Important Instructions to examiners:

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

Q.1 (A) Attempt any SIX: **12M**

a) Draw well labelled Electromagnetic spectrum.

ANS: **(Diagram 2M)**

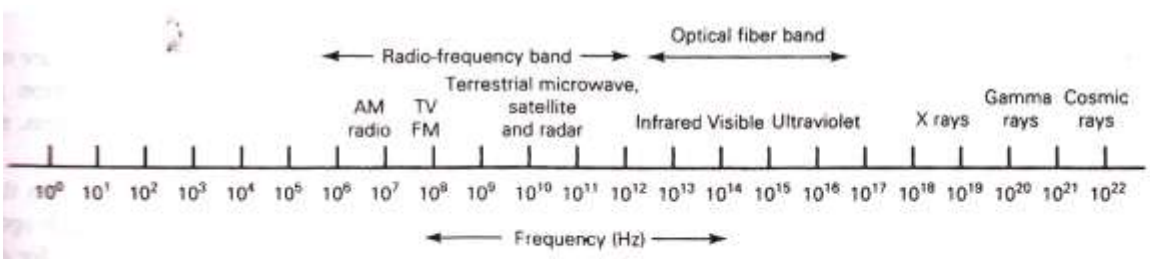


Fig. Electromagnetic spectrum.

b) State frequency range and application of ground wave propagation.

ANS: **(Frequency range 2M-Any 1)& (Applications 2M – any 2)**

Ground wave propagation range:

-For long distance-3MHz to 5MHz

-For Short distance-3MHz to 30MHz

Application:

- Ground surface mapping
- Remote sensing
- Target positioning
- Monitoring
- Navigation

c) Calculate the characteristic impedance of a transmission line having L= 0.5 mH/km, C= 0.08µF and negligible R and G.

ANS: **(2M)**

Given:

L= 0.5 mH

C= 0.08µF

R & G= Negligible

Z_o= ?

Solution:

$Z_o = \sqrt{L/C}$

$= \sqrt{\frac{0.5 * 10^{-3}}{0.08 * 10^{-6}}}$

$= \sqrt{6.25 * 10^{3}}$

=79.05 Ω

d) Define beamwidth and polarization of an antenna.

ANS: (**Each definition 2M)**

Beamwidth: The beamwidth of an antenna is described as the angles created by comparing the half-power points (3db) on the main radiation lobe to it's maximum power point.

Polarization: Polarization of an antenna refers to the direction in space of the E field (electric vector) portion of the electromagnetic wave being radiated by the transmitting system.

e) What is a folded dipole antenna? Draw its radiation pattern.

ANS: **(Description 1M, radiation pattern 1M**)

Folded dipole antenna: The folded dipole is essentially a single antenna made up of two elements. One element is fed directly, whereas the other is conductively coupled at the ends.

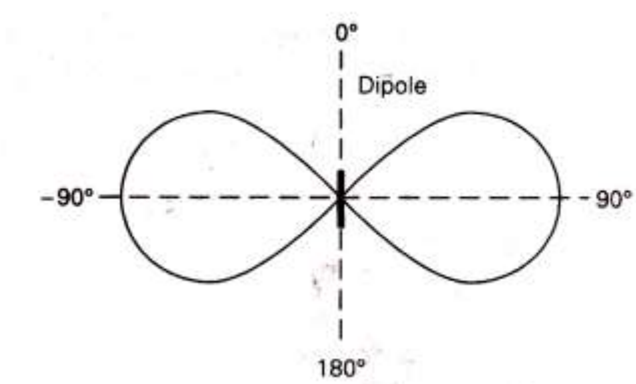


Fig. Radiation pattern antenna

f) Define sensitivity of AM receiver.

ANS: **(Defination 2M)**

Sensitivity of AM receiver:

The sensitivity of a receiver is the minimum RF signal level that can be detected at the input to the receiver and still produce a usable demodulated information signal.

OR

The sensitivity of a radio receiver is its ability to amplify weak signals.

g) Draw input and output waveforms of practical diode detector.

ANS: (**waveforms 2M)**

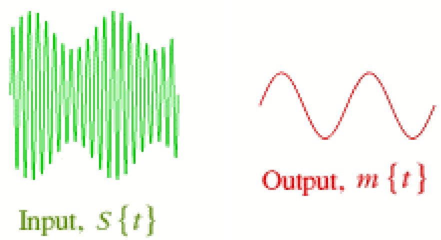


Fig. Input and output waveforms

h)Why FM reception is noise free? Justify.

ANS: **(2 M)**

- The information in FM signal is in the frequency of the modulated signal.
- The limiter in the FM receiver limits the distortion in the amplitude of the modulated signal and the frequency is unchanged.
- So, any noise in the envelope of the signal is removed by the limiter.
- Therefore FM reception is almost noise free.

(B) Attempt any TWO : **8M**

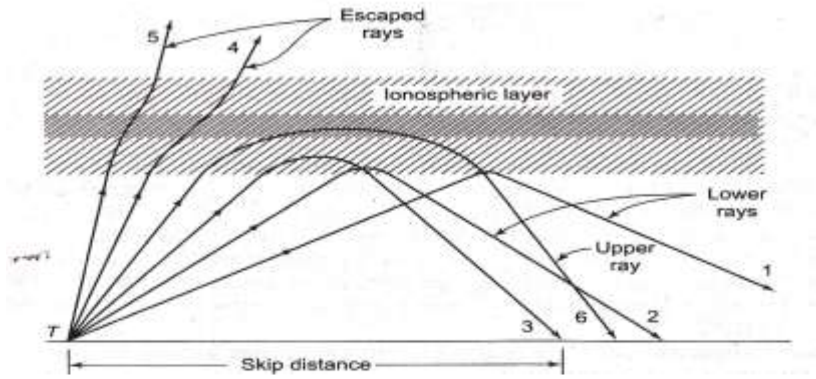
a) Define skip distance. How it can be kept constant?

ANS**: (Defination 2M, Description 2M)**

Skip distance:

Skip distance is defined as the minimum distance from a transmit antenna that a sky wave at a given frequency will be returned to Earth.

Skip distance can be kept constant by keeping the radiation angle θ_r constant for all the transmissions



b) Derive the relation between reflection co-efficient (e) and VSWR.

