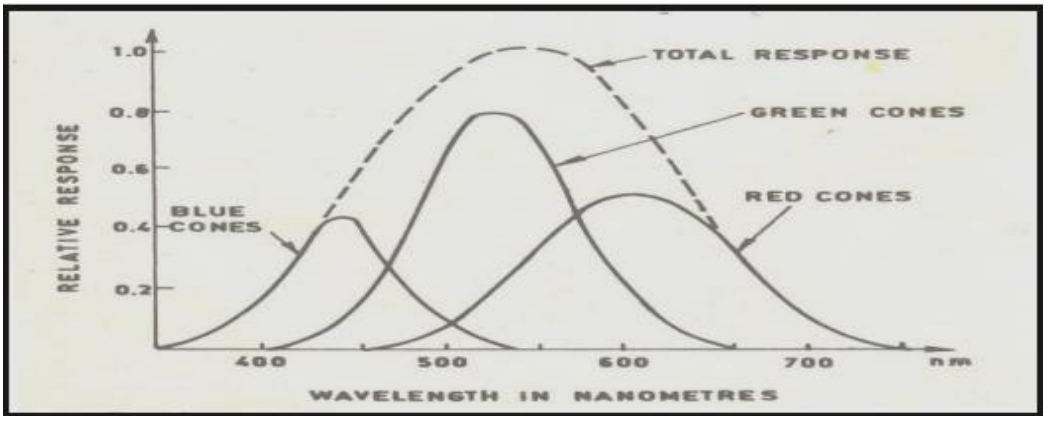
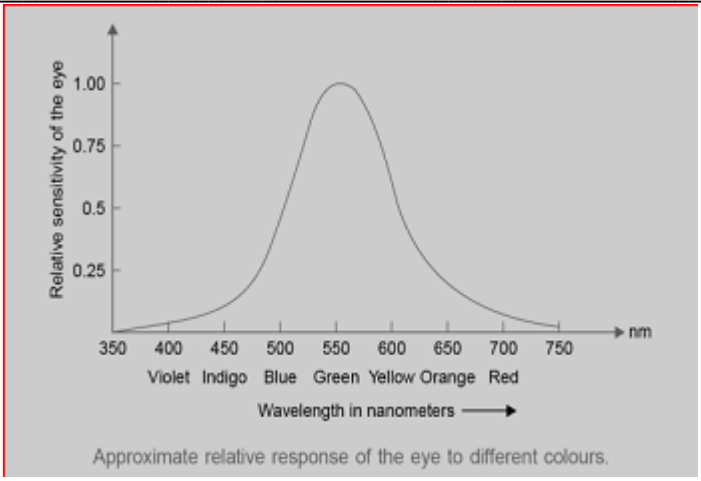


Fig: Spectral response of human eye.

OR



Approximate relative response of the eye to different colours.

Function of Cone:

The cones that are sensitive to colour are broadly in three different groups. One set of cones detects the presence of blue colour in the object focused on the retina, the second set perceives red colour and the third is sensitive to the green range.

viii) Justify the use of AM for picture signal in T.V.

Ans: **[02 M]**

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 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 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.

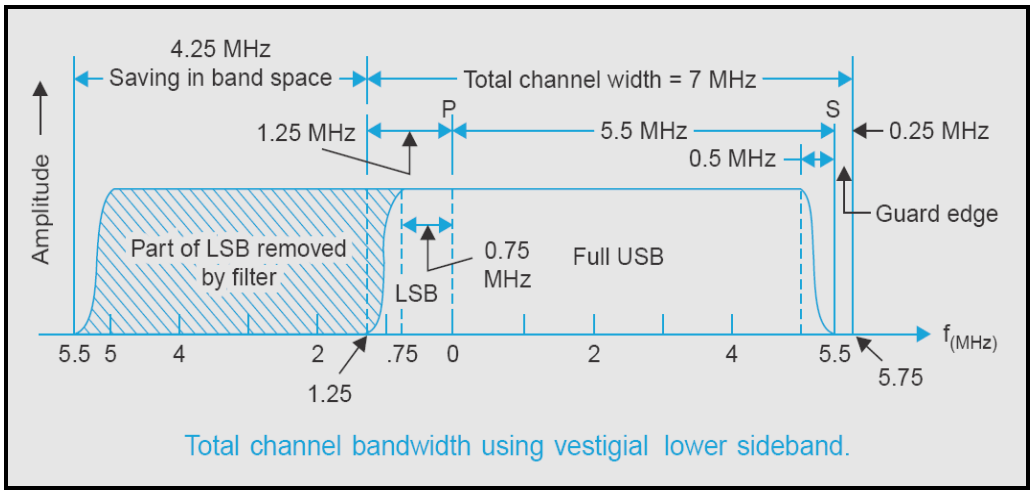
Q1 b) Attempt any TWO of the following: **[08M]**

i) Define VSB transmission. Also draw VSB spectrum / B.W. for colour signal.

Ans: - [02M definition and 1M for VSB spectrum & 01M for B.W of colour signal]

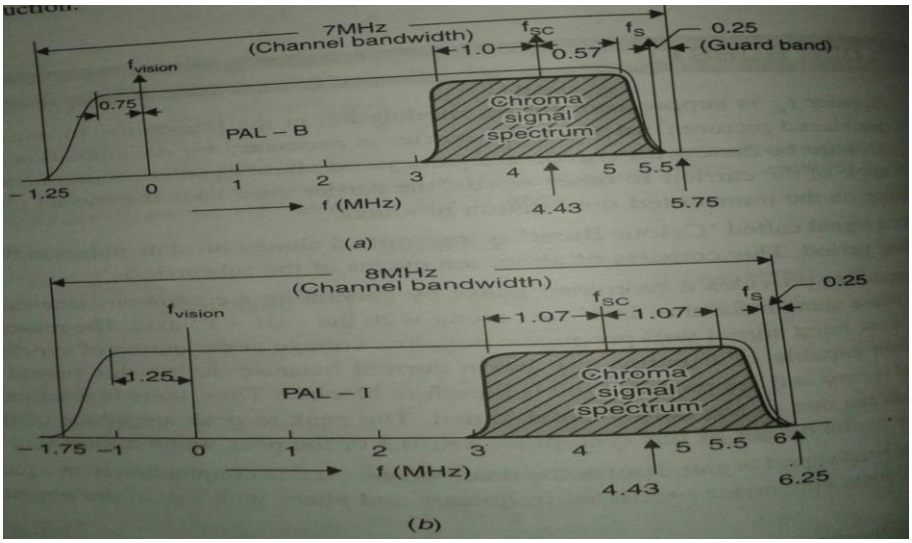
VSB Transmission:

- In TV signal transmission 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.



Total channel bandwidth using vestigial lower sideband.

OR



ii) Explain the need of serrated V. Sync. Pulse during vertical banking period.

Ans:

Explanation:- **[02 M]**

- 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.

Diagram: **[02 M]**

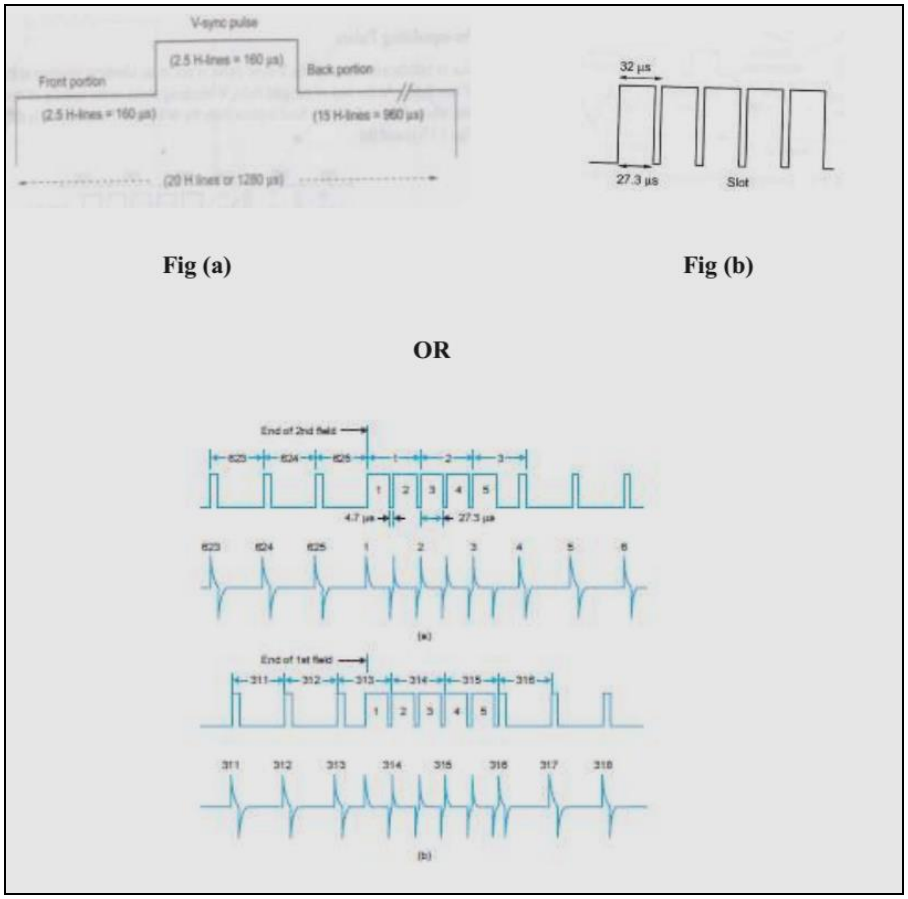
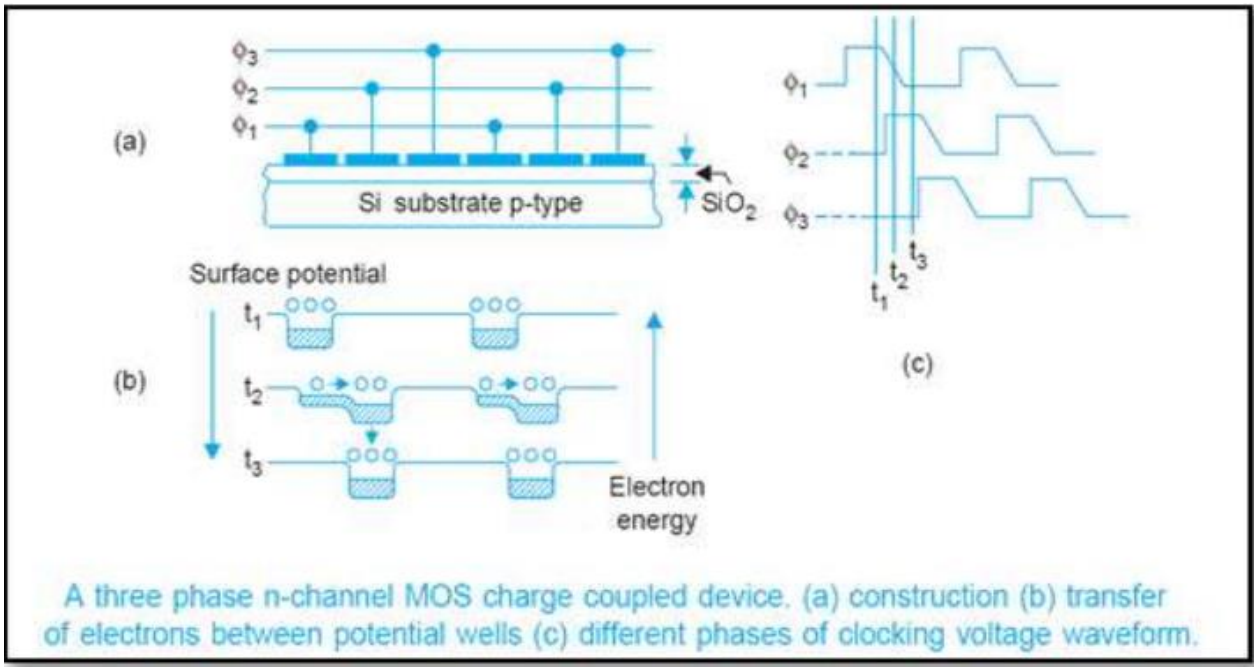


