Important Instructions to examiners:

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

Q.1

(A) Attempt any SIX of the following: **12M**

(a) Define transmission bandwidth and give its formula.

Ans:

Definition: **1M**

Transmission Bandwidth is the difference between the upper frequency limit & lower frequency limit of the signal.

OR

It is a frequency range over which information signal is transmitted.

Formula for transmission bandwidth is: **1M**

BW= upper frequency limit- lower frequency limit of the signal.

(b) Define deviation ratio and state its formula for frequency modulation.

Ans:

Definition: **1M**

Deviation ratio is the modulation index corresponding to maximum deviation & maximum modulating frequency.

Formula for deviation ratio in frequency modulation is given by, **1M**

$$\text{Deviation Ratio} = \frac{\text{Maximum Deviation}}{\text{Maximum Modulating Frequency}}$$

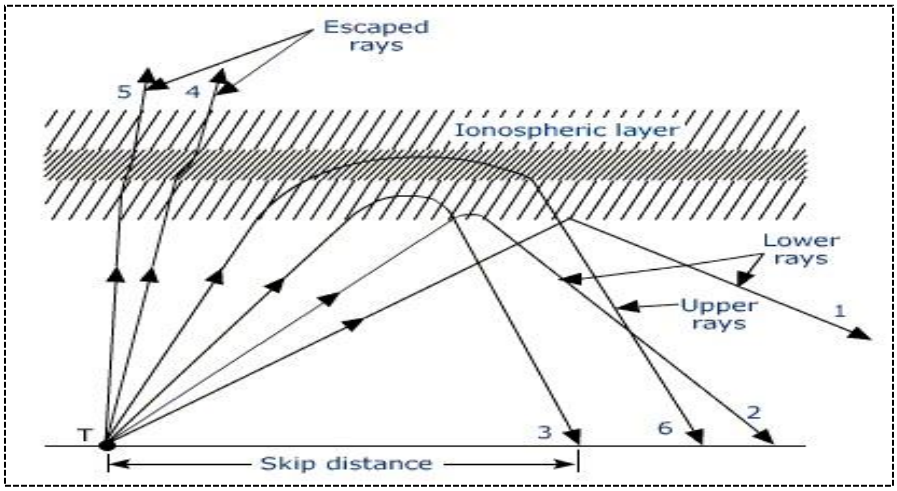
(c) Define skip distance and maximum usable frequency with suitable Sketch.

Ans:

Skip Distance: **½ M**

The skip distance is the shortest distance from a transmitter, measured along the surface of the Earth, at which a sky wave of fixed frequency (more than f_c) will be returned to Earth.

Sketch: **½ M**



Maximum usable frequency: **1M**

Maximum usable frequency (MUF) is the highest radio frequency that can be used for transmission between two points via reflection from the ionosphere.

(d) Define beam width and directivity for antenna.

Ans:

Directivity for Antenna: **1M**

Directivity is the ability of an antenna to focus energy in a particular direction when transmitting, or to receive energy better from a particular direction when receiving.

Beam width for antenna: **1M**

Antenna Beam width is the angle between the half-power of an antenna pattern or beam over which the relative power is at or above 50% of the peak power. Antenna beam width is also known as the half-power.

(e) Define selectivity and sensitivity for AM radio receiver.

Ans:

Selectivity: **1M**

Selectivity of AM radio receiver is its ability to reject unwanted signals. The Selectivity decides adjacent channel rejection of receiver.

Sensitivity: **1M**

Sensitivity of AM radio receiver is defined as its ability to amplify weak Signals.

(f) What do you mean by aspect ratio?

Ans:

Aspect ratio: **2M**

The aspect ratio of an image describes the proportional relationship between its width and its height. It is commonly expressed as two numbers separated by a colon, as in16:9.

(g) State working principle of camera tube.

Ans:

Working: **2M**

Camera tube performs the dual function of converting the optical image of televised scene into an electrical image & then scanning the this electrical image with an electron beam to produce electrical signal which vary in accordance with the variation of light intensities in the picture elements of the scanned electrical image.

(h) Give the applications of CCTV.

Ans: (Any Two) (Each 1 mark)

Applications of CCTV: 2M

1. **Industrial Processes**:
   In several industries, CCTV supervision is required to monitor the stages involved in various processes.

2. **Reining In Crime**:
   CCTV is a very efficient tool to rein in crime because the recorded footage is substantial evidence against the criminal.

3. **Traffic Monitoring**:
   This enables the authority to keep a check on traffic jams, accidents, etc.

4. **In Retail Industry**:
   CCTV in retail facilitates monitoring financial transactions, products on display, any incident of theft and many more such things that require to be maintained record of.

(B) Attempt any TWO of the following: 8M

(a) State the need of modulation.

Ans: (Any four) (Each 1 mark)

Need of modulation: 4M

1) Reduction in height of antenna: as frequency of modulation increases the height of antenna reduces

2) Avoid mixing of signals: If baseband signals are used to modulate at different carrier frequencies, then they will occupies different slots in the frequency domain so they cannot mix.

3) Increases the range of communication: The modulation process increases the frequency of the signal to be transmitted. Hence increases the range of communication.

4) Multiplexing is possible: Multiplexing is possible only only with modulated signal.

5) Improves quality of reception: With frequency modulation & digital communication techniques like PCM the effect of noise is reduced to great extent. This improves quality of reception.

(b) Draw AM and FM in time domain and frequency domain.

Ans: (For AM:- time domain diag.-1M, Frequency domain diag.-1M

For FM:- time domain diag.-1M, , Frequency domain diag.-1M)

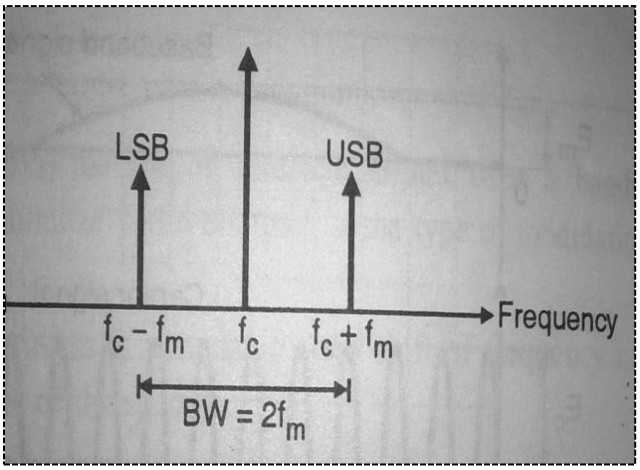
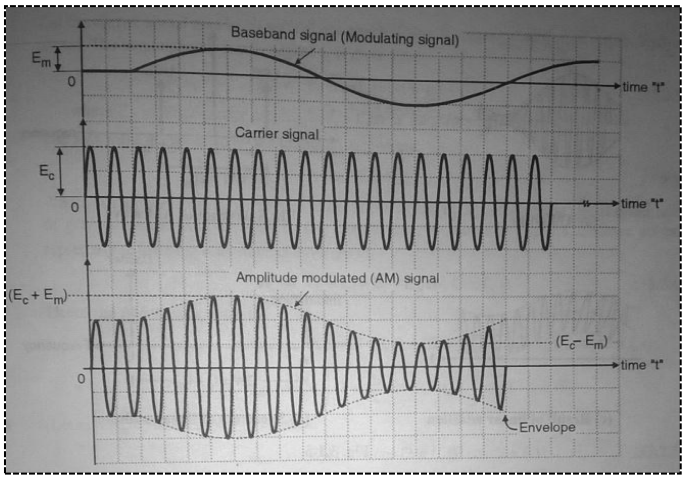


Fig. AM in frequency Domain



Fig, AM in Time Domain

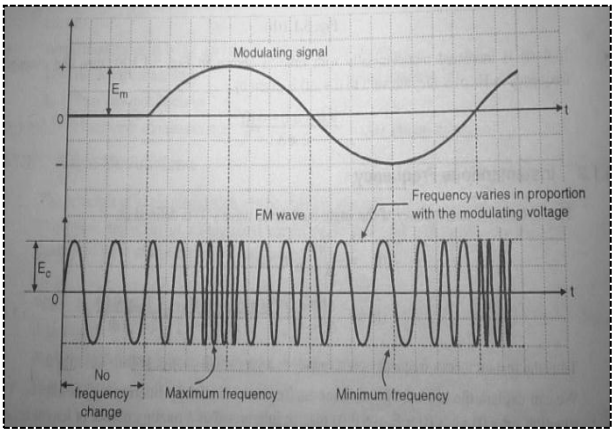


Fig. FM in Time Domain

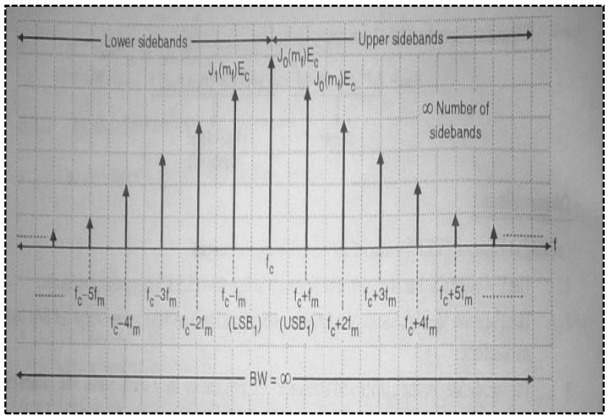


Fig.FM in Frequency Domain

(c) Describe the concept of pre-emphasis and de-emphasis with the help of neat diagram.

Ans: **(Each concept-1M, Each diagram-1M)**

Pre-emphasis: **1M**

In FM noise has greater effect on higher modulating frequencies. This effect can Be reduced by increasing the value of modulation index (m_f) for higher modulating Frequencies (f_m). This can be done by increasing the deviation (d) & deviation can be Increased by increasing the amplitude of modulating signal at higher modulating frequencies.

"The artificial boosting of higher modulating frequencies is called as **Pre-emphasis**."

