**Q1 a) Attempt any six of the following:** **12M**

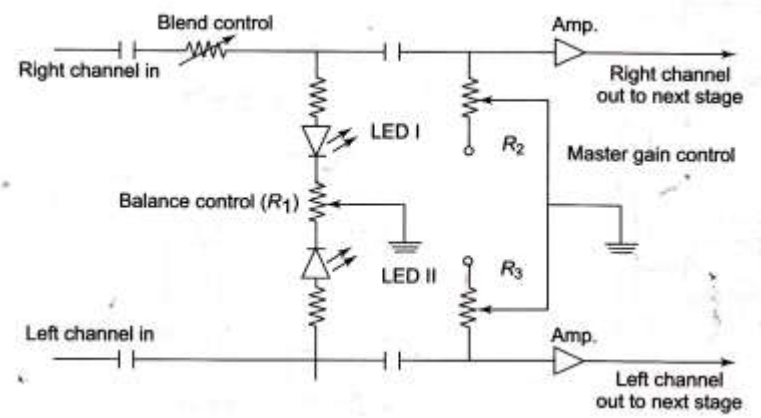
**i) List any four types of Microphones.**

**Ans: - Types of microphones: any four ½ each** **(2 marks)**

- Moving coil microphone.
- Ribbon microphone.
- Crystal microphone.
- Capacitor or condenser microphone
- Carbon microphone
- Electret microphone

**ii) Draw neat circuit diagram of stereo control.**

**Ans:- Circuit Diagram of Stereo control:-** **2M**




**iii) Define:-**

**1) Frequency Modulation**

**2) Modulation Index for FM**

**Ans:-**

**FM:-** **01M**

This is the modulation technique in which frequency of carrier is changed according to amplitude variation in modulating signal.

**Modulation Index for FM** : **01 M**

The modulation index for FM, $m_f$ is defined as

$$m_f = \frac{(maximum)\ frequency\ deviation}{modulating\ frequency} = \frac{\delta_f}{f_m}$$

**iv) State operating principal of optical recording.**

**Ans:-**

**Optical recording of a sound is of two types: any one** **02M**

**Recording on photographic films:**

It is the process of converting audio signals into variation of light intensity falling on the film. Intensity of a light from a slit is made to vary in accordance with sound pressure variations. when this varying lights falls on the edge of the main film, a photograph of varying light intensity is recorded in the same way as variation of light from a picture are recorded

**OR**

**Recording on CD:**

This is done with the help of laser beams, made ON and OFF by digitized audio signals. These beams fall on a photo resist material on a rotating disc and caused pits of varying width & fixed depth & thus records signals in binary form, flats & pits making 1s & 0s respectively.

**v) List two advantages and two disadvantages of compact disc(CD).**

**Ans: Advantages of CD: ( any two)** **½ marks for each point=1M**

i. Signal to noise ratio is high
ii. Compact disc is immune to the surface contamination
iii. Dynamic range is high
iv. Channel separation is high
v. Wow does not exist
vi. Flutter does not exist
vii. Total distortion is low
viii. Frequency response is excellent & covers complete audio range

**Disadvantage of CD: (any two)** **½ marks for each point=1M**

i. The cost of CD is more than the high fidelity
ii. Recording cannot be erased
iii. Read only in nature.
iv. CD read/ write need specialized setups.

**vi) State any four selection criteria of microphone.**

**Ans: Selection criteria of microphone: ( any four)** **½ marks for each point= 2M**

1) High sensitivity
2) High signal to noise ratio
3) Flat frequency response over most of audio frequency range
4) Natural Resonant frequency outside the audible range

5) Very Low distortion

6) Correct output impedance to match line impedance

**vii) List different Tone controls**

**Ans:-**

- Bass Control **01M**
- Treble Control **01M**

**viii) List any Two Characterstic of Audio Amplifier**

**Ans:- Characteristics of Audio amplifier (any two)** **01M each**

a) Gain
b) Bandwidth
c) Distortion
d) Power output
e) Impedance

**Q1 b) Attempt any two of the following :-** **08M**

**i) A broadcast AM amplifiers radiates 50KW of carrier power. What will be the radiated power at 85% modulation.**

**Ans:-**

(i) $P_t = P_c\left(1+\frac{m_a^2}{2}\right)$ ——— 1 mark.

where $P_t$ = transmitted total power
$P_c$ = Carrier Power.
$m_a$ = modulation Index.

Given data

$P_c = 50\ KW = 50 \times 10^3\ W$
$m_a = 85\% = 0.85$ } —1M.

$\therefore P_t = 50\times10^3\left[1+\frac{(0.85)^2}{2}\right]$ —1M

$= 68.06\times10^3\ W$

$P_t = 68.06\ KW$ — 1M.

Ans:- The radiated power at 85% modulation is 68.06 KW.

**ii) Compare AM & FM on the basis of:-**

**1) Bandwidth**

**2) No. of sidebands**

**3) Modulation index**

**4) Power in sideband**

Ans:- **1 Mark for each point**

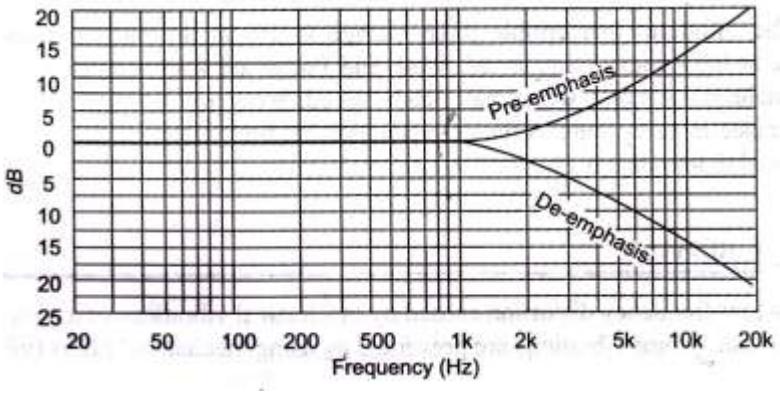
| **Parameters** | **AM** | **FM** |
|---|---|---|
| **Bandwidth** | $2F_m$ | $2(m_f + \Delta)$ |
| **No. of sidebands** | 02 | infinite |
| **Modulation index** | Less than 1 | Greater than 1 |
| **Power in sideband** | Lesser than carrier or $P_c (m_a)^2 / 2$ **OR** Power loss is there | Same as transmitted power **OR** no power loss |