Fig (a) Fig (b)

OR

iii) Draw schematic of CCD camera and explain its working.

Ans: Diagram:- **[02 M]**



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.

Explanation:- **[02M]**

- The operation of solid state image scanners is based on the functioning of charge coupled devices (CCDs) which is a new concept in metal-oxide-semiconductor (MOS) circuitry.
- The CCD may be thought of to be a shift register formed by 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 charge of one element is transferred along the surface of the silicon chip by applying a more positive voltage to the adjacent electrode or gate, while reducing the voltage on it.
- The accumulation of charge carries under the first potential wells of two consecutive trios is shown in Fig. (b) Where at instant t1 a potential φ1 exists at the corresponding gate electrodes.
- In practice the charge transfer is affected by multiphase clock voltage pulses (see Fig. (c)) which are applied to the gates in a suitable sequence. The manner in which the transition takes place from potential wells under φ1 to those under φ2 is illustrated in Fig. (b).
- A similar transfer moves charges from φ2 to φ3 and then from φ3 to φ1 under the influence of continuing clock pulses. Thus, after one complete clock cycle, the charge pattern moves one stage (three gates) to the right.
- The clocking sequence continues and the charge finally reaches the end of the array where it is collected to form the signal current.
- The lines are then independently addressed and read into a common output diode by application of driving pulses through a set of switches controlled by an address register

Q2) Attempt any FOUR of the following **[16 M]**

a) Explain how H-Resolution is used to calculate the bandwidth of picture signal transmission.

Ans:

Explanation: **[03 M]**

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

While aiming at equal vertical and horizontal resolutions and assuming the same Kell factors the effective number of alternate black and white segments (N) that get scanned in one horizontal line are-

Na × aspect ratio = 585 × 4/3 = 780

For equal vertical and horizontal resolution, the same resolution factor may be used while determining the effective number of distinct picture elements in a horizontal line. Therefore, the effective number of alternate black and white segments in one horizontal line for equal vertical and horizontal resolution are:

N= Na× aspect ratio × k= 585 × 4/3 × 0.69 = 533

To resolve these 533 squares or picture elements the scanning spot must develop a video signal of square wave nature switching continuously along the line between voltage levels corresponding to black and peak white. This is shown along the bar pattern drawn in Fig. (a).

Since along one line there are 533/2 ≈267 complete cyclic changes, 267 complete square wave cycles get generated during the time the beam takes to travel along the width of the pattern.

Thus the time duration t_h of one square wave cycle is equal to

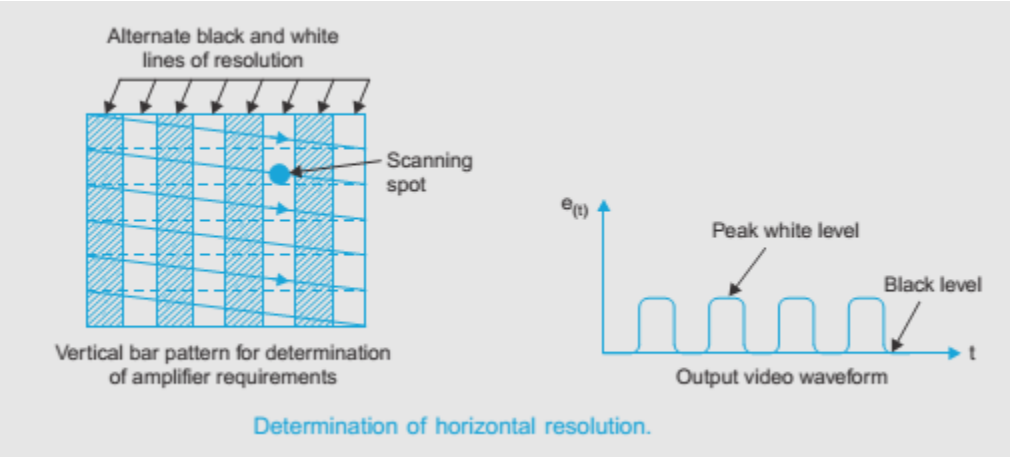
$$t_h = \frac{\text{active period of each horizontal line}}{\text{number of cycles}}$$

$$= \frac{52 \times 10^{-6}}{267} \text{ seconds}$$

$\therefore$ thg frequency of the periodic wave

$$f_h = \frac{1}{t_h} = \frac{267 \times 10^6}{52} = 5 \text{ MHz}$$

Diagram:- **[01 M]**

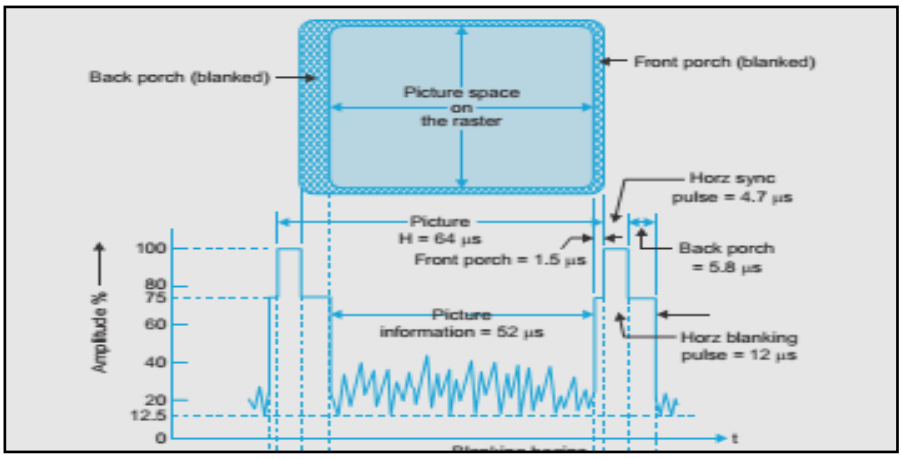


Determination of horizontal resolution.

b) Draw H-blanking details for one H-line and explain function of front and back porch.

Ans:

Diagram: **[02 M]**



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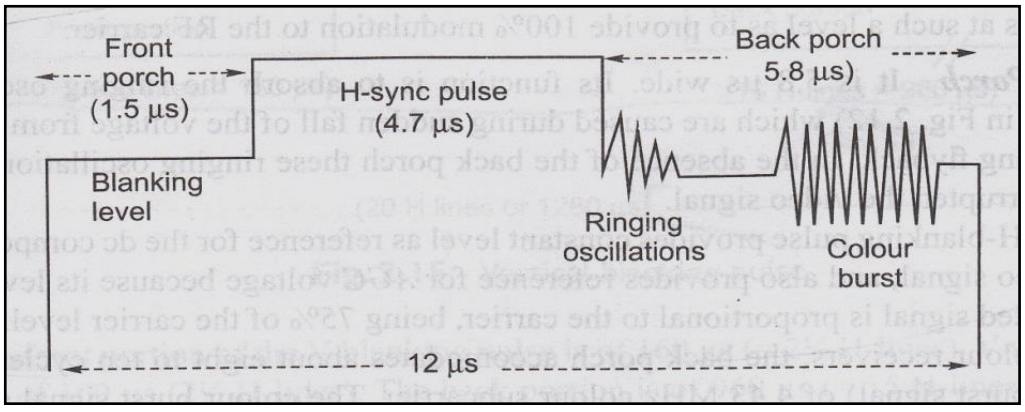


- **Function of Front porch:** **[01 M]**

This is a brief cushioning period of 1.5 µs inserted between the end of the picture detail for that line and the leading edge of the line sync pulse. This interval allows the receiver video circuit to settle down from whatever picture voltage level exists at the end of the picture line to the blanking level before the sync pulse occurs.

