



MODEL ANSWER

SUMMER- 18 EXAMINATION

Subject Title: Audio Video Engineering

Subject Code:

17537

Important Instructions to examiners:

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



Q1 a) Attempt any three.

12

i) Compare mono and stereo amplifier.

Ans: Any 4 points- 4mks

SR.No	Stereo amplifier	Mono amplifier
1	Stereo means solid and phone is sound in Greek, means three dimensional sound.	Mono means one sound or one dimensional sound.
2	Sound arises from the two different amplifiers so that sound appears to be surrounded.	Monophonic sound system has one source
3	It has two different channels (left and right) corresponds to two amplifiers and loud speakers.	Mono amplifier has one channel and one speaker system
4	Stereo amplifier can have multipeaker system which gives surround system	Multiple speakers can be connected but with same source.
5	With stereo system sound reproduced is actual feels original	The monophonic sound is cheap to be produced but lacks naturalness.
6	Used in Hi-Fi amplifier system	Used in public address system

ii) List different types of amplifiers used in cable TV system. State the function of each.

Ans: Any 2 types with function- 2 mks each

1. Trunk amplifier:

Trunk amplifiers with equalizers are used at regular intervals in the trunk system to overcome the losses in the cable, which increases towards the high end of the spectrum. These trunk line repeaters providing a gain of about 20 dB, compensate the corresponding loss of a cable run of about 600m, depending on the type of cable used and maintain the signal level 1 to 3 mV.

2. Bridging amplifier:

Bridging amplifier is used for feeding a branch lines from the main trunk, distributing the signal to subscriber drops. A bridge amplifier, sometimes used with trunk amplifier, providing a gain of about 20 to 40 dB, to feed the signals to the subscriber cables through directional couplers and signal splitters which provide isolation from reflections or interferences coming from subscriber set.

3. Line amplifier:

Line amplifiers are inserted in the branch line to make for the cable losses that connects the distribution system. Typical gain is 20 to 40 dB

iii) Define:



- i. **Aspect ratio:**
- ii. **Horizontal resolution:**
- iii. **Hue:**
- iv. **Saturation:**

i. Aspect ratio:

The **aspect ratio** of an image describes the proportional relationship between its width and its height. The frame adopted in all television systems is rectangular with width/height ratio, i.e., aspect ratio = 4/3.

$$\text{Aspect Ratio} = \text{Width of the Screen} / \text{Height Of the Screen} = 4/3$$

2 Horizontal resolution:

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

3. Hue:

This is the predominant spectral colour of received light which means it is the actual colour seen by the eye. Red, Green, Blue, Yellow, Magenta, represent different in the visible spectrum.

4. Saturation:

It represents the spectral purity of a colour light. It is the amount of white light that is mixed with a colour. A fully saturated colour will have no white light mixed with it. For example, a Pure Red without White is a saturated colour.

iv) List different lenses used in CD mechanism. State the function of each.

Ans:- 4 types and each function- 1 mks each

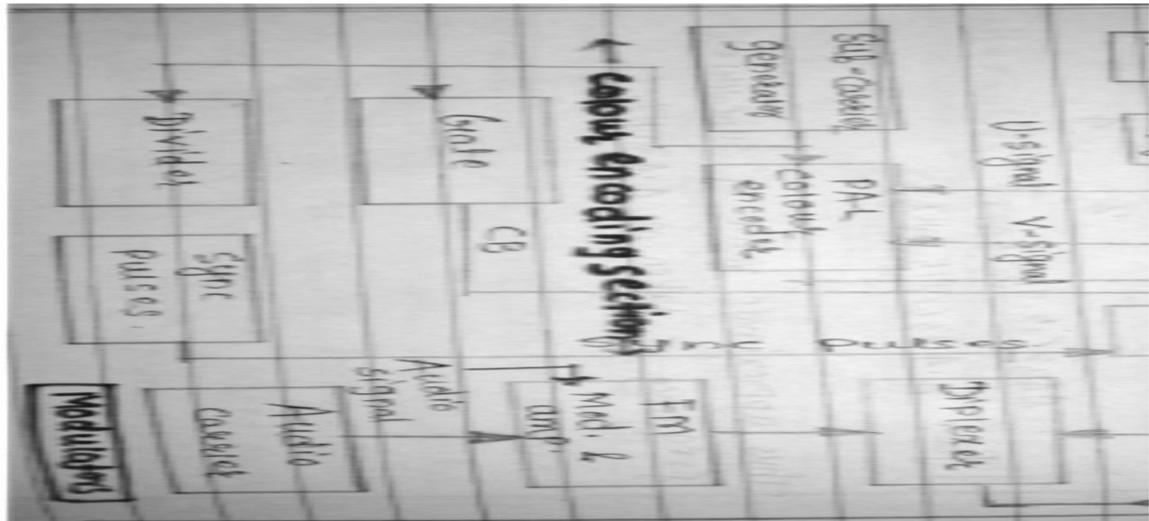
Types of Lenses used in CD player.

1. Collimation lens
2. Concave lens
3. Objective lens
4. Cylindrical lens

Collimation lens: The collimator lens is used to produce completely parallel beams of laser. This lens together with the objective lens is used to focus the laser beam to the disc surface.

Concave lens: In single-beam linear optical block assembly this concave lens is used to concentrate the laser beam, reflected from the disc surface, onto the photodiode array. This lens is mainly used to improve the sensitivity of the photodiode array.

Objective lens: Before hitting the disc surface, the laser beam comes out of the pickup assembly



Explanation:-

A PAL colour TV transmitter consists of following three main sections.

1. Production of Luminance (Y) and Chrominance (U and V) signals- Colour camera tube produces R, G and B voltages pertaining to the intensity of red, green and blue colours respectively in pixels. The luminance signal Y is obtained by a resistive matrix, using grassman's law.

$$Y=0.3R+0.59G+0.11B.$$

For colour section Y is inverted colours R&B obtained from the colour camera tubes are added to it to get (R-Y) and (B-Y) colour difference signal. These signals are weighted by two resistive matrix network which gives U & V signals as $U=0.493 (B-Y)$ & $V=0.877(R-Y)$.

2. PAL encoder - PAL switch which operates electronically at 7812.5Hz with the help of bistable multi-vibrator and feeds the subcarrier to balanced modulator with phase difference of +90° on one line and -90° on the next line. The PAL encoder consists of a sub carrier generator and two balanced modulator with filters to produce modulated subcarrier signal. These signals are added vertically to give Chroma signal (C). Then Chroma signal is mixed with Y signal along with sync. And blanking pulses to produce Colour Composite Video Signal (CCVS).

3. Video and Audio modulators and transmitting antenna

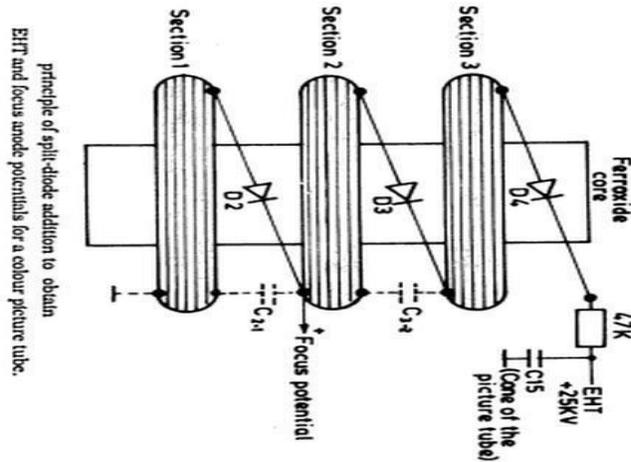
Video and Audio modulators and transmitting antenna: CCVS amplitude modulates the main video carrier. It is followed by a sharp VSB filter to attenuate the LSB to give AMVSB signal for transmitter. Audio signal modulates separate carrier. This modulation is FM type. AMVSB video signal along with audio signal passes to the transmitting antenna through Diplexer Bridge which is a wheat-stone's bridge.

ii) Explain EHT generation in colour TV with circuit diagram.

Ans:Diagram- 3 mks,explanation- 3 mks

⁶⁰/₆₁ EHT is a voltage generator, which generates around 17KV for B/W TV & 25 KV for colour TV using the principle of auto transformer action $V=L di/dt$

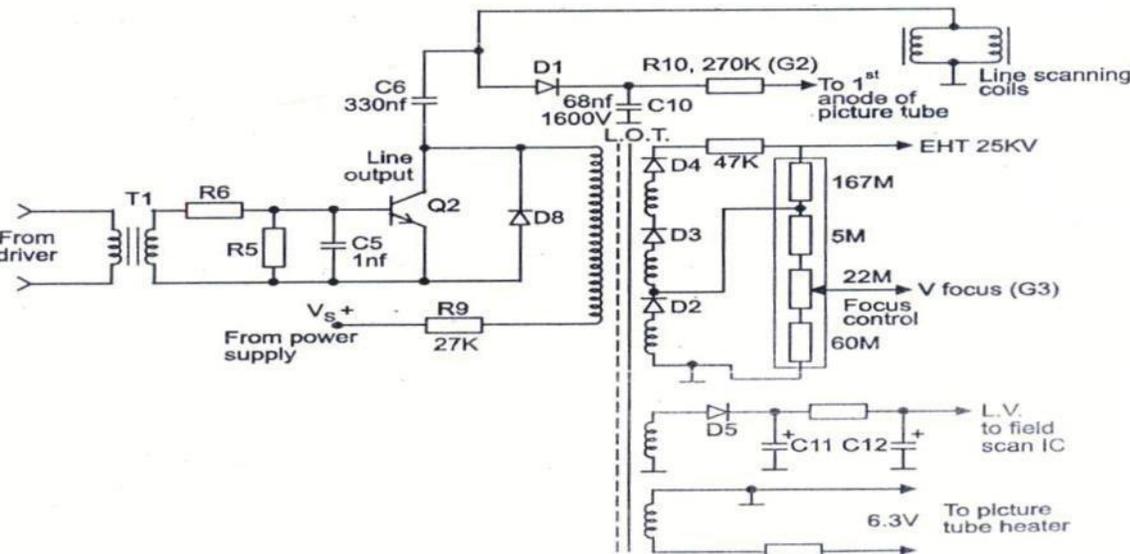
1001 In colour TV to generate EHT up to 25 KV the diode split addition technique is used. The principle of “DIODE-SPLIT ADDITION” is illustrated in figure below.



