MODEL ANSWER

SUMMER– 19 EXAMINATION

Subject Title: Audio Video Engineering 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 anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1		**Attempt any THREE of the following:**	**12-Total Marks**
	a)	**Differentiate Woofer. Tweeter and Squawker depending on** **(i) Frequency Range** **(ii) Size** **(iii) Weight** **(iv) Attenuation**	**4M**
	Ans:		**1 marks for each point**

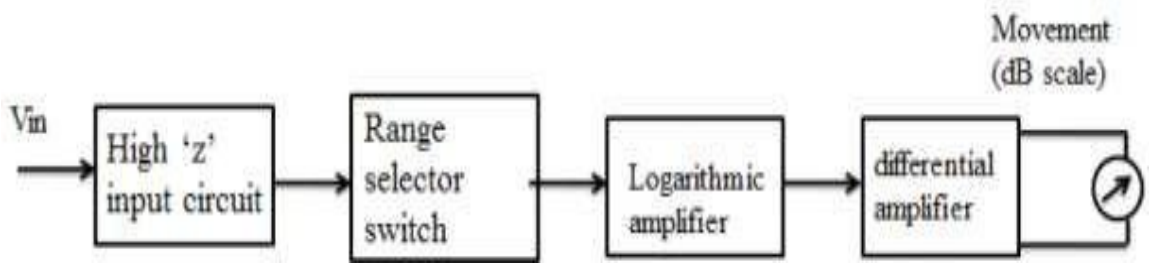
Sr. No.	Parameter	Woofer	Squawker	Tweeter
1	**Frequency Range**	16Hz to 500Hz	500Hz to 5KHz	5KHz to 20KHz
2	**Size**	Size is largest to match the impedance to	They are of medium size, kept in	They process High frequency, hence their size is small.

		the air.	between tweeter & woofer.		
3	**Weight**	Heavier than tweeter & Squeaker	Heavy than tweeter & light in weight than woofer	Light in weight than woofer & Squeaker	
4	**Attenuation**	Attenuates frequency more than 500 Hz	Gives response to mid frequency 500 Hz to 5 Khz and attenuates other	Gives response to 5 Khz. to 20 Khz. and attenuation other frequency in audio band	

b) **Draw the block diagram of dB meter and explain it's operation.** **4M**

Ans: **Block diagram:** **2M**

OR



Working **2M**

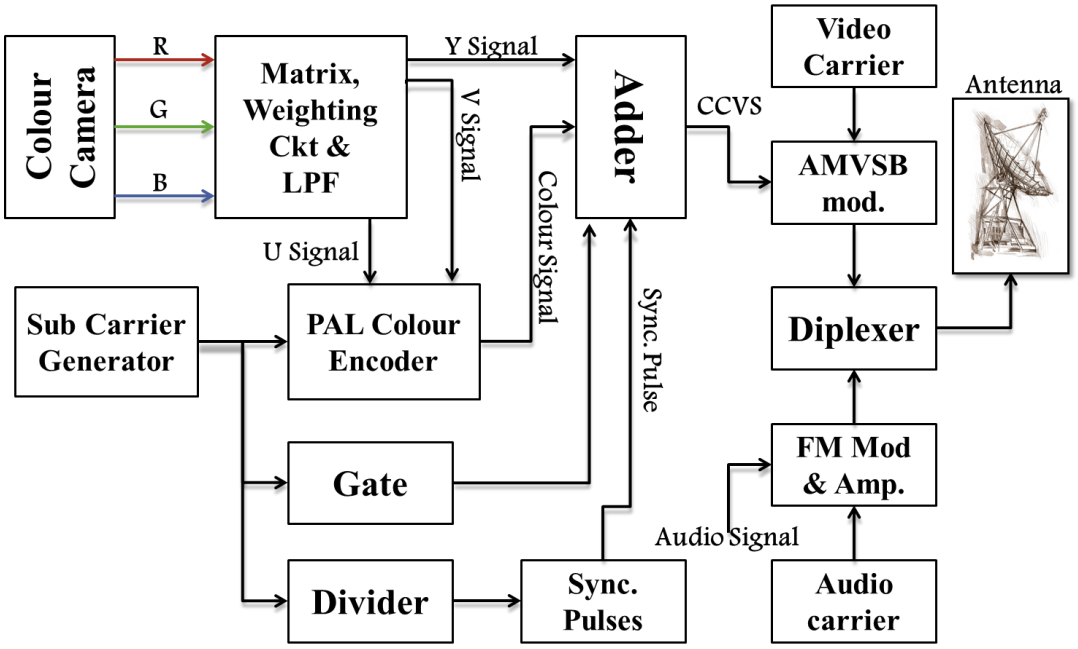
- The RF signal to be measured is connected to the input of high impedance input circuit through a RF connector, whose input impedance is 75 Ω.
- The range selector switch selects the band and range of its frequencies to be tuned.
- The logarithmic amplifier is connected to the differential amplified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

c)	**List CCIR-B standard for colour TV(any eight)**	**4M**
Ans:	**CCIR-B standards used for TV system**	**½ marks for each**

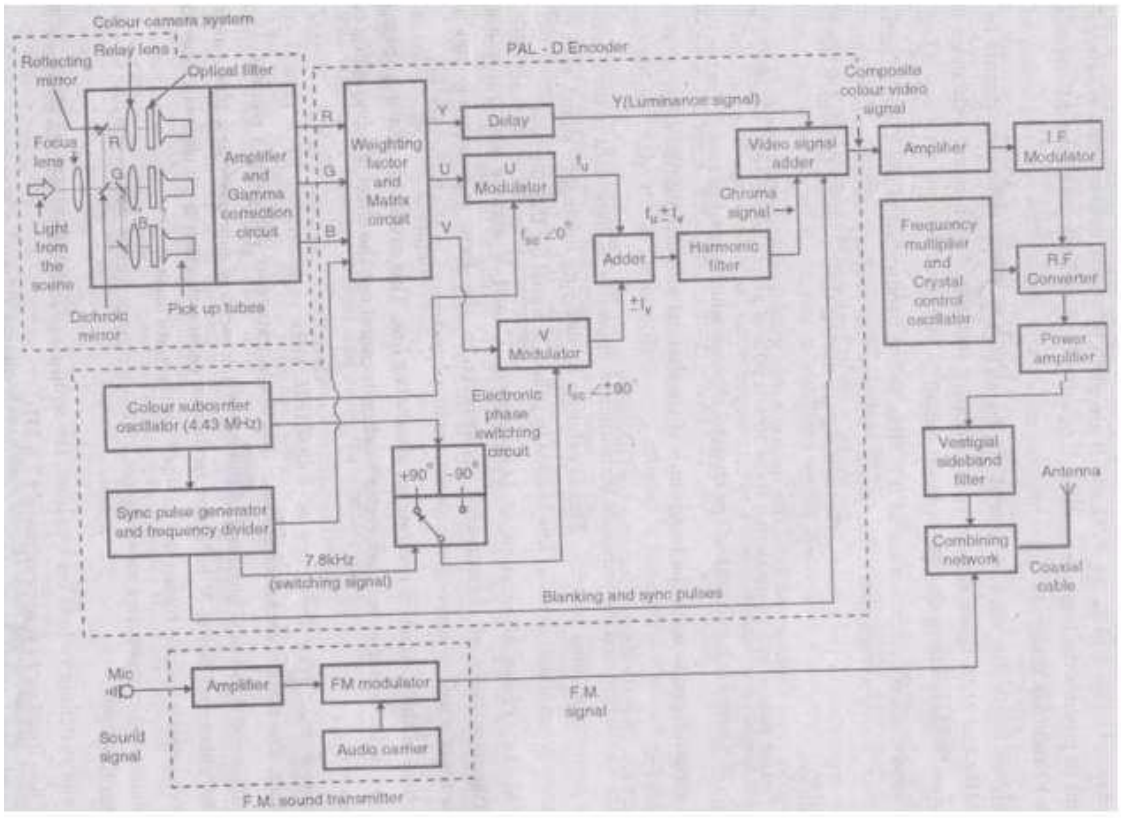
Reception	
Camera output	R, G, and B video signals
Luminance signals	Y=0.30R+0.59G +0.11B
Colour difference signals chosen for transmission	(B-Y) and(R-Y)
Type of colour signal modulation	Suppressed carrier amplitude modulation Of two subcarriers in quadrature having same numerical value.
Colour difference signals	U=0.493(B-Y) V=0.877(R-Y)
Composite colour signal	Y+U sin ωm t+-Vcos ωmt
Amplitude of modulated Chroma signal	u2+v2
Colour subcarrier frequency	4.433185 MHz
Duration of burst	10+1
Chroma encoding	Phase and amplitude modulation
Bandwidth for colour signals (u and v)	Fsc-1.3 MHz to fsc+0.6 MHz
Transmission	
No. of lines per picture (frame)	625
Field frequency (Fields/second)	50
Interlace ratio, i.e., No. of fields/picture	2/1

Picture (frame) frequency, i.e., Pictures/second	25	
Line frequency and tolerance in lines/second,(when operated non-synchronously)	15625 ± 0.1%	
Aspect Ratio (width/height)	4/3	
Scanning sequence	(i) Line: Left to right (ii) Field: Top to bottom	
System capable of operating independently of power supply frequency	YES	
Approximate gamma of picture signal	0.5	
Nominal video bandwidth, i.e., highest video modulating frequency (MHz)	5	
Nominal Radio frequency bandwidth, i.e., channel bandwidth (MHz)	7	
Sound carrier relative to vision carrier (MHz)	+5.5	
Sound carrier relative to nearest edge of channel (MHz)	– 0.25	
Nearest edge of channel relative to picture carrier (MHz)	–1.25	
Fully radiated sideband	Upper	
Nominal width of main sideband (upper) (MHz)	5	
Width of end-slope of full (Main) sideband (MHz)	0.5	
Nominal width of vestigial sideband	0.75 MHz	
Vestigial (attenuated) sideband	Lower	
Peak white level as a percentage of peak carrier	10 to 12.5	