ANS:

Relation between reflection co-efficient (e) and VSWR:

SWR $= \frac{V_{max}}{V_{min}}$ **1M**

V_{max} = Ei +Er **1/2M**

V_{min} = $E_i - E_r$ **1/2M**

Therefore equation can be written as

$e E_i = E_r$

$$SWR = \frac{Ei + Ei\,e}{Ei - Ei\,e}$$ **1M**

$$SWR = \frac{Ei\,(1+e)}{Ei\,(1-e)} = \frac{(1+e)}{(1-e)}$$

SWR(1-e)= (1+e)

SWR= SWR e= 1+e

SWR= 1+e+(SWR)e

`SWR-1= e(1+SWR)

$$E = \frac{SWR - 1}{SWR + 1}$$ **1M**

c) Explain how PLL can be used as FM modulator.

ANS: (<u>**2M diagram,2M explanation)**</u>

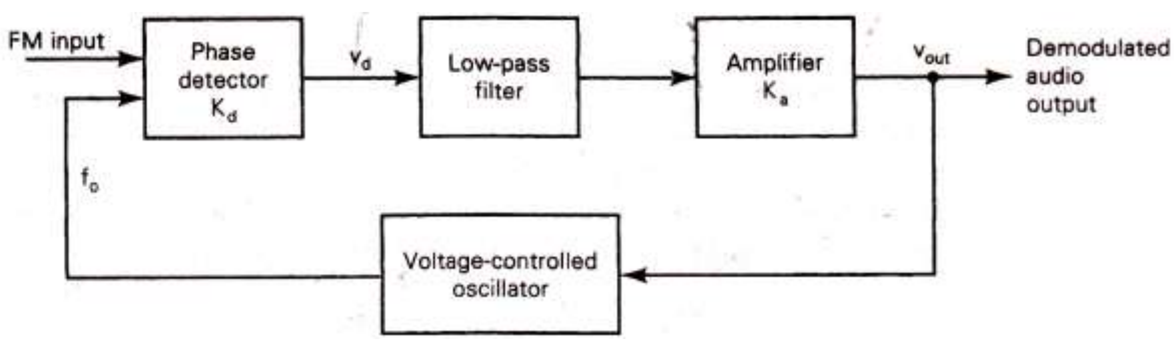


Fig.Block diagram for a PLL FM demodulator

Explanation:

- A PLL frequency demodulator requires no tuned circuits and automatically compensates for changes in the circuit frequency due to instability in the transmit oscillator.
- After frequency error at the input of the phase comparator.
- Therefore, if the PLL input is a deviated FM signal and the VCO natural frequency is equal to the IF center frequency, the correction voltage produced at the output of the phase comparator and fed back to the input of the VCO is proportional to the frequency deviation.
- If the IF amplitude is sufficiently limited prior to reaching the PLL and the loop is properly compensated.

Q.2 Attempt any FOUR: 16M

a) Explain tropospheric scatter propagation with relevant diagram.

ANS: **(2M diagram,2M explanation)**

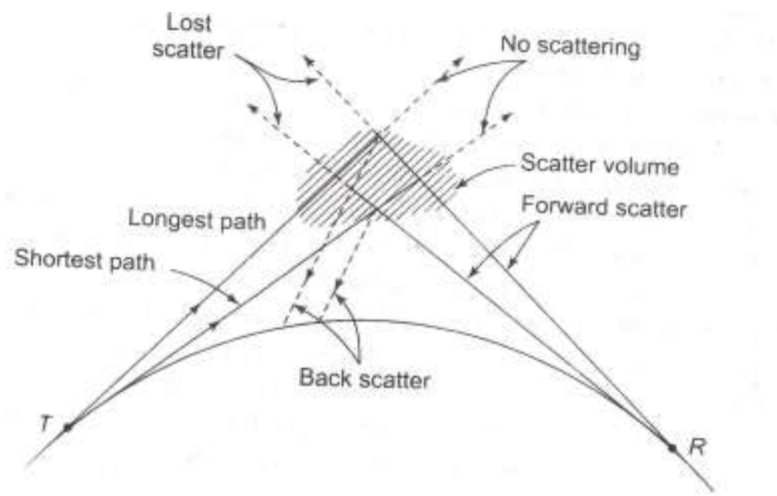


Fig. tropospheric scatter propagation

Tropospheric scatter propagation:

- It is also known as troposcatter,or forward scatter propagation, tropospheric scatter propagation is a means of beyond the horizon propagation for UHF signals. It uses certain of the troposphere, the nearest portion of the atmosphere.
- The reasons for the scattering are not fully understood. But there are two theories. One suggests reflections from “blobs” in the atmosphere, similar to the scattering of searchlight beam by dust particles.
- The best frequencies, which are also the most often used are centered 900,2000and 5000MHz .
- This method of propagation is often used to provide long-distance telephone and other communication links, as an alternative to microwave links or coaxial cables over rough or inaccessible terrain.
- Tropospheric scatter propagation is subject to two forms of fading. The first is fast, occurring several times per minute at its worst, with maximum signal strength variations in excess of 20dB.
- The second form of fading is very much slower and is caused by variations in atmospheric conditions along the path.
- It has been found in practice that the best results are obtained from tropo scatter propagation if antennas are elevated and then directed down toward the horizon.

b) Draw generalized equivalent circuit and RF equivalent circuit of a transmission line.

ANS: **(2M each)**

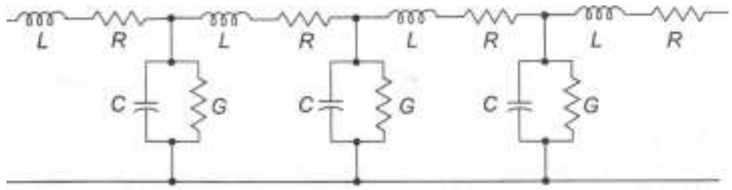


Fig. Generalized RF equivalent circuit of a transmission line

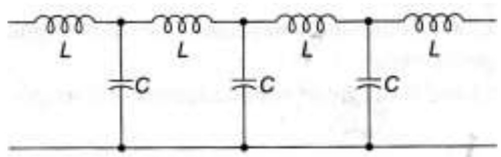


Fig. ` RF equivalent circuit of a transmission line

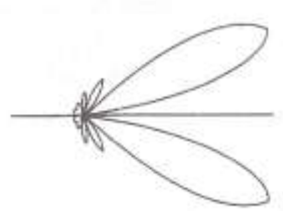
c) List characteristics of non-resonant antenna. Draw its radiation pattern.

ANS: (**Characteristics 2M-any 4) & (radiation pattern)**

Characteristics of non-resonant antenna:

i. Properly terminated transmission line.
ii. Produces no standing waves.
iii. Correct terminator resistor.
iv. No power is reflected.
v. Only forward travelling waves will exist.
vi. Correctly matched transmission line.
vii. All the transmitted power is dissipated in terminating resistance.