Diagram: **1M**

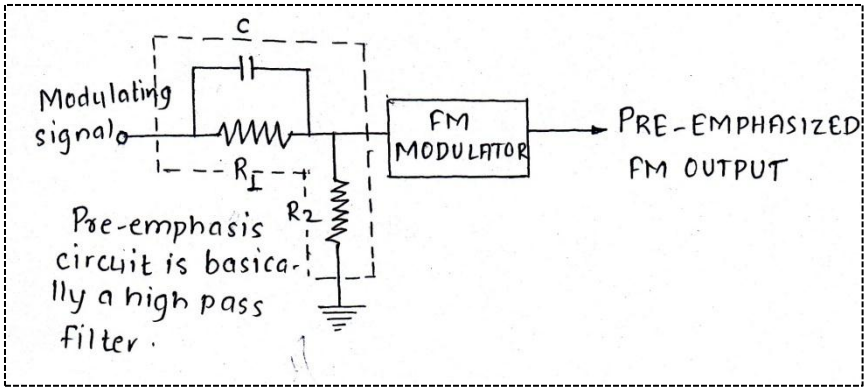


Fig. pre-emphasis Circuit

De-emphasis: **1M**

The artificial boosting of given to the higher modulating frequencies in the process of pre-emphasis is nullified or compensated at the receiver by a process called de- emphasis. The artificially boosted high frequency signals are brought to their original amplitude using de-emphasis circuit.

Diagram: **1M**

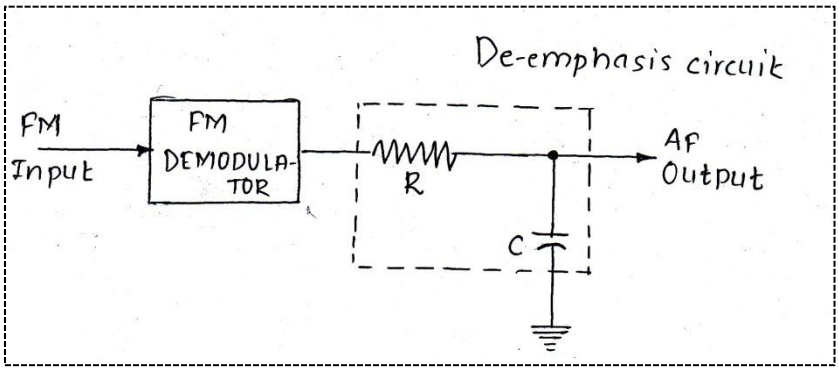


Fig. De-emphasis circuit

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

a) A 10kW carrier wave is amplitude modulated at 80% depth of modulation by a sinusoidal modulating signal. Calculate the sideband power, total power and transmission efficiency of the AM wave.

Ans: (1M – equation, 1M – sideband power, 1M- Total power, 1M- Transmission efficiency)

Given: P_c = 10kW and m= 0.8

i) Side band powers:

$$P_{USB} = P_{LSB} = \frac{m^2}{4} * P_c$$
$$= \frac{(0.8)^2}{4} * 10kW$$
$$= 1.6kW$$

∴ Total **Side band power = 1.6+1.6= 3.2kW**

ii) Total power:

$$P_t = P_c + P_{USB} + P_{LSB}$$
$$P_t = 10+1.6+1.6$$
$$\mathbf{P_t = 13.2kW}$$

iii) Transmission efficiency:

$$\eta = \frac{m^2}{2+m^2} * 100\%$$
$$\boldsymbol{\eta = 24.4\%}$$

b) Draw a neat sketch and describe the working of reactance modulator for FM generation.

Ans: (sketch-2M, Description – 2M)

Sketch **2M**

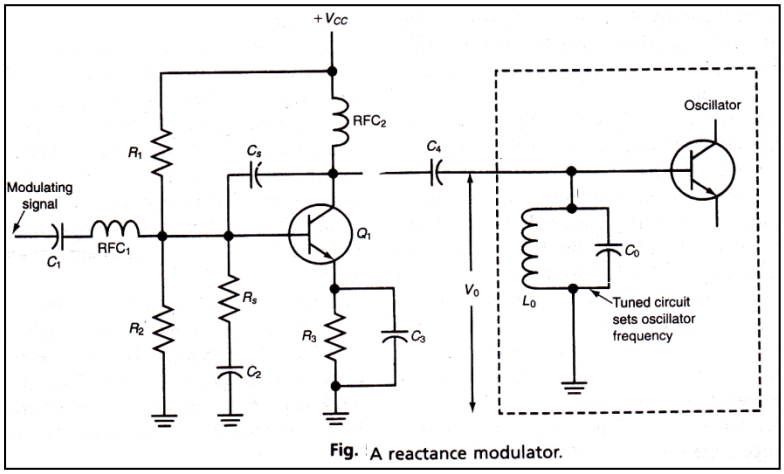


Fig. Reactance modulator for FM generation.

Working: **2M**

- A reactance modulator is illustrated in figure. It is basically a standard common-emitter class A amplifier. Resistors R1 and R2 from a voltage divider to bias the transistor into the linear region. R3 is an emitter bias resistor.
- The oscillator signal from the RC phase-shift circuit made up of Cs and R_s.
- The value of Cs is chosen so that its reactance at the oscillator frequency is about 10 or more times of the value of Rs. if the reactance is much greater than the resistance, the circuit will appear predominantly capacitive; therefore the current through the capacitor and Rs will lead the applied voltage by about 90◦.
- Since the collector current is in phase with the base current, which in turn is in phase with the base voltage, the collector current in Q1 leads the oscillator voltage V0 by 90 ◦. Of course, any circuit whose current leads its applied voltage by 90◦ looks capacitive to the source voltage.
- The modulating signal is applied to the modulator circuit through C1 and RFC1. The RFC helps keep the RF signal from the oscillator out of the audio circuit from the modulating signal usually comes. The audio modulating signal will vary the base voltage and current of Q1 according to the intelligence to be transmitted. The collector current will also vary in proportion. As the collector current amplitude varies, the phase shift angle changes with respect to the oscillator, voltage, which is interpreted by the

oscillator as a change in the capacitance. So as the modulating signal changes, the effective capacitance of the circuit varies and the oscillator frequency is varied accordingly.

- An increase in capacitance lowers the frequency, whereas a lower capacitance increases the frequency. The circuit produces direct frequency modulations.

c)

i) Draw the waveforms of PAM, PWM and PPM.

Ans: (waveforms – 2marks)

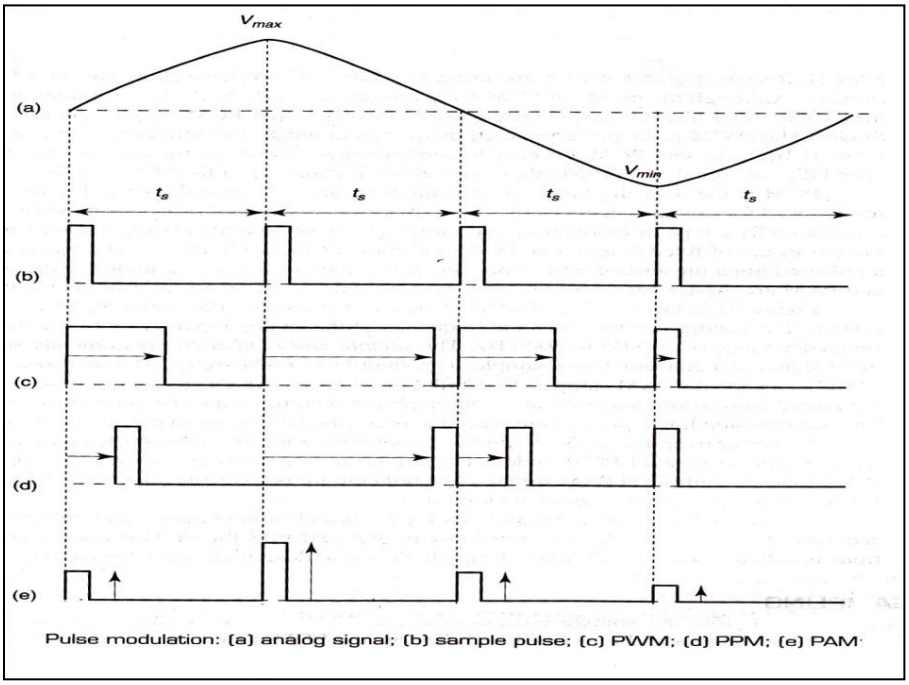


Fig. waveforms of PAM, PPM & PPM

ii) State the bandwidth requirements for FM.

Ans: (2marks.)

Bandwidth requirements for FM: **2M**

- Bandwidth of an FM wave is defined as the frequency difference between the highest pair of side band.

- Identity the bandwidth of FM is infinite, because its spectrum consists of infinite number of upper & lower sidebands.
- But practically it depends on the number of significant sidebands.
- The number of sidebands having significant amplitudes will increase with increase in the value of modulation index m_f.
- The simplest method to calculate the bandwidth is as follows:
  BW = 2fm*no. of significant sidebands.

d) What is the importance of electronic communication?

Ans: (4 marks)

Importance of electronic communication: **4M**

- Communication means the process of exchanging information. It is used for conveying thoughts, ideas and feelings to one another.
- The communication between human being can be verbal, non-verbal, via body language, facial expressions, written words etc.
- Two of the main barriers in human communication are distance and language.
- Out of them the distance problem is solved now a day's means of introducing long distance communication.
- Human communication took a dramatic turn in the late in nineteenth century when electricity was discovered.
- The telegraph was invented in 1844 and the telephone in 1876.
- The next step was introduction of radio. The first radio was demonstrated in 1895.
- Invention of radio was a huge leap forward in the field of communications.
- Knowledge and information come pouring in from all the corners of world due to the electronic communication means.
- This has changed our society from our society and the key part of it is communications because without electronic communications, we could not apply or use the available information in a timely way.

e) Describe Duct propagation.