- **Function of Back Porch:** **[01 M]**

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.

c) Explain the working principle of colour camera tube.

Ans:- **[04 M]**

- **Photo electric effect:**

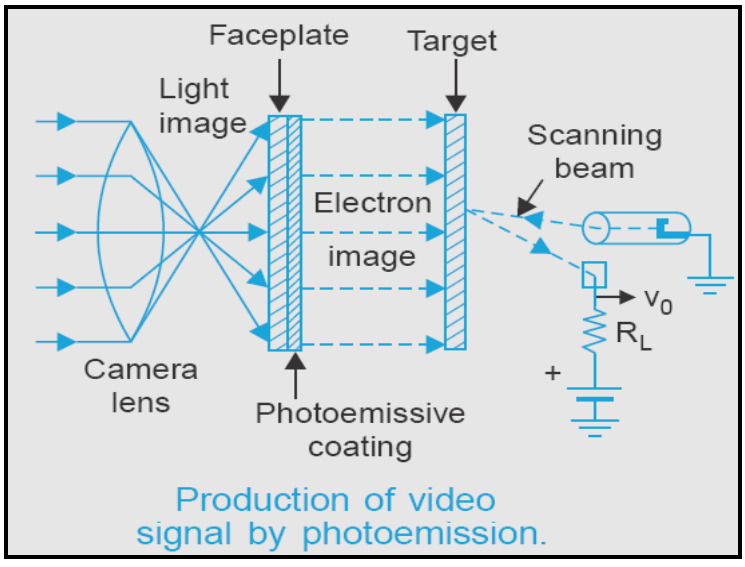
The two photoelectric effects used for converting variations of light intensity into electrical variations are:

1. **Photoemission &**
2. **Photoconductivity.**

1. Photoemission: **[02 M]**

1. Certain metals emit electrons when light falls on their surface. These emitted electrons are called **photoelectrons** and the **emitting surface a photocathode**. Light consists of small bundles of energy called **photons**.

2. When light is made incident on a photocathode, the photons give away their energy to the outer valence electrons to allow them to overcome the potential-energy barrier at the surface.

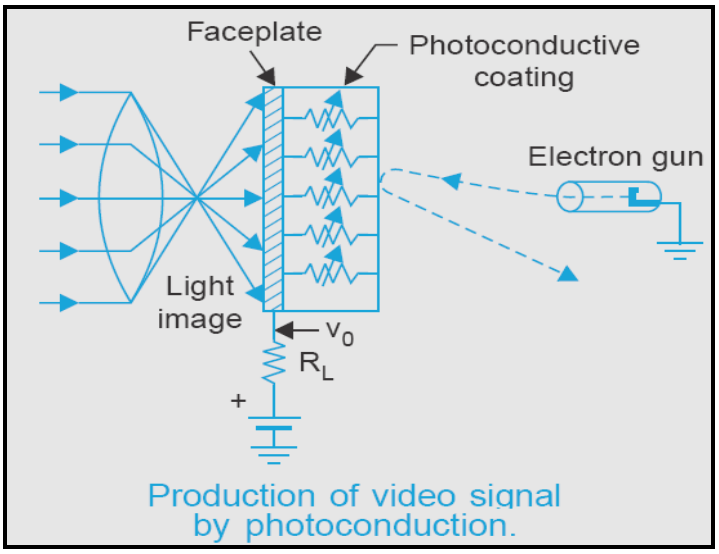


Production of video signal by photoemission.

2. Photoconductivity. **[02 M]**

1. The second method of producing an electrical image is by **photoconduction**, where the **conductivity or resistivity** of the photosensitive surface **varies** in **proportion** to the **intensity of light focused on it.**

2. The variations in resistance at each point across the surface of the material are utilized to develop a varying signal by scanning it uniformly with an electron beam.



Production of video signal by photoconduction.

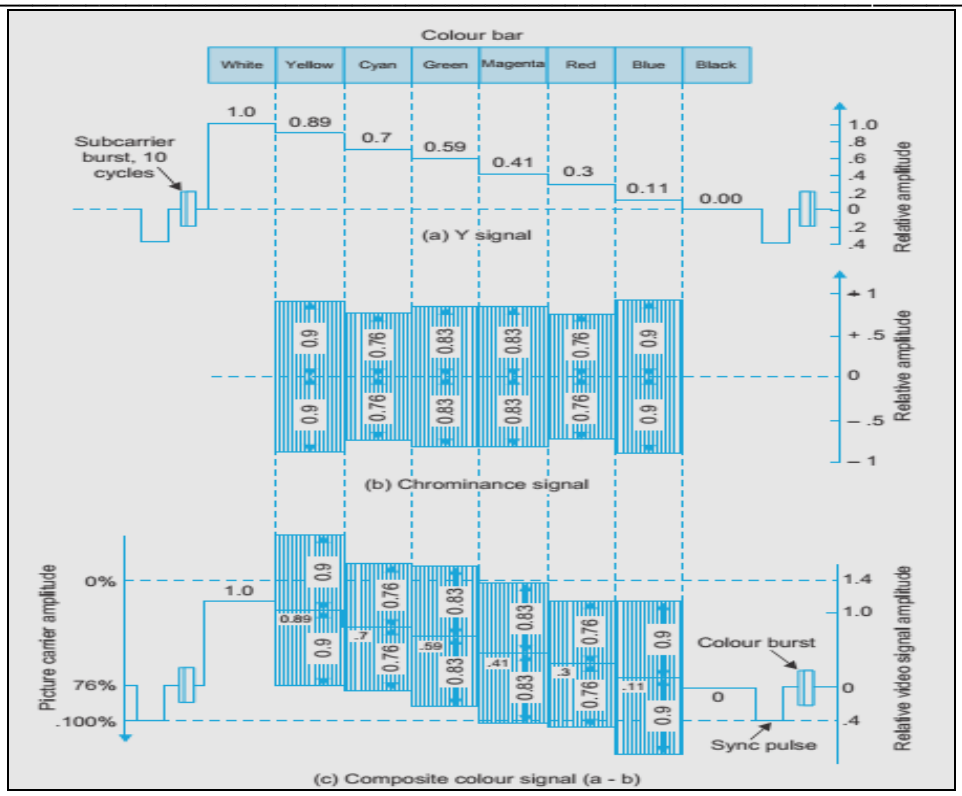
d) Explain why colour signals are weighted, with proper diagrams.

Ans:- **[Diagram 02M & explanation 02M]**

- The resultant chrominance signal phasor (C) is added to the luminance signal (Y) before modulating it with the channel carrier for transmission.

- It is observe that it is not practicable to transmit this chroma waveform because the signal peaks would exceed the limits of 100 percent modulation. This means that on modulation with the picture carrier some of the colour signal amplitudes would exceed the limits of maximum sync tips on one side and white level on the other. For example, in the case of magenta signal, the chrominance value of ± 0.83 when added to its luminance amplitude of 0.41 exceeds the limits of 100 percent modulation of both white and black levels. Similarly blue signal amplitude greatly exceeds the black level and will cause a high degree of over-modulation.

- If over-modulation is permitted the reproduced colours will get objectionably distorted. Therefore, to avoid over-modulation on 100 percent saturation colour values, it is necessary to reduce the amplitude of colour difference video signal before modulating them with the colour subcarrier. Accordingly, both (R–Y) and (B–Y) components of the colour video signal are scaled down by multiplying them with what are known as ‘weighting factors’. Those used are 0.877 for the (R–Y) component and 0.493 for the (B–Y) component.

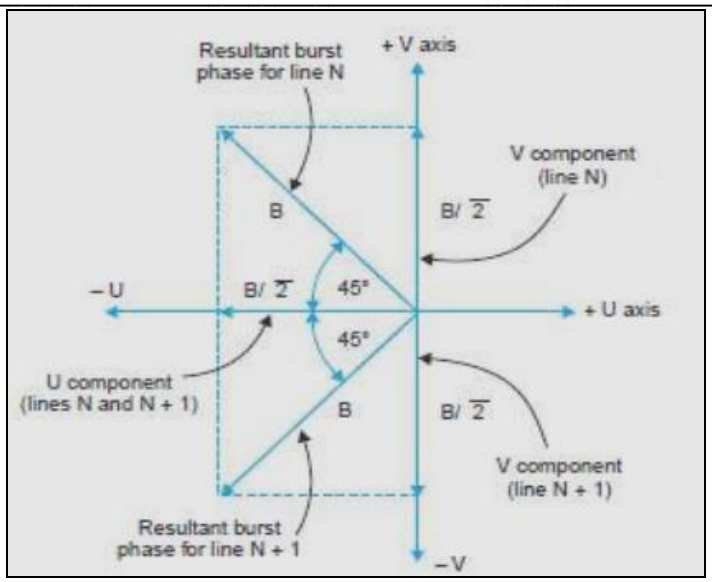


e) Explain PAL-V switching with phasor diagrams.