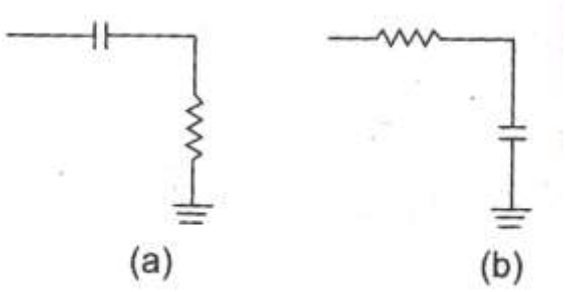
**iii) Compare Pre-emphasis and De-emphasis process (any four)**

**Ans:-**

**Concept of pre-emphasis & de-emphasis** **01m each**

| **Pre emphasis** | **De emphasis** |
|---|---|
| It is the artificial boosting of higher audio frequencies accordance with the pre arranged curve | It is the process of removing artificially boosted higher frequencies. |
| It is a High pass filter circuit used at FM transmitter | It is a low pass filter circuit at FM receiver |
| pre-emphasis ckt dig as given below | de-emphasis ckt dig as given below |
| pre-emphasis response curve as given below | de-emphasis response curve as given below |




(a) *Pre-emphasis circuit*
(b) *De-emphasis circuit*

**Q2 Attempt any four of the following :-** **16M**

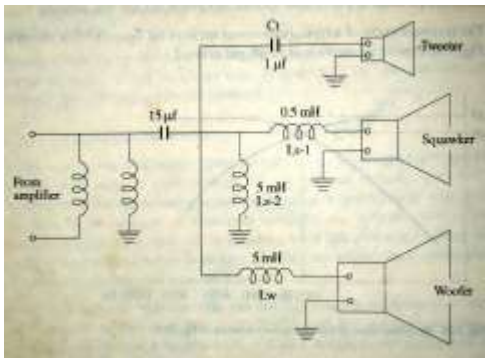
**a) Draw neat circuit diagram of 3 way speaker system, describe its operation.**

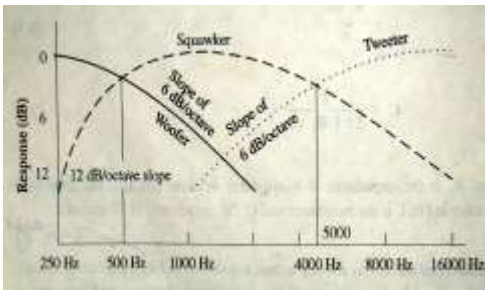
**Ans:-** **(circuit diagram 02M,Explanation 1.5M,Response curve 0.5M)**

**3 way Cross Over Network:**

When multi-way speaker system is used to get flat frequency response for the entire range of audio frequency it is essential to have a cross over network to divide the incoming signal into separate frequency ranges for each spectrum.

In absence of cross over network, the speaker will suffer overheating and output will be Distorted when full power at frequencies outside the range in fed to them. As well as overall efficiency will be much reduced.



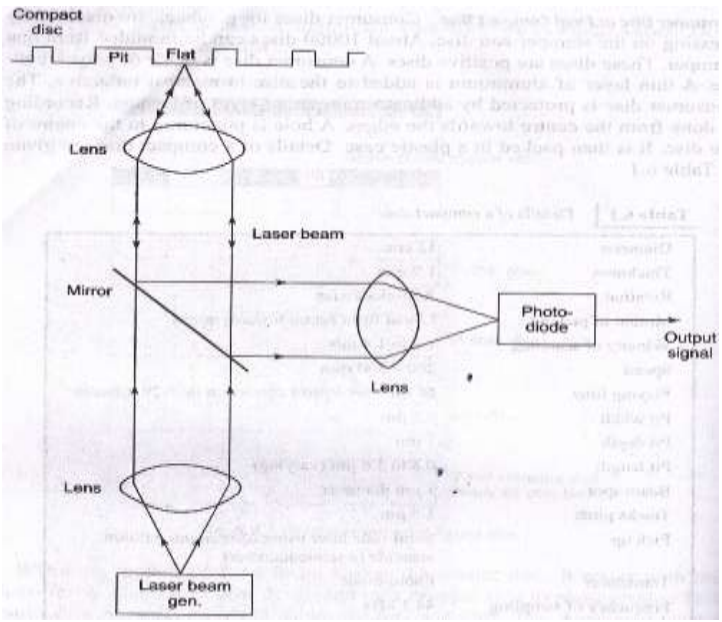

Ct of 1μf in series with tweeter prevent 100 and mid frequencies reaching the tweeter.
$L_w$ of 5mH in series with woofer prevents high and mid frequencies reaching to woofer.

$L_{s1}$ and $L_{s2}$ allows only mid frequency range to reach to squawker.

**b) Draw neat block diagram of detection circuit, state its operating principle.**

**Ans:-**

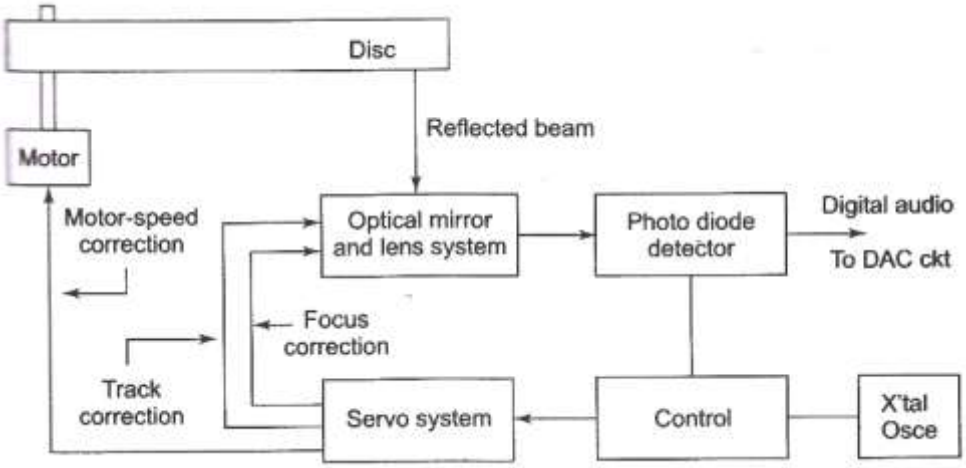
**Diagram:-** **02M**




**Explanation:** **2M**

A layer beam is incident on the compact disc through a half silver mirror. The returning beam is reflected from the aluminum flat surface and represents the logic 1. There is only a little reflection from a pit and it represents logic 0.