Ans:

Diagram: **2M**

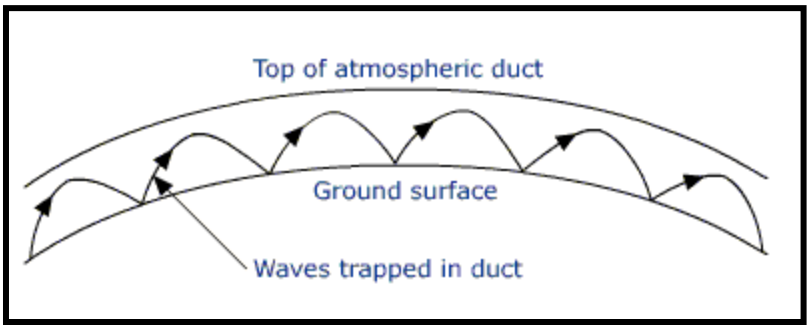


Figure: - Duct propagation

Explanation: **2M**

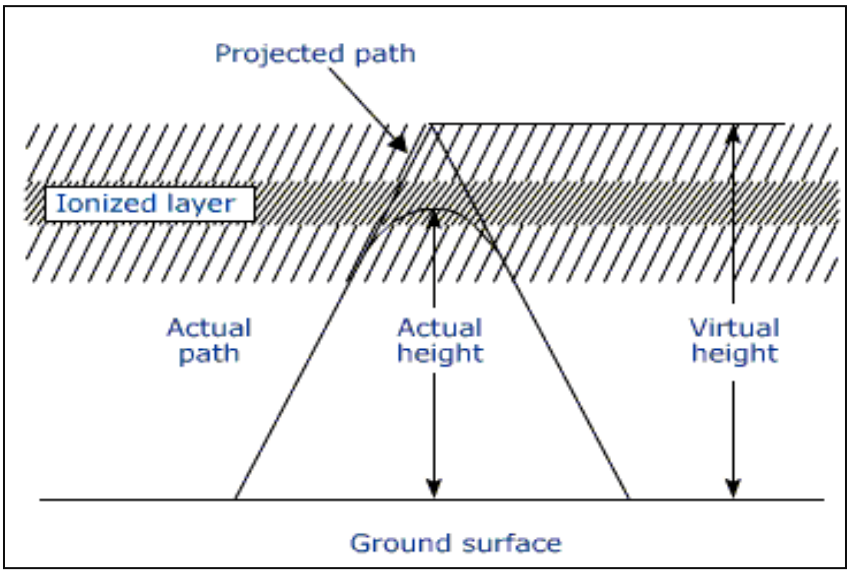
- At such short wavelengths everything tends to happen very rapidly. Refraction and absorption tend to be accentuated.
- One new phenomenon which occurs is super refraction, also known as ducting.
- As air density decreases and refractive index increases with increasing height above ground. The change in refractive index is normally linear and gradual.
- But under certain atmospheric conditions a layer of warm air may be trapped above cooler, often over the surface of water.
- The result is that the refractive index will decrease far more rapidly with height than is usual.

The rapid in refractive index will do to microwave what the slower reduction of these quantities, in an ionized layer, does to HF waves; complete bending down takes place.

f) Describe with neat diagram the concept of actual height and virtual height related to wave propagation.

Ans: (diagram- 2marks, description: 1mark each)

Actual height & virtual height: **2M**



- **Virtual height** is the height above earth's surface from which a refracted wave appears to have been reflected. **1M**

OR

- The maximum height that the hypothetical reflected wave would have reached is the virtual height.

- **Actual height** is the height above earth's surface from which a refracted wave had actually have been reflected. **1M**

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

a) Define PWM and describe generation of PWM by IC555.

Ans: (definition – 2 marks, Description of PWM-1mark, Diagram -1mark)

Pulse width Modulation (PWM): **2M**

Pulse width modulation is defined as the process of varying the width of the pulse in propagation to the instantaneous variations of message.

Diagram: **1M**

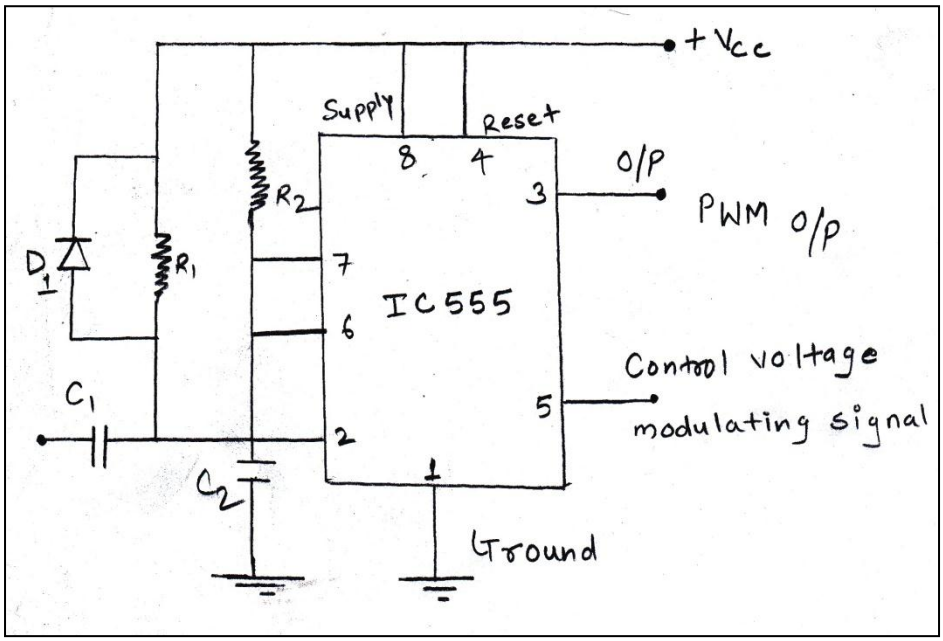


Fig. PWM using IC555

Description: **1M**

- The timer IC555 is operated in monostable (multivibrator) mode.
- R1C1 network acts as a differentiator.
- The clock pulse is differentiated by R1C1 positive half is introduced at pin2 (trigger input) of 555.
- These trigger pulses decide the starting instants (leading edge) of PWM pulses.
- PWM pulses go high at the instant of arrival of these triggering pulses.
- The termination of these pulses depend on
  R2C2 discharge time
  The modulating signal applied to control input pin 5.
- When no modulating input is given output is a periodic train of pulses of width I.IR2C2 & frequency same as clock input.
- When the modulating signal is applied the charging time of capacitor varies as it charges to (2/3 Vcc $+V_{mod}$), where V_{mod} which can be either positive or negative, which results in variation of pulse width of output signal.
- As soon as V_{c2} is equal to control voltage the PWM pulse goes to zero. Thus PWM is generated at output oin 3 of IC555. (Control voltage is adjusted to 2/3 V_{cc}).

- The modulating signal applied to pin 5 will vary the control voltage of IC 555 in accordance to modulating voltage. As this voltage increases, the capacitor C_2 is allowed to charge through R_2 up to higher voltage & hence for longer time. The width of corresponding output pulse will increase due to this action.

b) What do you understand by transverse electromagnetic wave? Draw electromagnetic spectrum.

Ans: (transverse electromagnetic wave-2marks, electromagnetic spectrum-2marks)

Transverse electromagnetic wave: **2M**

- The electromagnetic waves are oscillations, which propagate through free space. They travel through free space at the speed of the light.
- These waves are known as electromagnetic waves because the electric and magnetic fields are simultaneously present.
- The directions of these fields are perpendicular to each other and to the direction of propagation of the wave.

OR

- The electromagnetic waves are as shown in the figure.

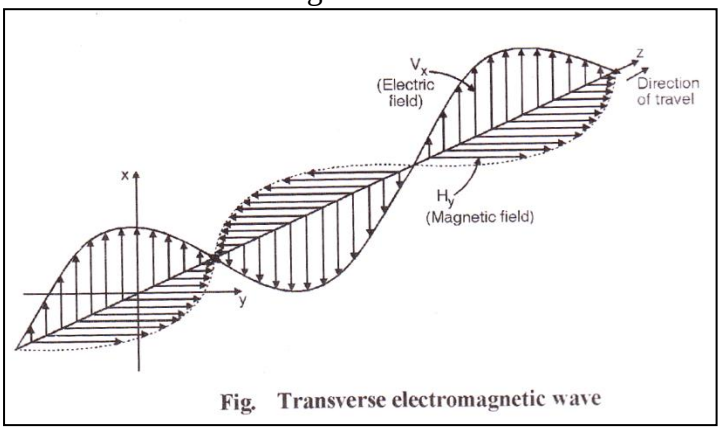
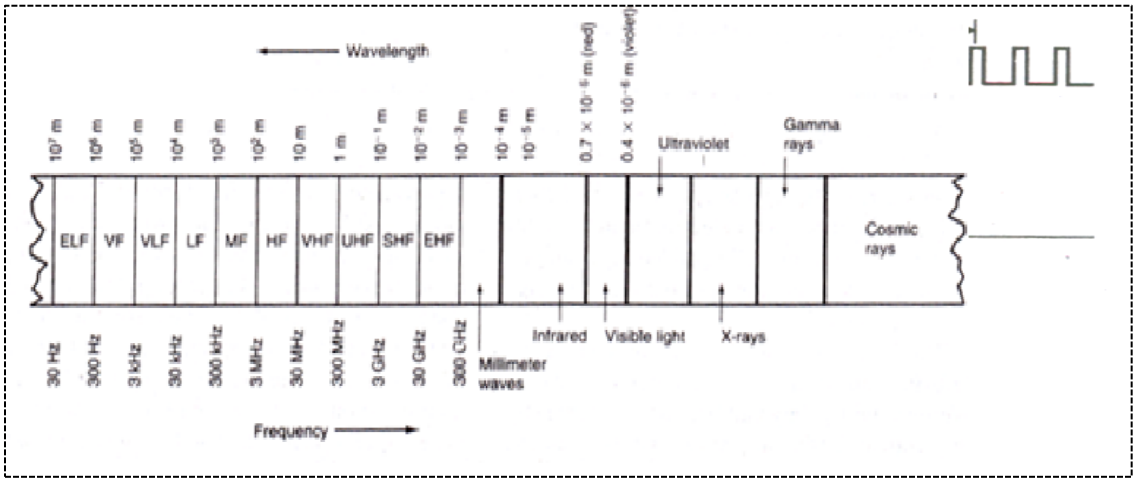


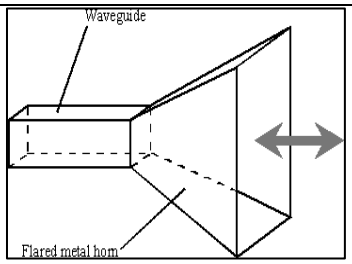
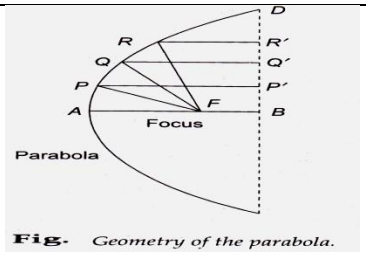
Fig. Transverse electromagnetic wave

Diagram of electromagnetic spectrum: **2M**



c) Compare dish antenna and horn antenna for four points.