Ans:- **[Diagram 02M & Explanation 02M]**

Explanation:-

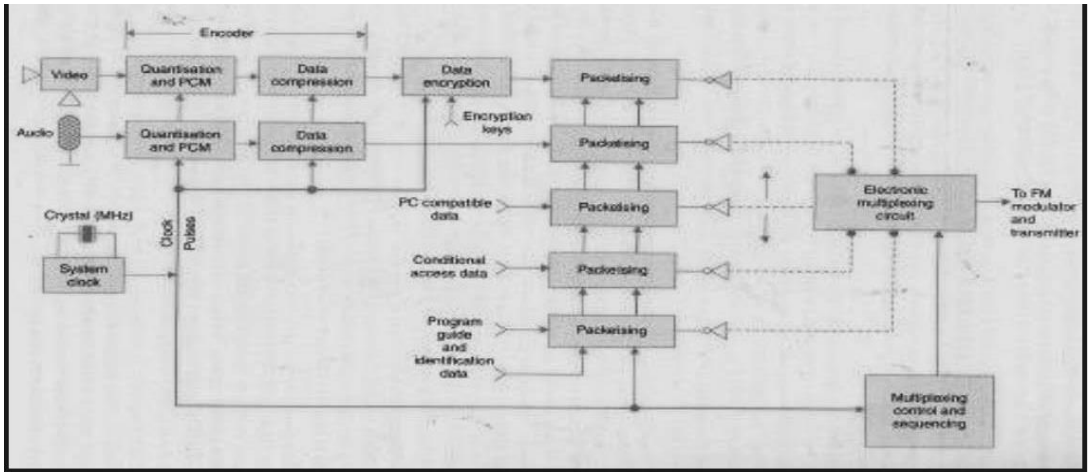
- If the PAL signal were applied to an NTSC type decoder, the (B – Y)output would be U as required but the (R – Y) output would alternate as + V and – V from line to line.
- Therefore, the V demodulator must be switched at half the horizontal (line) frequency rate to give + V only on all successive lines.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



f) Draw basic block diagram of digital T.V. transmission and explain its working

Ans:- **[Diagram 02M & explanation 02M]**

NOTE*:- Any other relevant diagram can be considered*



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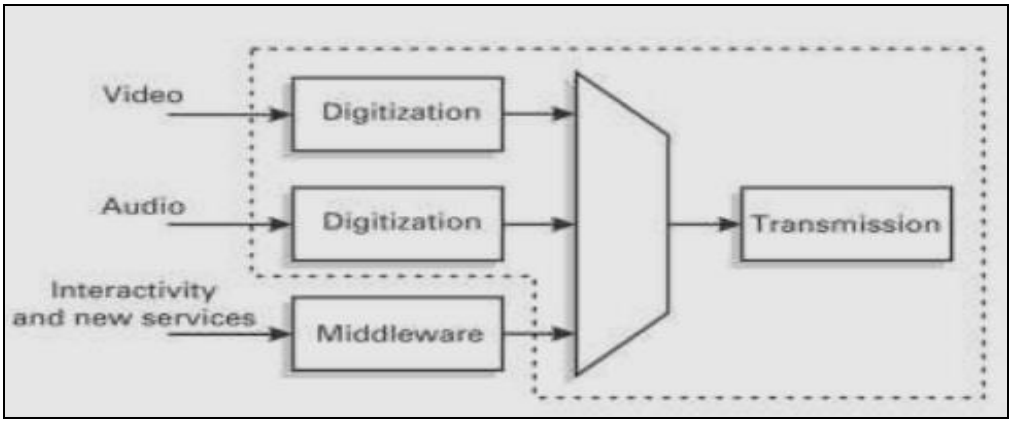


Explanation:

- 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: **[16 M]**

a) Explain how image continuity is achieved motion pictures.

Ans: **[04 M]**

- In motion pictures, twenty-four still pictures of the scene are taken per second and later projected on the screen at the same rate.
- Each picture or frame is projected individually as a still picture, but they are shown one after the other in rapid succession to produce the illusion of continuous motion of the scene being shown.
- A shutter in the projector rotates in front of the light source and allows the film to be projected on the screen when the film frame is still, but blanks out any light from the screen during the time when the next film frame is being moved into position.
- As a result, a rapid succession of still-film frames is seen on the screen. With all light removed during the change from one frame to the next, the eye sees a rapid sequence of still pictures that provides the illusion of continuous motion.

b) Define:

i) Persistence of vision
ii) Image continuity
iii) glass structure (Wrong ques., It should be Gross structure)
iv) Luminance

Ans:

i) Persistence of vision:- **[01 M]**

It is the storage characteristics of the human eye. 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 1/16th of a second.

ii) Image continuity:- **[01 M]**

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 1/16th 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 enough, they appear to the eye as a complete picture unit, with none of the individual elements visible separately.

iii) Gross structure:- **[01 M]**

It is defined as Geometric form and aspect ratio of the picture.

iv) Luminance:- **[01 M]**

It is the amount of light intensity as perceived by the eye regardless of the colour.

c) Justify, why negative modulation is preferred for TV signal transmission.

Ans: **[Any FOUR, 1M each]**

1. **Noise interference on picture signal is less:** The noise pulse in the transmitted signal shall increase the amplitude is the carrier which will move towards the black. The noise pulses would tend to produce black spots which are less noticeable against a grey background.
2. **More power available from the transmitter:** The transmitter may be over modulated during the sync pulses without adverse effect since the nonlinear distortion thereby introduced does not very much affect the shape of sync pulses.
3. **Saving in transmission power:** Carrier amplitude will remain low for most of the time as the signal content is more in white than in black. This will cause saving in transmission power.
4. **Effect of noise on picture signal:** If noise spikes are present in video signal they extend into black level. So, if noise spikes are produced on the screen they appear as black dots, which are less annoying to human eye than that of white dots if positive modulation is used.
5. **Effect of noise on synchronization:** The synchronization pulses are affected by noise. There will be loss of horizontal or vertical synchronization which results in diagonal or vertical rolling of picture.
6. **Peak power available:** In negative modulation black level is at maximum amplitude, so output power in transmitter is more.

d) List any four characteristics of digital TV signal.

Ans: **[Any FOUR, 1M each]**

***Note:* any other relevant point should be considered**

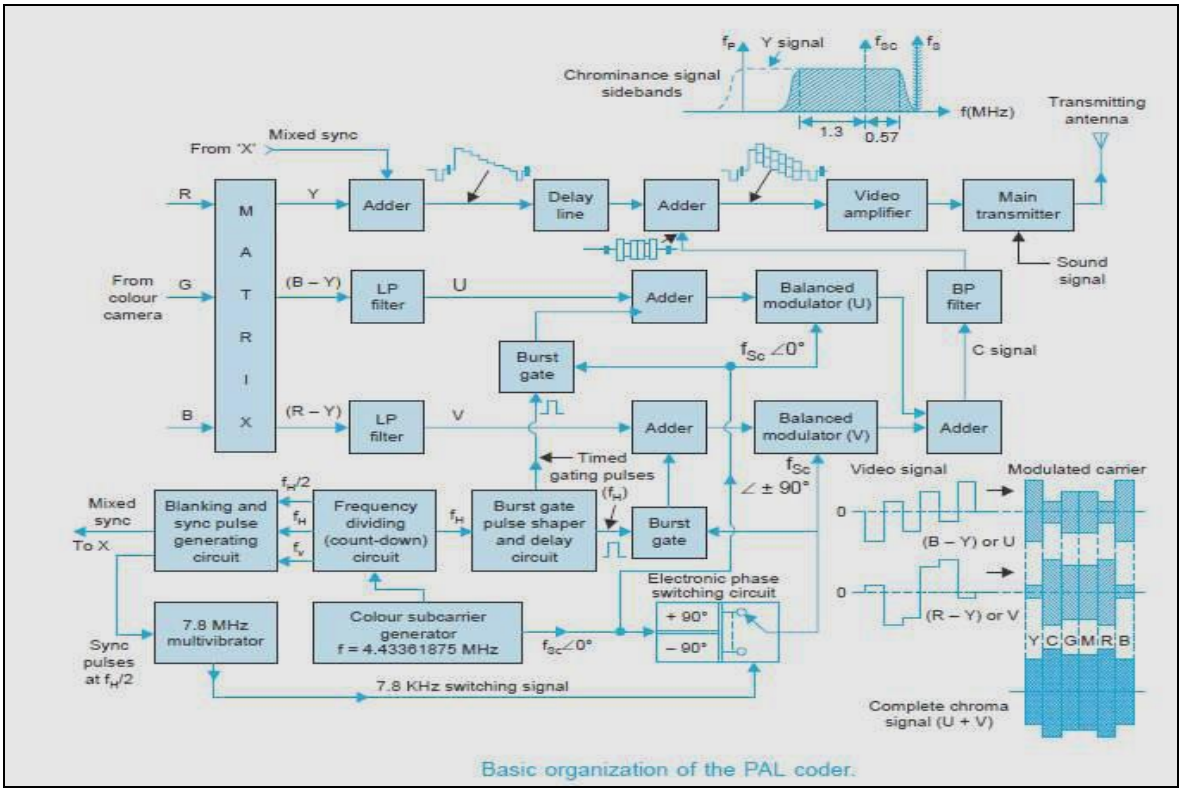
Characteristics of Digital signal:- (4 parameters)

1. T.V scanning Line :1250
2. Aspect ratio : 16:9
3. Interlace ratio: 1: 1 progressive
4. Active lines: 1152
5. Field frequency: 40Hz

6. Line frequency: 62.5KHz
7. Luminance signal Y = 20MHz
8. Sample per active line: 1920
9. Wide band colour signal: 7Mhz
10. Narrow band colour signal: 5.5MHz

e) Draw well labelled block diagram of PAL encoder.