The three layers of secondary windings are shown wound round on the ferroxide core of the L.O.T. Each winding is identical to the other and has the same number of turns.

The same magnitude of voltage will therefore be induced in each section every time the flyback derived input pulse get applied to the primary winding. Because of the close proximity of individual layers and interlayer capacitance exists between each of them. It is indicated in the diagram by dotted because this capacitor physically does not exist. If a diode is connected between the end of one layer of winding and the start of the next the AC voltages induced in each layer can be made to charge up all the inter-layer capacitances to the same voltage. Since capacitances are effectively in series, the total output voltage appearing at the output terminal is the sum of all the voltages appearing across all of them. The diode shown connected in series between the layers are physically embedded in the windings and form an integral part of the transformer. The three windings are so designed that voltage induced in each layer from the fly back transformer is 8.33KV. This makes the total potential equal to $(8.33KV+8.33KV+8.33KV \approx 25 KV)$ and forms the EHT supply source.

OR



Anode potential (G2) is obtained for screen grid separately at collector of Q2

This is rectified by D1 and then filtered by C10. Output DC voltage is 550 to 800 V. Any failure of G2 means no beam current and hence no spot is produced on screen.

Focus anode (G3) potential needed is 6.5kV to 7.5kV. It is obtained from diode split winding (D2, D3 and D4). Each stage produces potential of 8kV.

Q2 Attempt any four.

16

a) Describe the principle of LCD with neat diagram.

Ans: Diagram- 2 mks, explanation- 2 mks

Working Principle -LCD TV has two sheets of polarized glass plates with some Liquid Crystal Solution trapped between them, forcing the liquid crystal into a twisted structural arrangement.

Working :- LCD TV uses the LCD Display technology to produce images.

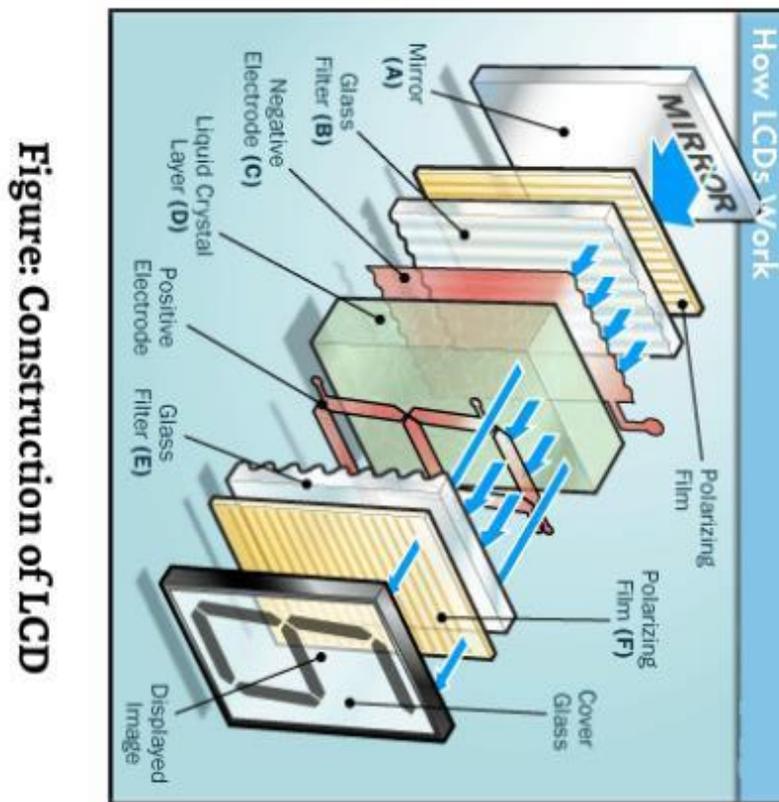


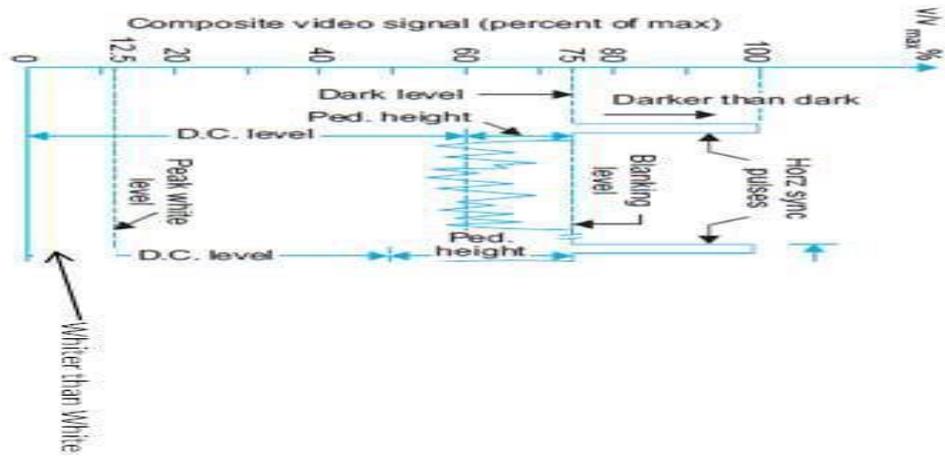
Figure: Construction of LCD

LCD is a form of visual display technology that functions by sandwiching a layer of liquid crystals between two transparent electrodes or conductive surfaces. Liquid Crystals are specialized molecules that flow like liquids but polarize light like solid, crystalline structures.

LCD technology works by selective passage of light, which passes through millions of individual LCD structures. These shutters are arranged in grids and constitute coloured filters, allowing only the RGB portion of the light to pass through. White light is typically provided by a series of CCFLs (Cold Cathode Fluorescent Lamps), which are rear of the screen. Every single sub – pixel is formed by a shutter filter combination, and these sub – pixels blend together to form whole picture.

b) Draw and explain composite video signal.

Ans:- Diagram- 2 mks, explanation- 2mks



DC level: DC level average brightness of the scene.

corresponds to

Blanking level: The sync pulses are added at 75% level called the blanking level.

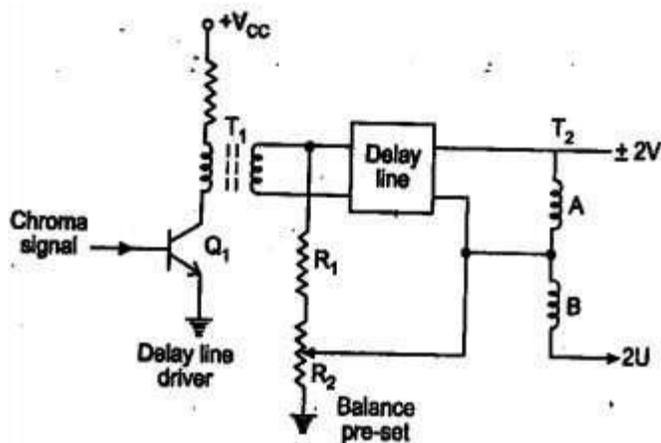
Whiter than white level: The lowest 10% of voltage range is not used to minimize noise effects which is known as whiter than white level.

Pedestal height: The pedestal height is the difference between the pedestal level and the average value (dc level) axis of the video signal.

c) Explain how U and V signal separated in colour TV system.

Ans :- Diagram- 2 mks, explanation- 2 mks

Diagram



Explanation:-

Chroma signal is applied to Q1. Chroma signal is applied to delay line through transformer T1. This signal after delay line appears across A winding. Direct signal is fed to center top of T2 transformer. Voltage induced into winding A and B is equal in magnitude but opposite in phase due to signal from delay line. Whereas voltage induced into winding A and winding B is equal in magnitude and same phase. This means that direct and



delayed signals have same phase in one winding but are of opposite phase in second winding. Thus results in separation of U and V signal.

d) List four advantages of fluorescent display system used in CD player.

Ans:- Any 4 advantages- 4 mks

1. Displays the pitch of the channel, band etc.

Helps the listener to adjust the pitch of his interest by seeing the display.

Helps to know the voice band when using the karaoke system.

Uniform brightness, low cost etc.

In addition to ten numerals, the display can be used to show letters including punctuation.

gives hexadecimal encoding for display the digits 0 to F.