Ans: (1mark – each point)

Sr. no.	Parameter	Horn Antenna	Dish Antenna
1.	**Definition**	A **horn antenna** or **microwave horn** is an antenna that consists of a flaring metal waveguide shaped like a horn to direct radio waves in a beam.	A **Dish antenna** is an antenna that uses a parabolic reflector, a curved surface with the cross-sectional shape of a parabola, to direct the radio waves.
2.	**Frequency Range**	Horns are widely used as antennas at UHF and microwave frequencies , above 300 MHz	Dish antennas are used in the high frequency part of the radio spectrum, at UHF and microwave (SHF) frequencies
3.	**Structure**		 Fig. Geometry of the parabola.

4.	**Application**	As feed antenna, satellite antenna.	Satellite tv reception, point to point microwave links.

d) Define and describe folded dipole antenna with the help of its radiation pattern.

Ans: (Definition – 1mark, description – 2 marks, radiation pattern -1mark)

Folded Dipole Antenna: 1M

A **folded dipole** is a dipole antenna with the ends folded back around and connected to each other, forming a loop.

Description: 2M

- The folded dipole antenna is a single antenna, but it consists of two elements. The first is fed directly while the second is coupled inductively at the ends. The radiation pattern of the folded dipole is the same as that of a straight dipole, but its input impedance is greater.
- The total current fed in is *I* and the two arms have equal diameters, and then the current in each arm is *I/2*.
- Only half the current flow in the first arm, and thus the input impedance is four times that of the straight dipole. Hence Rr = 4*72=288Ω for a half-wave folded dipole with equal diameter arms.
- Although the folded dipole has the same radiation pattern as the ordinary dipole, it has many advantages: its higher input impedance and its greater bandwidth, as well as case and cost of construction and impedance matching.

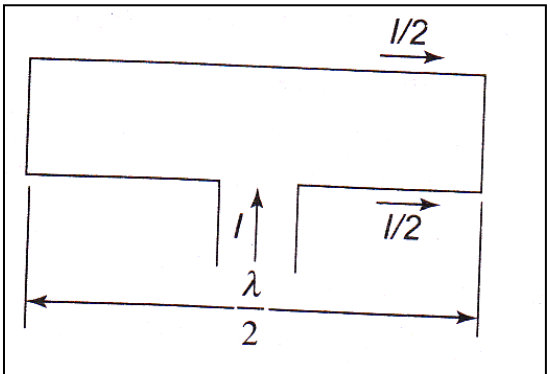


Fig. *Folded dipole.*

Radiation pattern: **1M**

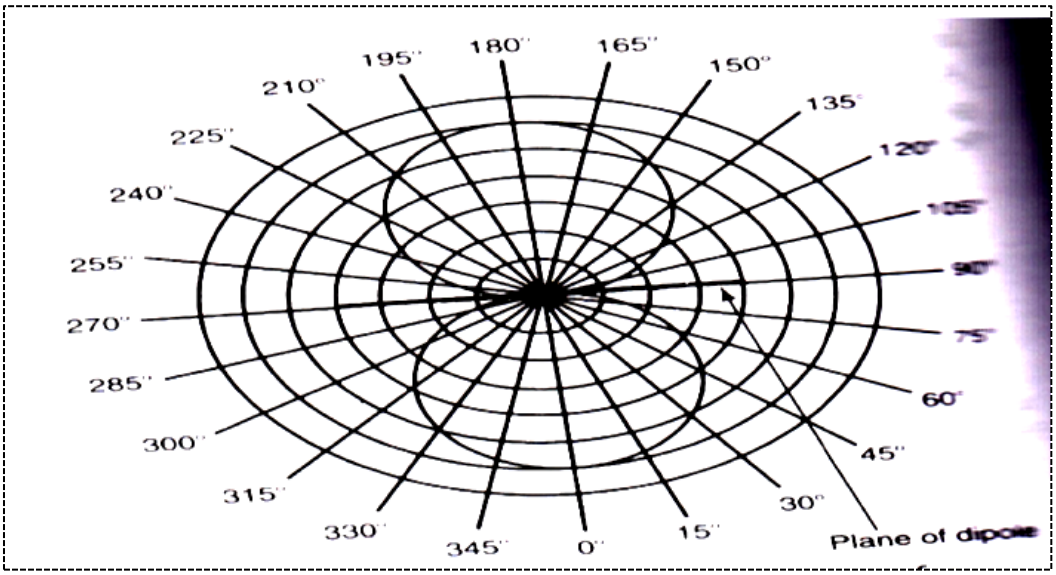


Fig. Radiation pattern

e) Define antenna. What do you mean by resonant and non-resonant antennas? State different types of antennas.

Ans: (definition -1mark, Resonant Antenna-1mark, Non-Resonant Antenna-1mark, Different types of antennas-1mark)

Antenna: **1M**

An antenna is a structure that is generally a metallic object, often a wire or group of wires, used to convert high-frequency current into electromagnetic waves, and vice versa.

Resonant Antenna: **1M**

It is properly terminated transmission line, which produces standing waves.

Non-Resonant Antenna: **1M**

It is properly terminated transmission line, which produces no standing waves.

Different types of antennas: **1M**

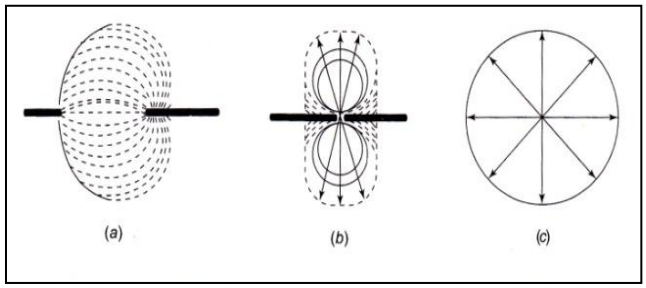
- Half wave Dipole Antenna
- Telescopic Antenna
- Folded dipole Antenna
- Loop Antenna
- Yagi-uda Antenna
- Microwave Antenna : dish, horn
- Micro strip Antenna: rectangular, circular & square.

f) i) Define: Half wave dipole antenna & draw its radiation pattern.

Ans: (definition-1Mark, Diagram-1mark)

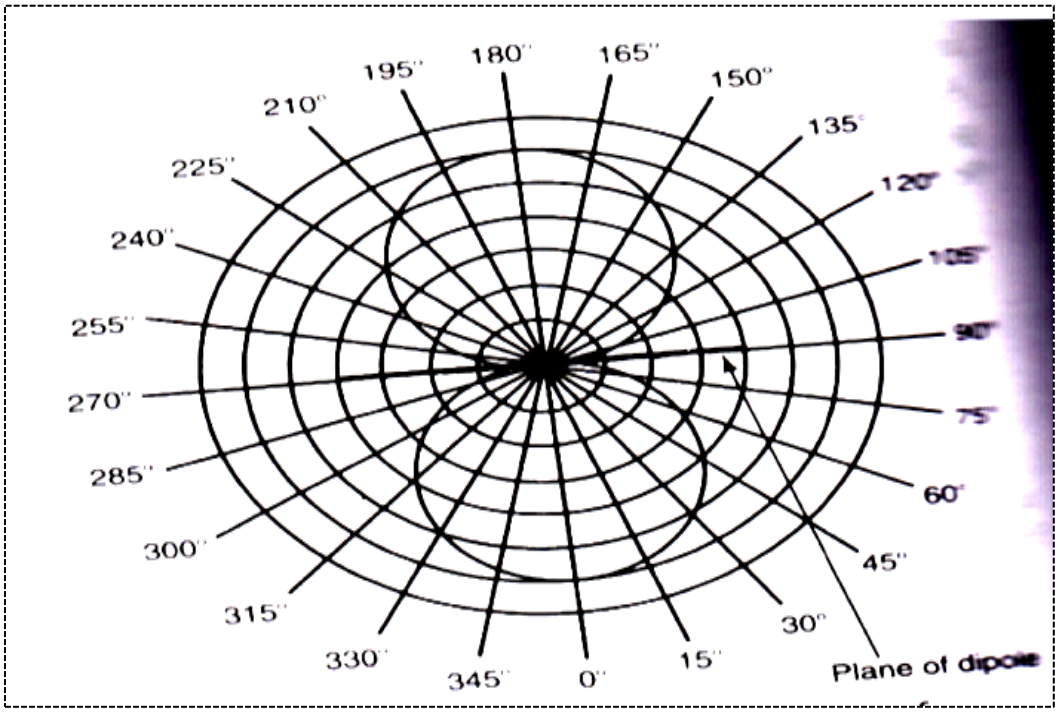
Half wave Dipole Antenna:

A dipole antenna having an approximate physical length of one half wavelength of applied frequency is called as half-wave dipole antenna.