Ans: (Note: any other relevant diagram should be considered) **[04 M]**



Basic organization of the PAL coder.

f) List two advantages and two disadvantages of digital T.V. system.

Ans:

- **Advantages:-** **[Any TWO, 01M each]**

1. The digital broadcast offers better quality of picture and sound.
2. Digital transmission will be able to broadcast in high-definition. This means that you will be able to watch some of your favorite TV channels in HD for free.
3. Digital TV transmission improves sound, which will help you to make watching television way better.
4. The digital broadcast consumes less bandwidth than the analog one. With the digital television, have access to more channels.

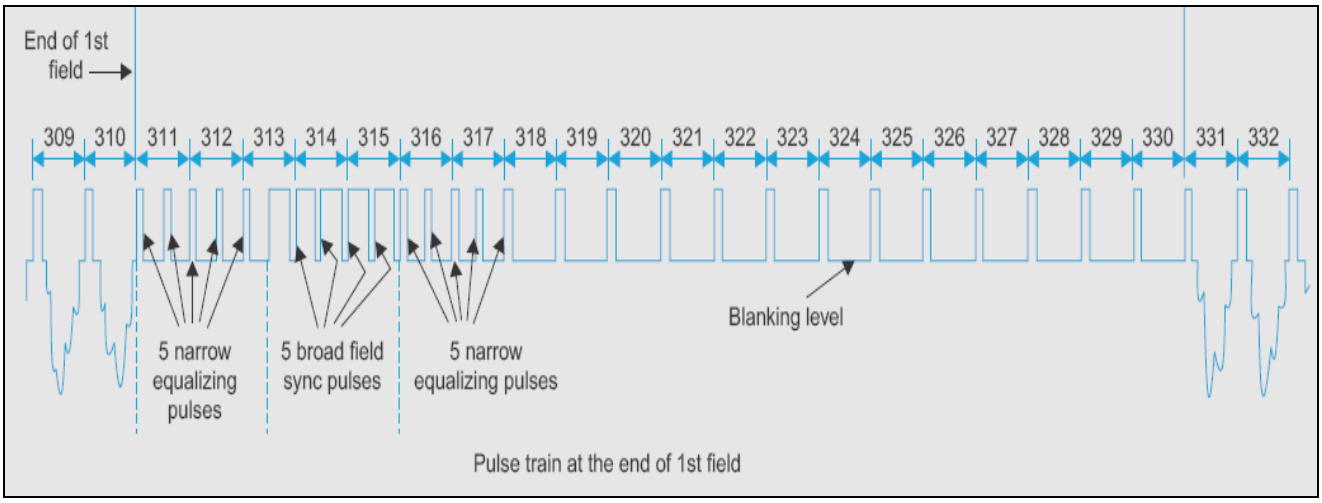
- **Disadvantages:-** **[Any TWO, 01M each]**

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

Q. 4 Attempt any FOUR of the following: **[16M]**

a) Draw vertical blanking period details after 1st field and label it well. **[03 M Diag. 01 M label]**

Ans:

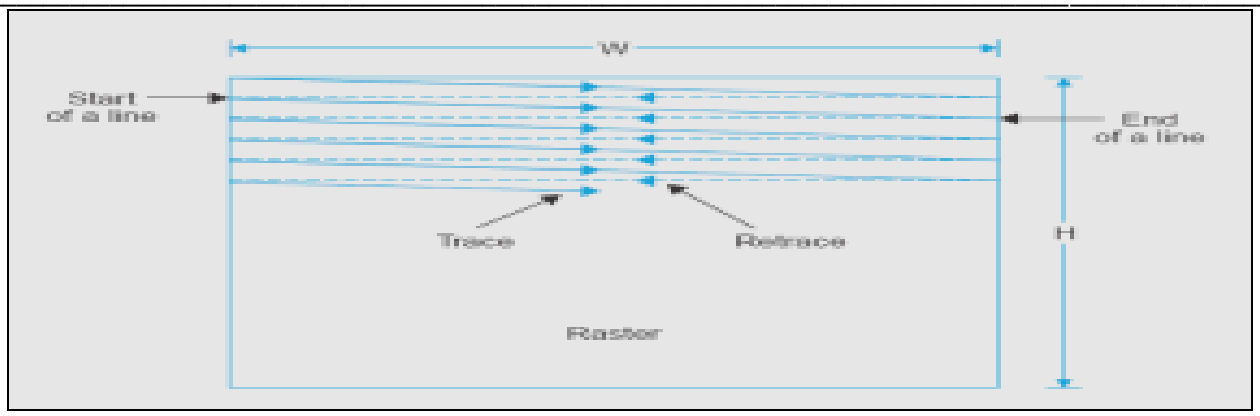


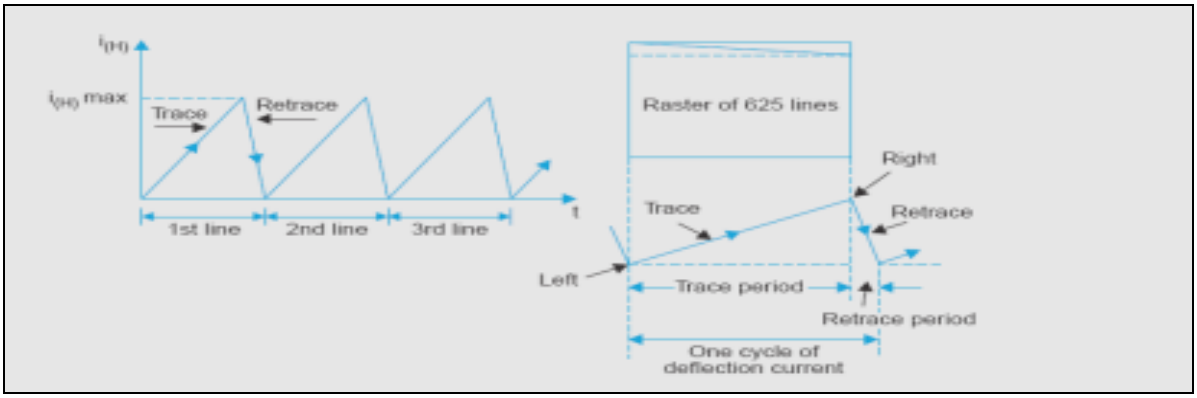
b) Explain H and V scanning in TV system.

Ans: **[02M H scanning & 02M V scanning]**

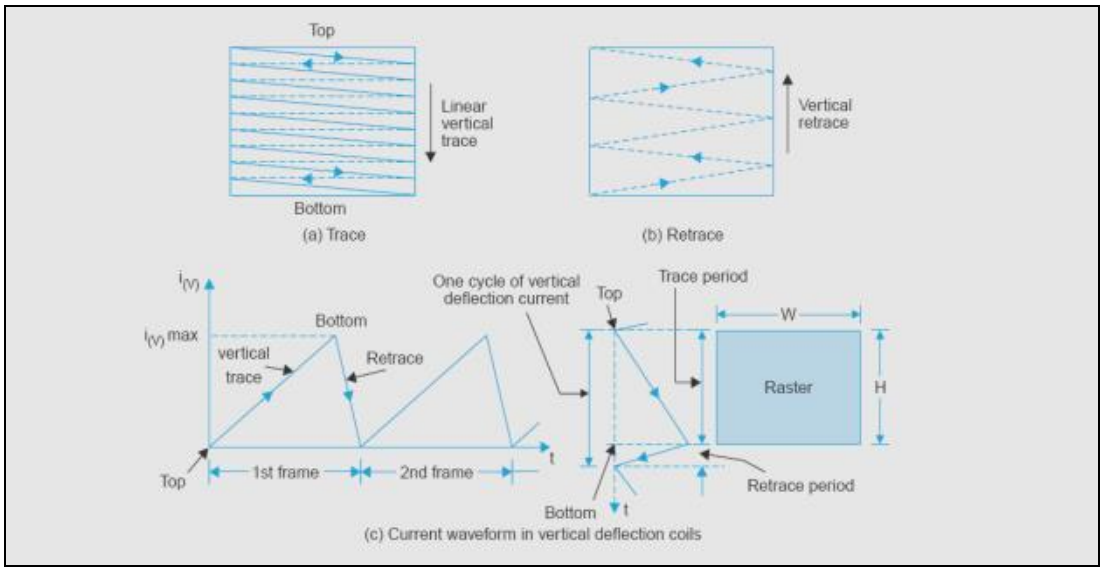
Note:- diagram are not compulsory and if at all they have drawn the diagram marks should be given

- **Horizontal Scanning:** Fig. shows the trace and retrace of several horizontal lines. The linear rise of current in the horizontal deflection coils (see next figure) deflects the beam across the screen with a continuous, uniform motion for the trace from left to right.
- At the peak of the rise, the sawtooth wave reverses direction and decreases rapidly to its initial value. This fast reversal produces the retrace or flyback. The start of the horizontal trace is at the left edge of raster.
- The finish is at the right edge, where the flyback produces retrace back to the left edge.