Radiation pattern:



d) Draw well labeled sketch of yagi antenna and give the function of its elements.

ANS**: (Diagram 2M (any one) ,explanation 2M)**

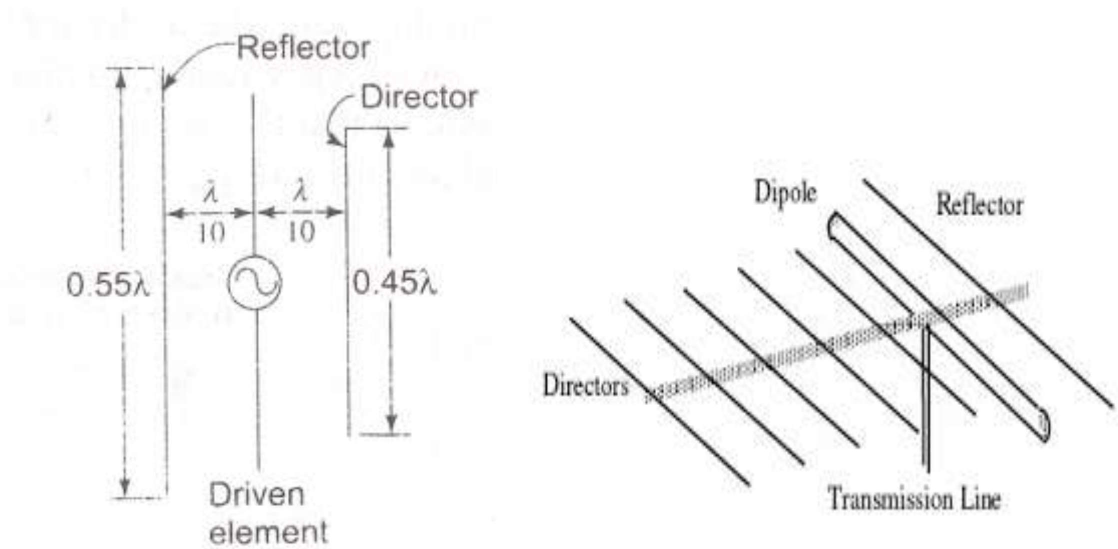


Fig.Yagi uda antenna

The function of elements of Yagi Antenna:

A yagi antenna is a linear array consisting of a dipole and two or more parasitic elements; one reflector and one or more directors.

1. The driven element is a half-wavelength folded dipole; it is connected to the transmission lines however, it is generally used for receiving only.
2. The reflector is a straight aluminum rod approximately 5% longer than the dipole, and the director is cut approximately 5% shorter than the driven element.
3. There are one or more directors in Yagi antenna, which guide the required signal to diapole for proper reception by enhancing the signal strength.

e) With the help of block diagram ,describe the function of TRF radio receiver.

ANS: **((Diagram 2M,explanation 2M)**

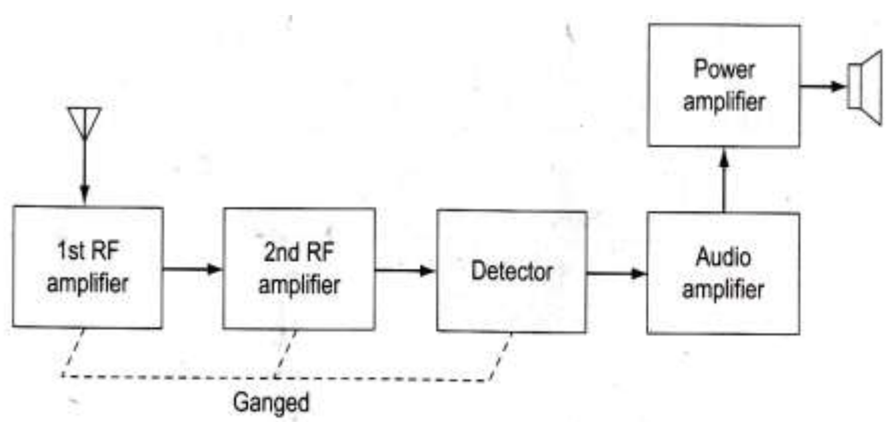


Fig. Block diagram of TRF radio receiver

Function of TRF radio receiver:

1. The block diagram of three-stage TRF receiver that includes an RF stage, a detector stage and an audio stage.
2. Generally two or three RF amplifiers are required to filter and amolify the received signal to a level sufficient to drive the detector stage.
3. The detector converts RF signal directly to information and the audio stage amplifies the information signal to a usable level.
4. TRF receivers are probably the simplest designed radio receiver available today.

f) Explain the operation FM radio receiver with the help of block diagram.

ANS**: <u>(Diagram 2M,explanation 2M</u>)**

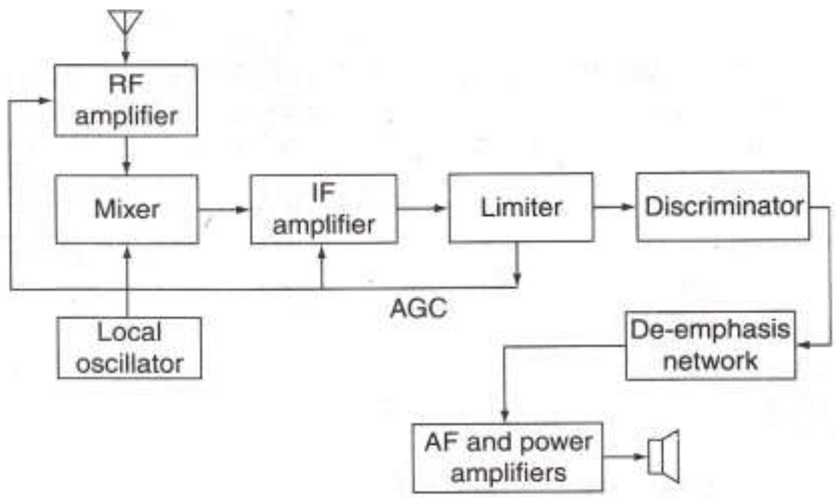


Fig. Block diagram of FM radio receiver

Operation FM radio receiver:

1. RF amplifiers: Its main purpose is to reduce the noise figure ,which could otherwise be a problem because of the large bandwidth needed for FM. It also required to match the input impedence of the receiver to that of the antenna.
2. Oscillators and Mixers: The oscillator circuit takes any of the usual forms, with the colpitts and clap predominant ,being suited to VHF operation. A very satisfactory for the front end of an FM receiver consists of FET's for the RF amplifier and mixer, and a bipolar transistor oscillator.
3. Intermediate frequency and IF amplifiers: Typical figures for receivers operating in the 88- to 108-MHz band are an IF of 10.7MHz and a bandwidth of 200 kHz. Two IF amplifiers stages are often provided ,in which case the shrinkage of bandwidth as stages are cascaded must be taken into account.