**OR**



**Explanation:**

- Detection in optical recording is equivalent to playback process. In this a laser beam produced by a solid state laser of semiconductor aluminum gallium arsenide is made incident on the CD through half silver mirror the mirror allows the beam to pass through itself but does not allow the returning beam to pass.
- The returning beam is reflected from the aluminum flat surface & represents digit 1.there is only little reflection from a pit & it represents 0. Thus the laser beam is the replica of the original laser beam modulated by digits of audio signal.
- Light is not reflected from the pit fully reflected from flat surface. Thus binary digits are reproduces when this ON-OFF reflected light falls on a photodiode.
- The digital output of photodiode is processed & converted into the original signal by using DAC

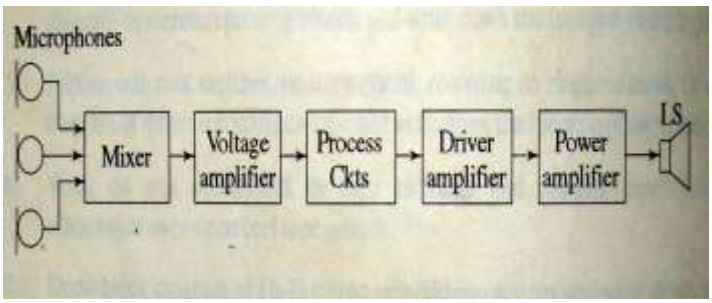
- Control signals allow any combination of track to be played in any sequence with the help of keyboard.
- A clock signal is obtained from the disc itself. It is compared with a crystal oscillator signal. Any discrepancy result in generation of a correction signal which is applied to the servo system.

The binary digits are reproduces when this ON-OFF reflected light falls on a photosensitive diode. The digital output of the diode is analog signal by using digital to analog converter.

**c) With the help of neat diagram, of PA system describe function of each block.**

**Ans:-**

**Public Address system Diagram:-** **02M**




**Function:-** **02M**

The intensity of sound decreases with distances. Hence when a large gathering is to be addressed, sound needs to be amplified so that people at a distance from the rostrum or stage may receive good intensity of sound for comfortable listening.

The system which fulfills the above requirement is called public address system or P.A system.

The in used in sports meet public meeting auditorium, concerts, functions etc.also used to convey information to isolated location like, railway station airport, hospitals, factories, schools etc.

In an electro acoustic system in which sound in first converted into electrical signals by a microphone

1) **Microphone** – it picks-up sound wave and convert them to equivalent electrical signal called audio signals. Generally 2 or more microphones are used and in addition, an auxiliary input for tape/record player CD player.
2) **Mixer**- the out of microphones in fed to mixer stage. The function of the mixer stage in to effectively isolate different channels from each other before feeding to main amplifier. It may be built in unit or a separate plug-in unit.

**Three type of mixers**

1) Simplest – no amplifiers only gain controls (faders) and isolating services resistors.
2) Little sophisticated- common amplifiers after isolating resistors.
3) Most sophisticated – Has separate pre amplifier for separate channels then after gain control potentiometers and isolation resistor. There is a common amplifier followers
Function of preamplifier & amplifiers to amplify weak signals.

**3) Voltage amplifiers-** amplifiers the output of mixer stage.

**4) Processing circuit-** these circuits have master-gain control (volume control) and tone control circuit.

**5) Driver amplifier** – it gives voltage amplification to the signal to such an extent that when feed to power amplifier (next stages) the into internal resistance of that stage is reduces. Thus drivers the power amplifier to give more power.

**6) Power amplifier** – it gives desired power amplification to the signal generally push pull amplifier is used, so that harmonics are eliminated from the output and transformer core us bit saturated,

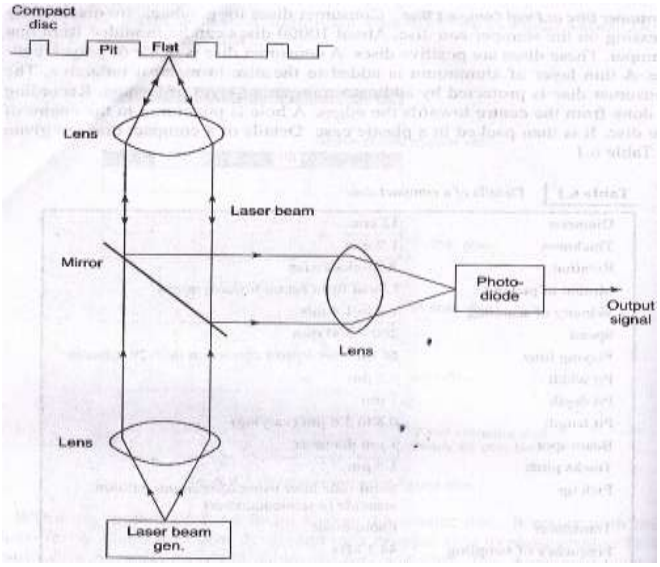
The output of the power amplifier is connected to the loudspeaker through a matching transformer to match the low impedance of the L.s for max transfer of power

**7) Loudspeaker**- Converts electrical signal into pressure variation resulting in sound.

**d) What is the role of detection circuit in CD player. State its operating principle.**

**Ans:-**

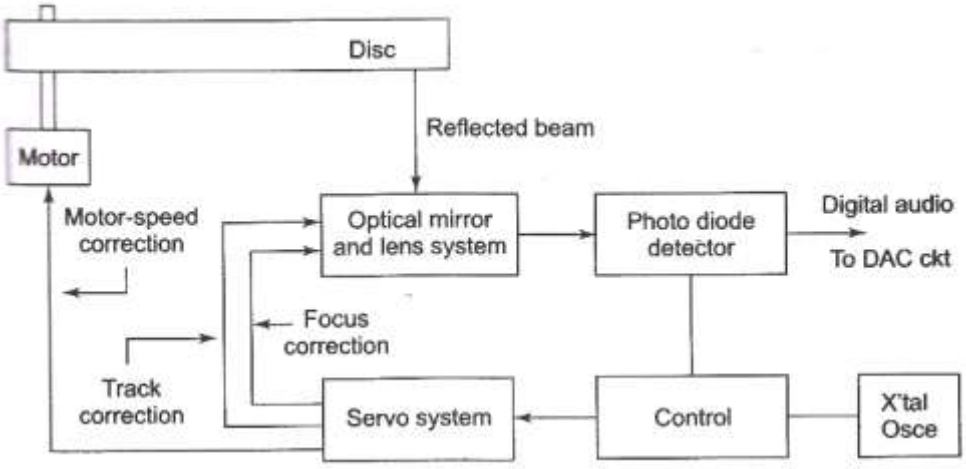
**Diagram:-** **02M**




**Explanation:** **2M**

A layer beam is incident on the compact disc through a half silver mirror. The returning beam is reflected from the aluminum flat surface and represents the logic 1. There is only a little reflection from a pit and it represents logic 0.