		Type of sound modulation	FM, ± 50 KHz	
		Pre-emphasis	50 μs	
		Resolution	400 max	
	d)	**State the advantages and disadvantages of fluorescent display system.**		**4M**
	Ans:	**Advantages:** 1. Emits a very bright light with clear contrast. 2. Easily support display elements of various colors. 3. The light produced by most VFDs contain many colors and can often be filtered to produce a more pure Colour such as deep green or deep blue. 4. Being rugged, inexpensive. 5. Easily configured to display a wide variety of customized messages. 6. Most VFD's continue to function normally in subzero temperatures making them ideal for outdoor devices in cold climates. 7. In addition to ten numerals, the display can be used to show letters including punctuation. 8. It gives hexadecimal encoding for display the digits 0 to F. 9. To remove the ambiguity letter "B" is small "b" and number "8" is in 7 segment display, otherwise both would have looked same. 10. It can give short message giving status information in CD player like "no disc" or "error" etc. 11. The fluorescent numbers and messages can be seen in the dark also. **Disadvantages:** **1.** high power consumption then LCD 2. some segments of a display gradually becoming brighter or dimmer than others 3. flickering	**3M(any 3 points)** **1M(any 1 points)**
(B)		**Attempt any ONE of the following :**		**6-Total Marks**
	a)	**Draw the block diagram of colour TV transmitter and write function of any three block.**		**6M**
	Ans:	**Block diagram:**		**3M**


Colour Camera
R
G
B
Matrix, Weighting Ckt & LPF
Y Signal
V Signal
U Signal
Colour Signal
Adder
CCVS
Video Carrier
Antenna
AMVSB mod.
Diplexer
Sub Carrier Generator
PAL Colour Encoder
Sync. Pulse
Gate
FM Mod & Amp.
Audio Signal
Divider
Sync. Pulses
Audio carrier

OR


Colour camera system
Relaying lens
Reflecting mirror
Optical filter
Focus lens
Light from the scene
Dichroic mirror
Pick up tubes
Amplifier and Gamma correction circuit
PAL - D Encoder
Weighting factor and Matrix circuit
Delay
U Modulator
V Modulator
Adder
Harmonic filter
Y(Luminance signal)
Composite colour video signal
Video signal adder
Chroma signal
Amplifier
I.F. Modulator
Frequency multiplier and Crystal control oscillator
R.F. Converter
Power amplifier
Vestigial sideband filter
Antenna
Combining network
Coaxial cable
Colour subcarrier oscillator (4.43 MHz)
Sync pulse generator and frequency divider
Electronic phase switching circuit
+90°
-90°
7.8kHz (switching signal)
Blanking and sync pulses
Mic
Amplifier
FM modulator
Audio carrier
Sound signal
F.M. signal
F.M. sound transmitter

Functions:-- **3M(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 grass man's law. **Y=0.3R+0.59G+0.11B.**

For colour section Y is inverted colours R and 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" and „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 multivibrator and feeds the sub-carrier to balanced modulator with phase difference of +900 on one line and -900 on the next line.

The PAL encoder consists of a sub carrier generator and two balanced modulator with filters to produce modulated sub carrier 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).

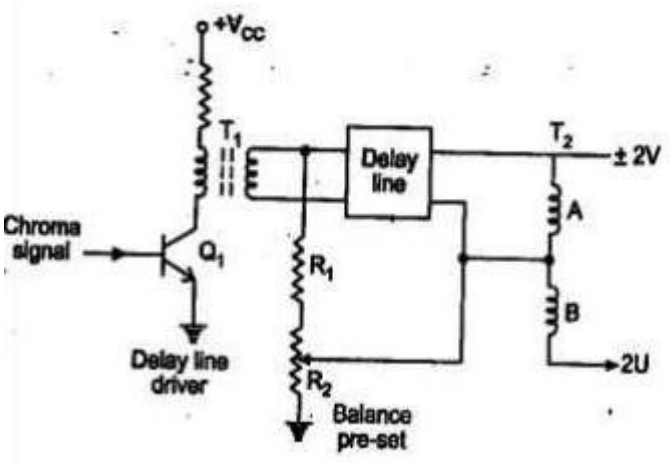
3. **Video and Audio modulators and transmitting antenna**:

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.

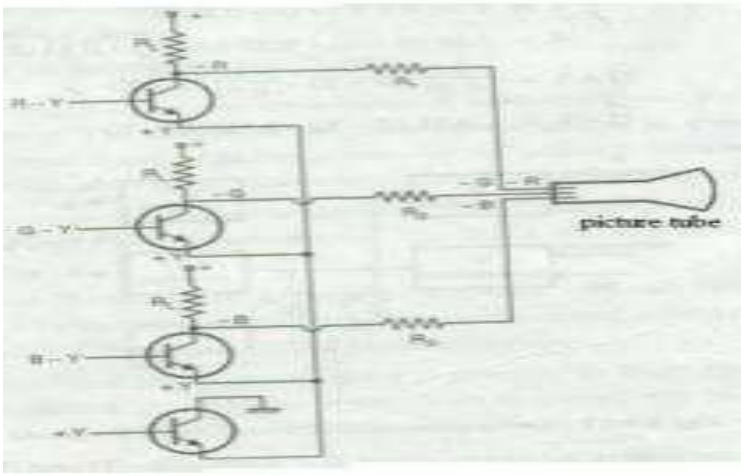
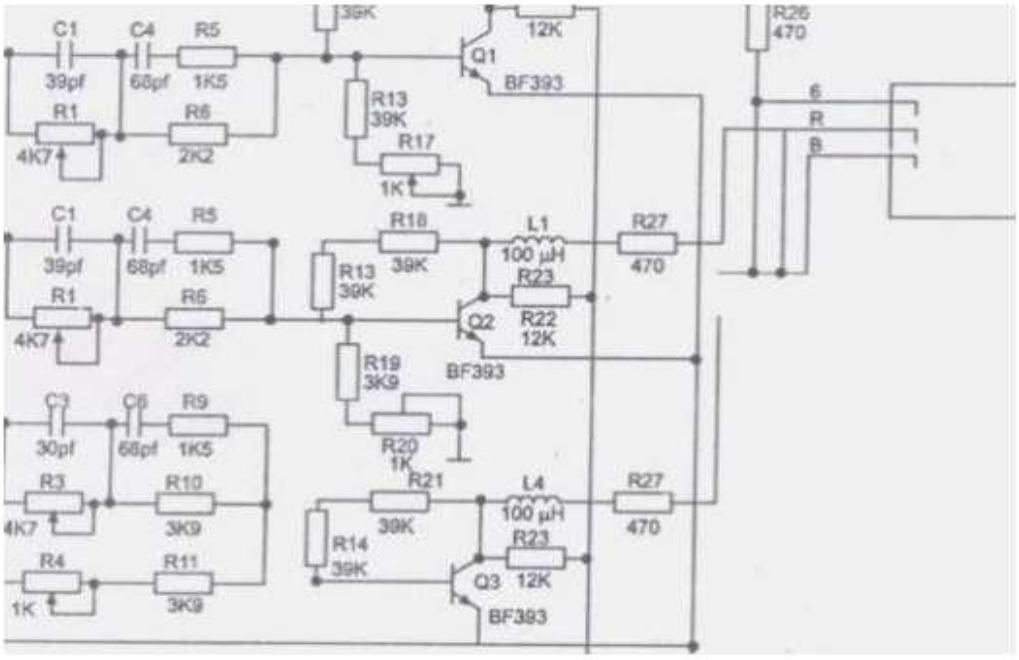
AMVSB video signal along with audio signal passes to the transmitting antenna through Diplexer Bridge which is a whetstones bridge.

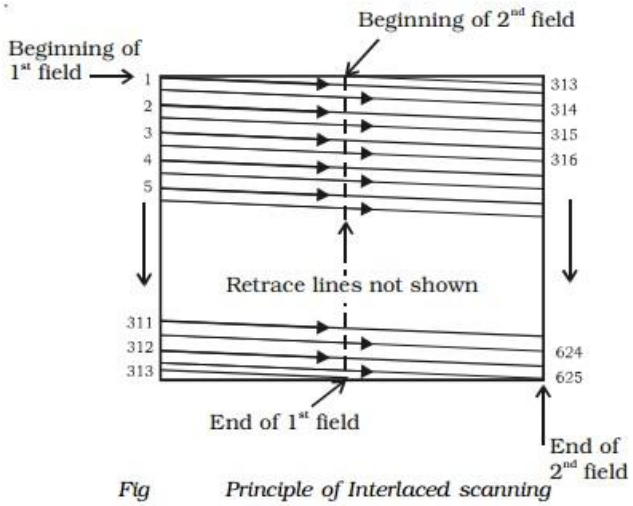
b)	**Draw and explain basic circuit for separation of 'U' and 'V' signals.**	**6M**
Ans:	**Diagram:--**	**3M**