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

(a) Define the following term with respect to wave propagation

(i) Reception (ii) Attenuation (iii) Absorption (iv) Polarization

ANS: **(Each definition 1 Mark, Marks should be given even if student assume reflection or refraction)**

(i) **Refraction:** It is defined as changing of direction of an electromagnetic ray as it passes obliquely from one medium into another with different velocities of propagation.

OR

Reflection: Electromagnetic wave reflection occurs when an incident wave strikes a boundary of two media and some or all of the incident power does not enter the second material.

OR

Reception: It is the process of capturing electromagnetic wave from the free space by an antenna.

(ii) **Attenuation:** The reduction in power density with distance is equivalent to power loss and is called as wave attenuation.

(iii) **Absorption:** The reduction in power of a wave as it propagates through earth's atmosphere because of various substances such as gases, liquids, and solids.

(iv) **Polarization:** It is orientation of the electric field vector in respect to the surface of earth (i.e. looking at the horizon).

(b) Define the term standing wave ratio. Why the high value of SWR is often undesirable?

ANS: **(Definition of SWR-2 Marks, High value-2 Marks)**

Definition of SWR:

It is defined as the ratio of the maximum voltage to the minimum voltage or the maximum current to the minimum current of a standing wave on a transmission line.

$$SWR = \frac{V_{max}}{V_{min}} \text{ (unitless)}$$

- When incident and reflected waves are equal in amplitude (a total mismatch), SWR is infinity. This is the worst case condition. This means that complete transmitted wave is reflected back to the source which is not desirable.

(c) State the concept of Hertzian dipole and draw its radiation pattern.

ANS: **(Concept- 2Marks, Radiation pattern- 2Marks)**

Concept:

- A hertz antenna is a resonant antenna. That is it is a multiple of quarter-wavelengths ling and open circuited at far end.
- Standing waves of the voltage and current exist along a resonant antenna. Each pole of the antenna looks as if it were an open quarter-wavelength section of transmission line.
- Thus, there is voltage maximum and current minimum at the ends and a voltage minimum and current maximum in the middle.
- The impedance varies from a maximum value at the ends of approximately 2500Ω to a minimum value at the feed point of approximately 73Ω.

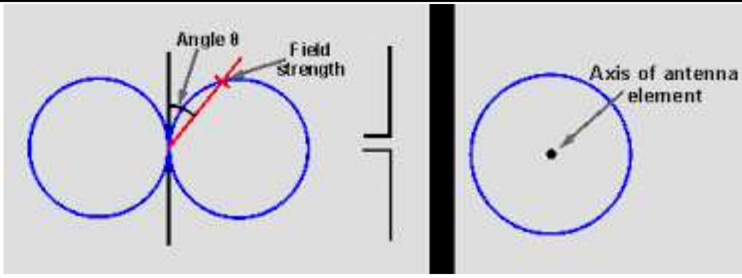
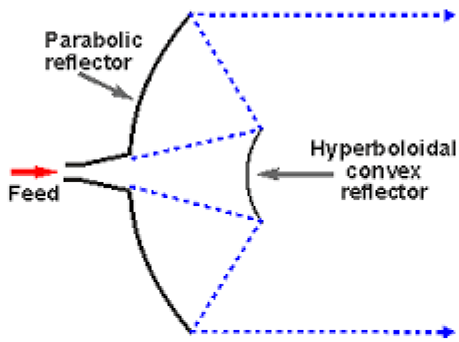


Fig.radiation pattern.

(d) Describe the working of parabolic reflector antenna with cassegrain feed. Support the description with neat diagram.

ANS: **(Diagram- 2 Marks, Explanation- 2 Marks)**



- The primary radiating source is located in or just behind a small opening at the vertex of the paraboloid rather than at the focus. The primary antenna is aimed at a small secondary reflector located between the vertex and focus.
- The rays emitted from the primary antenna are reflected from the cassegrain sub-reflector and then illuminate the main parabolic reflector just as if they had originated at the focus.
- The sub-reflector must have a hyperboloidal curvature to reflect the rays from the primary antenna in such a way as to function as a virtual source at the paraboloidal focus.
- The cassegrain feed is commonly used for receiving extremely weak signals or when extremely long transmission lines or waveguide runs are required and it is necessary to place low-noise preamplifiers as close to the antenna as possible.

(e) State the concept of AGC. Explain simple AGC circuit for radio receiver.

ANS: **(Concept-1 Mark, Circuit diagram 1.5 Marks, Explanation-1.5 Marks)**

Concept:

An AGC circuit compensates for minor variations in the received RF signal level. The AGC circuit automatically increases the receiver gain for weak RF input levels and automatically decreases the receiver gain when a strong RF signal is received.

Circuit Diagram:

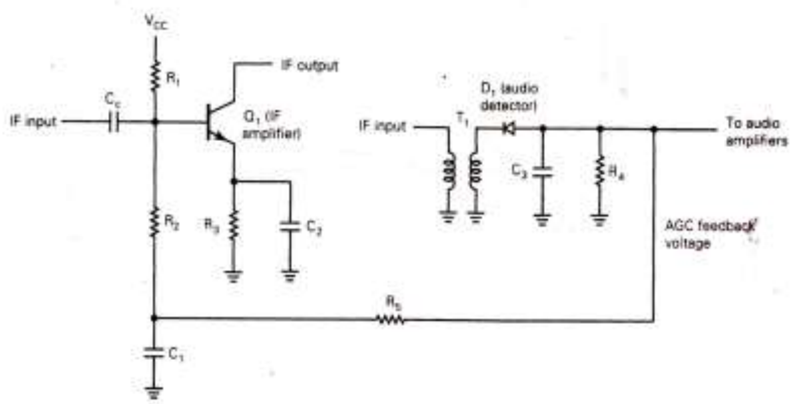


Fig. AGC circuit diagram

Explanation:

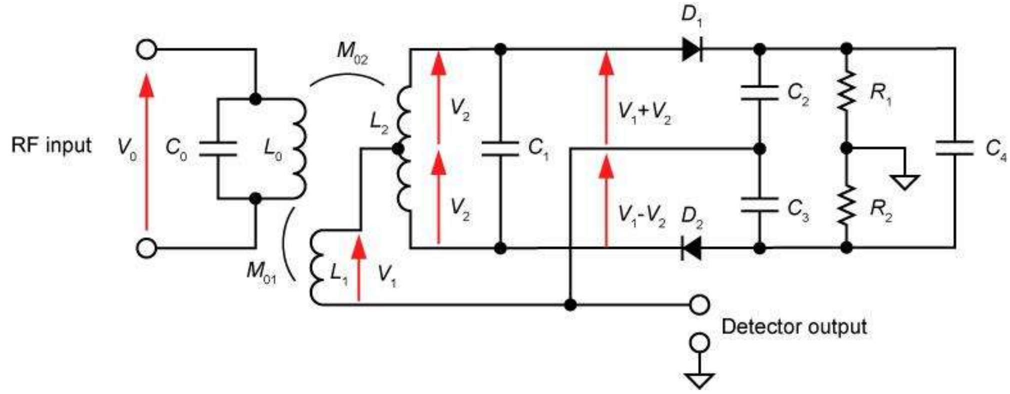
- The circuit shown above is a negative peak detector and produces a negative voltage at its output. The greater the amplitude of the input carrier, the more negative the output voltage.
- The negative voltage from the AGC detector is fed back to the IF stage, where it controls the bias voltage in the base of Q1. When the carrier amplitude increases, the voltage on the base of Q1 becomes less positive, causing the emitter current to decrease.
- As a result, re' increases and the amplifier gain decreases, which in turn causes the carrier amplitude to decrease. When the carrier amplitude decreases, the AGC voltage becomes less negative, the emitter current increases, re' decreases. And the amplifier gain increases.
- Capacitor C1 is an audio bypass capacitor that prevents changes in the AGC voltage due to modulation from affecting the gain of Q1.

(f) Draw the circuit diagram of ratio detector and state the advantages of ratio detector over other types of FM detectors.

(Circuit Diagram-2 Marks, Advantages- 2 Marks)

ANS: **(<u>Circuit Diagram-2 Marks, Advantages- 2 Marks)</u>**

Circuit Diagram:



Advantages of Ratio Detector:

- The output voltage is proportional to the difference between the individual output voltages. Thus ratio detector behaves identically to the input frequency changes.
- It does not require any external amplitude limiting circuitry.
- A large value capacitor connected at the output side will provide amplitude limiting.

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

(a) Define two different types of radio wave propagation. State three characteristics of each.

ANS: **(Definition- 0.5 Mark each (any two), characteristics 0.5 Marks each, any two)**

Ground Wave propagation: The ground waves travel along the surface of the earth.

Characteristics of ground wave propagation:

- The ground wave leaves the antenna and remains closed the earth. The ground wave will actually follow the curvature of the earth and therefore can travel distance beyond horizon.
- The ground wave propagation is the strongest at the low and medium frequency ranges. The ground waves are the path chosen by the signal when frequency is between 30KHz to 3MHz.
- The ground waves must be vertically polarized to prevent short circuiting of the electric field components.

Sky Wave Propagation: The transmitted signal travels into the upper atmosphere where it is bent or reflected back to earth.

Characteristics of sky wave propagation:

- The four main ionospheric layers are F2, F1, E and D in the descending order.
- The D layer is the lowest and it exists at a height of about 70Km from the earth surface.
- The E layer existing at an approximate of 100Km, and disappears in the night.
- The F1 layer is at about 180Km height and has an approximate thickness of 20Km in the day time.
- The F2 layer is the most reflecting layer for the HF radio signals incident on it.

Space wave propagation: Space waves travel in a straight line directly from the transmitting antenna to the receiving antenna.

Characteristics of space wave propagation:

- The direct or space waves are not refracted like sky waves nor do they follow the curvature of the earth like the ground waves.
- Due to the straight line nature of the space waves they will at some point be blocked due to curvature of earth.
- If the signal is to be received beyond horizon then the receiving antenna must be tall enough.

(b) Describe the radiation and dielectric losses in transmission lines.

ANS: **(Radiation loss-2 Mark, Dielectric loss-2 Mark)**

Radiation Loss: Radiation losses occur because a transmission line may act as an antenna if the separation of the conductors in an appreciable fraction of wavelength. This applies more to parallel wire lines than to co-axial lines. Radiation losses are difficult to estimate, being normally measured rather than calculated. They increase with frequency for any given transmission line, eventually ending that line’s usefulness at some frequency.

Dielectric Loss: Dielectric heating is proportional to the voltage across the dielectric and hence inversely proportional to the characteristic impedance for any power transmitted. It again increases with frequency because of gradually worsening properties with increasing frequency for any given dielectric medium. For air, dielectric heating remains negligible.

(c) Draw the constructional sketch of broadside array antenna and describe its working with radiation pattern.

ANS: **(Construction Diagram-2 Marks, working-1 Mark, radiation pattern-1 Mark)**

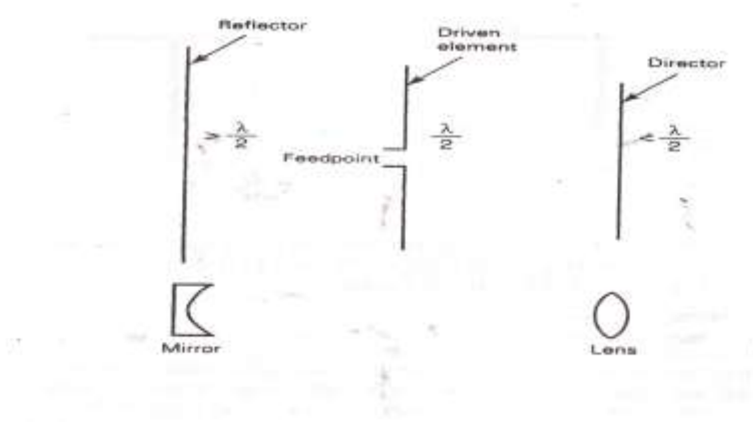


Fig. Broadside array

Working:

- The signal that is radiated from element 2 has travelled one-half wavelength farther than the signal radiated from element 1 (i.e. they are radiated 180^0 out of phase).
- Crisscrossing the transmission line produces an additional 180^0 phase shift. Therefore, the currents in all the elements are in phase, and the radiated signals are in phase and additive in a plane at right angles to the plane of the array.
- Although the horizontals radiation pattern for each element by itself is omni-directional, when combined their fields produce a highly directive bidirectional radiation pattern. Directivity can be increased even further by increasing the length of the array by adding more elements.