**OR**



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The binary digits are reproduces when this ON-OFF reflected light falls on a photosensitive diode. The digital output of the diode is analog signal by using digital to analog converter.

**e) Describe how DSBSC AM signal is generated by Diode balance modulator, with neat diagram.**

**Ans:-**

**Diagram** **2M**

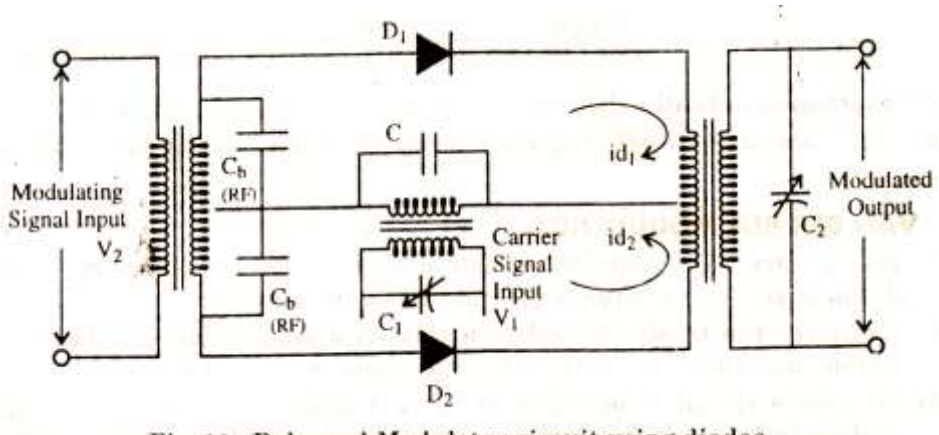



Fig. 11 : Balanced Modulator circuit using diodes

**Explanation:** **2M**

This is a circuit can be used for generating the two side bands with the suppression of carrier.

The balanced modulator is constructed using components which are of non linear behavior can be analyzed by certain mathematical equations,

1) i = bv where b = conductance
2) if the circuit operates in amplifier form then equation is i = a + bv where a = dc component
3) If the circuit is constructed using certain non linear devices then equation modifies to i = a + bv + $cv^2$ where c = non linear constant may be positive or negative.

**f) Define:-**

**1) Phase Modulation**

**2) Modulation Index for PM**

**Ans:-**

**Phase modulation:** **2M**

The phase shift of the carrier signal is varied in proportional with the amplitude of the modulating signal. The amplitude of the carrier remains constant.

**Modulated index:** **2M**

The modulating index is defines as Mp = δp is expressed in radiance where δp is maximum frequency deviation.

**Q3 Attempt any four of the following:-** **16M**

**a) Derive mathematical for total power in AM.**

**Ans:-**

$$P_{total} = \frac{(V_{carrier})^2}{R} + \frac{(V_{LSB})^2}{R} + \frac{(V_{USB})^2}{R}$$ 01M

The above expression is represented in terms of Peak values, but for the power rms values are considered. So

$$V_{c(rms)} = \frac{V_c}{\sqrt{2}} \text{ using concept } V_{rms} = \frac{V_{max}}{\sqrt{2}}$$

$$V_{LSB(rms)} = +\frac{m_a V_c}{2\sqrt{2}} \quad \text{where } V_{LSB} = \frac{m_a V_c}{2} \quad \text{... Derived in the sideband expressions}$$

$$V_{USB(rms)} = -\frac{m_a V_c}{2\sqrt{2}} \quad \text{where } V_{USB} = -\frac{m_a V_c}{2} \quad \text{... Derived in the side band expressions}$$

$$P_c = \frac{(V_{carrier})^2}{R} = \frac{(V_c\sqrt{2})^2}{R} = \frac{V_c^2}{2R}$$ 01M

$$P_{total} = \left(\frac{V_c}{\sqrt{2}}\right)^2 \frac{1}{R} + \left(\frac{m_a V_c}{2\sqrt{2}}\right)^2 \frac{1}{R} + \left(-\frac{m_a V_c}{2\sqrt{2}}\right)^2 \frac{1}{R}$$ 01M

$$P_t = \frac{V_c^2}{2R} + \frac{m_a^2 V_c^2}{8R} + \frac{m_a^2 V_c^2}{8R}$$

$$P_t = \frac{V_c^2}{2R}\left[1 + \frac{m_a^2}{4} + \frac{m_a^2}{4}\right]$$

$$P_t = P_c + \frac{m_a^2}{4} P_c + \frac{m_a^2}{4} P_c$$

$$P_t = P_c\left(1 + \frac{2m_a^2}{4}\right)$$

$$\boxed{P_t = P_c\left(1 + \frac{m_a^2}{2}\right)}$$ 01M

**b) Define Modulation, why it is needed.**

**Ans:-**

**Modulation :-** **02M**

It is a process in which one or more characteristics of high frequency carrier signal is varying according to instantaneous value of low frequency modulating signal or information signal

**Need of modulation:** **02M**

- Low frequency signals cannot be transmitted for long distance that's why there is a need of modulating the information signal in short, it improves the signal strength.
- To reduced antenna heights, noise & distortion
- To narrow banding the signal
- To reduce the complexity of the equipment

**c) What is the bandwidth required for an FM signal in which the modulating frequency is 2KHz and maximum deviation is 10KHz?**

**Ans:-**

**Carson's rules:**

Given data:
Modulating frequency is 2KHz fm(max)
Maximum deviation is 10KHz

Bandwidth for a FM signal = $2(\Delta+fm)$ ……2 M
= 2(2K+10K)
= 2(12K)
= 24 KHz…….. 2M