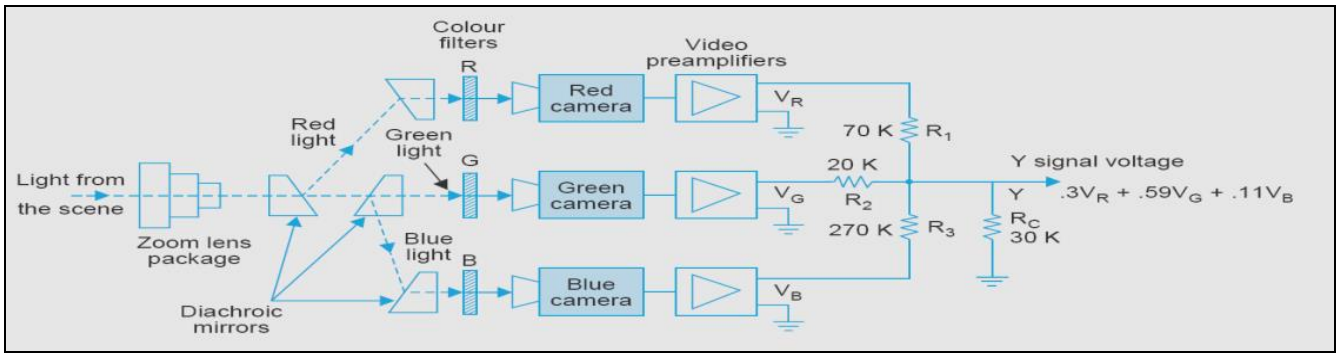


- **Vertical scanning.** The sawtooth current in the vertical deflection coils (see Fig. below) moves the electron beam from top to bottom of the raster at a uniform speed while the electron beam is being deflected horizontally.
- Thus the beam produces complete horizontal lines one below the other while moving from top to bottom.
- As shown in Fig., the trace part of the sawtooth wave for vertical scanning deflects the beam to the bottom of the raster. Then the rapid vertical retrace returns the beam to the top. Note that the maximum amplitude of the vertical sweep current brings the beam to the bottom of the raster.



c) Draw block diagram of colour camera and explain its working.

Ans: **[02M Diagram & 02M explanation]**

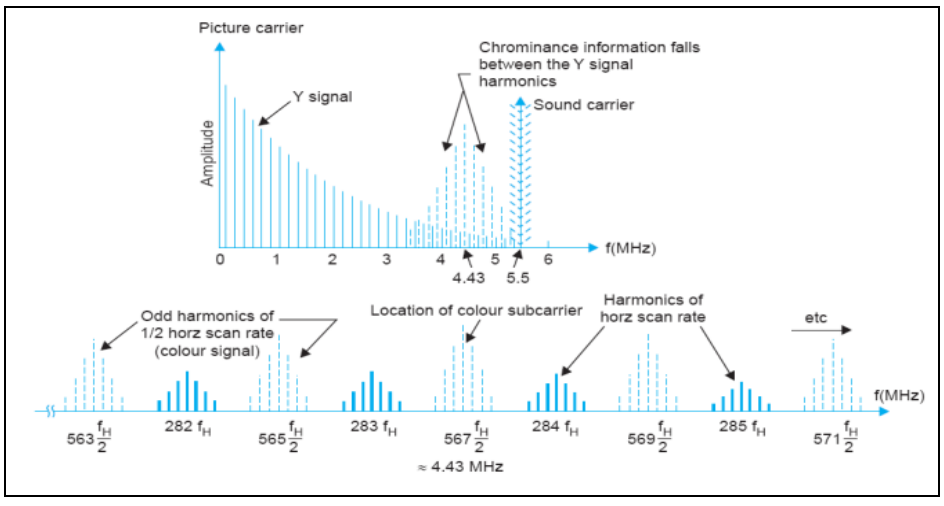


Explanation:

- Figure shows a simple block schematic of a 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 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 dichroic mirrors.
- A dichroic mirror passes one wavelength and rejects other wavelengths (colours of light). Thus red, green, and blue colour images are formed. The rays from each of the light 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.

d) Explain frequency interleaving used in colour signal transmission.

Ans:- **[02M Diagram, 02M Explanation]**



Explanation:

- When picture carrier is modulated by luminance signal at line frequency 15625Hz, the video signal is not continuous one. It consists of clusters of energy located around harmonics at frame frequency (25Hz, 50Hz).
- Thus individual clusters are separated by wide gap, which can be used to accommodate colour information.
- This process of accommodating information of one signal in gap occurring in other signal is called frequency interleaving.
- The lower amplitude excursions that occur on either side of the peaks are spaced at 50 Hz intervals and represent harmonics of the vertical scanning rate. The vertical sidebands contain less energy than the horizontal because of the lower rate of vertical scanning.
- Note that the energy content progressively decreases with increase in the order of harmonics and is very small beyond 3.5 MHz from the picture carrier.

e) Calculate exact PAL colour subcarrier frequency. Also list factors influencing it.

Ans: (Any other relevant factor can be considered) **[02M Calculation, 02M Factors]**

1. The carrier frequency is so chosen that its sideband frequencies fall exactly mid-way between the harmonics of the line frequency.
2. This requires that the frequency of the subcarrier must be an odd multiple of half the line frequency.
3. In order to avoid crosstalk with the picture signal, the frequency of the subcarrier is chosen rather on the high side of the channel bandwidth.
4. It is 567 times one-half the line frequency in the PAL system.
5. This comes to: **(2 ×283 + 1) 15625/2 = 4.43 MHz.**

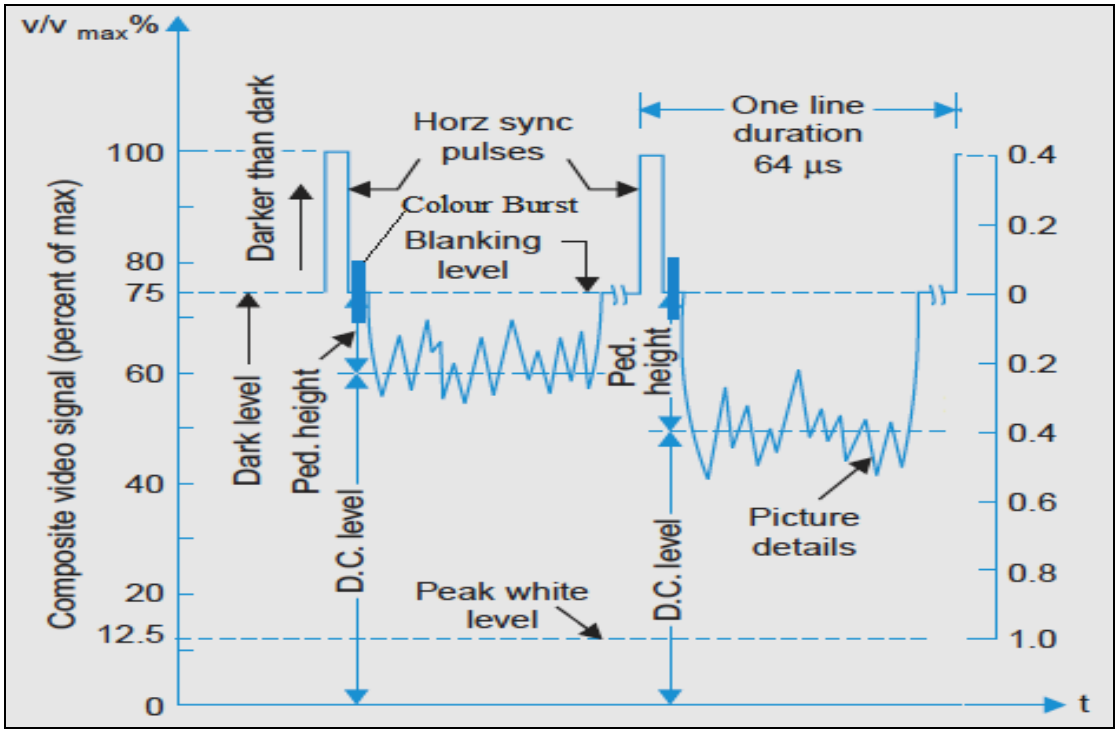
- **Factors influencing colour subcarrier frequency:**

1. 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.
2. 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.
3. Fsc cannot be chosen for the following reasons:
    1) 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.
    2) A very high subcarrier will bring it too close to the sound signal spectrum and cause another type of interference due to mutual interference.
    3) It is technically difficult to obtain reasonably linear phase characteristics near the cut-off point of the video bandwidth.
    4) A higher values of fsc would place the complex chroma signal in this region causing its distortion.

5) Any phase shift of the chroma signal affects hues and hence too high a value of fsc is not desirable.

f) Draw well labeled CCVS for one horizontal line

Ans: **[04 M Diagram]**



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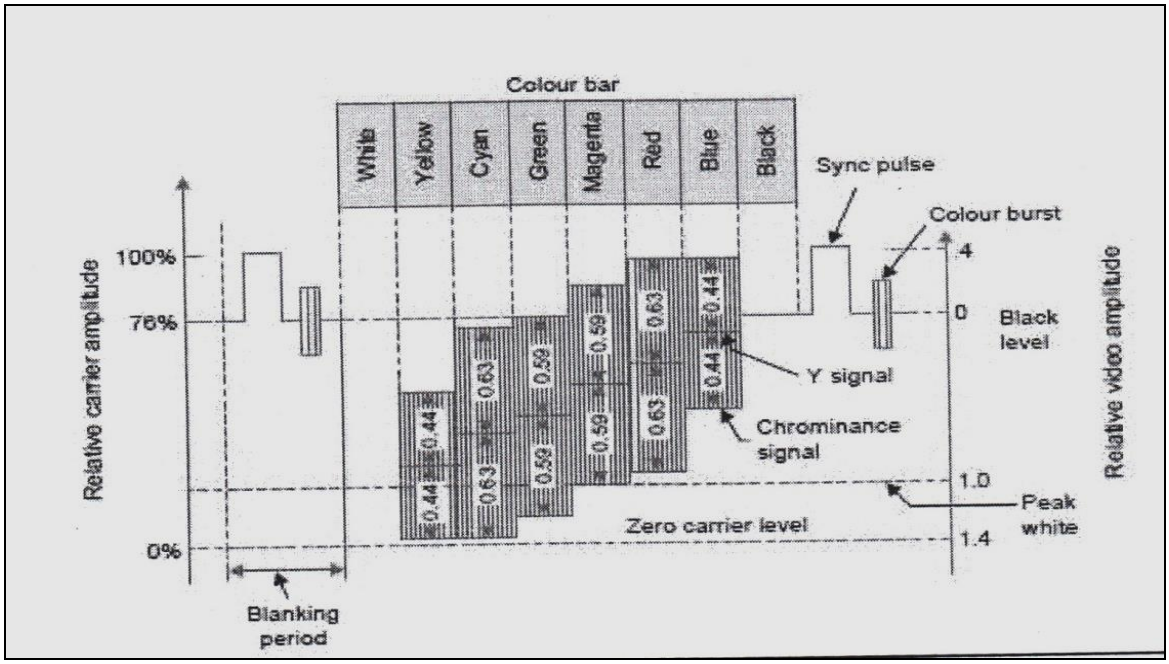


Q. 5 Attempt any Four of the following. **[16 M]**

a) Define Compatibility, Give different factors which has to be considered to fulfill compatibility.