Radiation Pattern:

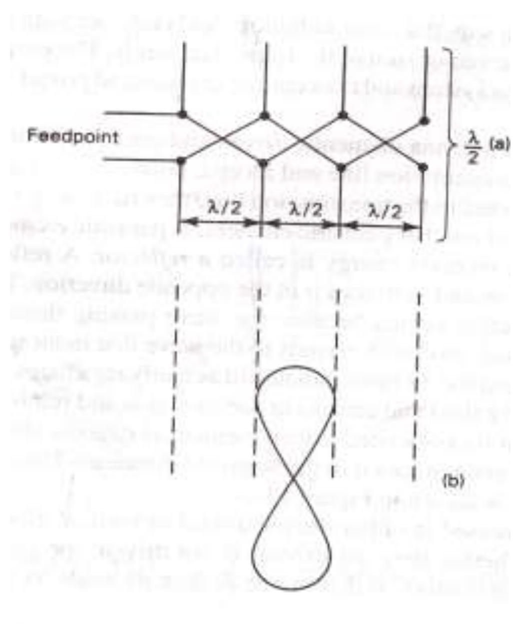


Fig. Radiation pattern

(d) Draw the block diagram of super-hetrodyne receiver with output waves after each block.

ANS**: <u>(Correct diagram- 4 Mark)</u>**

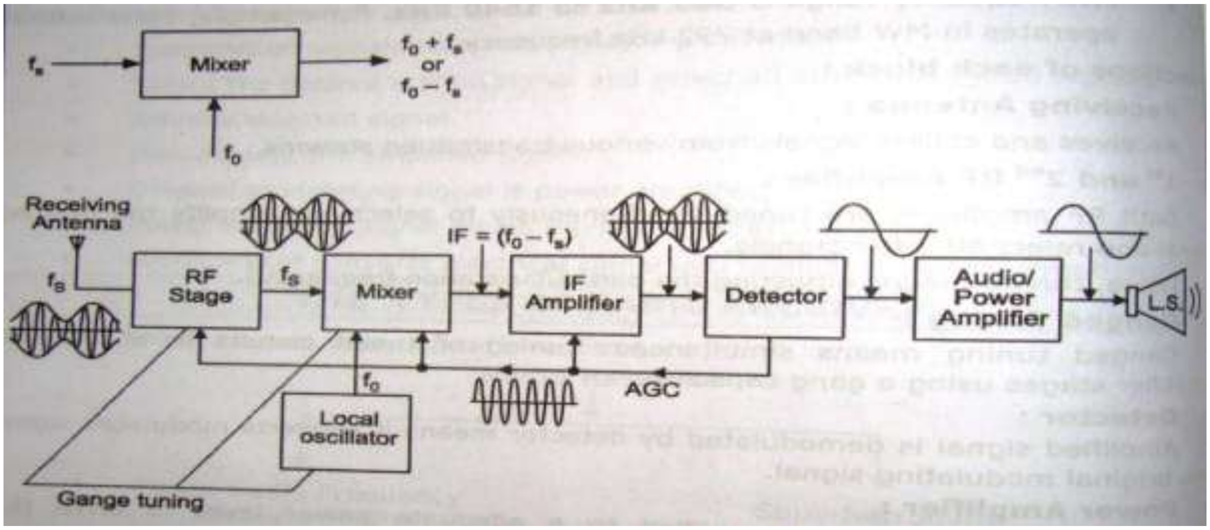


Fig.Block diagram of super-hetrodyne receiver

(e) State any four factors influencing the choice of intermediate frequency for radio receiver.

ANS**: <u>(Any four factors- 1 Mark each, other relevant point should also be given marks)</u>**

- At very high (gigahertz) frequencies, **signal processing circuitry performs poorly**. Active devices such as transistors cannot deliver much amplification (gain). So a high frequency signal is converted to a lower IF for more convenient processing.
- In receivers that can be **tuned to different frequencies**, is to convert the various different frequencies of the stations to a common frequency for processing. It is difficult to build multistage amplifiers, filters, and detectors that can have all stages track in tuning different frequencies
- Intermediate frequency is to **improve frequency selectivity**.
- It is always **easier to design, filters, amplifiers, oscillators** and other electronic circuits at lower and standard frequency rather than higher frequency.

(f) Draw block diagram of foster-seely FM detector and explain its working.

ANS: **<u>(Block diagram- 2 Marks, Working- 2 Marks)</u>**

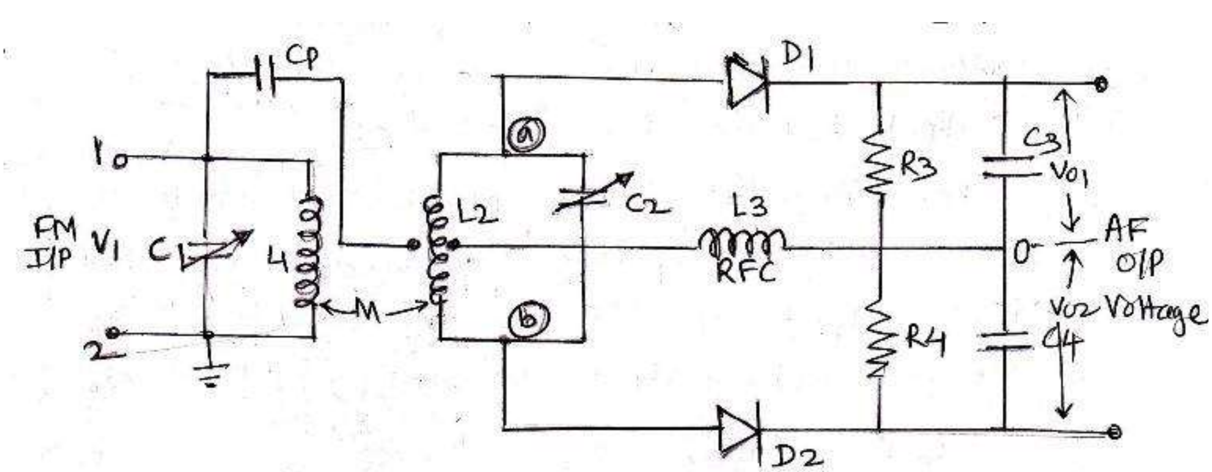


Fig. foster-seely FM detector

Working:

- Output voltage of the phase discriminator is equal to the difference between the output of the two diode rectifier. Therefore vo = vo1 – vo2
- This is due to the change in phase shift between primary and secondary winding depending on input frequency.
- **Output voltage at fin = fc :**When the input frequency is equal to center frequency the phase shift between primary and secondary voltages is exactly 900 hence net output voltage is zero as vo = vo1 – vo2
- **Output voltage for fin > fc :**For fin > fc the phase shift between primary & secondary winding voltages is such that the output ofD1 is higher than D2. Hence net output is positive
- **Output voltage for fin < fc :**For fin < fc the phase shift is such that output of D2 is higher than ofD1 making the output voltage negative.