**(Note:- Marks should be credited if the students solve the sum either by Carson's rules or Bessel's rules)**

**d) Redraw the given diagram with proper nomenclature. Write the function of channel. Refer Fig. no 1**

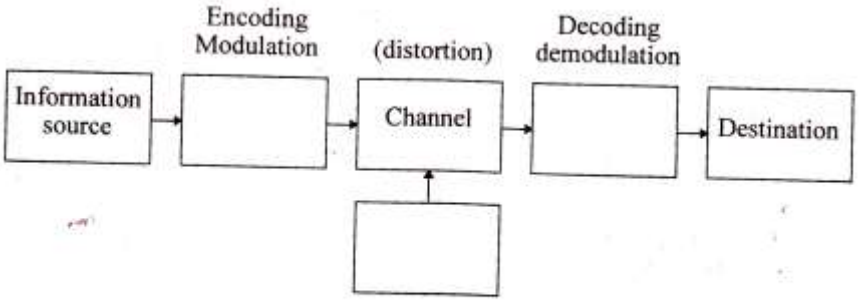
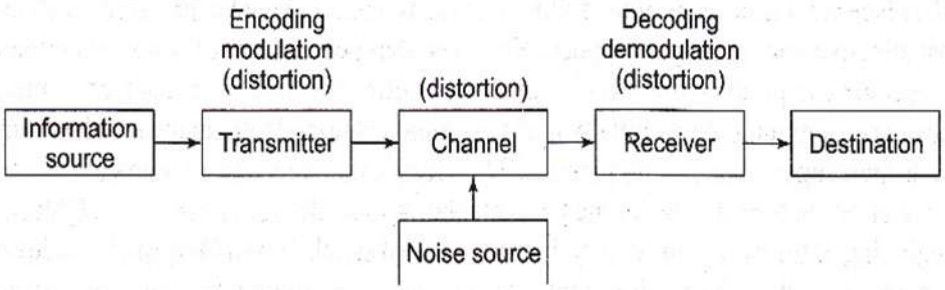



**Fig. No. 1**

**Ans:-**

**Diagram :-** **(01M for each block)**



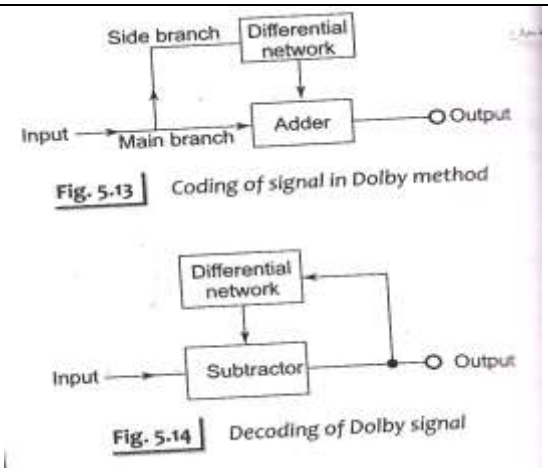
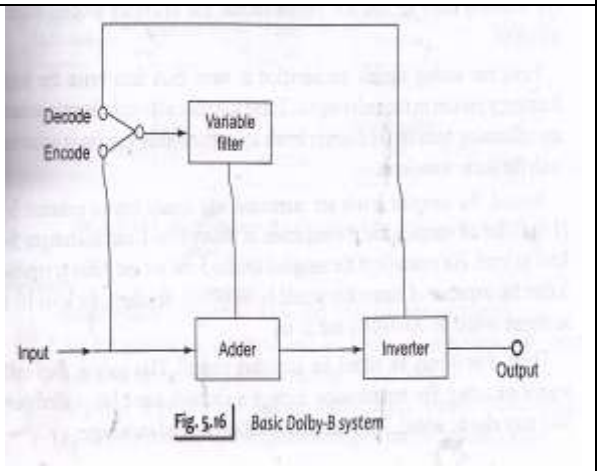
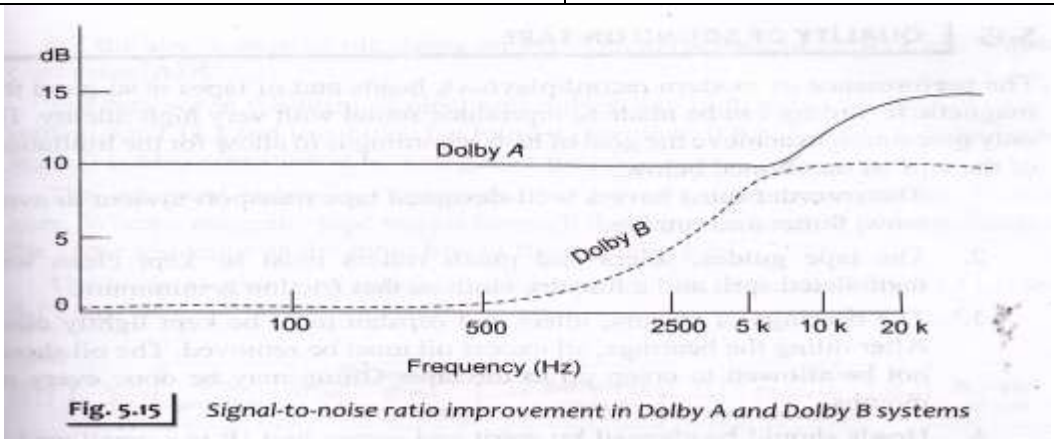

**Function of channel:-** **01M**

The transmission medium or communication channel provides a means of transporting signals between transmitter and receiver and can be used simple as pair of copper wires or as complex as microwaves, satellites or optical fiber communication system

**e) Compare Dolby A & Dolby B system on the basis of**

**1) Operating Principle**
**2) SNR**
**3) Bands**
**4) Advantages**

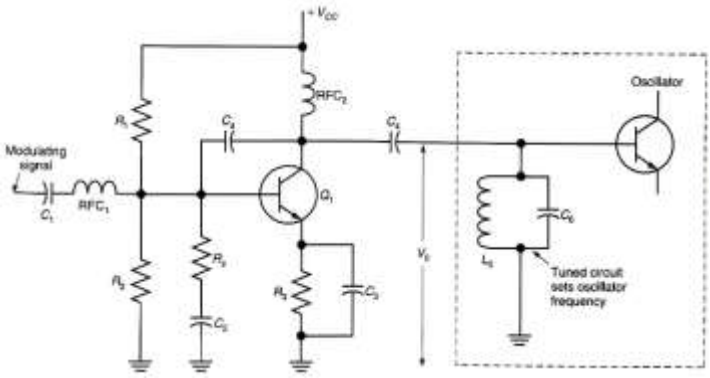
**Ans:-** **( 01M for each parameter)**

| Parameters | Dolby A | Dolby B |
|---|---|---|
| **Operating Principle** |  Fig. 5.13 Coding of signal in Dolby method  Fig. 5.14 Decoding of Dolby signal |  Fig. 5.16 Basic Dolby-B system |
| **SNR** |  Fig. 5.15 Signal-to-noise ratio improvement in Dolby A and Dolby B systems | |
| **Bands** | 1) Below 80Hz<br>2) 80Hz to 2999Hz<br>3) 3KHz and above<br>4) 9KHz and above | Signal frequency band 500Hz and above |
| **Advantages** | Improves signal to noise ratio with respect to hiss and modulation noise. | The low level signals in high frequency range are boosted by 10dB. |

**f) Draw neat diagram of reactance modulator. Write operating principle of it.**

**Ans:-**

**Circuit diagram:-** **2M**




**Principle:-** **2M**

In reactance modulator a transistor is operated as a variable reactance and it is connected across the tuned circuit of an oscillator.