Ans : **[01M for definition, 03 M for factors.]**

Compatibility implies that

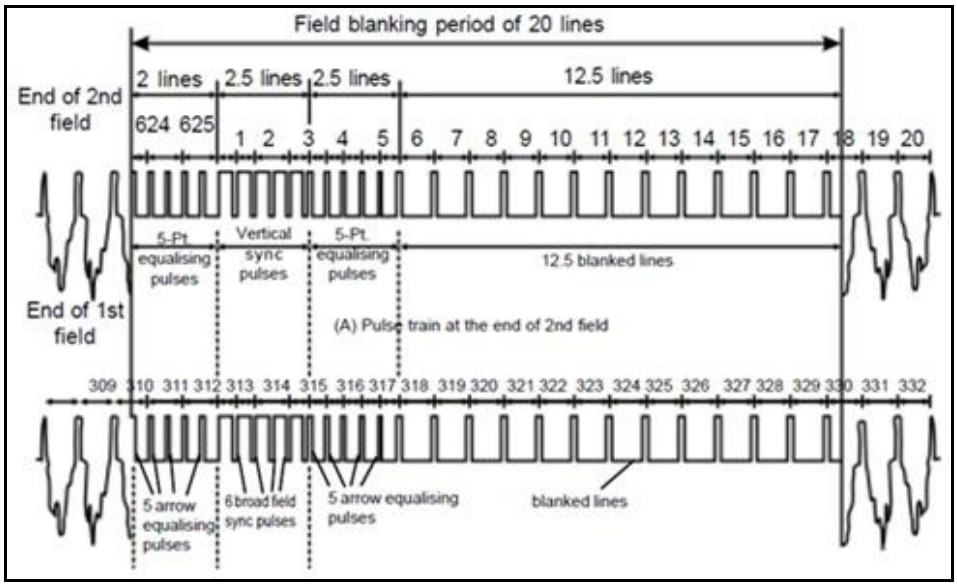
The colour television signal must produce a normal black and white picture on a monochrome receiver without any modification of the receiver circuitry.

To achieve this, 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) Explain the purpose of pre and post equalizing pulses during V-blanking period.

Ans: **(2 -2 M for pre & post equalizing pulses.)**



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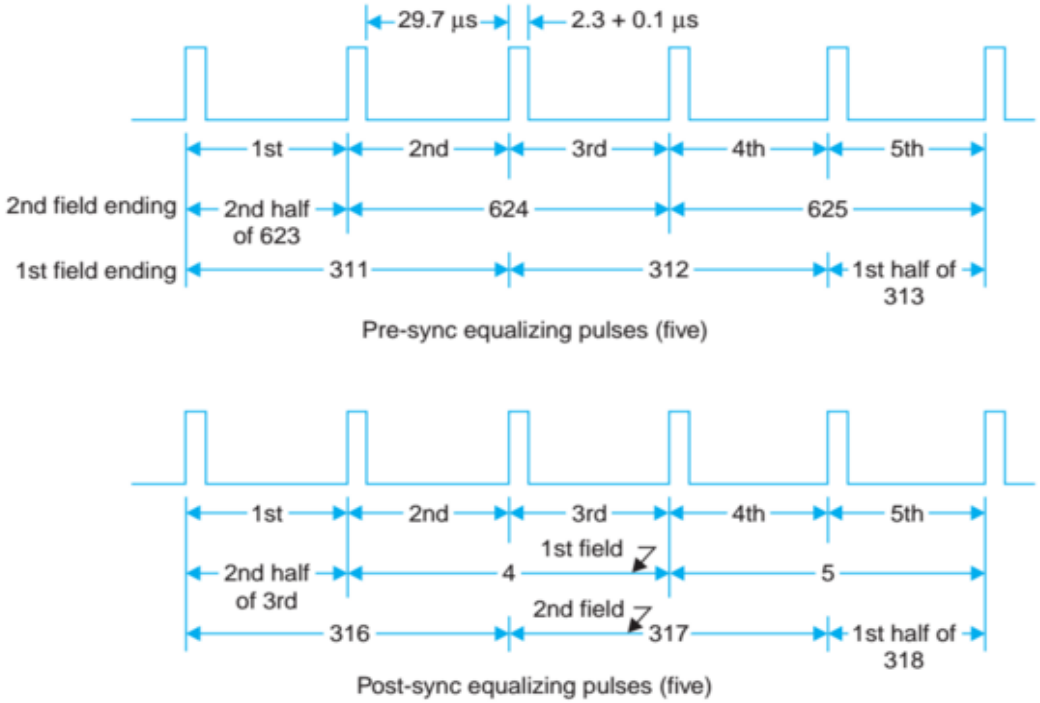


Pre-sync equalizing and Post-sync equalizing pulses.

The inequality in potential levels for the two fields continues during the period of discharge of the capacitor once the vertical sync pulses are over and the horizontal sync pulses take-over.

· 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 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.

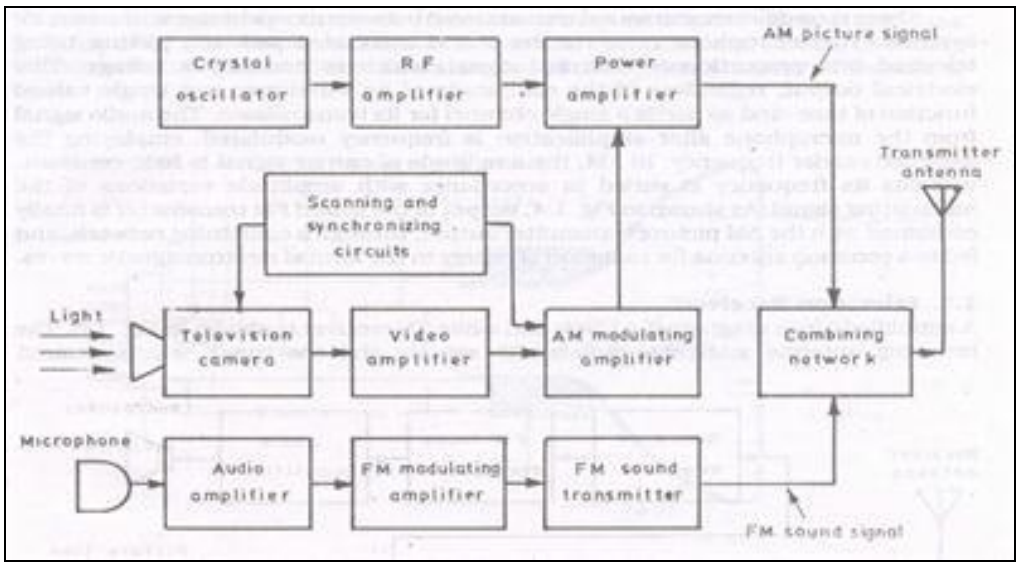
· Pre-equalizing pulses being of 2.3 µs duration result in the discharge of the capacitor to essentially zero voltage in both the fields, despite the half-line discrepancy before the voltage build-up starts with the arrival of vertical sync pulses.

· 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.

c) Draw block diagram of monochrome T.V. transmitter.

Ans:- **[04M]**

Note:- Any relevant diagram can be considered



d) List -8 CCIR-B standards used for PAL TV signal transmission.

Ans: **[Characteristics of CCIR-B system:- Any 8 ½ M each]**

1. Number of scanning lines/frame =625
2. Field (vertical) frequency =50Hz
3. Line(horizontal) frequency= 15625Hz
4. Aspect ratio(width/height) =4:3
5. Horizontal trace time =52µs
6. Horizontal retrace time= 12µs
7. Total scanning line lost in vertical retrace= 64µs
8. Front porch= 1.5µs
9. Back porch= 5.8µs
10. Horizontal sync pulse= 4.7µs
11. Colour sub carrier frequency= 4.43MHz
12. Colour system Phase Alteration by Line –Delay (PAL-D)
13. U signal(weighted B-Y) U=0.493 (B-Y)
14. V signal(weighted R-Y) V=0.877(R-Y)
15. Total vertical blanking duration 1280µs or 1.280ms
16. Vertical sync pulse =160µs
17. Pre and post equalizing pulse 5 pulse each
18. Sync pulse top 100%
19. Blanking/pedestal level 75%
20. Black level 72-75%
21. White level 10-12.5%
22. Width of video signal =5MHz
23. Chroma signal bandwidth -1.3MHz to +1.57MHz

24. Video IF =38.9MHz
25. Audio IF= 33.4MHz
26. Inter carrier frequency= 5.5MHz
27. Audio modulation Frequency Modulation(FM)
28. Video modulation Amplitude Modulation (AM)
29. Total channel width in VHF= 7MHz
30. Total channel width in UHF= 8MHz

e) Explain why colour difference signals are preferred for transmission than pure colour signals.