To remove the ambiguity letter „B’ is small „b’ and number „8” is in 7 segment display, otherwise both would have looked same.

can give short message giving status information in CD player like -no disc or -errors etc.

The fluorescent numbers and messages can be seen in the dark also.

e) Describe NHK MUSE system for HDTV.

Ans: Relevant proper description – 4 mks

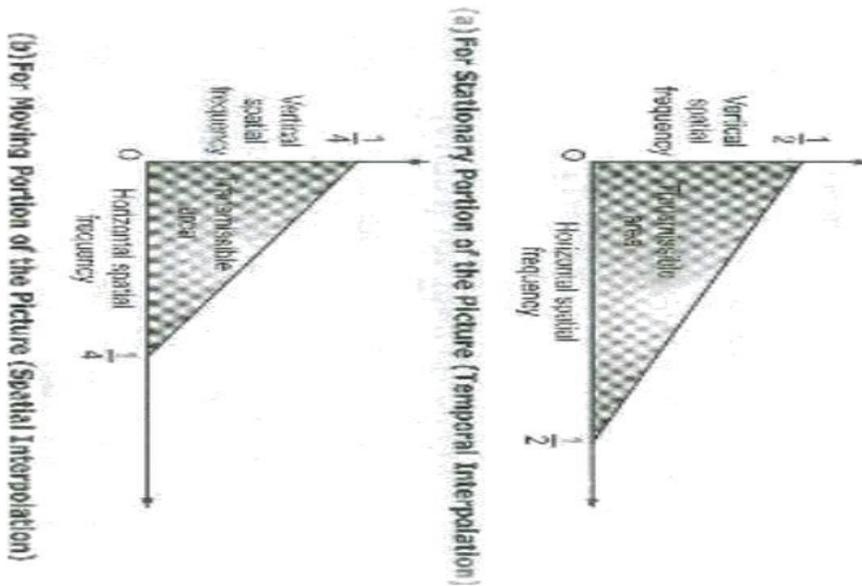
Explanation:- MUSE stands for Multiple Sub-Nyquist Sampling Encoding and is an HDTV bandwidth compression scheme developed by NHK.. It uses fundamental concepts for performance exchange in the spatio-temporal (transitory transformation)

domain along with motion compensation to reduce the transmission bandwidth down to near about 10MHz. The processed HDTV signal can be then transmitted using a single BDS channel.

Temporal Interpolation- In MUSE the luminance and colour information are sent by time multiplexed components (TMC). The colour information is sent sequentially with a time compression of four. The TMC signal is bandwidth reduced means of 3 – dimensional offset sub – sampling pattern over a four –field sequences. The stationary areas of the picture are reconstructed by temporal interpolation of samples from four fields.

Spatial Interpolation- For a moving picture area the final picture is reconstructed by spatial interpolation using samples from a single field. Hence moving portions of the picture are reproduced with one-quarter the spatial resolution of the stationary areas.

The spatial frequency response for both stationary and moving areas of the picture is shown in figure below.



The lack of resolution during movements of the entire scene as in case of camera panning, zooming or tilting is prevented by introducing spatial motion compression technique. A vector representing the motion of the scene is calculated for each field at the encoder. This signal is multiplexed in the vertical blanking interval and transmitted to the receiver. In decoder, the read – out addresses of picture elements (pixels) from previous fields are shifted according to the information provided by the motion vector so that the data can be processed in still – picture mode.

f) State necessity of crossover network. Draw and explain three way crossover network.

Ans: Need- 1 mks, diagram- 2 mks, explanation- 1 mks

Necessity of Cross over Network- A single cone type speaker is not able to provide uniform response and adequate output power over the entire AF range.

A loudspeaker mechanism with a heavy and large diameter called woofer can reproduce low frequencies. A loudspeaker with a light and small diameter cone known as tweeter which performs much better at the high frequency audio frequency range. For proper functioning of a dual speaker system, it is necessary that the frequency range to be covered by the combination of speakers should be split into two ranges at a frequency called cross-over frequency. Hence woofers & tweeters are used with cross-over networks, for getting a uniform frequency response over the entire frequency range.

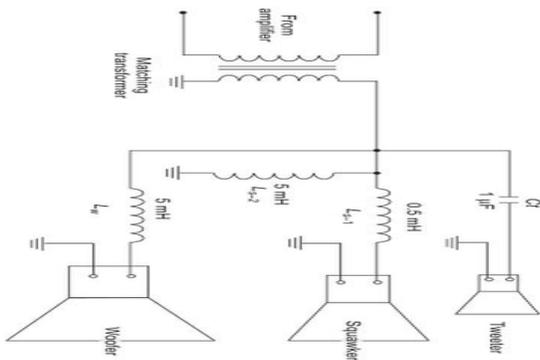
Distribution Frequency

Woofer: 16Hz-500 Hz

Squawker: 500 Hz- 5000 Hz

Tweeter: 5000-20000 Hz.

Three way crossover network



- Fig 11** In three way cross-over network shown in the fig, inductor L of 5mH in series with woofer prevents high frequencies from reaching the woofer. Similarly, capacitor of $1\mu\text{F}$ in series with tweeter avoids low and mid frequencies from reaching the squawker.
- Fig 11** The response curve for three way cross-over network is shown in fig. Single filtering element (used in woofer and tweeter) gives attenuation of 6dB per octave and double element (used in squawker) gives attenuation of 12dB per octave.

Q3) Attempt any four.

16

- a) Draw and describe block diagram of DB meter.
Ans: Diagram- 2 mks, description- 2 mks



Principle: The logarithmic term is applied to an electronic voltmeter when the current or voltage produced in the indicating instrument by an applied voltage is proportional to the logarithm of applied voltage. Such a characteristic leads to a linear decibel scale for the indicating instruments and finds many applications in electronics. The reading on the meter scale is calibrated in decibels and hence the instrument is called a dB voltmeter or simply dB meter.

Working: The RF signal to be measured is connected to the input of high impedance input circuit through a RF connector, whose input impedance is $75\ \Omega$. The range selector switch selects the band and range of its frequencies to be tuned. The logarithmic amplifier is connected to the differential amplifier whose signal output deflects the dB scale in the dB meter. To obtain logarithmic characteristics, the meter uses a diode in feedback loop of an op-amp. dB is the unit for losses and gains.

- b) Differentiate PAL, NTSC and SECAM system.
Ans: - Any 4 relevant comparison- 4 mks

Sr. No.	Parameter	PAL	NTSC	SECAM
1.	Full form of system	Phase Alternation of Line	National Television System Committee	Sequential Colour A Memory
2.	Inventing country.	Germany in 1967	USA in 1957	France in 1970
3	Countries where used.	Germany, India, UK	USA, Canada, Japan, Mexico.	France, East Europe, Africa.
4	Transmission of colour.	By colour difference signals.	By colour difference signals.	By colour difference signals.
5	Video bandwidth.	5 MHz	4 MHz	6 MHz
6	Noise	High	High	Very high.
7	Identification signal	Needed	Not needed	Needed
8	Cost	Costliest	Less than PAL but higher than SECAM	Cheapest

c) Draw and explain Dolby NR recording system

Ans: Diagram-2M, explain-2M

- FO
R7
 - FO
R7
 - FO
R7
- Dolby NR is a noise reduction system developed by Dolby Laboratories for use in analog magnetic tape recording. It works by companding i.e. reducing the dynamic range of the sound during recording and expanding it during playback. It was one of the most important innovations that made fidelity practical on cassette tapes which normally have high noise because of the slow speed and narrow tape format created initially for compact voice recorders, and is common on stereo tape players and recorders to the present day.

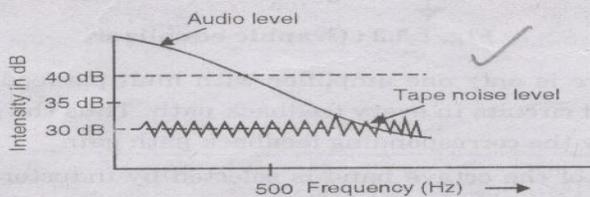
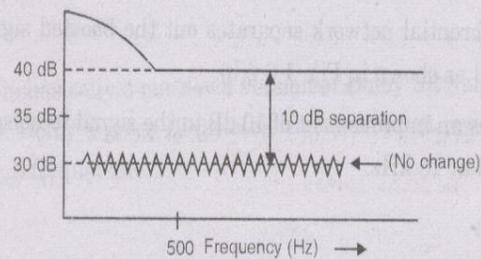
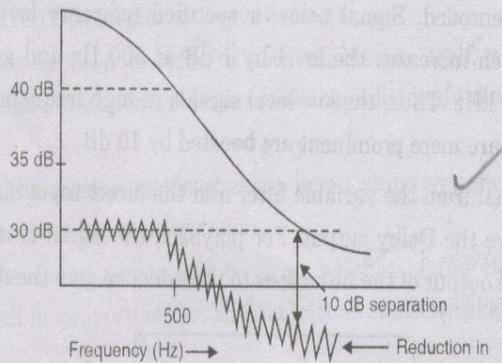


Fig. 1.6.1(a) : Without Pre-emphasis



(b) After Pre-emphasis before recording



(c) After de-emphasis

Fig. 1.6.1 : Reduction of noise in dolby system

Dolby A-system:

- In this system, boosting of lower level signal is done in 4 frequency bands: 16 to 80 Hz, 80 to 2999 Hz, 3000 Hz and above and 9000 Hz and above.
- Each band of frequency is processed separately by using low pass, band pass and high pass filters and limiters.
- The 16 Hz to 80 Hz signal goes to a low pass filter which improves the signal to noise with respect to hum and rumble.
- 80 Hz to 2999 Hz signal goes to the band pass filter which deals with the mid-band noise.
- Most of the sound energy is concentrated in this band.