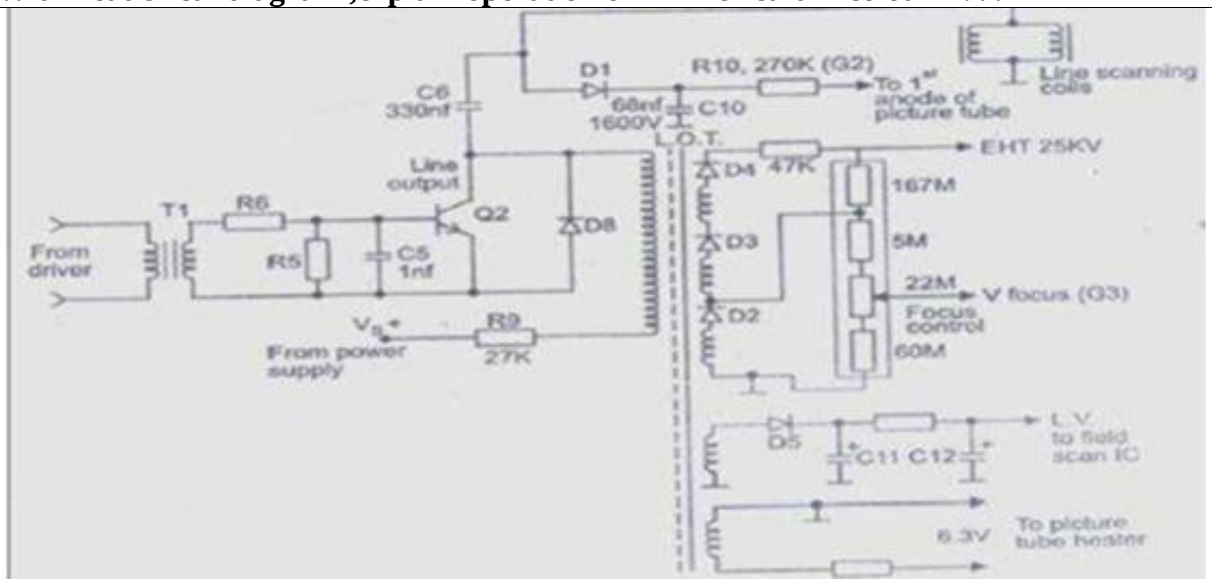


Explanation:-- **3M**

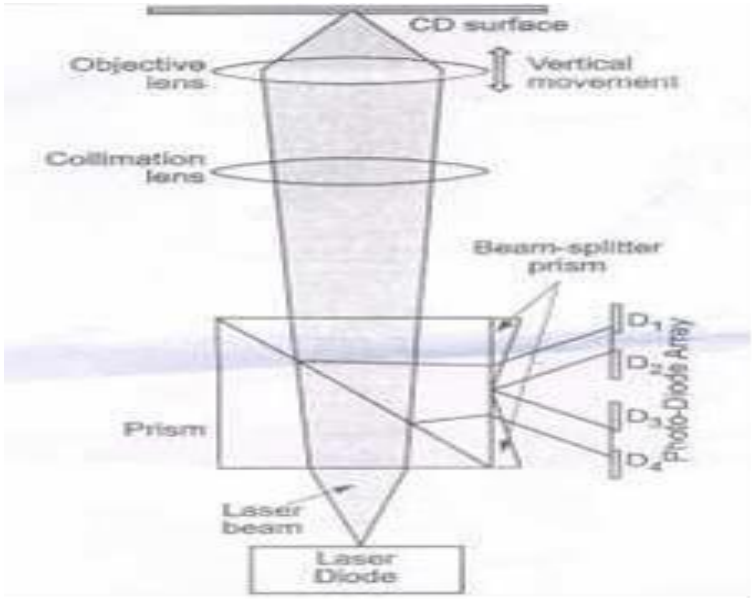
Chroma signal is applied to delay line through transformer T1. This signal after delay line appears across A winding. Direct signal is fed to center top of T2 transformer. Voltage induced into winding A and B is equal in magnitude but opposite in phase due to signal from delay line. Whereas voltage induced 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 one winding.Thus results in seperation of U and V signal.

Q.2		**Attempt any FOUR of the following:**	**16-Total Marks**
	a)	**Draw and explain the circuit diagram of RGB drive amplifier.**	**4M**
	Ans:	**Diagram:** 	**2M**
		OR 	
		Explanation:-- RGB amplifier circuit consists of three identical video amplifiers for driving the 3 cathodes of Picture tube.Tjhe inputs of amplifiers obtained from the decoded red,red green and blue Outputs of Chroma IC.Q1, Q2, Q3 arehigh frequency transistor of type BF393 or BF869. The 3amplifiers are of same design so their frequency response is nearly same. 3amplifiersare identical so only one considered to explain Q1 of green signal amplifier is connected in CE configuration. 150 V dc suooly is filtered by L2 and C9, C7 and C8 are bypass to the emmitter supply.R15 and R12 provide negative feedback to improve dc stability. L3 in the collector	**2M**

		Load used to extend bandwidth. C1 at input to amplifier is to improve step response.Thed.c. collector voltage, determines the picture tube cut-off voltage is fixed by R17. RI is varied for monochrome reproduction at high lights.	
	b)	**Describe the interlace scanning in T.V. system. State its advantages.**	**4M**
	Ans:	 *Fig Principle of Interlaced scanning*	**Diaram: 1.5 M**

	Explanation:-- • In this scanning, the total number lines are divided into two groups called fields. During the presentation of the first field, only the odd numbered lines are scanned, while during the second field all the even numbered lines are scanned. • Half way along the bottom of the first field, the vertical retrace returns the scanning beam to the top of the image and completes the unfinished lines. (i.e) The remaining even numbered lines are then scanned during second field. This method of scanning is known as 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 alternatively to cover the entire picture area. The principle of interlaced scanning is shown in Fig . **Advantage:** • The flicker is reduced to a greater extent because the picture frame is covered from top to bottom at the double rate.	**Expl 1.5 M** **Advantage: 1M**
c)	**With neat circui diagram ,explain operation of EHT circuit in colour T.V.**	**4M**
Ans:	 **Explanation:** • 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.	**Diagram 2M** **2M**
d)	**Explain function of CD-pick up assembly with neat diagram.**	**4M**

Ans: **CONTRUCTION:**



2M

Explanation:--

- A low power laser diode to illuminate the CD tracks.
- Lens and prism arrangement to direct the laser beam to the CD surface and to direct the reflected laser beam towards photo-diode array.
- A photo diode array to obtain data, focus and tracking signal from the reflected laser beam.
- Focus and tracking coils to focus the beam to the CD surface and to move the assembly to proper track across the disc surface.

2M

Optical arrangement in a single-beam radial tracking pick-up assembly:

- In the optical pick-up unit, the laser diode emits laser beam from a small point into an elliptical or conical distribution. This beam is passed through various prism and lens to form a very small diameter light beam on the disc surface at the center of the track.
- The objective lens is controlled by the tracking and focusing coil to keep the beam focused on the CD and to keep the condensed beam at the center of the track.
- This laser beam is reflected back by the flat area and the pits on the disc surface. This reflected beam is applied to a group of photo-diodes through objectives lens, collimator lens and some prism arrangement.
- These photo-diodes induce voltage according to the reflected beam falling on it. Focus error and tracking error voltage generated by this photo-diode array is applied to the tracking and focusing coil to control the objective lens and data signal generated by this photo-diode array is sent to an amplifier to amplify the data signals
- picked-up from the disc. Finally, the output from the

amplifier is processed to produce the audio signal stored on the disc surface.

	e)	**Describe the operation of Yugi-uda Antenna and draw its radiation pattern.**	**4M**
	Ans:		**1M**

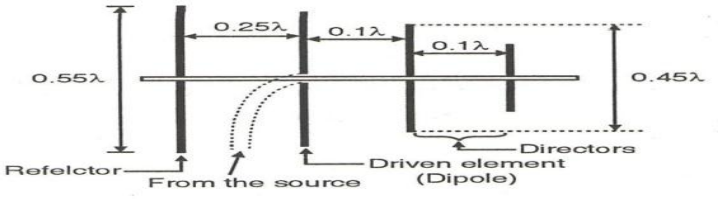
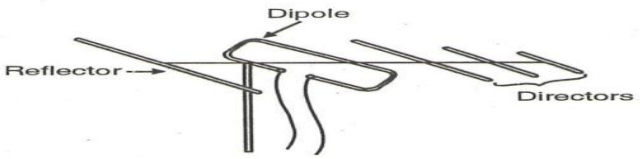


Fig. Yagi-Uda antenna



Operation:-- **2M**

It consist of driven element i.e dipole antenna, reflector and director. They are arranged Collinearly and close together.

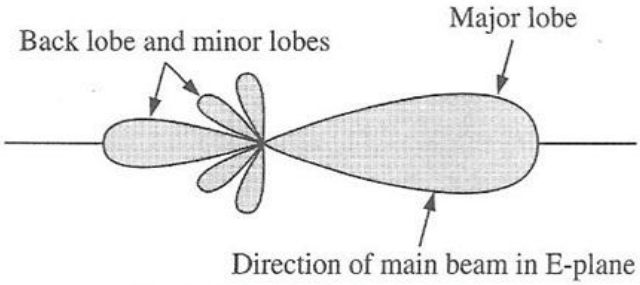
Such antennas are widely used for TV signal reception at receiver for locations within 40 to 60 KM for transmittor.

The reflector is placed the back of the folded dipole,reflector reflect unwanted signal.The director is placedin front of folded dipole which collect wanted signal.

The directors are always more than one and always face the transmitting antenna. The folded dipole with one or two directors and reflector gives high gain. It also provides high beam width per unit area of array, so some times they are called as 'Super gain antenna'. The reflector and directors are collectively called as parasitic elements.

The separation between the reflector, folded dipole and directors is minimum 0.1λ ifthis distance is reducedthan 0.1λ, then the input impedence of the array get decreased. The radiation patteren can be improved by increasing front to back ratio. This can be obtained by bringing radiators closer i.e. array element closer. The signal feed point is at folded dipole. The parasitic Element are not connected anywhere elecricaly.