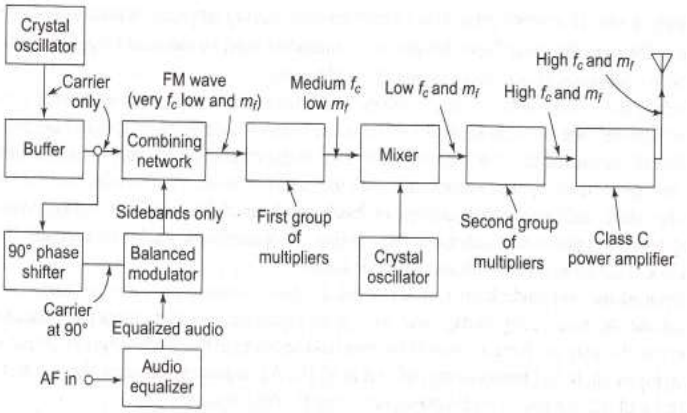
As the instantaneous value of modulating voltage changes, the reactance offered by the transistor will change proportionally. This will change the frequency of oscillator to produce FM wave.

**Q4 Attempt any four of the following:** **16M**

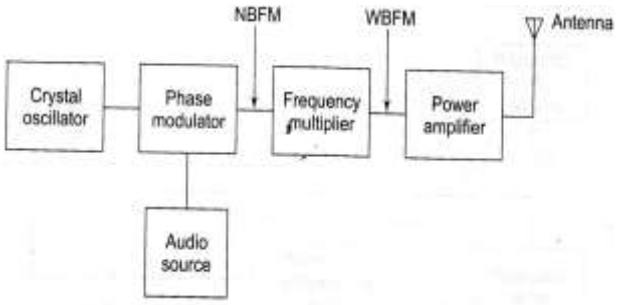
**a) Draw neat block diagram of FM transmitter. Writer Function of each block.**

**Ans:-**

**Diagram :-** **02M**




**OR**




**Operation:-** **2M**

- The crystal oscillator generates the carrier at low frequency typically at 1 MHz. This is applied to the combining network and a 90 degree phase shifter.
- The modulating signal is passed through an audio equalizer to boost the low modulating frequencies. The modulating signal is then applied to a balance modulator.
- The balance modulator produces two sidebands such that their resultant is 90 degree phase shifted with respect to the un-modulated carrier.
- The un-modulated carrier and 90 degree shifted sidebands are added in the combining network .The output of combining network is equivalent to FM wave. This FM wave has low carrier frequency Fc and low value of the modulating index mf .
- The carrier frequency and the modulation index are then raised by passing the FM wave through the first group of multipliers. The carrier frequency is then raised by using a mixer and then the Fc and mf both are raised to required high values using the second group of multipliers.
- The FM signal with high Fc and high mf is then passed through a class C power amplifier to raise the power level of the FM signal

**b) Give detail classification of modulation.**

**Ans:-** Analog Modulation Classification

**I.** Amplitude Modulation (AM) **1.5 M**
   a) Low level modulation
   b) High level modulation

II. Frequency Modulation (FM) **1.5 M**
   a) Narrow band modulation
   b) Wide band modulation

III. Phase Modulation ( PM) **1M**

**c) List any four specification of PA system.**

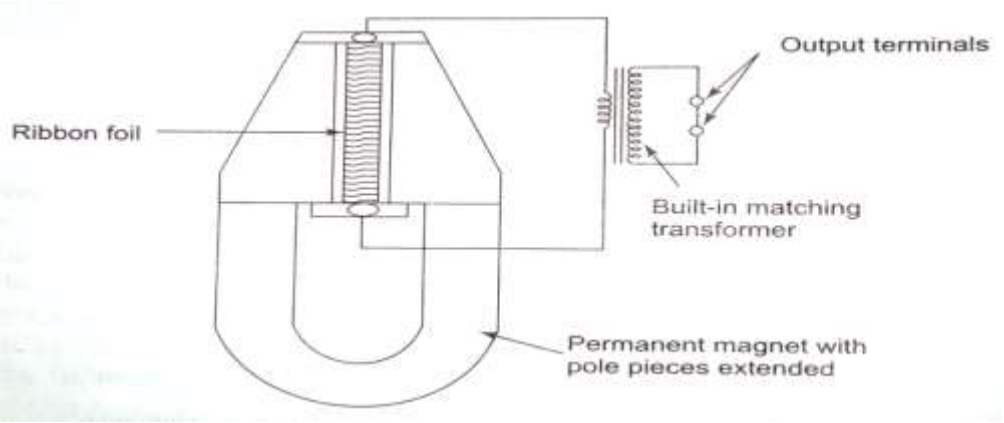
**Ans:- Specification of PA system (any four)** **01M each**

- Acoustic feedback
- Distribution of sound intensity
- Reverberation
- Orientation of loudspeaker
- Ambient noise
- Dynamic range limitation
- Selection of microphone
- Sense of direction of the source sound
- Phase delay
- Matching
- Grounding

**d) Give constructional details of ribbon Microphone with neat diagram.**

**Ans:-**

**Ribbon microphone:** **02M**




**Construction:** **02M**

The main parts of a ribbon microphone are permanent magnet, ribbon conductor.

- The permanent magnet is a specially designed horse-shoe magnet with extended pole pieces. It provides a strong magnetic field.
- The ribbon is a light aluminum foil. It is corrugated at right angles to its length to provide greater surface area. This ribbon is only about 0.2 mg in weight, less than 1 micron thick and about 20 mm long and 3 mm wide.
- The ribbon is suspended in the magnetic field of the permanent magnet & the stiffness of the suspension is small.
- The whole unit is enclosing in a circular or rectangular baffle.