Q5) Attempt any FOUR: 16M

a) Define virtual & actual height in sky wave propagation. Draw neat sketch depicting both the height.

ANS: **(Diagram 2M,each Defination 2M)**

Actual Height:

In sky wave propagation, the incident wave returns back to each due to refraction.

In this process it bends down gradually & not sharply. The maximum height attained by the wave is called as `Actual Height'.

Virtual Height:

When the incident wave bends ground gradually in sky wave propagation, the incident & reflected rays follow exactly the same path as those if the signal would have been reflected from a surface located at greater height. This height is called as `Virtual Height'.

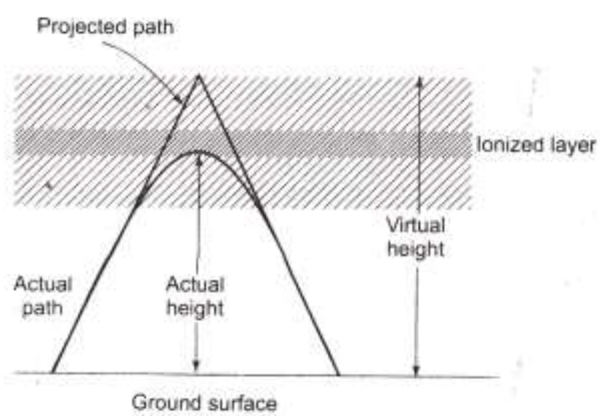


Fig. Actual and Virtual height

b) State any four properties of quarter wave transmission line.

ANS: **(4M)**

Properties of quarter wave transmission line:

1. Physical length of line=λ/4.
2. They have very important impedance transmission properties.
3. They reflect the opposite of its load impedance.
4. If a quarter wavelength line is connected to an impedance then the normalized input impedance of this line is equal to the normalized load admittance.

c) Draw neat sketch of loop antenna with its radiation pattern. Explain how they are used for direction feeding.

ANS**:** **(Diagram 2M, Explanation 2M)**

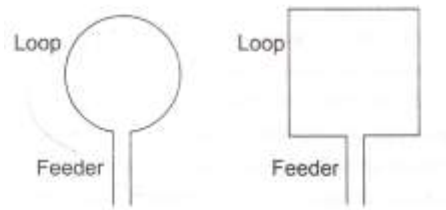


Fig.Loop antenna

Explanation:

When current flows through the loop, a magnetic field is generated around it. The magnetic field is perpendicular to the loop. The radiation pattern is doughnut pattern. No radiation is received normal to the plane of loop & a null is obtained in this direction.

∴ This type of directional pattern is used for direction finding. Such equipment consist of a small loop, vertical 7 rotatable about a vertical axis mounted on the top of a portable receiver to the meter.

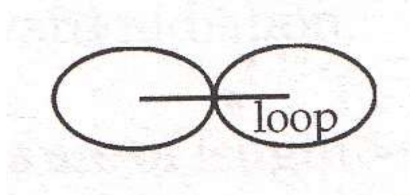


Fig.Radiation pattern

d) Describe the frequency tracking in AM radio receiver.

ANS: (**4M)**

The AM receiver has number of tunable circuits (e.g. antenna, mixer, local oscillator, tuned circuit etc.) All these circuits must be tuned correctly. If any station is to be tuned.

∴Capacitor in the various tuned circuit are ganged.

Due to the arrangement it is possible to used only one tuning control to vary the tuning capacitors simultaneously. The local oscillator frequency (f0) must be precisely adjusted to a value which is above the signal frequency (fs) by IF.

i.e. f_0=fs+I.F.

If the tuning is not done correctly then

f_0-fs ≠I.F.

∴Stations will appear away from their current position on frequency dial of the receiver.

Process in which the local oscillator frequency follows or tracks the signal frequency to have a correct frequency difference is called as tracking.

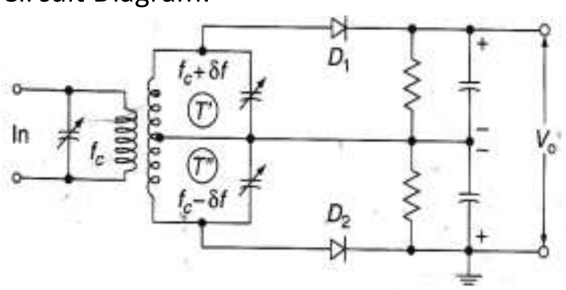
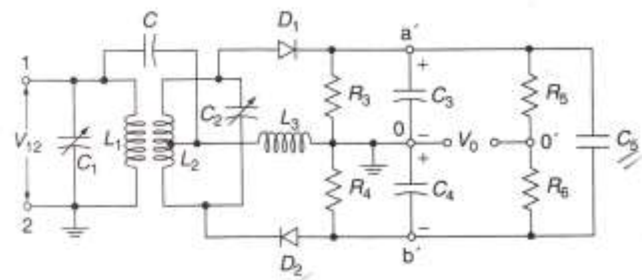
e) If AM radio receiver is not RF aligned, what are the effect on radio receivers output?

ANS: **(4M)**

If AM radio receiver is not RF aligned then all the broadcasting stations seems to get shifted on the dial. e.g; A station with frequency 640kHz came in at 650kHz on the dial. Due to this ,it is also possible that some of the stations on right side of dial will be off.

f) Compare Balance slope detector & Ratio detector on the basis of working principle & circuit diagram.

ANS : (**Each point 1M)**

Sr. No.	**Balance slope detector**	**Ratio detector**
1	$V_0=V_{01}-V_{02}$	$V_0=1/2(V_{01}-V_{02})$
2	Output characteristics depends on primary & secondary frequency relationship.	Output characteristics depends on primary & secondary phase relationship.
3	Alignment /tuning is very critical.	Not critical.
4	Linearity of output characteristics is poor.	Very good linearity
5	Amplitude limiting is not provided.	Amplitude limiting is provided
6	Circuit Diagram:- 	Circuit Diagram:- 

Q.6 Attempt any FOUR:- **16M**

a) **Explain the basic principle of transmission line. Also give classification of transmission lines on the basics of construction.**

ANS: **(Principle-2M, Classification 2M)**

Principle of Transmission Line:-

Transmission lines are conducting wires used for connecting points that are some distance apart from each other's.