Dolby B system:

- This system is simpler than the Dolby A system. In this system a single frequency band above 500 Hz is encoded. Signal below a specified reference level are passed through a variable filter which increases the level by 1 dB at 500 Hz and goes on increasing and is about 10 dB at 10 kHz. Thus, the low level signals in high frequency range, where hiss and modulation noises are more prominent are boosted by 10 dB.
- The processed signal from the variable filter and the direct input signal are added as shown in fig to give the Dolby output. For playback the signal is inverted and given to the variable filter. The output of the filter goes to the adder to give the decoded output.

Dolby C system: Dolby C provides up to 20 dB noise reduction in the high frequency range, but the resulting recordings sound much worse when played back on equipment that does not have Dolby C noise reduction.

- Some of this harshness can be mitigated by using Dolby B on playback. It utilizes anti-saturation and spectral skewing techniques. Dolby C first appeared on reel-to-reel cassette decks in the 1980's.



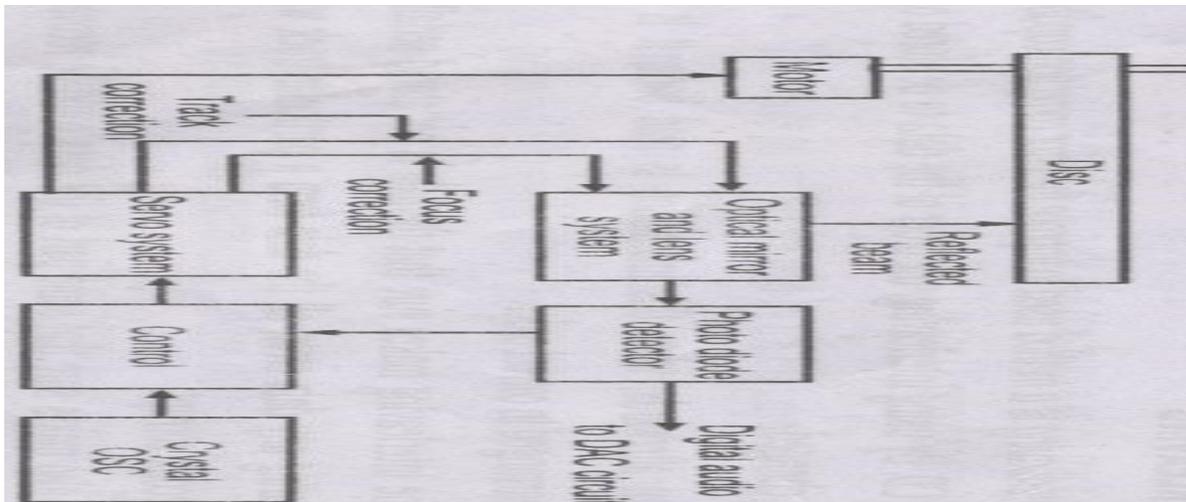
Dolby SR: Dolby SR system is the company's second professional noise reduction system, is a much more aggressive noise reduction approach than Dolby A. It attempts to maximize the recorded signal at all times using a complex series that changes according to the input signal.

As a result, Dolby SR is much more expensive to implement than Dolby B or C, but Dolby SR is capable of providing up to 25dB noise reduction in the high frequency range. It is only found on professional recording equipment.

Dolby S: The Dolby S system is basically a cut down version of Dolby SR and uses many of the same noise reduction techniques. Dolby S gives 10dB of noise reduction at low frequencies and up to 24dB of noise reduction at high frequencies.

d) Explain CD detection technique used in CD player with neat sketch.

Ans: Diagram-2M, explain-2M



Explanation

The signal on the disc surface is processed and reproduced within the CD player. During detection (i.e. decoding), the digital data on the disc surface is read by decoding surface and is converted into the analog audio signal required to drive the speaker and to regenerate the stored music.

Control signals allow any combination of tracks to be played in any sequence with the help of a keyboard. Also the display of next is provided to monitor the music being played. Clock signal is obtained from the disc itself. It is compared with a crystal oscillator signal. Any discrepancy results in generation of correction signal which is applied to the servo system. As it is a very high fidelity system, it is incorporated stereo sound. Stereo signals are multiplexed before modulation of the laser beam. After detection, these signals are demultiplexed to give to separate channels of stereo systems. Scanning of the tracks by laser beam is done from the center proceeding towards the edge. For this purpose the disc is rotated and the laser is moved from the center to the edge.

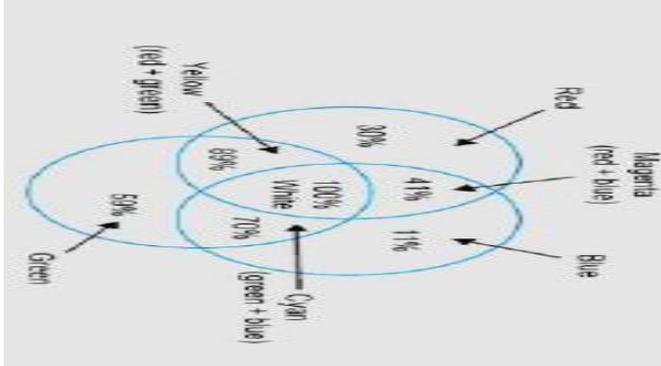
Scanning speed is about 1.2 m/s. Total track length is 6km. This gives playing time of 60 mins plus about 20 min time for error correction. Frequency response of a compact disc is from 20 Hz to 20 KHz. During decoding, the digital data on the disc surface is read by the decoding circuit and is converted into the analog audio signals required to drive the speaker and to regenerate the stored music.

e) State Grassman's law. Explain additive colour mixing.

Ans:- 2 mks each

Grassman's law: This property of the eye of producing a response which depends on the algebraic sum of the red, green and blue input is known as Grassman's law.

Additive mixing:- Additive mixing which forms the basis of colour television, light from two or more colours obtained either from independent sources or through filters can create a combined sensation of a different colour. Thus different colours are created by mixing pure colours and not by subtracting parts from white.



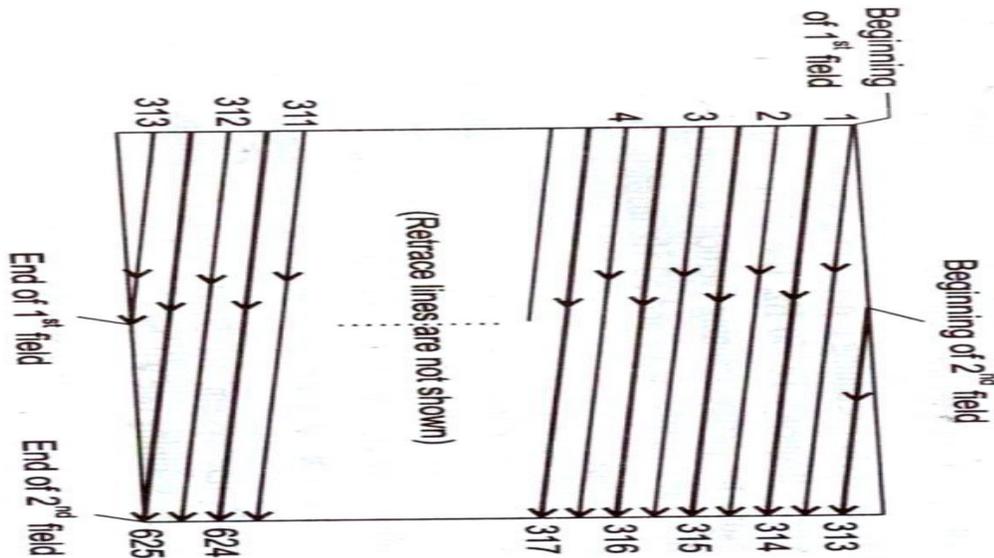
Q4 A) Attempt any three.

12

a) Describe interlaced scanning with neat sketch.

Ans:

Sketch- 2 mks, explanation- 2 mks



Explanation:-

In television pictures an effective rate of 50 vertical scans per second is utilized to reduce the flicker. This is accomplished by increasing the downward rate of travel of the scanning electron beam, so that every alternate line gets scanned instead of successive line.

When the beam reaches the bottom of the picture frame it quickly returns to the top to scan those lines that were missed in the previous scanning.

Thus, the total number of lines is divided into two groups called 'fields'. Each field is scanned alternately. This method of scanning is called interlaced scanning'.

In the 625 line TV system, for successful interlaced scanning, the 625 lines of each frame or picture are divided into sets of 312.5 lines and each set is scanned alternately to cover the entire picture area.



To achieve this, the horizontal sweep oscillator is made to work at a frequency of 15625 Hz (i.e. $312.5 \times 50 = 15625$) to scan the number of lines per frame, but the vertical sweep circuit is run at a frequency of 50 Hz (i.e. $25 \times 2 = 50\text{Hz}$)

Note that since the beam is now deflected from top to bottom in half the time and horizontal oscillator still operating at 15625 Hz, only half the total lines (i.e. 312.5) get scanned during each vertical sweep.