Radition Pattern:-- **1M**



Yagi Antenna Radiation Pattern

	f)	**Explain Dolby NR-recording system in brief.**	**4M**
	Ans:	**Diagram:**	**2M**

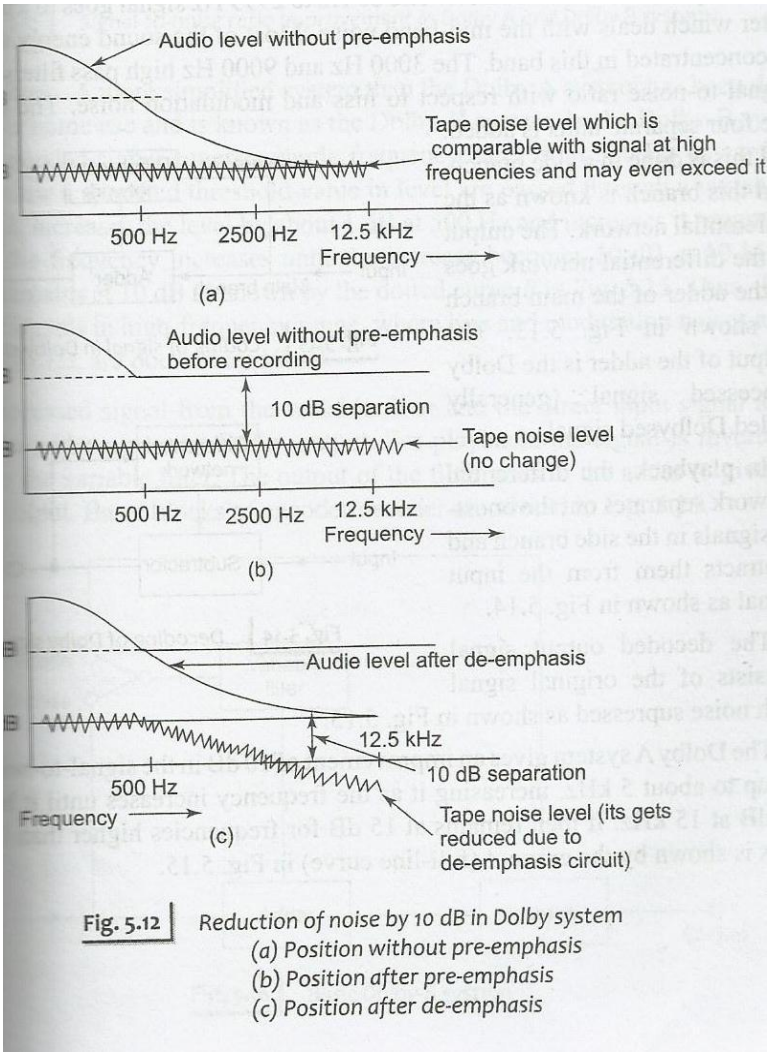


Fig. 5.12 *Reduction of noise by 10 dB in Dolby system*
(a) Position without pre-emphasis
(b) Position after pre-emphasis
(c) Position after de-emphasis

Explanation:

- When the strength of signal falls below a pre determine level (40 db over noise level), the circuits boost the strength before recording. All signals which are 40 db or higher pass through the dobly system directly without any change.
- The lower level signals pass through the boosing stages which boost these signals by 10-15 db. Boosting is done before recoding. A signal in the absence of boosting as shown in fig. (a). After boosting, the recording noise remains unchanged but the signal is boosted as shown in fig. b
- During play back, signal and noise both are reduced as shown in fig. c indicates that signal to noise ratio is finally improved.

2M

Q.3		**Attempt any FOUR of the following:**	**16-Total**

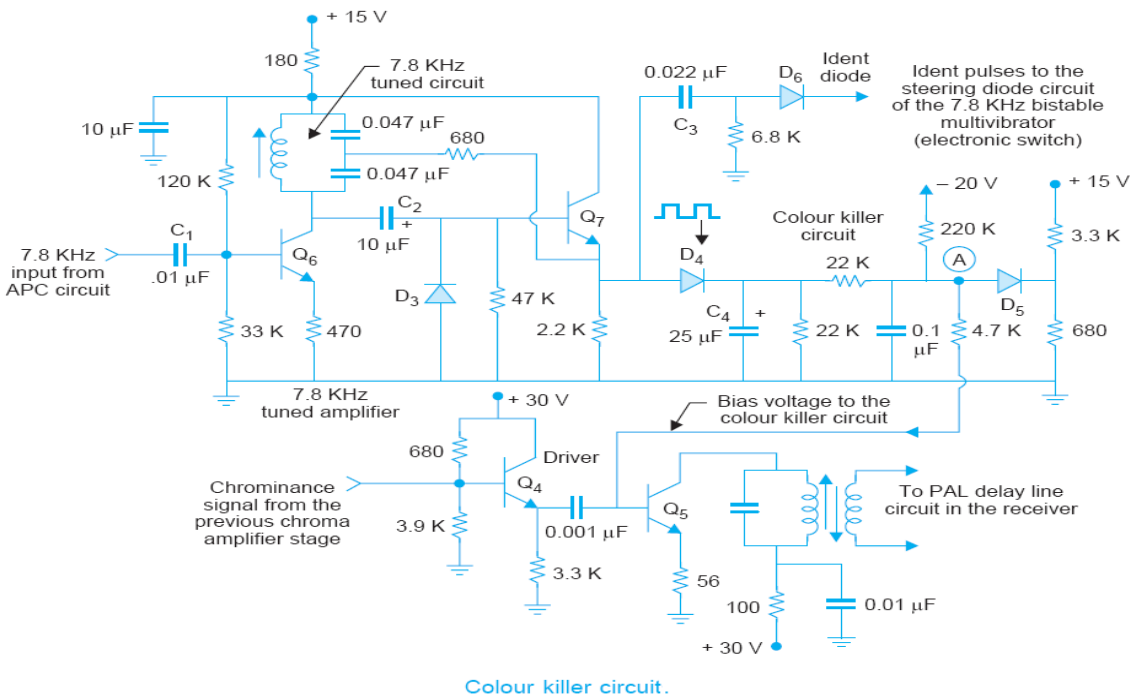
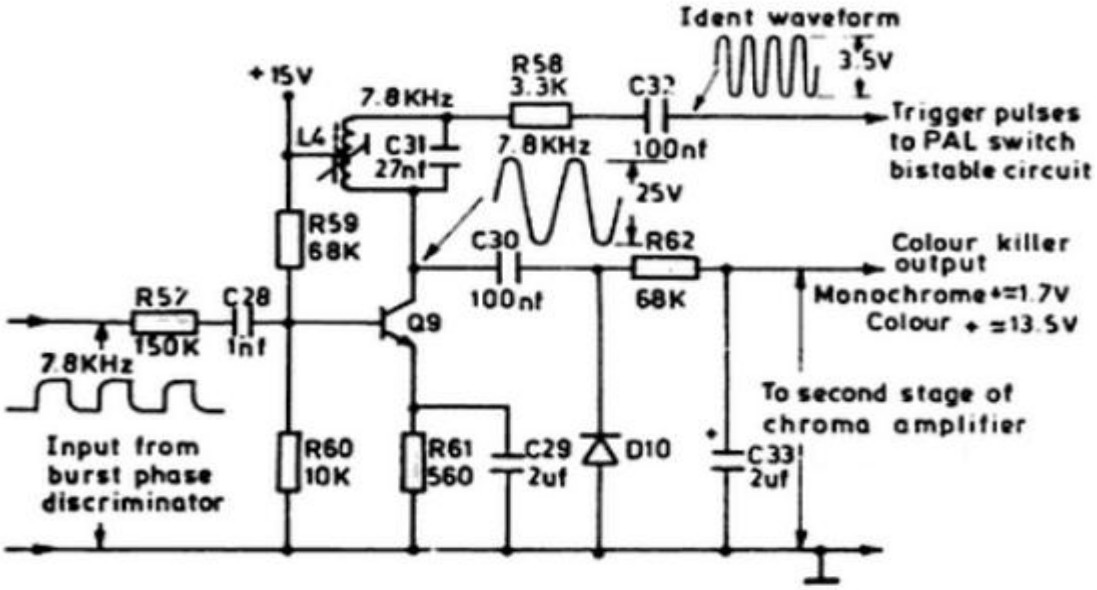
			Marks
	a)	**Explain the need of multiplexer and attenuator in cable T.V.**	**4M**
	Ans:	**Need of attenuator**: 1. To equalize the signal 2. To mix the signal at different proportion 3. Reduces distance by specific value which is expressed in dB **Need of Multiplexer:** • In electronics, a multiplexer (or mux) is a device that selects one of several analog or digital input signals and forwards the selected input into a single line. • A multiplexer of 2n inputs has n select lines, which are used to select which input line to send to the output. Multiplexers are mainly used to increase the amount of data that can be sent over the network within a certain amount of time and bandwidth. A multiplexer is also called a data selector. Need of multiplexer: • In cable distribution center many channel signals are separated, modulated and frequency is allotted to each channel. • Now to distribute this channel to users many channel signals must put into one single cable. So multiplexer gives one output from many signals.	**2M** **2M**
	b)	**Write short note on colour killer ckt.**	**4M**
	Ans:	**Diagram:--**  Colour killer circuit.	**2M**

Figure: Colour Killer circuit

OR



Burst phase IDENT amplifier and colour-killer generation circuit.

Figure: Burst Phase IDENT amplifier & colour Killer generation circuit

Explanation:--

- The colour killer circuit is shown in Fig. The forward bias of Q5, the last stage of band pass 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.
- The dc operating voltage to Q9 is supplied via center tap on L4. Such a connection causes L4 to function as a tuned transformer & enables a waveform of about 25V peak-to-peak to be developed at the collector of Q9.