OR

Diagram: **1M**



ii) Draw Yagi-Uda antenna and its radiation pattern.

Ans: (diagram – 1marks, radiation pattern–– 1marks)

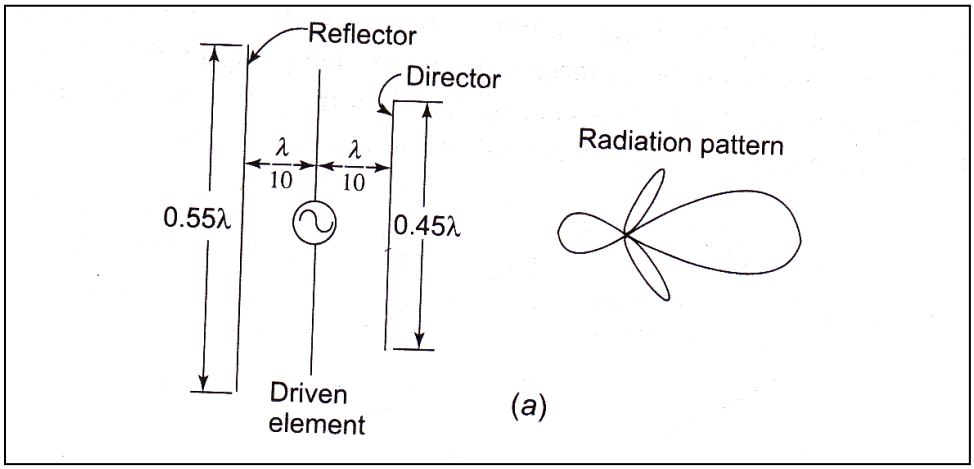


Fig. Yagi-uda Antenna radiation pattern.

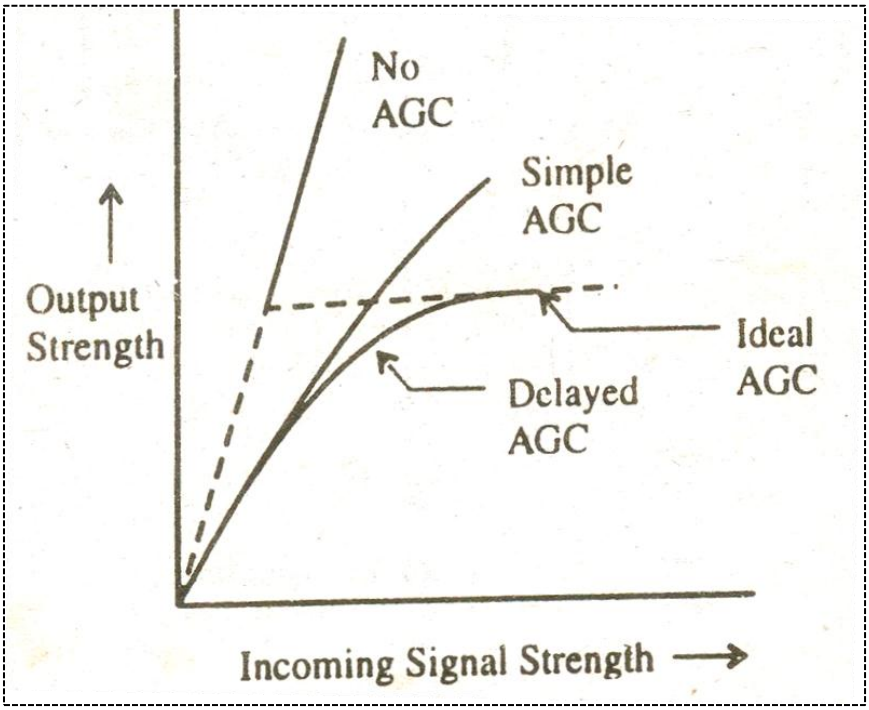
Q4. Attempt any FOUR of the following: 16M

a) Describe simple AGC and delayed AGC with the help of graph.

Ans: (diagram – 2 marks, explanation each – 1 marks)

The method of maintaining reproduced output constant over a wide range irrespective of any change in the signal by varying the respective gain of RF and IF stages is called as " AGC".

Diagram: **2M**



Simple AGC: **1M**

In this the bias voltage is applied to the respected stages proportional to the change in incoming signal. The overall gain of of a radio receiver is varied automatically. The AGC bias is proportional to the strength of received signal as shown in fig .

Delayed AGC: **1M**

From fig we can say that the AGC bias is not applied until the input signal strength reaches a predetermined level, so called delayed AGC. After predetermined level, AGC bias is applied like simple AGC but more strongly.

b) Describe with neat diagram practical diode detector.

Ans. (block diagram – 2 marks, explanation – 2 marks)

Block diagram: **2M**

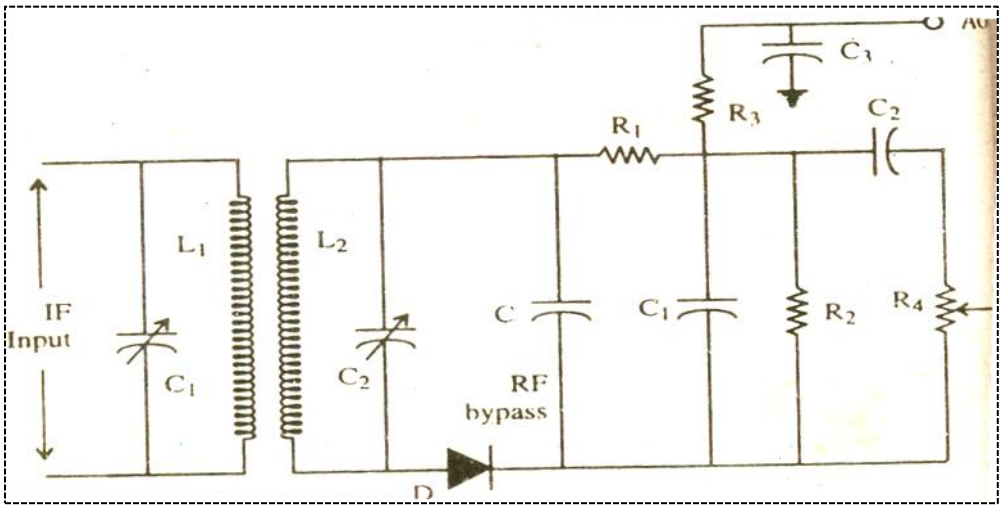


Fig. Block diagram practical diode detector

Working: **2M**

- In the above circuit, the previous linear diode detector resistance R is split into two resistances as R_1 and R_2.
- The load capacitor in the previous circuit exists here and acting as a RF bypass capacitor C_2, such that it bypasses the carrier signal of the selected modulated envelops which is negative side modulated envelope.
- The modulating signal voltage appears at the R_1 C_1 and R_3 C_3 combination. From the circuit equivalent these R_1 C_1 and R_3 C_3 low pass filter exist in parallel.
- The capacitor C_2 is placed so that it bocks dc and not allowing it appear across the volume control otherwise a fixed level of volume output exists in a radio receiver.
- The R_2 ensure a series dc path for the diode towards ground.

c) Describe with neat diagram balanced slope detector in detail.

Ans: (block diagram – 2 marks, explanation – 2 marks)

Diagram: **2M**

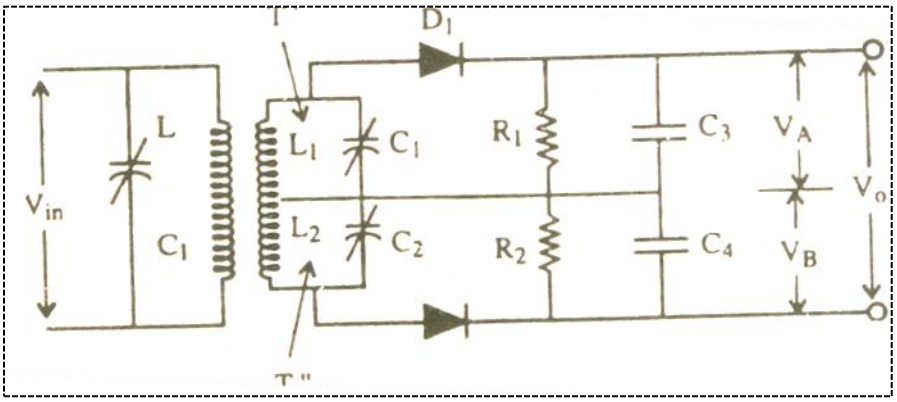


Fig. Block diagram balanced slope detector

Working: **2M**

- The circuit uses two slop detector connected back to back. The secondary side is divided into two sides T' and T'' circuit tuned to $f_c + \delta_f$ and T'' circuit is tuned to fc - δ_f as shown in fig.. When input signal frequency equals Centre frequency f_c under this condition, the voltages generated by the tuned circuits are 180^0 out of phase and generated and equal anf opposite signal voltages which provides resultant zero output voltages.
- When input signal frequency is near to $f_c + \delta_f$ then the T' tuned circuit will resonate and tries to give maximum voltages while T'' is not resonating, so its output will minimum.
- If the input signal frequency is near to to $f_c - \delta_f$ then the T'' will resonate giving maximum voltage while T' gives minimum voltages.

d) Draw the PLL as FM demodulator circuit and state its working principle.