Ans : [04M]

Explanation:

- By using colour difference signal bandwidth can be reduced.
- Y signal can be easily generated at the receiver.
- We can produce green colour from R-Y, B-Y colour difference signal. Hence no need to transmit all three primary colours.
- Number of component required for generating colours will be reduced.

f) Define and give function of pedestal height, DC level in CVS.

Ans : **DC level:- . [02 M]**

- 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.
- DC components of the signal for three lines have been identified, each representing a different level of average brightness in the scene.

Pedestal height:- . [02M]

- Pedestal height is the distance between the pedestal level and average value (dc level) of the video signal. This indicates average brightness since it measures how much the average value differs from black level.
- The output signal from TV camera is of very small amplitude. Hence, it is amplified by multistage high gain amplifiers. Sync and blanking pulses are added to it and then signal is clipped at proper value to form pedestal.
- Pedestal height determines brightness of scene. Large pedestal height makes picture brighter and vice versa. Operator who observes the picture in studio adjusts level for desired brightness by adding dc component to ac signal.

Q. 6 Attempt any Four of the following. **[16 M]**

a) Explain why (G-Y) signals are not selected for transmission of colour signal.

Ans: **[4 M]**

The color difference signals can be written

(G- Y) = - 0.51 (R – Y) – 0.186 (B – Y)…….**Equation No.1**

(R – Y) = - 1.96 (G – Y) – 0.36 (B – Y))……..**Equation No.2**

(B – Y) = - 2.76 (R – Y) – 5.36 (G – Y))……**Equation No.3**

In all colour T.V. system, (G – Y) signal is not selected for transmission because –

i) (G – Y) can be obtained by (R-Y) & (B-Y).

Above equation 1. Indicates that only fractions of (R-Y) & (B-Y) are needed i.e. amplitude of (G-Y) is smallest in the three signals. If (G-Y) is selected for transmission, then we will need amplifiers. To get (R- Y) & (B – Y)

ii) The proportion of G contents in Y is relatively large (59%). Hence the amplitude of (G-Y) is small as compared to (R-Y) & (B-Y). This causes S/N problems at the transmitting end. There is no such problem with (R-Y) & (B-Y). Therefore in colour transmitter only (R-Y) & (B-Y) is transmitted and (G-Y) is obtained at receiver end from these two signals.

b) Explain why colour subcarrier signal is suppressed before transmission.

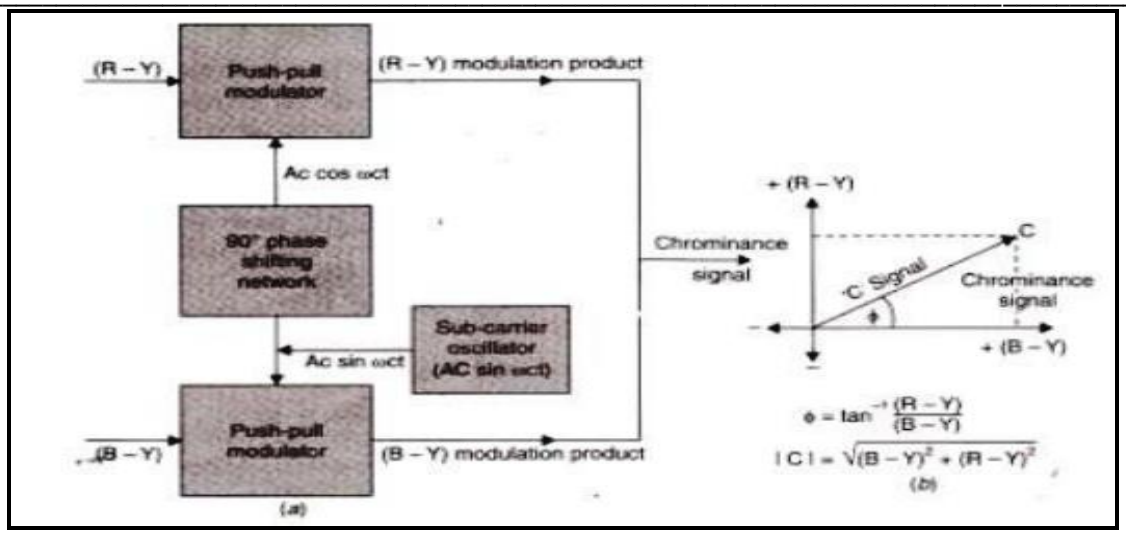
Ans: **[04 M]**

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.
- 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 signals

c) Draw block diagram of QAM for PAL system and explain its working. **[04 M]**

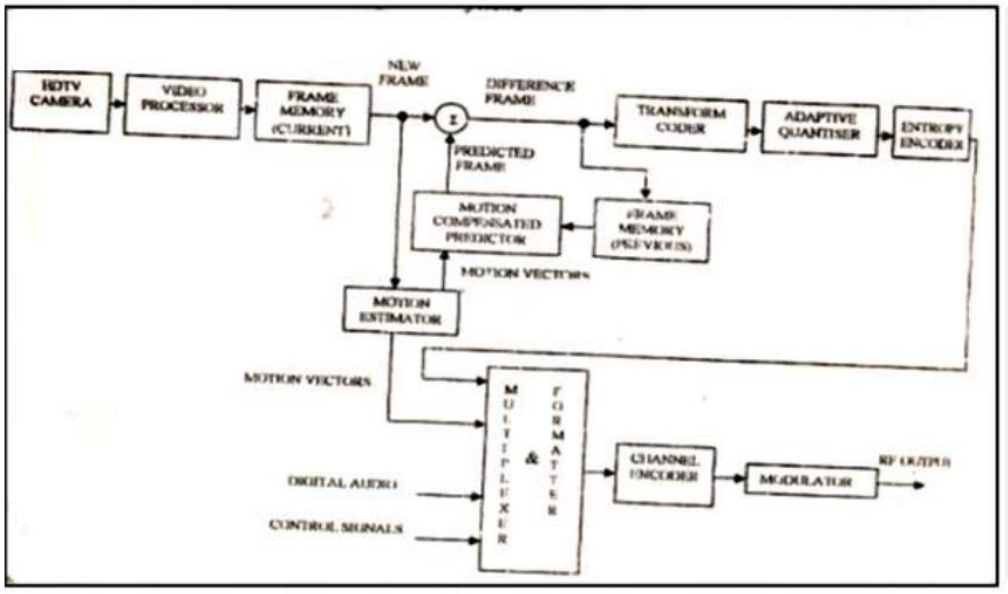
Ans: **[2M for Diagram, 2M for Explanation]**



- The problem of transmitting (B-Y) & (R-Y) video signals simultaneously with one carrier frequency can be solved by creating two carrier frequencies from same colour sub carrier. Here two modulators are used one for (B-Y) & other for (R-Y) modulator.
- Carrier frequency is generated by crystal oscillator & fed to (B-Y) modulator. Before feeding it to (R-Y) modulator, it is given a relative phase shift of 90^0.
- Now two modulated sub carrier are added vertically to produce resultant C signal represents sum of two AM signals, Mutually at right angle with each other, this technique is called as Quadrature amplitude modulation

d) Draw and Explain block diagram of HDTV.

Ans: **[2 M for block Diagram, 2 M for Explanation]**



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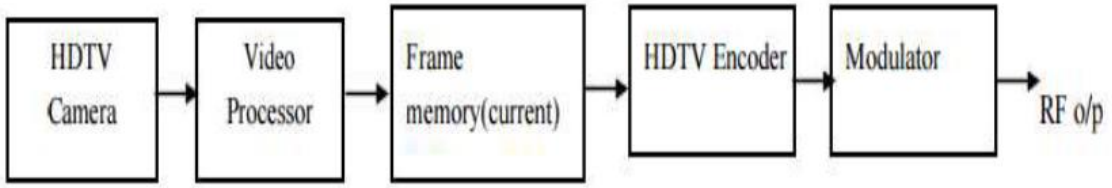
Block Diagram:-



- 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: a transform coder, 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.

e) List advantages of PAL TV.

Ans: **[Any four 1 M Each]**

1. The hue errors are automatically removed with the utilization of phase alternation of colour signals it receives.
2. No need of tint control.
3. 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.
4. 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.
5. With the help of a delay line and two adders, the PAL decoder adds colour signals of successive lines while cancelling out phase errors.
6. Excellent colour stability.

f) List characteristics and features of HD signals, transmission. **[04]**

Ans: **[2M Features, 2 M characteristics]**

Features: (Any 4)

1. Improvement in both vertical and horizontal resolution of the reproduced picture by approximately 2:1
2. Over existing standards much improved colour rendition (reproduction).
3. Higher aspect ratio of at least 5:3.
4. Stereophonic sound.
5. 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.

Characteristics: (Any 4)

1. 1125 scanning lines per frame.
2. 60 fields per second.
3. 2:1 interlace scan.
4. Aspect ratio 16:9.
5. Bandwidth 10MHz
6. Luminance signal Y = 20MHz
7. Sample per active line: 1920
8. Wide band colour signal: 7MHz
9. Narrow band colour signal: 5.5MHz