2M

- This is fed via C30 to diode D10 which functions as a HWR. The components R62 & c33 form a LPF which provides a steady dc level of about 13.5V as the output. This is the colour killer voltage which is used to control conduction of the second stage of Chroma signal amplifier.
- When a black and white picture is being received, there is no output from the burst discriminator & hence, no input to burst phase ident amplifier.
- Under this condition the colour killer output fails to less than 2V which is not enough to forward bias transistor of the Chroma amplifier. Thus the second Chroma amplifier stage is inhibited.
- This prevents application of any signal to the Chroma delay line & to the U & V demodulators. Thus any stray coloring signals are prevented from reaching RGB amplifier & hence, no colour noise appears on the black & white picture during monochrome receptions.

c)	**Draw and describe the operation of Graphic Equalizer.**	**4M**
Ans:	**Explanation:--**	**2M**

- A graphic equalizer is a high-fidelity audio control that allows the user to see
- graphically and control individually a number of different frequency bands in a stereophonic system. A typical graphic equalizer consists of several audio filter/amplifiers, each centered at a specific frequency in the audio range.
- Most graphic equalizers have two identical sets of filter/amplifiers, one for each channel in a stereophonic system.
- The gain (volume) controls in most graphic equalizers are slide potentiometers that are adjusted by moving a control button up or down. Gain is increased by sliding the button upwards.
- The slide potentiometers for each channel are placed side-by-side, with the lowest-frequency unit at the left and the highest-frequency unit at the right. In this way, the positions of the buttons appear to follow a graphical curve that represents the gain as a function of frequency for each channel.

2M

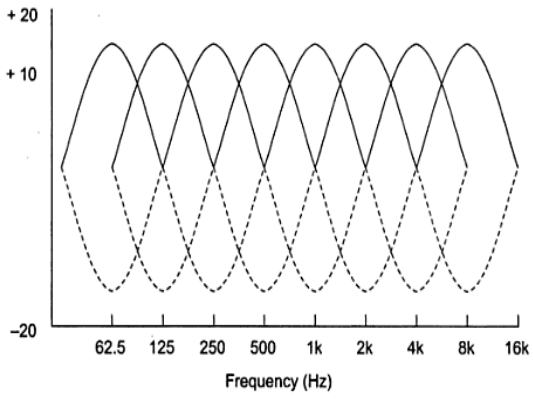


Fig. *Boost/cut for bands at frequencies centered one octave wide*

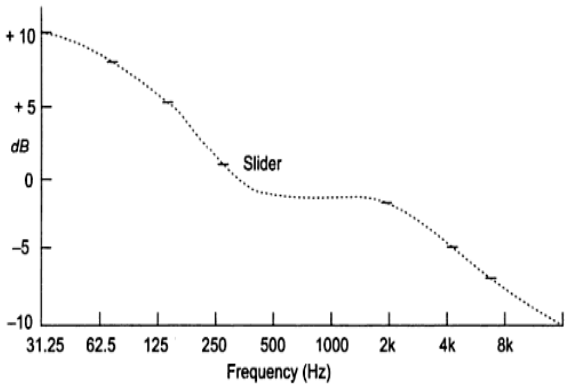


Fig. *Position of sliders of graphic equaliser to get a specified response curve (dotted line)*

Figure: Graphical Equalizer

OR

- Five point configuration, the graphic equalizer breaks up an audio input signal into five

different bands covering the range of human hearing. Once this is completed, the signal in each band can be adjusted to provide best sound. The center frequencies f1, f2, f3, f4 and f5 of the frequency bands of the graphic equalizer are usually fixed at pre-set values. Once these bands are added back together, they are passed through an amplifier which increases the amplitude of the signal to the point where there is enough power that can be heard through an ordinary speaker.

- The circuit diagram of graphic equalizer is shown in figure. The graphic equalizer consists of an amplifier for every segment of octave band. Such amplifiers are connected in parallel to cover the complete frequency range.
- The individual gains of these amplifiers are adjusted such that the required frequency response is obtained. Using five amplifiers for five octaves of frequency may be very expensive. Hence amplifier shown in figure is normally used.
- The figure shows, there is only one amplifier with multiple feedback paths. There are gain controls and LC tuned circuits in every feedback path. Thus the gain of every octave band is separately adjusted by the corresponding feedback path gain.

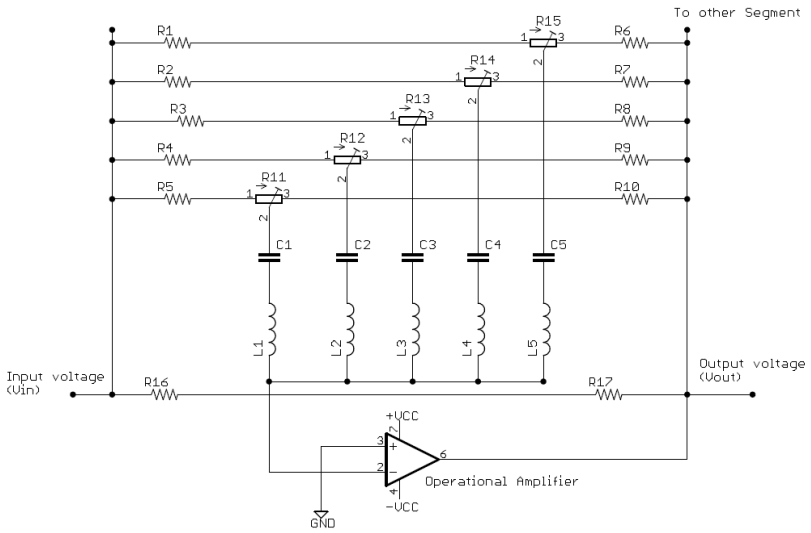


Figure: 5 channel equalizer

- The center frequency of the octave band is selected by inductors L1, L2, L3, L4 and L5. The gains of individual octave bands are adjusted by potentiometer controls in the feedback path.
- The combination of individual control setting for various octaves will provide the required frequency response. The peaks at individual octave bands overlap each other. Hence, phasing distortion needs to be avoided. This distortion occurs due to interaction between the overlapping peaks. The slider controls of each octave band can boost or cut the signals from +15 dB to – 15 dB.

	d)	**Explain function of CD player with neat block diagram.**	**4M**

Ans:

Explanation:--

2M

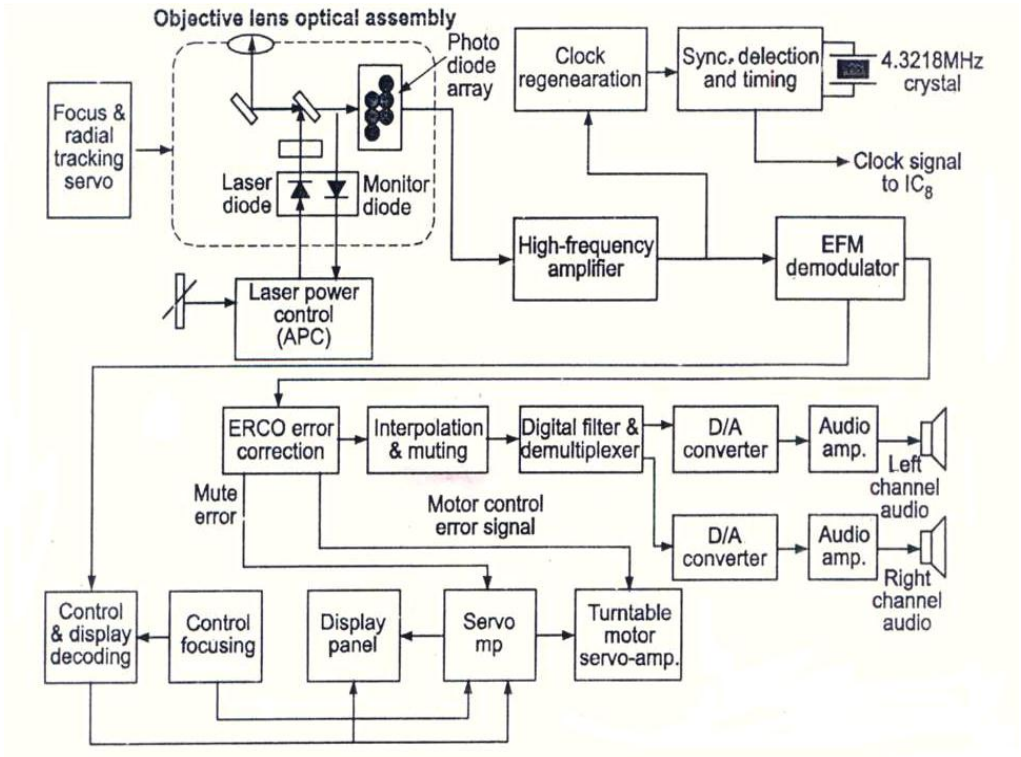
CLV: The CD player is also known as CLV or constant linear velocity system . In a CLV device such as the CD player the rotational speed of disc player is adjusted with movement of reading mechanism on the disc surface . This speed is changed to maintain constant linear velocity i.e. the signal on the 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 that signals are 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 ,photodetectors and laser diodes assembly in the optical pickup 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 modulation)format , this signal is sent to an EFM demodulator circuit.