Since the first field ends in a half line and the second field starts middle of the line on top of the screen, as shown in fig., the beam is able to scan the remaining 312.5 alternate lines during its downward journey.

The beam scans 652 lines per frame at the same rate of 15625 lines per second. Therefore, with interlaced scanning the flicker effect is eliminated without increasing the speed of scanning, which in turn does not need any increase in channel bandwidth.

b) Define Positive and Negative modulation. State any 2 merits and 2 demerits of negative modulation

Ans.: Each definition- 1 mks, 2 advantages- 1 mks, 2 disadvantages- 1 mks

Positive modulation:

When increase in brightness of the picture results in an increase in amplitude of modulated envelop it is called Positive Modulation.

Negative Modulation:

When polarity of modulating video signal is so chosen that sync. Tips lies at the 100% level of carrier amplitude and increasing brightness reduces amplitude of the modulated envelope, it is called negative modulation.

Merits of Negative Modulation:

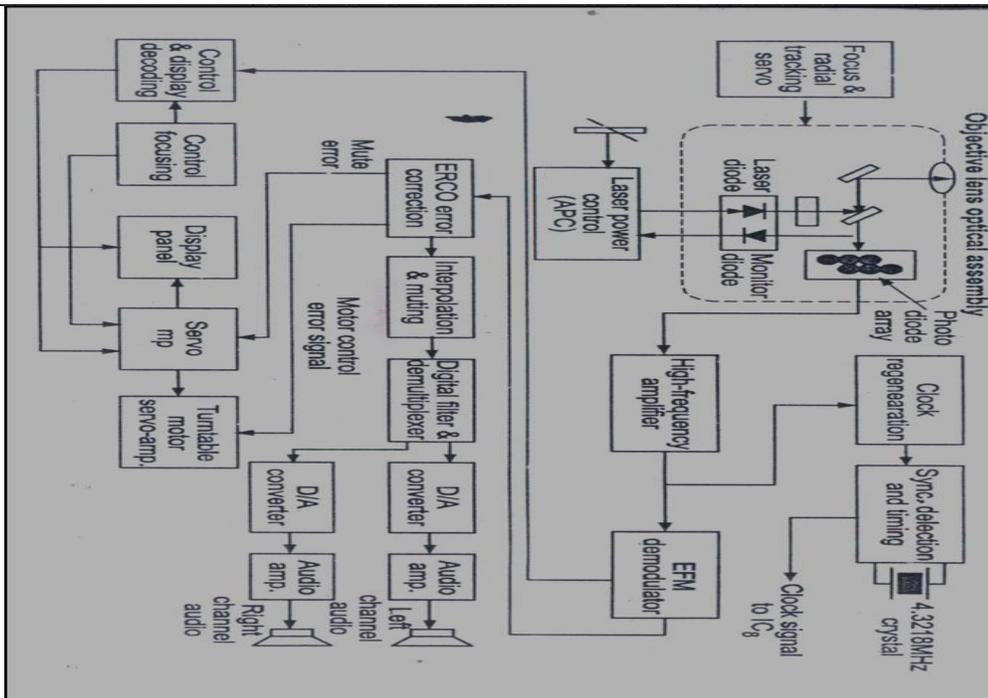
- Lesser noise interference on picture signal.
- Possible to obtain larger peak power output.
- Less picture signal distortion.
- Easy to develop true AGC voltage.
- More efficient operation.
- More power available from the transmitter
- Saving in transmission power

Demerits of Negative Modulation:

- The synchronization of the receiver is affected by spurious random pulses produced due to the effect of noise.
- The loss of horizontal and vertical synchronization may cause diagonal or vertical rolling of picture.

c) Draw and explain block diagram of CD player.

Ans: Diagram- 2 mks ,explanation- 2mks



CLV: The CD player is also known as CLV or constant linear velocity system. In a CLV device such as the CD player the rotational speed of disc player is adjusted with movement of reading mechanism on the disc surface. This speed is changed to maintain constant linear velocity i.e. the signal on the disc surface always moves at constant speed of 1.3 m per second under the pick-up head.

Half-Full Memory: This half –full memory circuit makes the disc to maintain a constant linear velocity when the reading mechanism moves from outer tracks of disc to inner tracks or from inner tracks to outer tracks on disc surface.

Decoding CD: During the decoding, the digital data on the disc surface is read by the decoding circuit and is converted into the analog and 0 signal required to drive the speakers and regenerate the stored music.

Optical pick-up: the signal stored on the CD surface as pits and flat areas are first picked up by the optical pickup made of lens assembly prism, photo detectors and laser diodes assembly in the optical pick-up unit.

High frequency amplifier: The signal is very weak so it is amplified by a high frequency RF amplifier circuit to bring signal to a proper level. This amplified and filtered high-frequency signal contains audio signal as well as synchronization signal in 14-bit EFM (eight to fourteen modulated) format, this signal is sent to an EFM demodulator circuit.

EFM Demodulator: The EFM modulator separates the modulated data and the timing signal from the signal received at its input. It also removes the additional coupling bits and convert the 14-bit EFM symbol to actual 8-bit data. The amplified and filtered EFM signal from high frequency amplifier is also given to clock generation circuit to synchronize detecting and timing circuit. These circuits are used to recover the bit clock and sync pattern data .The timing separated by this system is used to provide timing signal to the system.

ERCO Circuit: demodulated data from EFM demodulator is send to error correction (ERCO) circuit. The demodulated data signals also send to control and display decoding circuit, which recovers the control and display signal received from CD.

Interpolation and muting: The ERCO circuit is used for error detection and correction purpose. Any error found in the incoming data signal is send to interpolation and muting section by the ERCO circuit. The interpolation and muting section uses the following methods to correct error found in data stream read from the disc.

- Muting
- Last word held
- Linear Interpolation

Muting: In muting, when error is detected in the data stream , the player will mute (silence)the sound is not to send speaker .

CLV using the Clock Signal: The ERCO also responsible for maintaining constant linear velocity of CD rotation motor , For this , The TRCO circuit compare the clock signal derived from the incoming data with reference clock frequency.



De-interleaving: Signals from the ERCO contains audio signal in the interleaved format. before doing any further operation on this signal, it must be interleaved. The signal is then de-interleaved in the interpolation and muting section to restore the original sequence of information.

d) Differentiate between CATV and CCTV. (any four points)

Ans:- Any 4 points- 4 mks

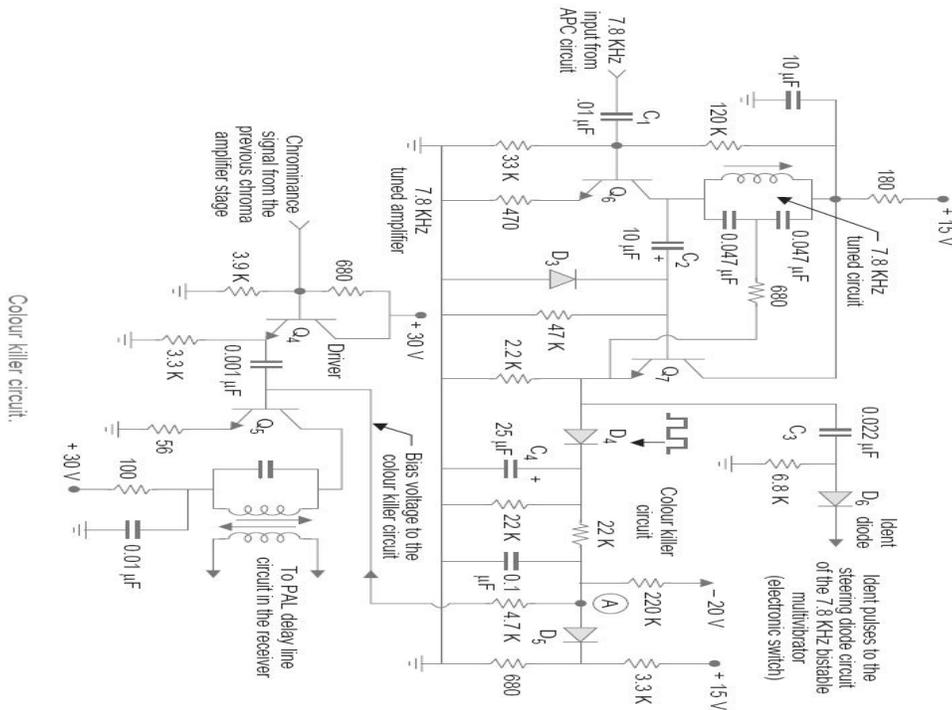
CATV	CCTV
CATV monitor has RF, IF as well as detector stages.	CCTV monitor does not have RF, IF and detector stages.
Audio section is present.	Audio section is not present.
Pay-TV channels are present in CATV with additional fees.	Pay-TV channels are not present.
Internet service can be provided.	Internet service cannot be provided.
CATV service provider can broadcast live programs from studio, some events etc. on their local TV channels.	Such facilities are not available.
Various channels such as scientific, geographical, sport news, entertainment etc. are provided by CATV.	Such channels are not provided.
Application: CATV's are used in homes, malls, shops for entertainment and value added service and in corporates and business environment for internet service.	Application: It is used for surveillance in college campus, industry, traffic control. Crowd control and also used for medical care and safety.