They are also used for impedance matching between transmitter & antenna from receiving antenna to receiver.

Classification:-

There are two types of transmission line:

- Two wire parallel conductor

  This are subdivided into 3 types that given as follows:

  a. Flat twin lead
  b. Open wire line
  c. Tubular twin lead

- Coaxial cable

b) **Define directivity & power gain of an antenna. Also give the relation between directivity & power gain.**

ANS**: (Directivity 1M, Power gain 1M, Relation-2M)**

Directivity :-

It is the maximum directive gain which is obtained in only one direction in which the radiation is maximum.

That is directivity = Max. directive gain

Power gain:

It is the ratio of power fed to an isotropic antenna to the power fed to a directional antenna, to develop the same field strength at the same distance, in the direction of maximum radiation

That is Power gain = $\frac{powerfed\ to\ the\ isotropic\ antenna}{power\ fed\ to\ the\ directional\ antenna}$

Relational between power gain & directive Gain:-

Relation between power gain & directive gain is $A_p = \eta D$

Where A_p = power gain

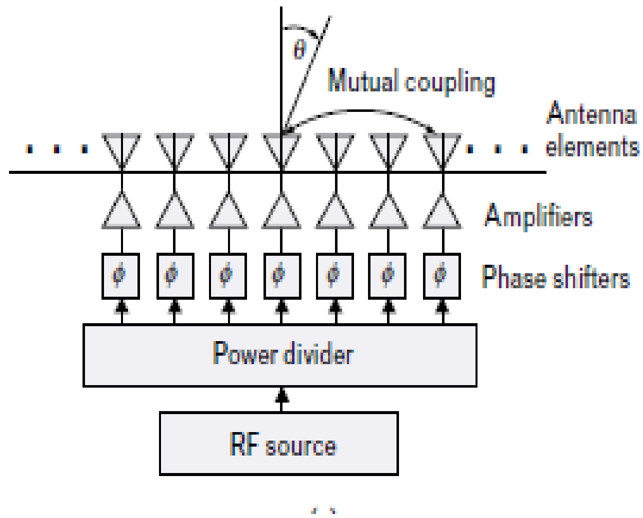
D = Directivity

η = Antenna efficiency

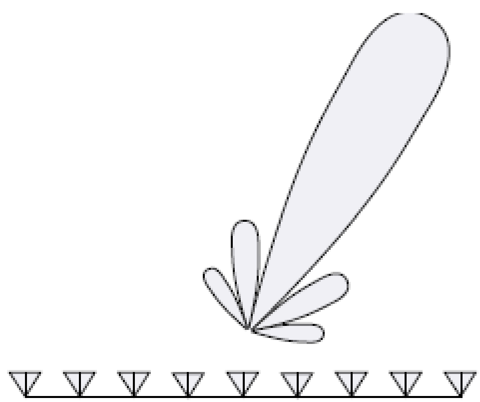
c) Draw the constructional sketch of phased array and describe its working with radiation pattern.

ANS: **(Sketch 1M, Radiation pattern 1M, Working 2M)**

Sketch:-



Radiation pattern:-



Working:-

- A phased array is a group of antenna connected to the one transmitter or receiver. The radiation bean the antenna can be adjust electronically without any moving physical paths.
- Transmission or reception in several directions is possible at once.
- There are two basic types of phased arrays in the first, as single high power output tube feeds a large number of antennas through a set of power divider & power shifter. In second type, many semicondu generators are used the number equal to radiating element.
- The phase relation between the generators is maintained through phase shifters. But these are low pov devices.
- The direction of beem or beems is selected by adjusting the phase difference provided by each phase shifter.

d) Why intermediate frequency has a constant value.

ANS: **(4M)**

- The frequency spectrum has been distributed for various purposes.
- Otherwise, the people may use the frequencies of their choice & there will be wide range of interference. So, in order to ensure proper reception of signals, the standards have been fixed for the transmission of frequencies & also for the intermediate frequency .
- Because if the intermediate frequency is varied the overall frequency value will also vary.
- The intermediate frequency value should be so designed that it should not lie within the range of mixer stage. Otherwise, there is the production of noise signal due to the interference of mixer frequency & intermediate frequency.
- The intermediate frequency should not be too high. Otherwise, it will reduce the selectivity of the receiver because of increase in bandwidth.

Considering all these factors intermediate frequency is kept constant.

e) Define the term fidelity & dynamic range of radio receiver.

ANS:- **(Each definition 2M)**

Fidelity:-

It is the ability of receiver to reproduce all the modulating frequencies equally.

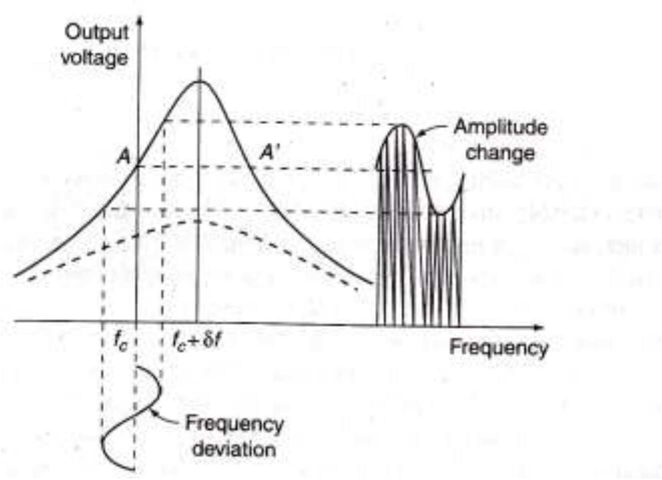
Dynamic range:-

It is the range of signal levels over which it can operate. The low end of range is governed by its sensitivity and high by overload or strong single handling performance.

f) With the help of characteristic curve, explain the working of slope detector.

ANS:- **(Characteristic curve 2M , Working 2M)**

Characteristic curve :-



Working :-

Slope detector is used to detect frequency modulated signal. It is basically a tank circuit suppose center frequency of the signal is f_c & deviation is δ. The resonant frequency of this tank circuit is adjusted to $(f_c + \Delta f)$. The amplitu

output voltage depends upon frequency deviation of input FM signal. Therefore output voltage of tank circuit is $\propto$ changes i
frequency at the input.