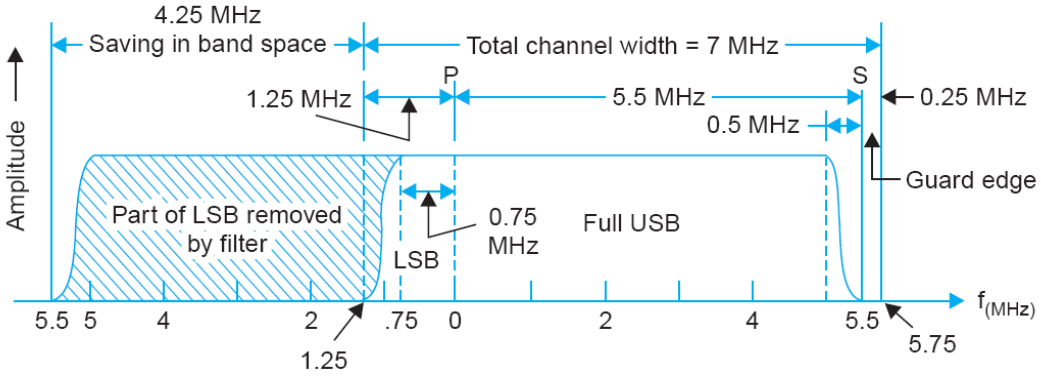


2M Diagram

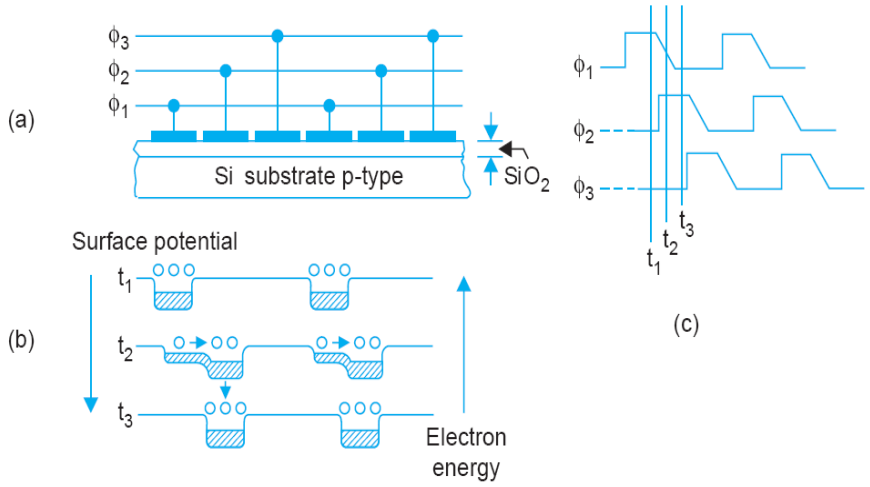
Figure: Block diagram of CD player

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 converts

		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 signals which are further multiplexed into signals received from CD. The ERCO circuit mainly used for the error correction & detection. The ERCO circuit will communicate with servo microprocessor to reduce the error generated during CD scanning. **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. **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. **Digital Filter and De-multiplexer:**The de-interleaved and regenerated is then send to digital filter and de-multiplexer , where it is filtered and separated in to left and right channel data. This circuit removes any effect of sampling frequency from the data signal , which would appear as interference in the form of aliasing noise in analog signal. **Oversampling:**During digital filtering oversampling method is used to remove both problems of aliasing noise and quantization error . **D/A convertor:**The output from digital filter and de-multiplexer circuit is send to D/A convertors. The right and left channels are processed by different D/A convertors . These convertors convert the 16-bit digital signal into the original analog audio signal. Because of the over sampling , done in the digital filter and de-multiplexer circuit simple low-pass filter is used . Following the D/A process. **Stereo Amplifier:**The analog output from converter is passed through a sample & hold circuit & a LPF circuit to obtain a smooth noise free output at the speakers. These signals are next fed to a stereo audio amplifier to raise left & right audio channel signal.	
	e)	**Explain VSB transmission with neat sketch.**	**4M**
	Ans:	• In the video signal very low frequency modulating components exist along with the rest of the signal. These components give rise to sidebands very close to the carrier frequency which are difficult to remove by physically realizable filters. • Thus it is not possible to go to the extreme and fully suppress one complete sideband in	**2M Explanation**

		the case of television signals. The low video frequencies contain the most important information of the picture and any effort to completely suppress the lower sideband would result in objectionable phase distortion at these frequencies.  Total channel bandwidth using vestigial lower sideband. **Figure: VSB** This distortion will be seen by the eye as 'smear'(spreaded) in the reproduced picture. Therefore, as a compromise, only a part of the lower sideband is suppressed, and the radiated signal then consists of a full upper sideband together with the carrier, and the vestige (remaining part) of the partially suppressed lower sideband. This pattern of transmission of the modulated signal is known as vestigial sideband or A5C transmission. In the 625 line system, frequencies up to 0.75 MHz in the lower sideband are fully radiated.	**2M Diagram**
Q.4	**(A)**	**Attempt any THREE of the following :**	**12-Total Marks**
	a)	**Explain the following term with respect to colour signal:** **(i) Hue** **(ii) Saturation** **(iii) Luminance** **(iv) Brightness**	**4M**
	Ans:	Contrast: This is the difference in intensity between black and white parts of the picture over and above the brightness level. 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. 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. Luminance or Brightness: This is the amount of light intensity as perceived by the eye regardless of the colour. In black and white pictures, better lighted parts have more luminance than the dark areas. Viewing distance: • The viewing distance from the screen of the TV receiver should not be so large that the	**1M Each**

		eye cannot resolve details of the picture. The distance should also not be so small that picture elements become separately visible. The above conditions are met when the vertical picture size subtends an angle of approximately 15° at the eye. • The distance also depends on habit, varies from person to person, and lies between 3 to 8 times the picture heights. • Most people prefer a distance close to five times the picture height**.**	
	b)	**Describe solid state camera based on CCD.**	**4M**
	Ans:	• 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.	**2M Explanation 2M Diagram**



A three phase n-channel MOS charge coupled device. (a) construction (b) transfer of electrons between potential wells (c) different phases of clocking voltage waveform.

Figure: Constructional details of CCD.

- The constructional details and the manner in which storing and transferring of charge occurs is illustrated in Fig. above. The chip consists of a p-type substrate, the one side of which is oxidized to form a film of silicon dioxide, which is an insulator.
- Then by photolithographic processes, similar to those used in miniature integrated circuits an array of metal electrodes, known as gates, is deposited on the insulator film. This results in the creation of a very large number of tiny MOS capacitors on the entire surface of the chip.
- The application of small positive potentials to the gate electrodes results in the development of depletion regions just below them. These are called potential wells.
- The depth of each well (depletion region) varies with the magnitude of the applied potential. As shown in Fig. (a), the gate electrodes operate in groups of three, with every third electrode connected to a common conductor. The spots under them serve as light sensitive elements.
- When an image is focused onto the silicon chip, electrons are generated within it, but very close to the surface. The number of electrons depends on the intensity of incident

light. Once produced they collect in the nearby potential wells. As a result the pattern of collected charges represents the optical image.

c) Describe the function of different motors used in CD player. **4M**

Ans: **1M Listing Names of motors 3M Function**

- The drive motors in CD players are used for various purposes such as for loading and unloading CD from tray, for rotating CD, for rotating laser beam etc. The motor circuit consists of transistor or IC components within the drive components are controlled by a PLL and servo processor.

Different types of motors used in CD players are:

- Tray loading or carriage motor,
- Slide sled feed motor and
- Spindle, disc, turn table motor.

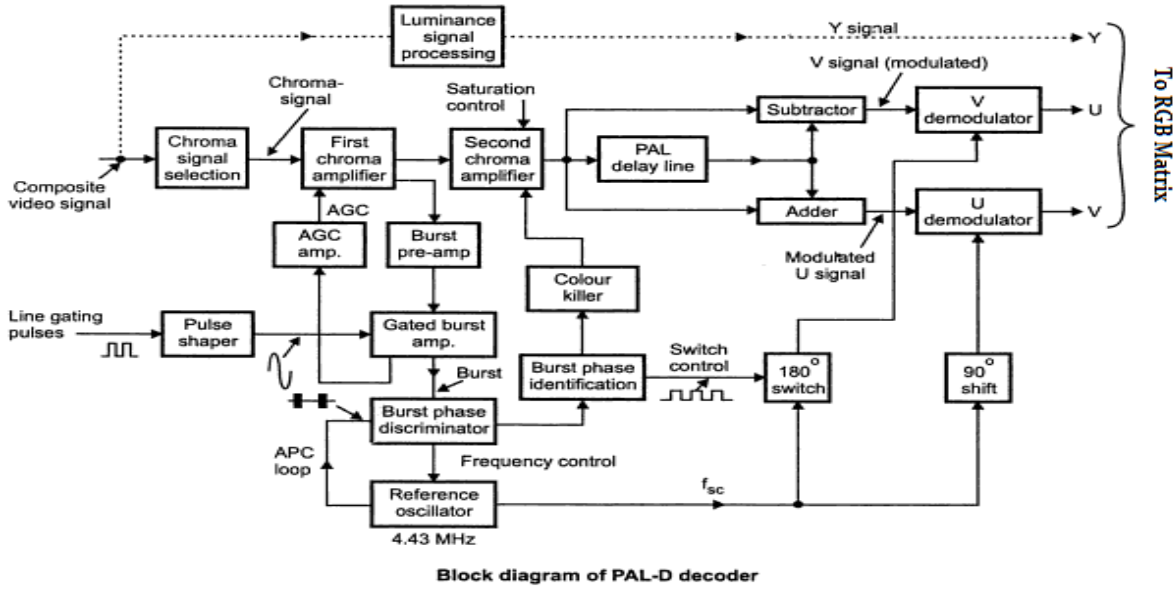
- There are three basic motors used in the CD player.CD players with auto CD changer or the table top changer may have up to five different motors or some portable or combination CD and cassette player may have only two motors but three motors used In CD players are most common.
- The **tray or loading motor** moves the CD tray in and out for loading and unloading the CD when the open/close switch is pressed.
- A **disc, spindle or turntable motor** rotates the CD at a variable speed. The disc motor rotates faster at the beginning and slows down as the laser assembly moves toward the outer edge of the CD.