B) Attempt any one.

6

a) Draw and explain colour killer circuit.

Ans: Diagram- 3 mks, explain- 3 mks

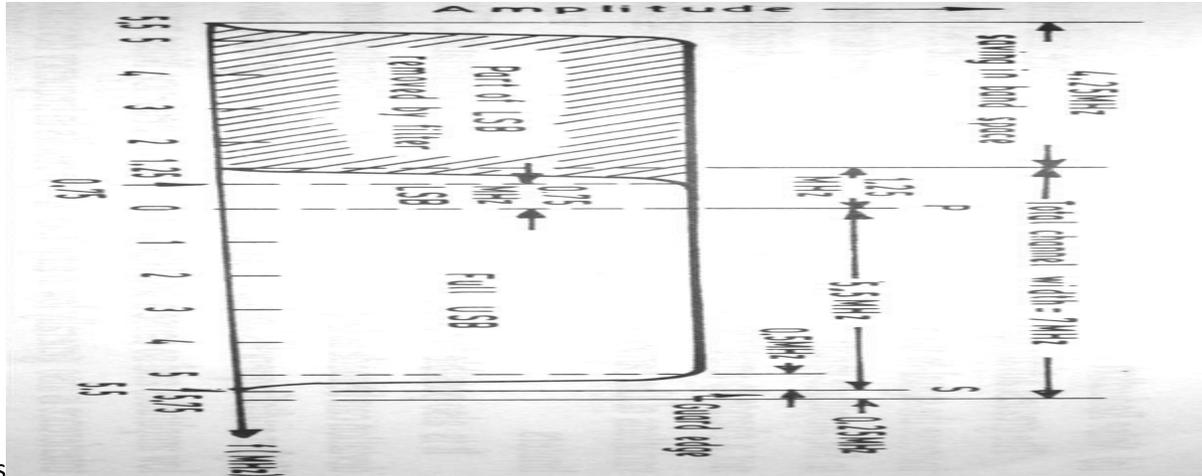


Working: The colour killer circuit is shown in Fig. The forward bias of Q5, the last stage of bandpass amplifier depends on the state of the colour killer circuit. When a colour signal is being received, the 7.8 KHz (switching rate of the (R – Y) signal) component is available at the APC (automatic phase control) circuit of the reference subcarrier oscillator. It is applied via C1 to the base of tuned amplifier Q6. The amplified 7.8 KHz signal is ac coupled to Q7. Diode D3 conducts on negative half cycles charges the capacitor C2 with the polarity marked across it.

The discharge current from this capacitor provides forward bias to Q7, the emitter follower. Such an action results in a square wave signal at the output of Q7. It is coupled back via a 680 ohm resistor to the tuned circuit in the collector of Q6. This provides positive feedback and thus improves the quality factor of the tuned circuit. The colour killer diode D4 rectifies the square-wave output from the emitter of Q7. The associated RC filter circuit provides a positive dc voltage at point „A” and this serves a source of forward bias to the chrominance amplifier Q5. Diode D5 is switched on by this bias and so clamps the voltage produced at „A” by the potential divider (3.3 K and 680 ohm) across the + 15 V line. When a monochrome transmission is received there is no 7.8 KHz input to the colour killer diode D4 and no positive voltage is developed at its cathode (point A). Both D5 and the base emitter junction of Q5 are now back biased by the – 20 V potential returned at „A” via the 220 K resistor. The chrominance signal channel, therefore, remains interrupted.

b) Explain vestigial sideband transmission used in TV transmitter. Draw its frequency response.

Ans: Diagram- 3 mks, explanation- 3



mks

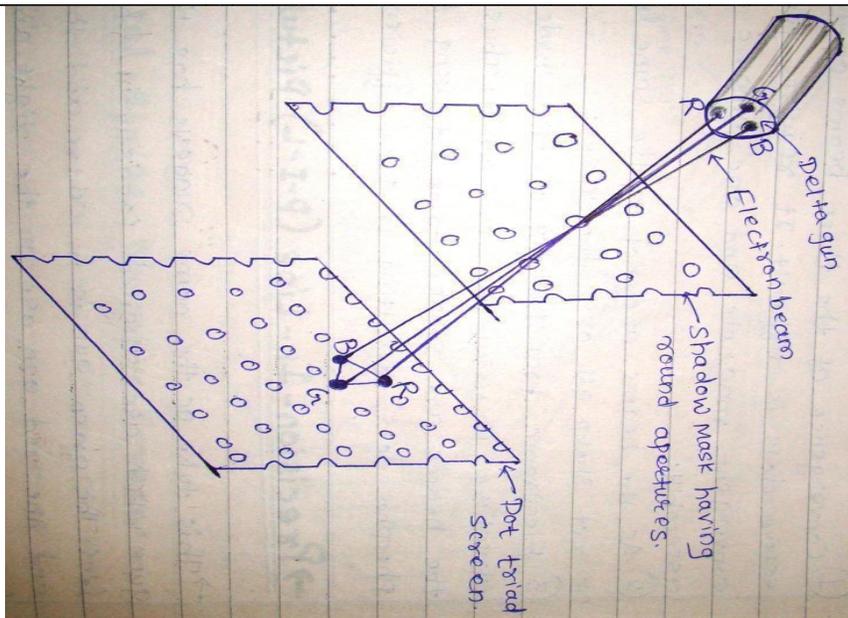
Explanation: The low video frequencies contain the most important information of the picture and any effort to completely suppress the LSB would result in phase distortion at these frequencies. This distortion will be seen by the eye as “smear” in reproduced picture. Therefore as a compromise, only a part of the lower sideband, is suppressed, and the radiated signal then consists of a full upper side band and a carrier signal and vestige (remaining part) of the partially suppressed lower sideband. This pattern of transmission of the modulated signal is known as Vestigial Sideband transmission.(VSB). In 625 line system, frequencies up to 0.75MHz in the lower sideband are fully radiated. Because of filter design difficulties it is not possible to terminate the B.W. of a signal abruptly at edges of the sidebands. As shown in figure above saving of band space which results from vestigial sideband transmission. The picture signal is seen to occupy a bandwidth of 6.75MHz instead of 11MHz.

Q5 Attempt any two.

16

a) Describe Precision-In-Line (PIL) and delta gun picture tube with neat sketch.

Ans: Diagram – 2 mks each , description- 2 mks each



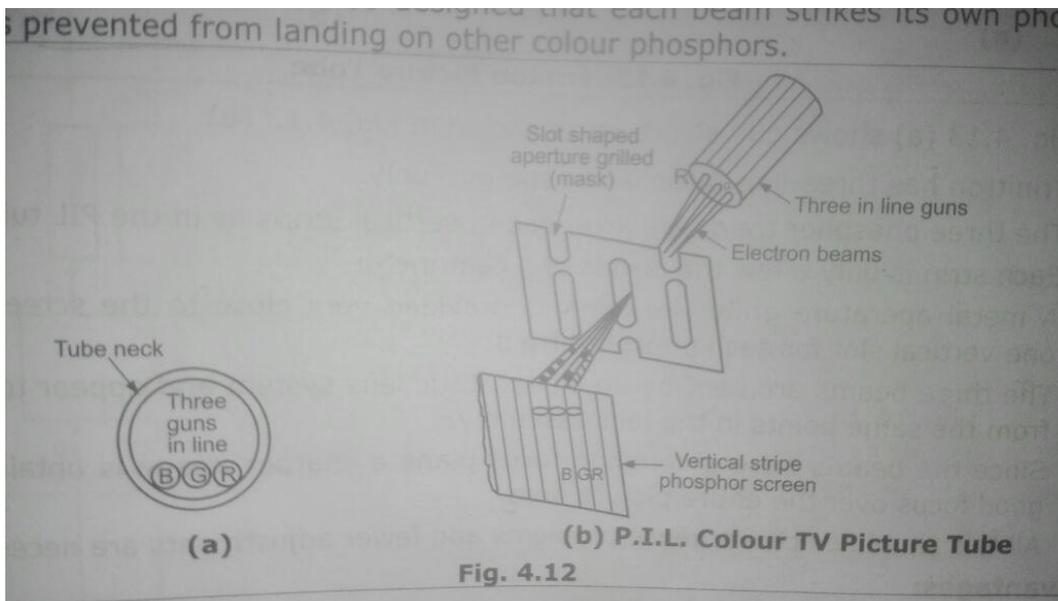
Working principle of delta gun picture tube:

Electron beam from the three guns strikes three phosphor dots of a triad. The dots of red, green and blue phosphor in a triad glow simultaneously, the intensity of glow being proportional to the intensity of video signal of respective colours. The eye adds the three colours emitted by the phosphor dots at a time and perceives the resultant colour of the concerned pixel as in the original picture.

Triads glow one after another in quick succession due to deflection of the beams and hence the whole picture is reproduced in its original colours.

The ratio of electrons passing through the holes to those reaching the shadow mask is only about 20%. The remaining 80% of the total beam current energy is dissipated as a heat loss in the shadow mask.

Precision-In-Line:



Precision in line picture tube -construction

The overall colour seen is determined both by the intensity of each beam and the phosphors which are being bombarded. If only one beam is „ON” and the remaining two are cut-off, dots of only one colour phosphor get excited. Example, when no transmission then our TV screen shows only blue raster.