Ans: (block diagram – 2 marks, explanation – 2 marks)

The **block diagram** of PLL FM demodulator is shown in the fig. **2M**

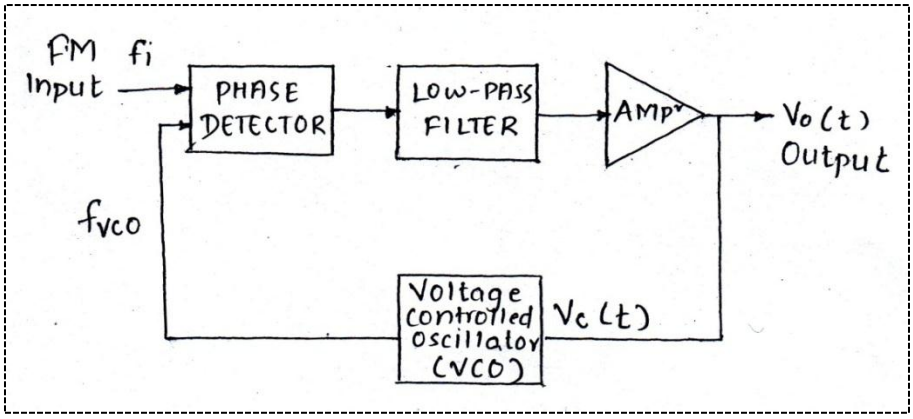


Fig.Block diagram of PLL as FM demodulator circuit

Function of each block: **2M**

- **Phase detector** : It is basically a balanced modulator and average output voltages that is linear function of the phase difference between the two inputs signals.
- **Low pass filter:** the frequency component is selected by the low pass filter which also removes much of the noise.
- **Amplifier:** The filtered signal is amplified by amplifier.
- **VCO:** Amplifier signal passed as a voltage to VCO where it results in frequency modulation of the VCO frequency.
- The error voltage produced at the output amplifier is proportional to the deviation of input frequency from centre frequency of the FM. Thus, AC components of the error voltage represent the modulation signal which is nothing but demodulated FM output.

e) Draw the block diagram of AM super heterodyne receiver and describe it's working.

Ans :(block diagram–2marks, explanation–2marks)

Diagram: **2M**

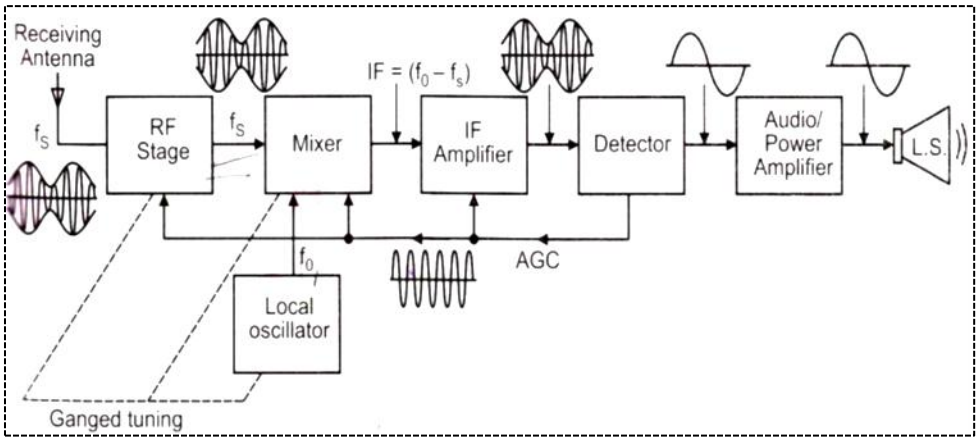


Fig. Block diagram of AM super heterodyne receiver

Functions of each block- **2M**

- **Receiving antenna-** AM receiver operates in the frequency range of 540 KHz to 1640 KHz.
- **RF stage-** Selects wanted signal and rejects all other signals and thus reduces the effect of noise.
- **Mixer-** Receives signal from RF stage Fs and the local oscillator Fo, and are mixed to produce intermediate frequency signal IF which is given as:
  IF=Fo-Fs
- **Ganged Tuning-** To maintain a constant difference between the local oscillator and RF signal frequency, gang capacitors are used.
- **IF stage-** The IF signal is amplified by the IF amplifier with enough gain.
- **Detector-**Amplified signal is detected by the detector to get original modulating The detector also provides control signals to control the gain of IF and RF stage called as AGC.
- **AGC-** Automatic gain control controls the gain of RF and IF amplifiers to maintain a constant output level at the speaker even though the signal strength at the antenna varies.

f) Describe the concept of interlaced scanning with neat sketch.

Ans. (diagram – 2 marks, explanation – 2 marks)

Diagram: **2M**

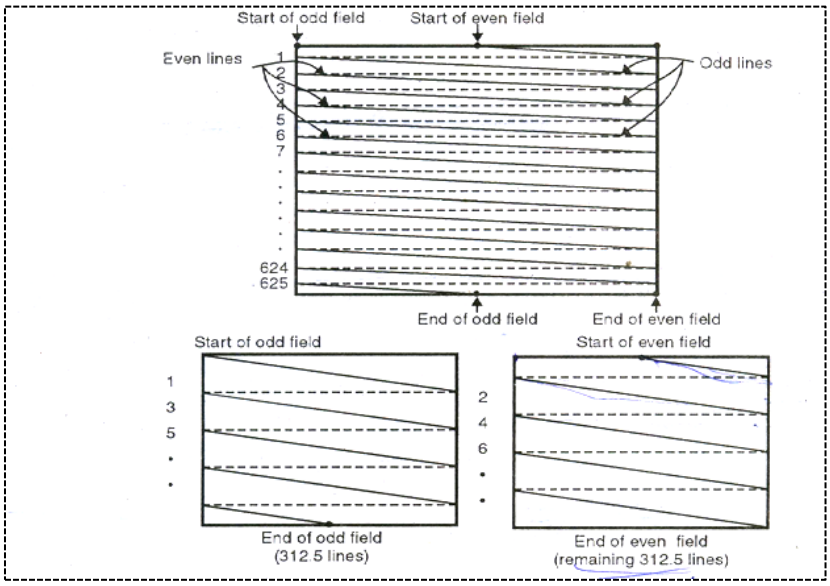


Fig. Interlaced scanning

Concept of interlaced scanning: **2M**

Interlace is a method of improving the quality of images displayed without increasing analog bandwidth. In a 625-line system, if 50 picture frames are scanned per second. In interlaced scanning the 625 lines are divided into two stages called fields. Each field contains 312.5 lines. The field scans the odd numbered lines (1.3, 5,-----) and is called the odd field. Similarly at the end of the odd field the even field starts, which scans even numbered lines (2,4,6,----) The odd and even scanning is shown in fig.

It is observed in interlaced scanning that each picture frame is divided into field of 312.5 lines each lines, thereby making the picture repetition rate double frame repetition rate,ie 50 field per second, whereas the number of lines scanned per second remains the same.

Q5. Attempt any FOUR of the following: 16M

a) What do you mean by image frequency and its rejection?

Ans: (define – 2 marks, explanation – 2 marks)

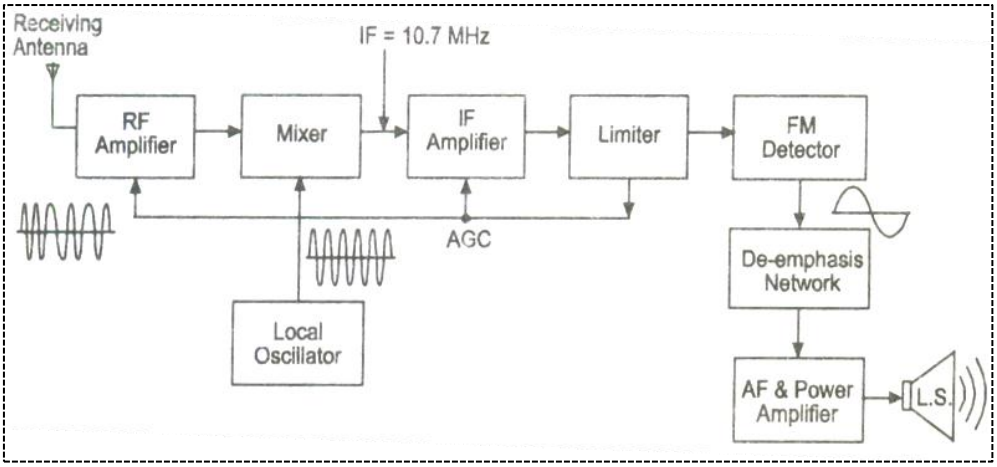
Image frequency:

- Image frequency (f_{si}) is the unwanted frequency whos frequency is greater than the radio frequency by twice the intermediate frequency i.e.,$f_{si} = f_s + 2IF$.
- When this unwanted frequency enters the radio receiver the effect will be as if two stations are being received simultaneously enhance it is undesirable.
- **Image rejection** must be achieved before the IF stage, hence image rejection depends on the front and selectivity of the receiver.

b) Describe the working of FM superheterodyne receiver with help of block diagram.

Ans: (block diagram – 2 marks, explanation – 2 marks)

Diagram: 2M



s

Fig. block diagram of FM super heterodyne receiver

Functions of each block- 2M

- **RF Amplifier:** In domestic AM receiver, RF amplifier is not used but in FM receiver, FM amplifier are used. Its function is to improve signal to noise ratio.

- **Mixer:** It is also known as frequency changer. Input signal frequency f_s and local oscillator frequency f_o are mixed down to convert received signal to intermediate frequency.

- **IF Amplifier**: It amplifies the of mixer output. Due to large bandwidth gain per stage is low. Therefore two or more stages of IF amplifier are used.

- **Amplifier Limiter**: It removes the unwanted amplitude that is added in original FM signal while travelling in free space.

- **FM Detector**: convert the FM signal into original modulation signal.

- **De-emphasis**: The artificially boosted high frequencies at transmitter are removed by de-emphasis.

- **AGC:** Automatic gain control is used to ensure that the original fed to the limiter is within its limiting range and also prevents overloading of last IF amplifier.

- **AF and Power Amplifier:** First the modulating signal is voltage amplifier and its power is increased to drive the loudspeaker.

c) Draw and describe with proper diagram vestigial sideband transmission.