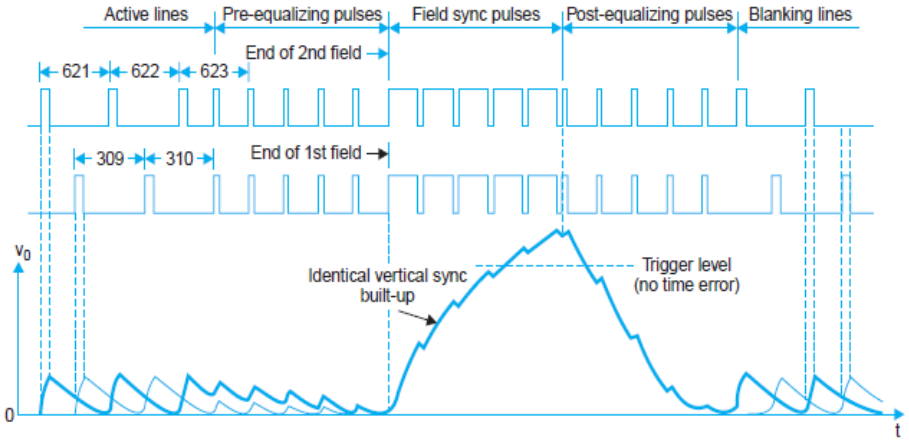
The **slide, feed or sled motor** moves the optical pickup unit from the center to the outer edge of the disc on sliding rods. Some players have a pick-up motor that travels in a radial or semicircle fashion.

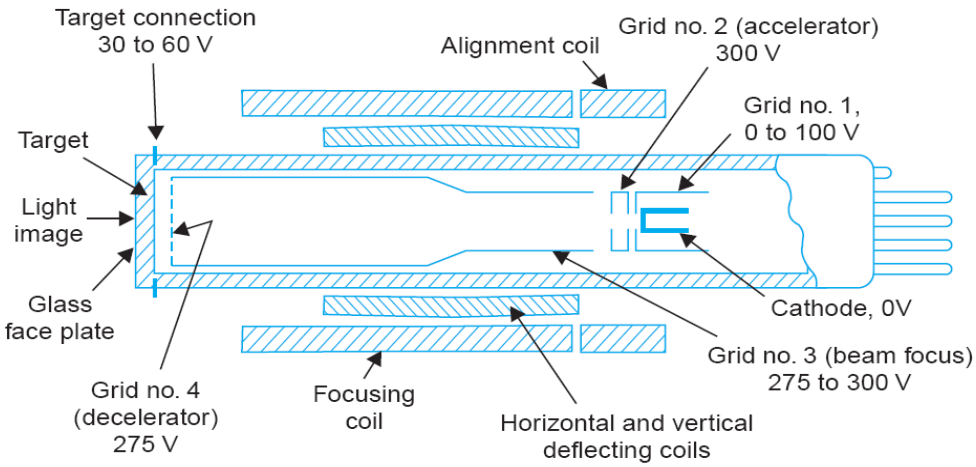
d) Compare CATV and CCTV(4pts) **4M**

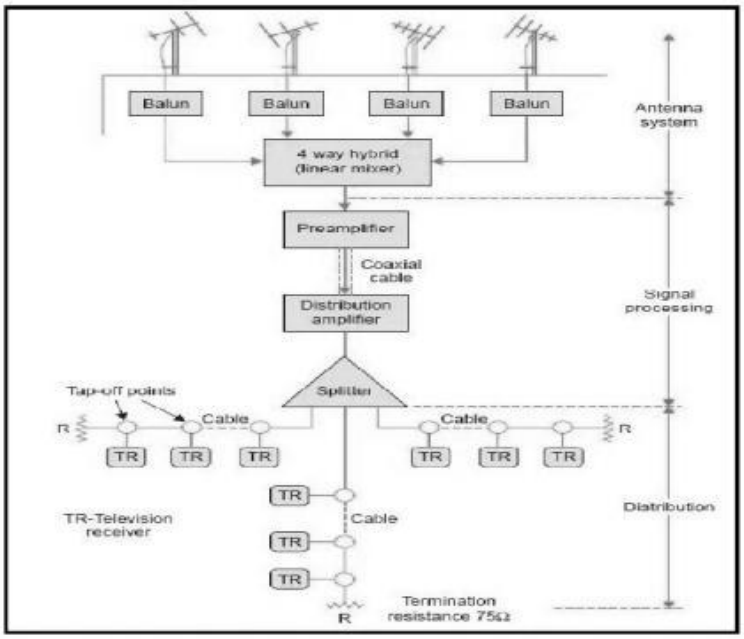
1M Each Point

Cable Television (CATV)	**Closed Circuit Television(CCTV)**
The CATV monitor has RF, IF as well as detector stages.	CCTV monitors 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 services can be provided	Internet service cannot be provided.
CATV service provider can broadcast live programs from studios, some events etc. on their local TV channels	Such facilities are not available
Various channels such as scientific, geographic, sports news, entertainment etc. are provided by CATV.	Such channels are not provided in CCTV.
CATV system is huge system covering not only a small community but also large areas	CCTV can cover only small area where it is installed for example a

		rather a whole city.	hospital, college etc.	
		Camera range of CATV is more with higher resolution.	CCTV camera range is limited to only some distance with less resolution.	
		Applications: CATV‟s are used in homes, malls, shops for entertainment and value added services and in corporate and business environment for internet services.	**Applications:** 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-Total Marks**
	a)	**Explain the operation of PAL-D decoder with its block diagram.**		**6M**
	Ans:	 **Block diagram of PAL-D decoder** **Figure: Block Diagram of PAL D decoder** **Chroma signal selection:** Its function is to select Chroma and colour burst signal from the incoming CCVS signal. It essentially consist of band pass circuit whose center frequency is chosen to be equal to that of Chroma sub-carrier itself i.e.4.43MHz. **1st Chroma amplifier*:*** The Chroma and burst signals are amplified by first Chroma amplifier which is controlled by DC voltage developed by the Automatic Chroma Control (ACC) amplifier. **2nd Chroma amplifier*:*** The second Chroma amplifier incorporates colour saturation control circuit. The output of colour killer also feeds into it. **PAL delay line (separation of U and V colour phasors):** This network separated U and V signals with are then fed to respective demodulator. **Gated burst amplifier:**	**3M Diagram** **3M Explanation**

		The gated burst amplifier separates the burst pulses and amplifies them a level suitable to operate the burst phase discriminator. **Automatic Chroma Control (ACC):** The magnitude of the voltage so fed back is proportional to the magnitude of the burst and therefore to the amplitude of Chroma signal itself. This voltage is used to control the first stage of Chroma amplifier in such way to ensure constant Chroma signal amplitude. **Burst phase discriminator:** It is sensitive to burst pulses and is designed to detect any differences which might exist between the phase of burst pulse and that of the reference oscillator. It produces at its output a dc voltage whose magnitude and polarity are proportional to the magnitude and direction of the detected phase difference. **Burst phase identifier:** This circuit is able to identify the phase relationship of the colour burst. **180º switch:** This switch is used to periodically invert the waveform fed to the v-signal demodulator. **Colour killer control:** This is just a half wave rectifier which produces a steady dc potential from the succession of burst pulses. During black and white transmission the dc potential is absent and hence biases the 2nd Chroma amplifier to cut off state.	
b)		**Explain pre and post equalizing pulses with their need.**	**6M**
Ans:		**Note: Diagram is not mandatory, however any other relevant diagram can be considered.** **Explanation:--** • 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.  Fig. 3.9 Identical vertical sync voltage built-up across the integrating capacitor. **Figure: Pre & Post equalizing pulses.**	**4M**

		• The effect of these pulses is to shift the half-line discrepancy away both from the beginning and end of vertical sync pulses. • Pre-equalizing pulses being of 2.3 μs duration result in the **discharge of the capacitor** to **essentially zero** voltage in both the fields, despite the half-line discrepancy before the voltage buildup starts with the arrival of vertical sync pulses. **Need:** Post-equalizing pulses are necessary for a fast discharge of the capacitor to ensure triggering of the vertical oscillator at proper time. If the decay of voltage across the capacitor is slow as would happen in the absence of post-equalizing pulses, the oscillator may trigger at the trailing edge which may be far-away from the leading edge and this could lead to an error in triggering.	**2M**
	Q.5	**Attempt any TWO of the following**	**16 Total Marks**
	(a)	**Describe the working of vidicon Camera tube with neat sketch. State its Application.**	**8M**
	Ans:	 Vidicon camera tube cross-section. **Working :--** • The input light from scene passes through a lens system and is incident on the face plate made of optically flat glass. • The light from the face plate falls on a target plate which has two layers. Facing face plate is a thin coating of tin oxide which is transparent to light and is a good conductor of electricity. This layer is called signal plate. • The back from target plate (facing the electron gun) is coated with antimony trisulphide, a semiconductor. • The target plate is scanned by a focused electron beam produced by an electron gin consisting of indirectly heated cathode. • A control grid (G-1) • An accelerator grid (G-2) (300V)	**3M** **3M**