Similarly, if one beam is cut-off and the remaining two are kept ON, the rasters produced by excitation of the phosphors of the two colours will combine to create the impression of a complementary colour.

When all the three guns are active simultaneously, lighter shades are produced on the screen.

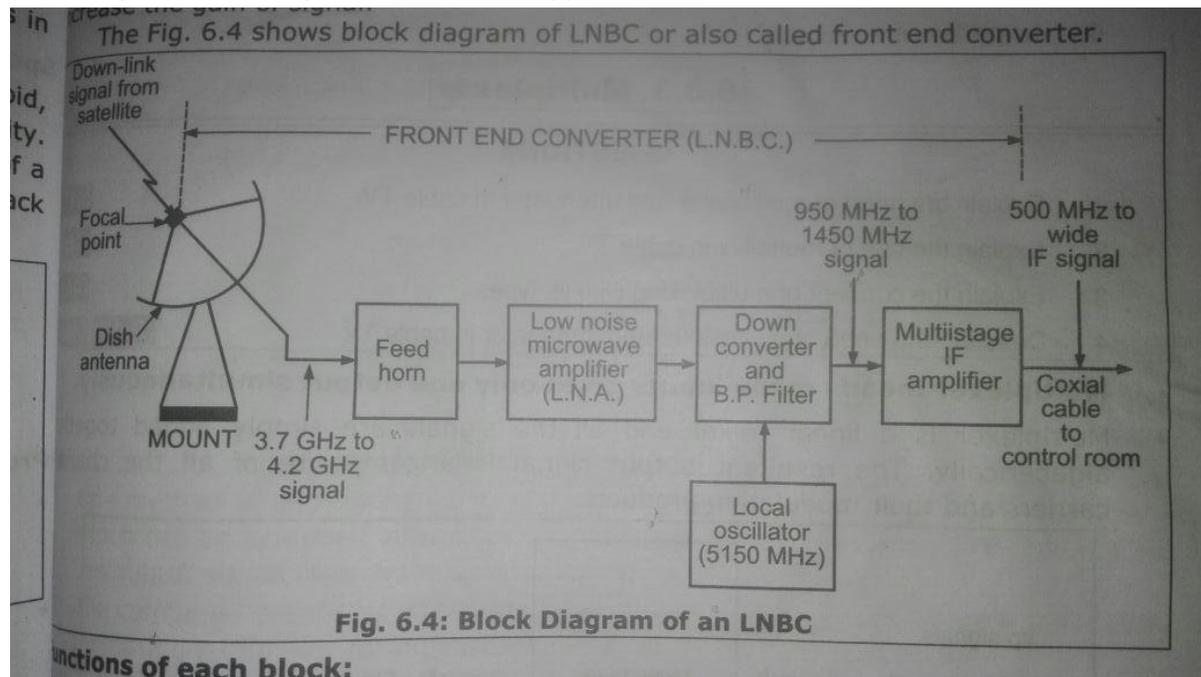
This is because red, green and blue combine that forms white and this combines with whatever colours are present to de-saturate them.

Naturally, intensity of the colour produced depends on the intensity of beam currents.

Back in a picture is just the absence of excitation when all three colour differences signal to zero, the only signal left to control the three guns would be Y signal and thus a black and white picture will be produced.

a) Draw and describe block diagram of LNBC. List its any two applications.

Ans:- Diagram- 4 mks, explanation- 2 mks, 2 applications – 2 mks



Dish antenna and feed horn: A feed horn is actually a flared open waveguide section which is mounted at focal point and its function is to receive signals reflected towards it by the delivers these to the close by located unit called as Low Noise Block Converter (LNBC).

Low Noise Amplifier (LNA): The CVS collected by the feed horn is fed to LNA which is specially designed to provide enough gain which maintains maximum possible S/N ratio.

Mixer (down convertors): Mixer translates the incoming microwave signals to a lower frequency range of 950-1450MHz. This is achieved by mixing local oscillator frequency of 5150 MHz at mixer and selecting only the difference from output.

Band pass filter: A BPF at the output mixer separates the wanted IF signals from the other signals.

Multistage IF amplifier: It amplifies the down converted signals and then sent through high grade coaxial cable to the CATV.

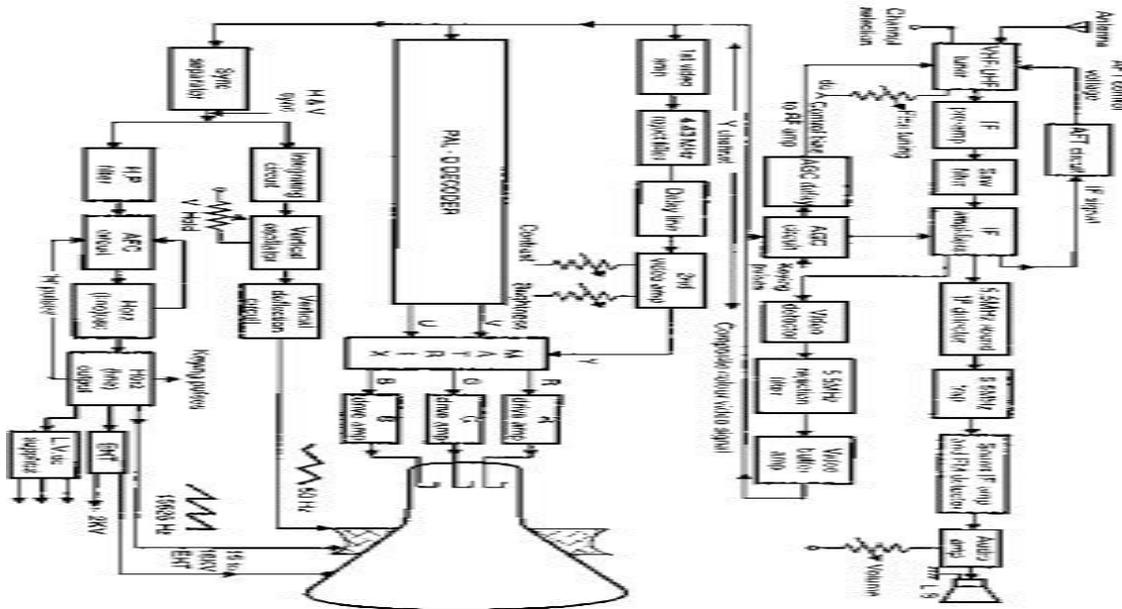
Applications of LNBC :- (Any two)

1. It is the device on the front of a satellite dish that receives the very low level microwave signal from the satellite, amplifies it, changes the signals to a lower frequency band and sends them down the cable to the indoor receiver.

2. This down conversion allows the signal to be carried to the indoor satellite TV receiver using relatively cheap coaxial cable; if the signal remained at its original microwave frequency it would require an expensive and impractical waveguide line

b) Draw block diagram of colour TV receiver. Write with function of each block.

Ans: Block diagram- 4 mks, explanation- 4 mks



Explanation:-

A colour TV receiver contains all the necessary circuits of a monochrome receiver plus additional circuits required for the reproduction of a colored picture. Basically a colour TV receiver is a black-and-white receiver with a decoder for the colour signals and a colour picture tube.

The figure is the functional block diagram of a colour TV receiver. The block diagram shows that the circuits like the RF tuner, VIF amplifier, the video amplifier, the deflection sync, the sweep circuits and the EHT sections are virtually the same as in black-and-white receiver.

However there are some minor differences in design and details. For example the RF response in case of colour TV is kept more uniform than in monochrome receiver; this is to avoid any attenuation of the colour sub-carrier.

The tuning of a colour TV is critical. To avoid any mistuning of the receiver, an arrangement called AFT (Automatic Fine Tuning) is used in most cases. This arrangement is similar to the AFC and can be switched off whenever manual tuning is required. The colour TV uses the inter carrier sound system with one difference.

The sound take-off point is at the last VIF stage immediately before the video detector. This is done to avoid interference between the sound IF and the Chroma signal. A separate diode detector is used to produce the sound IF but the rest of the audio circuits are the same as in a monochrome receiver.

The two main circuits which **distinguish a colour TV from a monochrome TV** are the colour **picture tube and the Chroma section** containing the colour circuits.

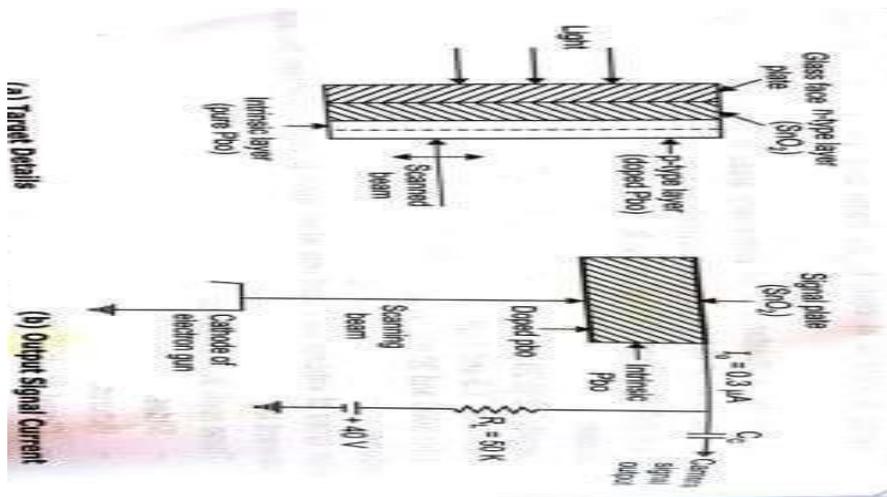
a) State any eight CCIR-B standards for colour signal transmission and reception.