Ans: (diagram – 2 marks, explanation – 2 marks)

Diagram: **2M**

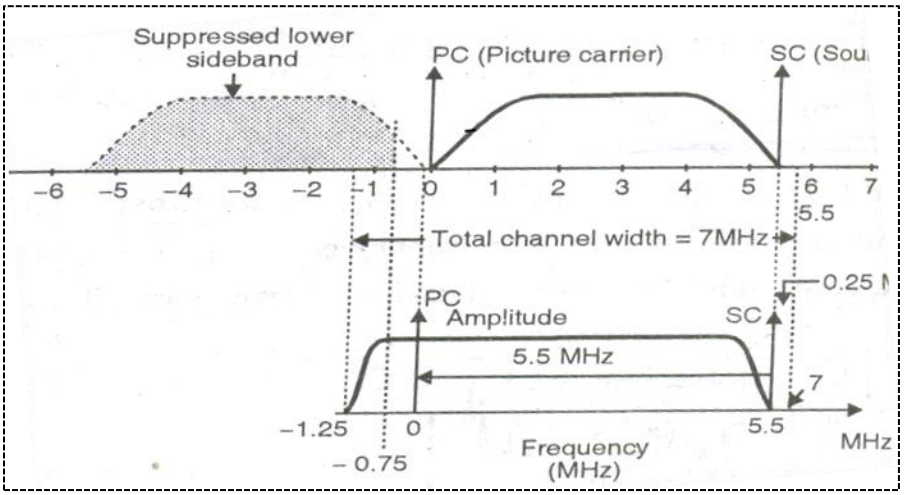


Fig. Vestigial sideband transmission

Explanation: **2M**

- We know that amplitude modulation is used for transmitting the video signal. The frequency spectrum of AM, it has carrier frequency at the centre with two sideband .Since both the sidebands contains the same information, we can transmit any one of the sidebands. By transmitting only one sideband and suppressing the carrier we can save the power and the bandwidth.
- In case of TV transmission, the video bandwidth of 5 MHz and if we use double sideband with full carrier it makes the total video bandwidth to be 10MHz.Its video bandwidth is 10MHz less number of channels will be accommodated in the frequency band used for transmission. The single sideband transmission can reduce the bandwidth to half but in case of TV we cannot transmit only one sideband for following reasons.
- The TV signal has a video bandwidth ranging from o Hz to 5 MHz the lower frequency contains the mean brightness of the scene. It is impractical to design filter having a uniform response throughout the frequency range. The frequency response of almost all filters is dropping on lower and high frequency side.
- In order to save the low frequencies we should either use filters having very step response or send a part of the lower side band.
- This part of the lower sideband which is transmitted along with the upper sideband is called vestige and hence the name vestigial sideband transmission.

d) List any 8 CCIR-B standards for color signal.

Ans: (Any eight) (each point – 1/2 marks)

Sr.no	Parameter	Standard
1	Camera output	R,G, and B video signal
2	Luminance signals	Y= 0.3R+0.95G+0.11B
3	Colour difference signal chosen for transmission	(B-Y) and (R-Y)
4	Types of colour signal modulation	Suppressed carrier amplitude modulation of two subcarrier in quadrature having same numerical value.
5	Color difference signal	U=0.493(B-Y),V=0.877(R-Y)
6	Amplitude of modulation Chroma signal	$(u^2 +v^2)^{0.5}$
7	Color subcarrier frequency	4.433185MHz
8	Duration of burst	10+-1
9	Chroma encoding	Phase and amplitude modulation
10	Bandwidth for color signal	F_{sc} – 1.3 MHz to fsc+0.6 MHz

e) Define:
i) **Viewing distance**
ii) **Luminance**
iii) **Hue**
iv) **Saturation**

Ans: (each - 1 mark)

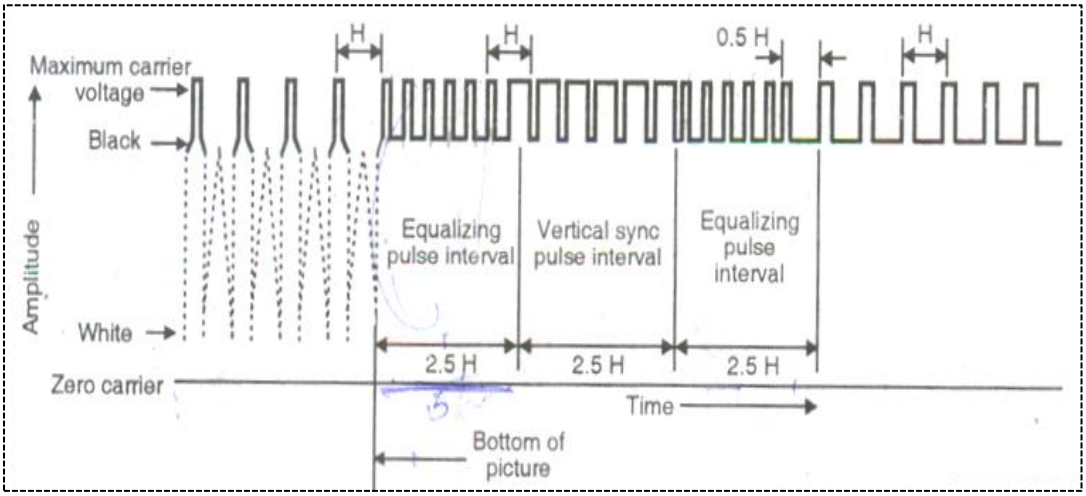
v) **Viewing distance**: The viewing distance lies between 3 to 8 times picture heights. The preferred distance is normally five times the picture height.

vi) **Luminance:** It is the amount of light intensity or the total amount of light energy that is received by the eye irrespective of the color of light.

vii) **Hue:** This is the predominant spectral color of received light which means it the actual color seen by the eye. Red, Green, Blue, Yellow, Magenta, Cyan represent different Hues in the visible spectrum.

viii) **Saturation:** It represents the spectral purity of color light. It is the amount of White light that is mixed with a color.

f) State necessity of equalizing pules. Describe pre equalizing and post equalizing.
Ans: **(diagram – 1 marks, necessity-1mark explanation – 2 marks)**



Pre equalizing and post equalizing:

- To, take care of the triggering difference due to the half-line discrepancy, five narrow pulses are added on either side of vertical sync pulses. These are known as per equalizing and post equalizing pulse. 2.5 horizontal line periods are used for the pre-equalizing and post equalizing pulses. The 2.5H is again divided into 5 parts ie.32micro sec. This 32 sec has a pulse of 2.3 micro sec. as shown in fig.
- Pre-equalizing pulses being 2.3 micro sec duration result in the discharge of the capacitor to essentially zero voltage in both the fields despite the half line discrepancy before the voltage build-up starts with the arrival of vertical sync pulses.
- Post equalizing pulses are necessary for a fast discharge of the capacitor to ensure triggering of the vertical oscillator at proper time.

Q. 6 Attempt any FOUR of the following: **16M**

(a) Define:

(i) Pedestal height
(ii) Blanking pulse
(iii) Color burst
(iv) Horizontal sync pulse

Ans: (each definition 1M)

(i) Pedestal height: **1M**

It is height of pedestal level from the level of average value.

(ii) Blanking pulse: **1M**

It is blank during retrace period of scanning process in transmitter & also in receiver. Composite video signal consist of horizontal & vertical blanking pulse.

(iii) Color burst:

Color burst is signal generated by a video signal generator used to keep the chrominance subcarrier synchronized in a color television signal.

(iv) Horizontal sync pulse:

It is used to trigger the scanning circuits to ensure

the synchronization for scanning at the transmitter & receiver.

(b) Describe with neat diagram working of plumbicon camera tube.

Ans: **(Working 3M Diagram 1M)**

Plumbicon camera tube is photoconductive target plate of lead mono oxide (PbO) sandwiched between n & p type layer. The tube has been named plumbicon because lead has been used in target material. The target consist of PIN diode as shown in figure.

Diagram: **1M**

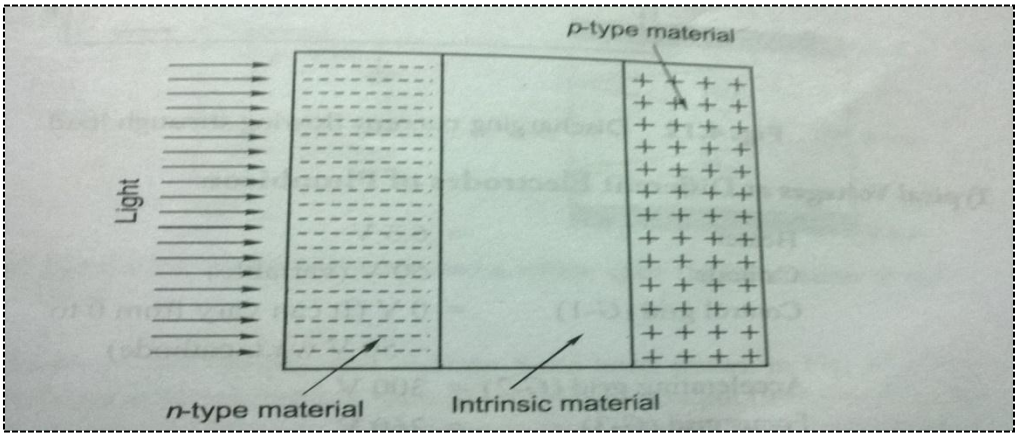


Fig. Plumbicon camera tube

Working: **3M**

When light falls on the target, electrons are released. The electric field gradient set up n the intrinsic layer is very high. This high gradient makes all released electrons sweep past the target quickly. The PIN diode acts as capacitor & free electrons released by light cause resistance to be formed across the capacitor. The capacitor discharges through t is resistance & potential difference difference across the capacitor decreases. The capacitor is charges to bias voltage in absence of light.

As intensity of light increases, resistance R decreases, & voltage on right hand side plate increases. Thus voltage on the plate towards gun side is the charge image proportional to the optical image. When scanning beam lands on the target, it leaves sufficient electrons to neutralize the positive charge. When positive charge neutralizes it amounts to flow of load current through load resistance. The current will proportional to the intensity of light. Thus the video signal is produced in the load.

(c) Draw and describe block diagram of color TV transmitter.