**e) Compare monophony & stereophony (any four points)**

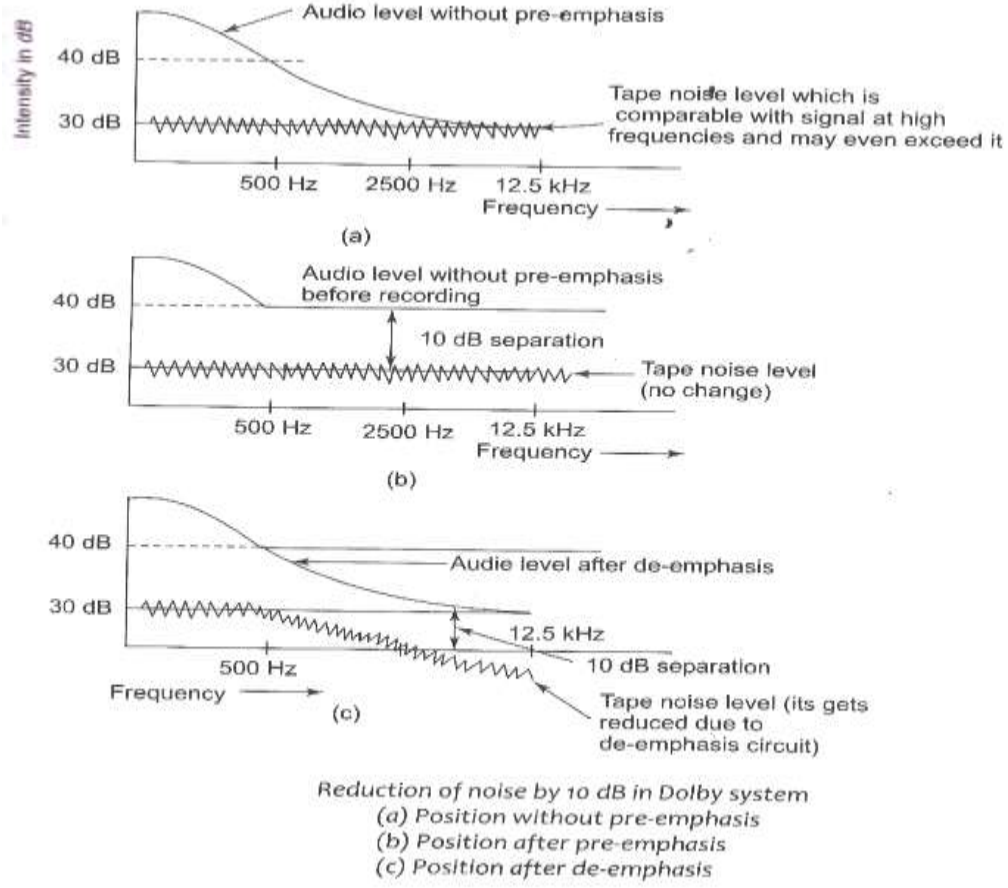
**Ans:-** **(01M for each point)**

| Monophony amplifier | Stereophony amplifier |
|---|---|
| 1. Only one amplifier is used. Single amplifier stage is known as mono amplifier | 1. At least two independent amplifiers are used. These part of amplifiers is called as stereo signal |
| 2. No naturalness | 2. Provides naturalness of sound signal. |
| 3. Listener cannot judge the direction of sound | 3. Listener can judge the direction of sound. |
| 4. Low cost | 4. Comparatively high cost. |

**f) Why the pre-emphasis & de-emphasis circuits are used for noise reduction? (any four point)**

**Ans:-**

**Diagram :-** **01M**




*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: - (01M each)**

1) Noise is more prominent during the quiet passages of music it is desirable to emphasis the low power notes before recording which is achieved by pre-emphasis. De-Emphasis bring backs the originality at reproduction of signal.

2) Pre-emphasis give equalization to high frequency low intensity sounds before recording and de-emphasis bring back original equalization during play back.

3) Pre-emphasis increases signal to noise ration and maintain high fidelity in sound reproduction. In playback high frequency signals are de-emphasis to reduce noise and intensity of signal

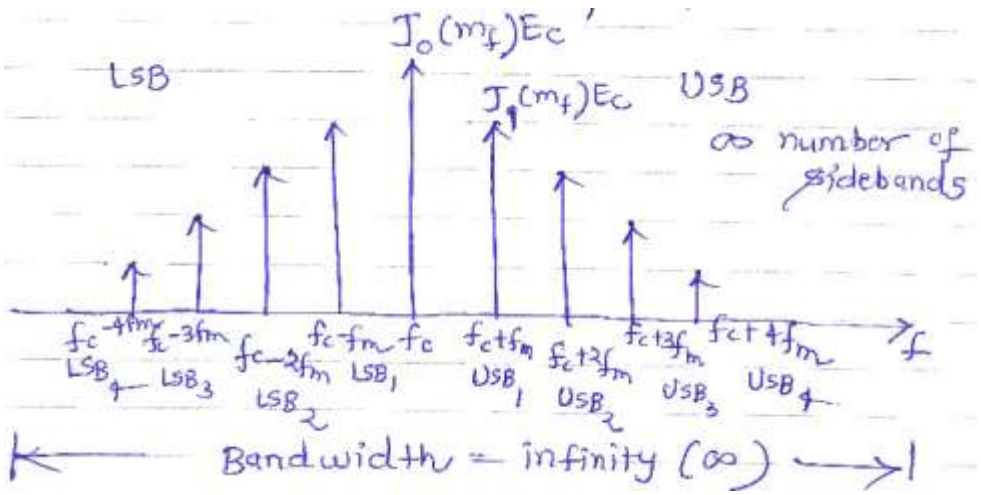
.

**Q5 Attempt any four of the following:** **16M**

**a) Draw frequency spectrum of FM wave. How significant sideband are determined**

**Ans:-**

**Diagram:-** **2M**




**Explanation:** **2M**

Any modulation process produces sidebands when a constant frequency sine wave modulates a carrier two side frequency are produced. The side frequencies are the sum and difference of the carrier & modulating frequency. In FM sum and difference sidebands frequencies are produced. In addition a theoretically infinite number of pairs of upper & lower sidebands are also generated.

As the result the spectrum of FM signal is usually wider than an equivalent AM signal.

Fig. shows an example of spectrum of a typical FM signal produces by modulating a carrier with a single frequency sine wave. The sidebands are spaced from the carrier $f_c$ are spaced from one another by a frequency equal to the modulating frequency $f_m$

The amplitude of the sidebands vary if each sideband is assumed to be a sine wave with a frequency & amplitude as shown &all these sine wave are added together then FM signal producing them.

The number of sidebands produced their amplitude& their spacing depends upon the deviation & modulating frequency.