Ans: Any 8 points – 4 mks

Parameters	standard
Number of lines per picture	625
Interlace ratio	2:1
Frame frequency	25
Field frequency	50
Aspect ratio	4:3
Line frequency	15625 Hz
Channel bandwidth	7MHz
Colour difference signals	$U=0.493(B-Y)$ $V=0.877(R-Y)$
Camera output	R, G and B video signals
Luminance signals	$Y=0.30R+0.59G+0.11B$
Colour difference signals chosen for transmission	(B-Y) and (R-Y)

b) State principle and explain working of plumbicon camera tube

Ans: Principle- 1 mks, working- 1 mks, diagram- 2 mks



Principle:

Plumbicon camera tube works on the principle of photo conductivity, where the resistance of target material shows a marked decrease when exposed to light.

Working: In the plumbicon, each element serves as a capacitor in series with a reverse bias light controlled diode.

In the signal circuit, the conductive film of PIN oxide is connected to the target

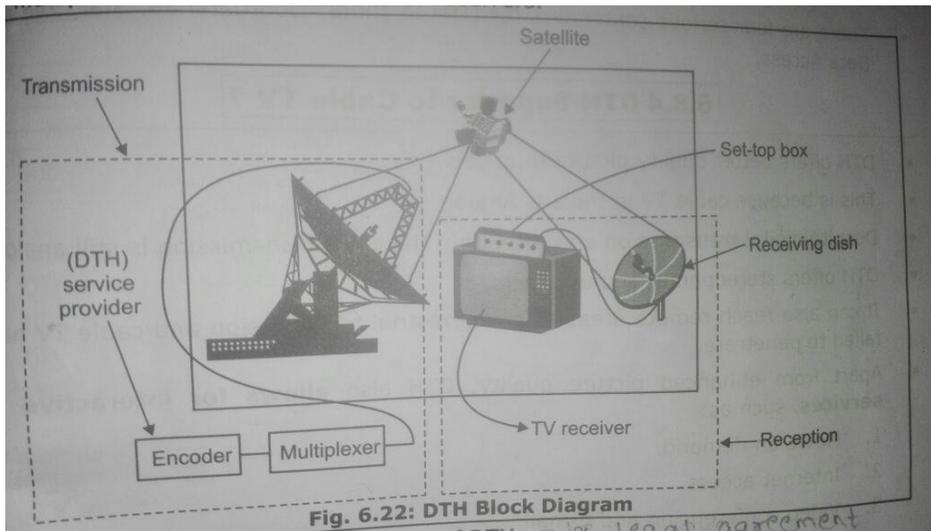
supply of 40V through an external load resistance R_1 to develop the camera output signal voltage. Light from the scene being televised is focused through the transparent layer of TIN oxide on the photo conductive lead monoxide .

Without light the target prevents any conduction. Because of absence of charge carriers there is no output current. The incidence of light on the target results in photo excitation of a semiconductor junction between PbO and dopped layer

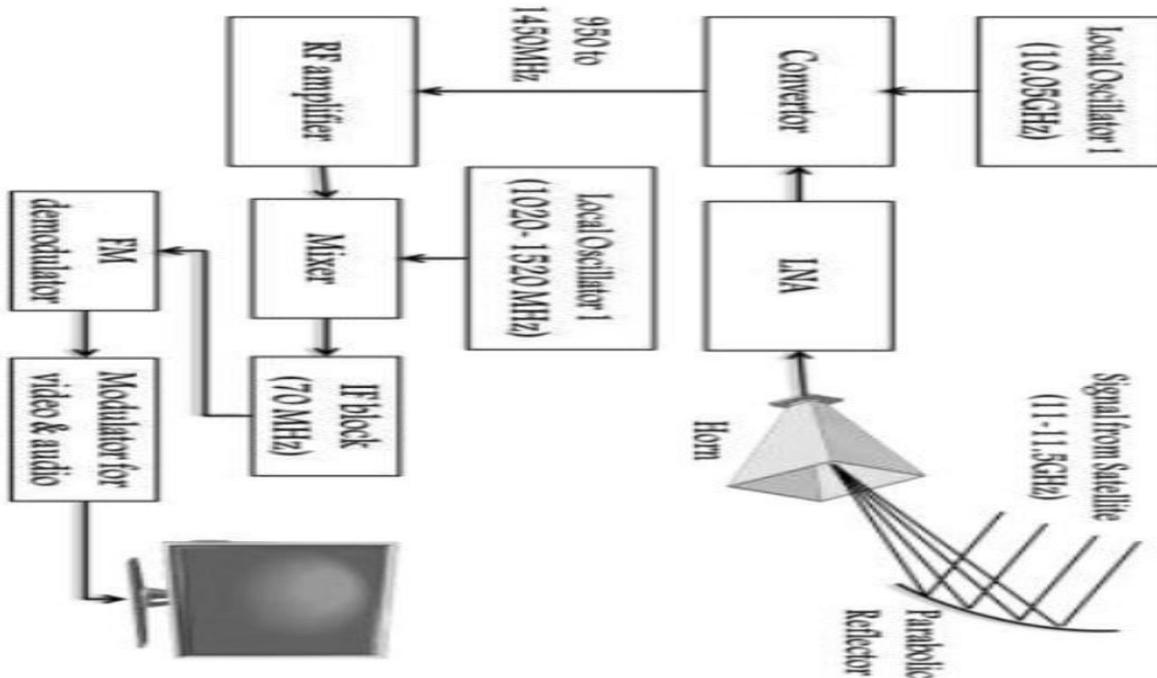
The resultant decrease in resistance causes flow of signal current which is proportional to the incident light of each photo element.

c) Explain DTH system with block diagram

Ans: block diagram – 2 mks, explanation- 2 mks



OR



Explanation:-

Direct to home technology refers to the satellite television broadcasting process which is actually intended for home reception. This technology is originally referred to as direct broadcast satellite (DBS) technology. In short, DTH refers to the reception of satellite signals on a TV with a personal dish in an individual home. The satellites that are used for this purpose is geostationary satellites. The satellite compresses the signal digitally, encrypts them and then is beamed from high powered geostationary satellites. They are received by the dishes that are given to the DTH consumers by DTH providers.

1) Outdoor unit:

It consists of a receiving antenna, low noise amplifier & converter the receiving antenna is parabolic reflector with a horn as the active element. The horn can be directly in front of reflector, or it may use an offset feed as shown in fig. The reflector diameter may be 0.6m for 11GHz & still smaller for K & Ka bands.

The low noise block consists of a low noise wide band amplifier followed by a converter. The output of converter consists of a signal of UHF frequency ranging from 950-1450MHz.

The advantage of using UHF frequency is that a low cost coaxial cable can be used as feeder from the outdoor unit to the indoor unit.

LNB cannot be kept indoor because long cable between horn & the first amplifier will cause substantial degradation of the overall noise figure of the set.

2) Indoor unit:

The wideband signal from LNB is fed to an RF amplifier. The amplified signal is fed to the channel selector circuits which selects the wanted band.

The selected channel is down converted to a fixed IF of 70 MHz by local oscillator and mixer. IF amplifier amplifies the signal which is then goes to FM detector. The detector recovers the original baseband signal, consisting of CVS & audio signal. These modulated signals are fed to the normal domestic TV receiver, which after due processing reproduces picture and sound.



d) Compare Woofer, Tweeter and Squawker depending upon

- Frequency response
- Crossover network
- Cost
- Application

Ans: Each relevant comparison- 4 mks

Parameters	Woofer	Tweeter	Squawker
Frequency response	Attenuation beyond the cut-off frequencies is 12db per octave	Attenuation beyond the cut-off frequencies is 12db per octave	It operates between the cut-off frequencies of woofer and tweeter.
Crossover network	2 way and 3way network	2 way and 3way network	Only 3 way network
cost	High	Low	Moderate
Application	They are used in PA system as they have high efficiency.	They electrodynamics driver	TV sets and cheap radio sets have mid-range speakers.

e) List frequencies used in TV channel allocation for band I and band III

Ans: Each band – 2 mks

The carrier frequency should be chosen ten times of highest modulating frequency to get better selectivity at RF and IF tuned amplifier in the receiver. Highest frequency for picture signal is 5MHz. Hence, the carrier frequency is always greater than 40 MHz. TV transmissions is generally in VHF and UHF.

VHF band= 30 to 300 MHz

UHF band=300 to 3000MHz.

Lower band VHF channel (band I): band I has three channels 2, 3 and 4 from 47 to 68 MHz

Higher VHF Channels (band III): band III channels 5 to 12 from 174 to 230 MHz

VHF band –I (47-68 MHz) channel width =7MHz

Channel No.	Frequency band (MHz)
2	47 to 54
3	54 to 61

VHF band- III (174-230 MHz) channel width =7MHz

Channel No.	Frequency band(MHz)
5	174 to 181
6	181 to 188
7	188 to 195
8	195 to 202
9	202 to 209