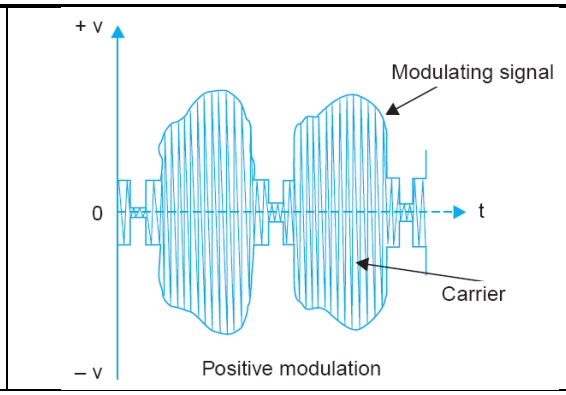
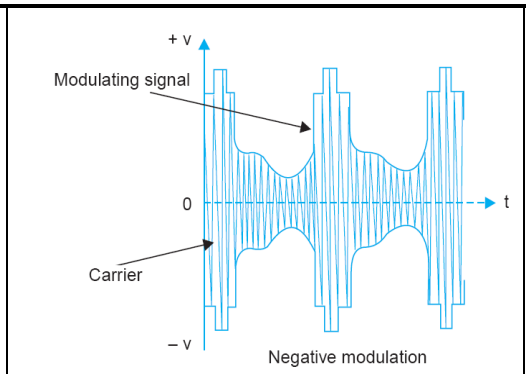
		• Focus grid(G-3) (260V) • Grid (G-4) (400V) • Deflection coils deflects the electron beam horizontally and vertically. • Focus coil sharpens beam **Application[minimum two application]** 1) TV Camera 2) Used in high-radiation environments such as nuclear reactors. 3) Storage-type camera tube 4) used by NASA for UV duties	**2applicat ion(1 EACH)**
	(b)	**Draw the block diagram of MATV and explain function of each block.**	**8M**
	Ans:	 **Figure: Block diagram of MATV** **Explanation:--** The block diagram of a basic MATV system is shown in Fig. One or more antennas are usually located on roof top, the number depending on an available telecasts and their direction. 1. Each antenna is properly oriented so that all stations are received simultaneously. In order to allow a convenient match between the coaxial transmission line and components that make up the system, MATV systems are designed to have a 75 Ω impedance. Since most antennas have a 300 Ω impedance, a BALUN is used to convert the impedance to 75 ohms. **2.** As shown in the figure, antenna outputs feed into a 4-way hybrid. A hybrid is basically a signal combining linear mixer which provides suitable impedance matches to prevent development of standing waves. **3.** The standing waves, if present, result in ghosts appearing in an otherwise good TV picture. The output from the hybrid feeds into a distribution amplifier via a preamplifier. **4**. The function of these amplifiers is to raise the signal amplitude to a level which is sufficient to overcome the losses of the distribution system while providing an acceptable signal to every	**4M** **4M**

receiver in the system.
5. The output from the distribution amplifier is fed to splitters through coaxial lines.

(c) **Compare positive and negative modulation and list merits and demerits of negative modulation.** **8M**

Ans: **Comparison(any 4 points) 1 M Each**
Merits(any 2 points) 2M
Demerits (any 2 points) 2M

	Positive Modulation		Negative Modulation
1.	When increase in brightness of that picture results in an increase of the amplitude of modulated envelope.it is called positive modulation.	1.	When increase in brightness reduce amplitude of the modulated envelope, it is called negative modulation.
2.	White level of video signal corresponds to 100% total magnitude.	2.	White level of video signal correspondence to 12.5% of the tota amplitude.
4.	Noise pulses do not affect synchronization but cause white spot in the picture	4.	Noise pulses are seen as less annoying black spot.
5.	More power is required with less efficiency	5.	If peak power available from transmitter is considered them less power is required for more efficiency.
6.	Black level of video signal correspondence to 25% of total magnitude.	6.	Blanking level starts at 75%

		7. 	7. 	

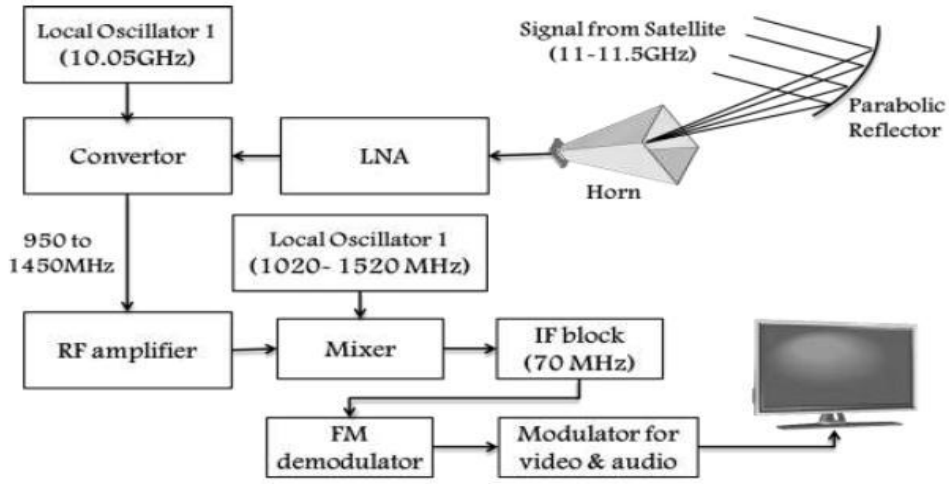
Merits of Negative Modulation:

- 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.

Q.6		**Attempt any FOUR of the following:**	**16Total Marks**
	(a)	**Describe Horizontal and Vertical resolution in T.V.**	**4M**
	Ans:	The scanning and reproduction of finest details of the picture is known as the resolution of a system. **Vertical resolution:** The ability of a scanning system to resolve vertical details in a scene depends upon the number of horizontal scanning lines used per frame. The maximum number of dark and white elements which can be resolved by human ye in vertical direction in a screen of height H is decided by number of horizontal lines into which the picture is split while scanning. **The vertical resolution = 0.7*585 = 409.5 lines**	**[2M Horizontal Resolution and 2M Vertical Resolution]**

		Horizontal resolution: It is the ability of scanning system to resolve horizontal details i.e. changes in brightness levels of elements along a horizontal scanning line.	
	(b)	**AM is preferred for picture and FM for sound signal transmission. Justify.**	**4M**
	Ans:	**<u>AM is preferred for picture because the following reasons,</u>** • 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. • 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. • In addition to this, circuit complexity and bandwidth requirements are much less in AM than FM. **<u>FM is preferred for sound because the following reasons,</u>** • The bandwidth assigned to the FM sound signal is about 200 kHz of which not more than 100 kHz is occupied by sidebands of significant amplitude. • The latter figure is only 1.4 per cent of the total channel bandwidth of 7 MHz. Thus, without encroaching much, in a relative sense, on the available band space for television transmission all the advantages of FM can be availed.	**2M** **2M**
	(c)	**Draw the block diagram of DTH system and explain its operation.**	**4M**
	Ans:	**Diagram:--**  **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	**2M** **2M**

		satellites. **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 convertor. The output of convertor 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:** • It consist of converter RF amplifier, mixer, IF modulator, modulator for audio and video • 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)	**Explain different controls available on Hi-Fi amplifier.**	**4M**
	Ans:	• **Balance control** • **Master Gain Control** • **Blend Control** • **Quasi Stereo Switch** • **Loudness control** • **Bass and treble control** **Balance Control:** • Two amplifiers of a stereo system, although independent of each other, are built as matched pair to give equal output for the same input. In spite of the two amplifiers being identical, there may be variations in the output of each channel due to variations in the characteristics of transistors & ICs and positioning of loudspeaker & furnishing with respect to the listener. The circuit used is called *BALANCE CONTROL*. • A simple circuit is shown in fig. The balance control is a potentiometer. When it is set in the center, the current through LED1 & LED2 should be identical, if the signals in the left & right channels are equal. In that case both LED will be equally bright.	**Each control 1 M**

		• In case of any inequality, the two brightness level will also become unequal. When balance control is moved down, the output of the left channel will increase while that of right one will decrease, and vice-versa when moved up. **Master Gain Control:** • A master gain control is used for adjusting overall volume without disturbing the balance. This is achieved by using dual concentric shafts, the inner shaft adjusts the balance control & the outer shaft, the overall gain or volume of the amplifier. • A typical master gain control circuit is shown above. R1 is adjusted for balancing two channels & then R2 & R3 are adjusted for increasing or decreasing the volume of the channels. R2 & R3 are ganged. **Blend Control:** • The stereo effect is diluted by this control when there is too much left-right effect. Diluting is done by misbalancing the two channels. • It is shown in fig. above; blend control potentiometer is set at zero resistance for balanced output. For disturbing the balance, this is advanced further to reduce gain of the left channel. • Although blending can be done by balance control also, but once set, the balance control is not disturbed. **Quasi Stereo Switch:** • When any one channel signal is made to go into both the channels, one can use both channels & their speakers for monophonic source of signal. This is done by a switch called quasi-stereo switch. **Bass & Treble Control:** • It is provided to tailor bass & treble as per personal taste of listener. **Loudness Control:** • Sometimes music is at low level of volume. At low levels there is considerable loss in bass in reproduction. It is, therefore necessary that there should be substantial boosting of bass at low levels. Boosting at treble may be only nominal because loss at high notes is quite small. The control which provides desired boosting at bass & at treble is called LOUDNESS CONTROL. • It boost audio by +12dB at 50Hz & +3dB at 10 KHz. The loudness control should be used only when sound level is low.	
	(e)	**State and explain Grassman's law**	**4M**
	Ans:	**Statement** : Eye perceives new colcours depending on the algebraic sum of red , green and blue light fluxes. This forms the basis of coolour signal generation and is known as Grassman's Law. **Explanation** : As stated earlier , the eye is not able to distinguish each of the colours that mix a form a new colour but instead perceives only the resultant colour. However , for the TV system it is necessary to know the quantum of each colour that on combination with colours	**2M** **2M**

		creates the additive effcct of a new colour . Based on the sensitivity of human eye to various colours , reference whit for CTV has been chosen to be mixture of colour light fluxes in the following ratio : 100% white = 30%red +59%green+11%blue Similary , yellow can be produced by mixing 30% of red and 59% of green , magenata by mixing 30% of red and 11% of blue and cyan by adding 59%of green to 11% of blue. Based on this it is also possible to produce white light by mixing 89% of yellow and 11% of blue or 70% of cyan and 30% of red. Thus the eye perceives new colours depending on the algebraic sum of red , green and blue light fluxes. This forms the basis of colour signal generation and is known as Grassman's Law.	