Ans: (Working 2M, Diagram 2M)

Diagram: **2M**

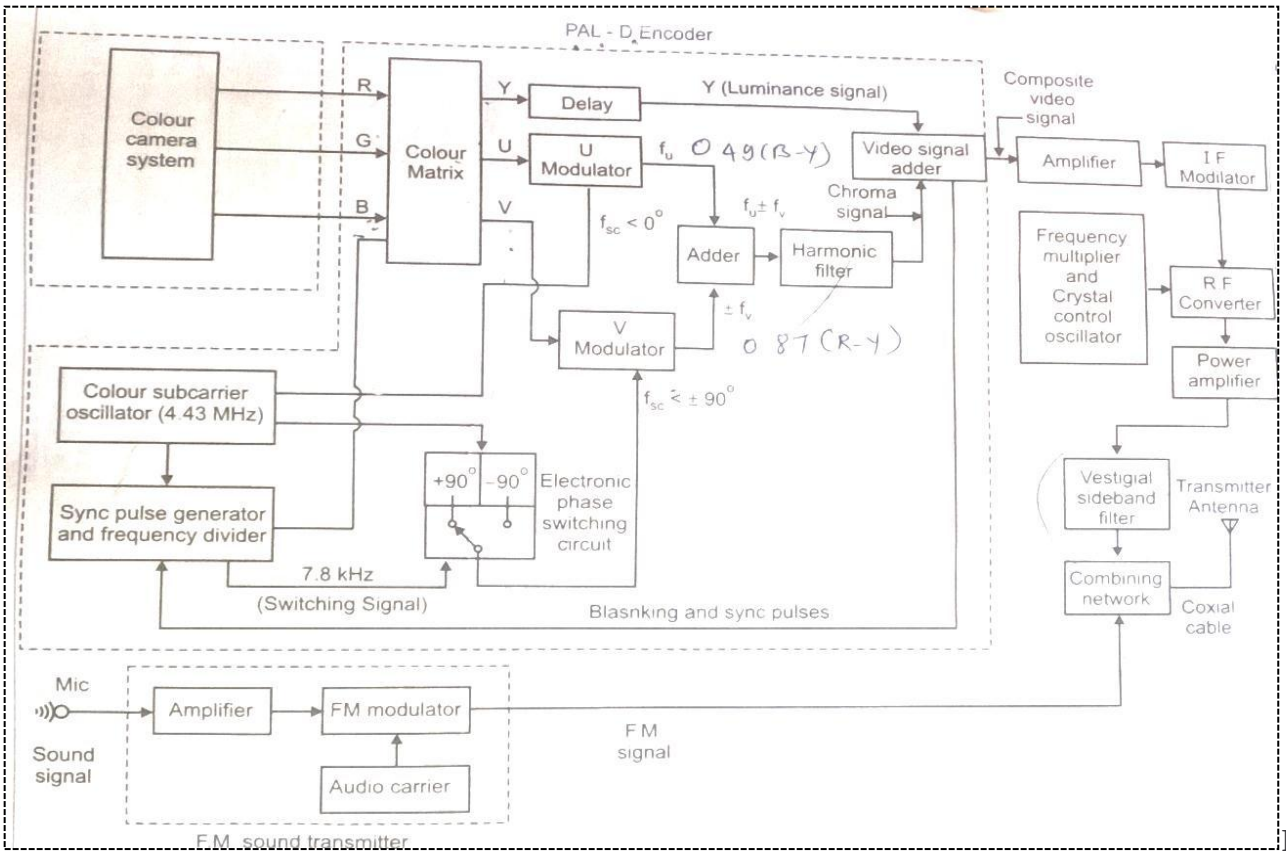


Fig. Block Fig. diagram of color TV transmitter

Working: **2M**

- **ACC Amplifier:** Rectifier provides dc voltage to ACC amplifier. After amplification , the voltag is used to control the gain of first stage of chroma amplifier in such a way to ensure constant chroma signal.
- **PAL delay line:** Averaging & seperats U & V modulated signal.
- **Adder & substractor:** U & V signals go to the adder stage & substractor stage direct as well as delay line.At the adder output we get 2U signal & at substractor we get 2jV.
- V signal & U signal demodulator provides V colour signal diferance & U colour signal difference respectively.

It consists of following blocks:

- **Colour camera**: It seperates the information into R,G,B.

- **Colour Matrix**: **Produce** Y,U,V signals & fed to respective U & V modulator.
- **Adder:** Adds u & V signals & provides combined signals to harmonic filter.
- **Synchronous pulse generator & frequency divider** provides blanking & synchronous pulse to video adder. Harmonic filter: It limits the bandwidth of colour signal within ± 1.5 MHz Phase Switching circuit provides ± 90º phase shift to the carrier frequency. Delay provides delay of 64µs to reach adder to wait for U & V signals to reach for video adder.
- **U modulator:** U signals & colour subcarrier are the inputs & results in U modulated signal.
- **V modulator**: V signal & colour subcarrier with 90% phase shift are inputs & results in V modulated signal.
- **Colour subcarrier oscillator**: it generates colour subcarrier frequency of 4.43 MHz & used as carrier signal to U & V modulator.
- **Video Signal Adder**: Adds croma signal, Y signal & blanking & synchronous pulse to form composite video signal.
- **Vestigial sideband filter**: Select only 5.5 MHz signal.
- **Combining Network**: Adds video & Audio signal & combined signal is transmitted through transmitted antenna.
- **Audio section:**

  Microphone converts sound in to weak audio signal. Amplifier amplifies weak audio signals. IM modulator –Audio signal & carrier applied to FM modulator which gives frequency modulated signal.

(d)Draw the neat diagram of PAL-D receiver.

Ans: (Working 2M, Diagram 2M)

Diagram : **2M**

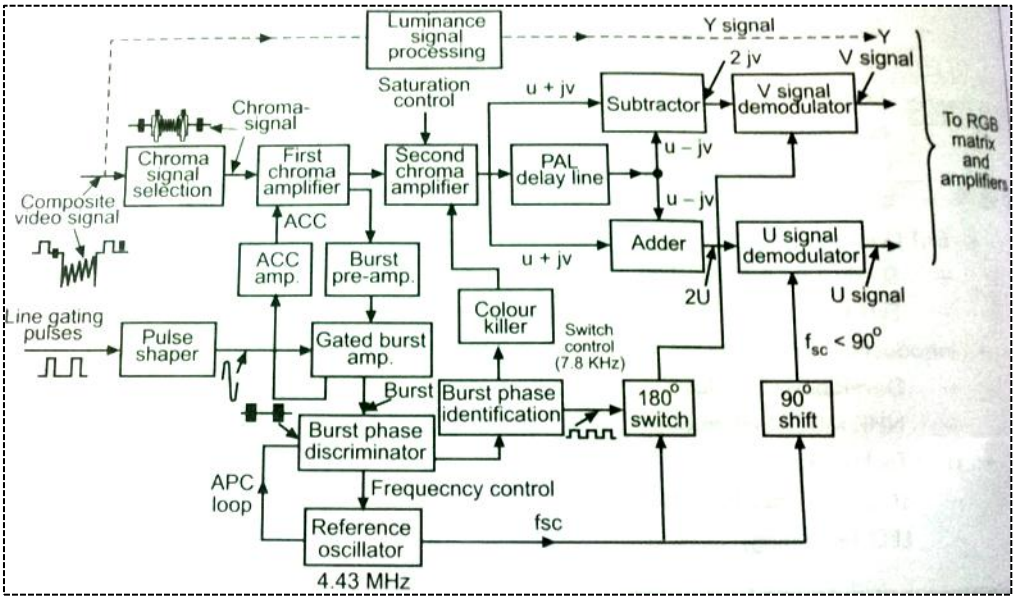


Fig. PAL-D receiver

It consists of following blocks: **2M**

- **Chroma Signal Selection**: It selects the chrominance signals & rejects all other unwanted components of the composite video signal.
- **Colour Killer circuit**: This circuit becomes 'ON' & disables chroma amolifier duringmonochrome reception. Thus it prevents coloured interface on the screen.
- **Synchronous Demodulator**: The output from adder & substractor consists of two independent signals (U & V).
- **Colour diiferance amplifier &** matrixing: The matrix is designed to produce (R-Y), (G-Y), (B-Y) signals from U,V & Y signals.
- **Burst Gate Amplifier:**Seperate the colour burst from chrominance signal.
- **Referance oscillator:** Generate exactly high frequency with same phase referance as original colour subcarrier.
- **Automatic Phase Control (APC):** Compares th localy generated subccarier to develop a control voltage.
- **Burst phase identification:** This circuit is able to identify phase relationship of colour burst.
- **Burst phase discriminator:** Gives the output as subc pulses having indent signal.Amplifier.

(e)Draw the diagram of colour picture tube. Describe its working principle.

Ans: (Explain any one) (Working 2M, Dia 2M)

Diagram: **2M**

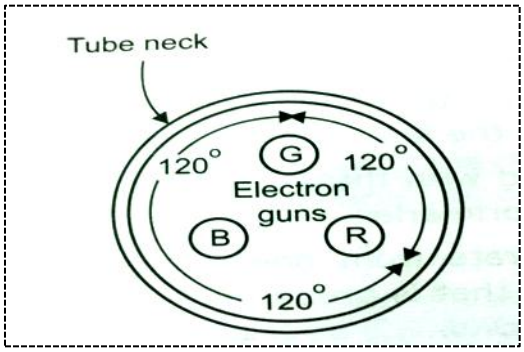


Fig. Delta Gun Picture Tube

Working principle of Delta Gun Picture Tube: **2M**

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

The traids glow one after another in quick succession due to deflections of the beam & hence the original picture is reproduced in its original colour.

(c) Compare CATV and CCTV with any four points. **4M**

Ans: (Each point- 1mark)

Sr No.	CATV	CCTV
1.	It has closed circuit	It has community antenna

2.	Requires baseband signal amplifier	Requires RF & distribution amplifier
3.	Termination' R' is not required	Termination 'R' is required
4.	Camera signal output is given to Audio Video of TV	Modulated RF signal is given to RF input of TV