**b) Draw block diagram of AM transmitter, write function of antenna.**

**Ans:-**

**Block diagram of low level AM transmitter:-** **3M**

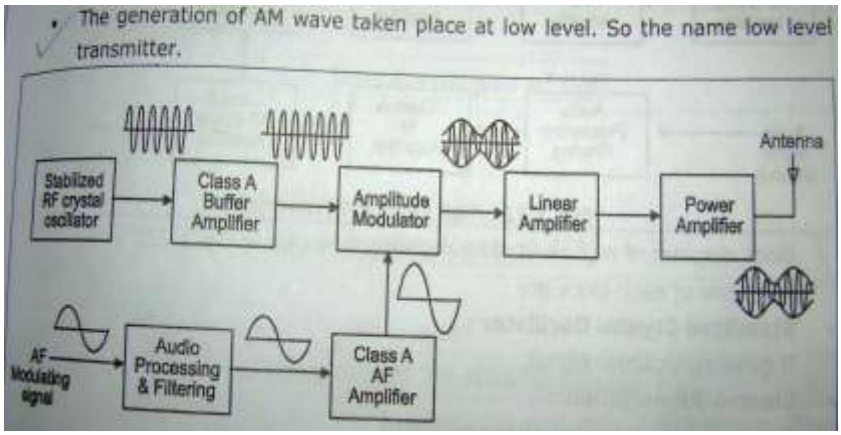



**Figure: Low level transmitter**

**OR**

**Block diagram of high level AM transmitter:-** **3M**

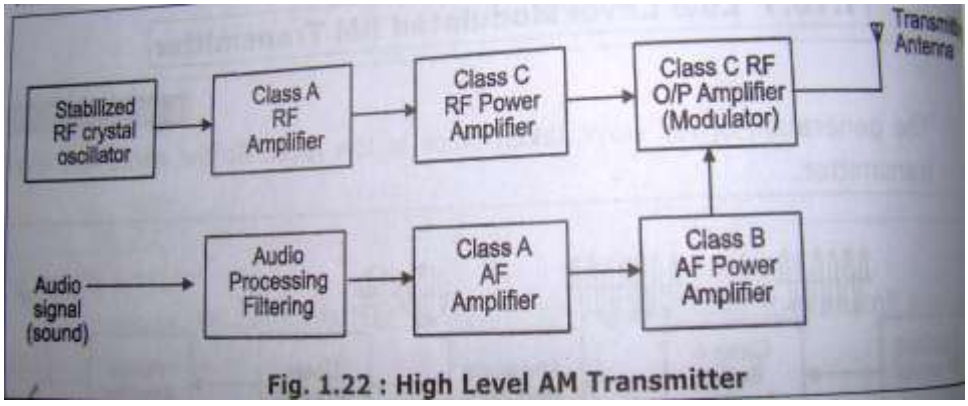



Figure : High level transmitter

**Functions of Antenna:** **1M**

- IT transmits AM wave of high power in free space
- It also acts as filter for RF waves.
- IT also acts as transducer.

**c) With the help of waveform show,**

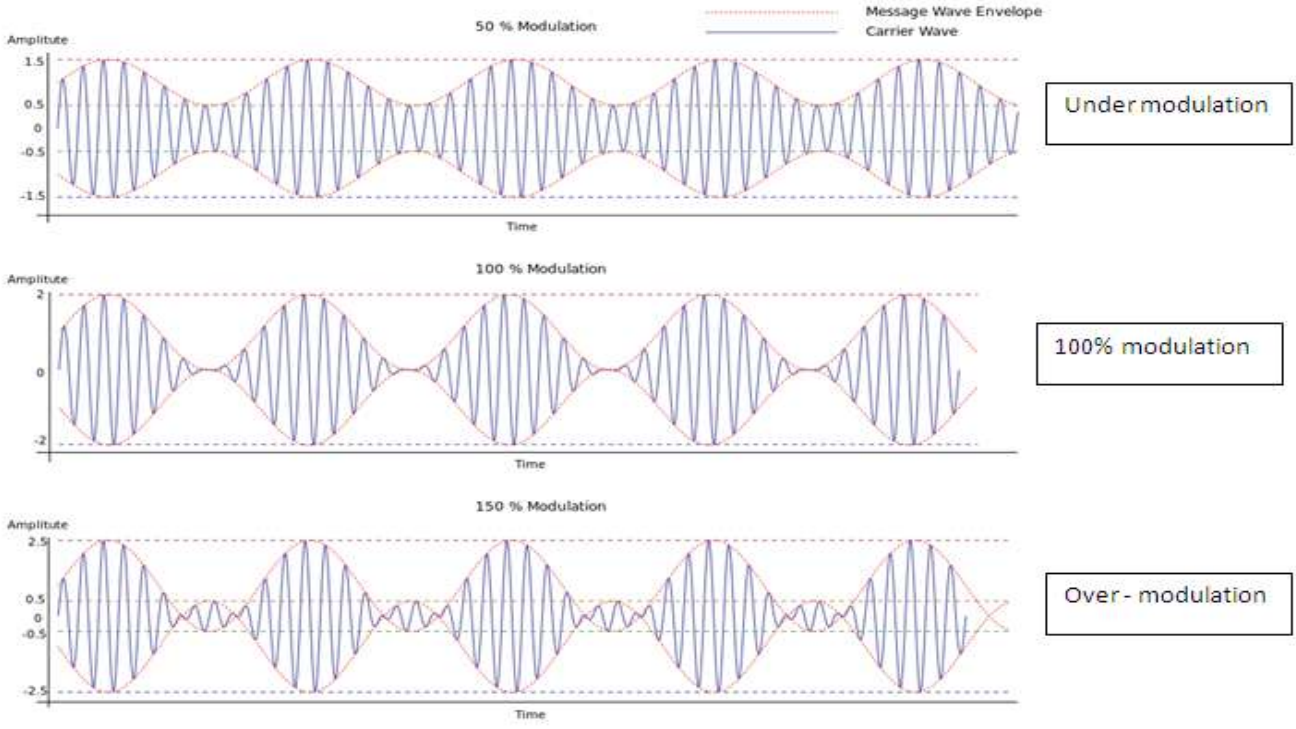
**i) 100% modulation**

**ii) Under modulation**

**iii) Over modulation**

**Ans:-**

**(Diagram 03M, Proper labeling 01M)**




**d) Write the causes which affect the fidelity? How it can be minimized.**

**Ans:-**

**Causes affecting fidelity:** **2M**

i. High signal to noise ratio.(s/n ratio\)

ii. Flat frequency response

iii. Low nonlinear distortion

iv. Large dynamic range

v. Creating sense of direction.

**Remedies:** **2M**

i. S/N ratio can be improved by using preamplifier of low noise figures proper shielding, grounding, decoupling & filtering circuits, stabilized power supply, microphones

ii. By using coupling capacitor and shunt capacitor in audio amplifier circuits.

iii. Nonlinear distortion can be reduced by using negative feedback in amplifier, designing bias circuit to keep Q point in the middle of linear portion of the characteristics curve.

iv. Dynamic range can be increased by using solid-state amplifier, dynamic microphones & L.S. which are capable of withstanding the large change in loudness.

Creating sense of direction can be improved by using high fidelity system.

**e) Compare woofer and tweeter on the basis of:-**

**i) Operating Frequency**

**ii) Size**

**iii) Connectivity with 'L' filter**

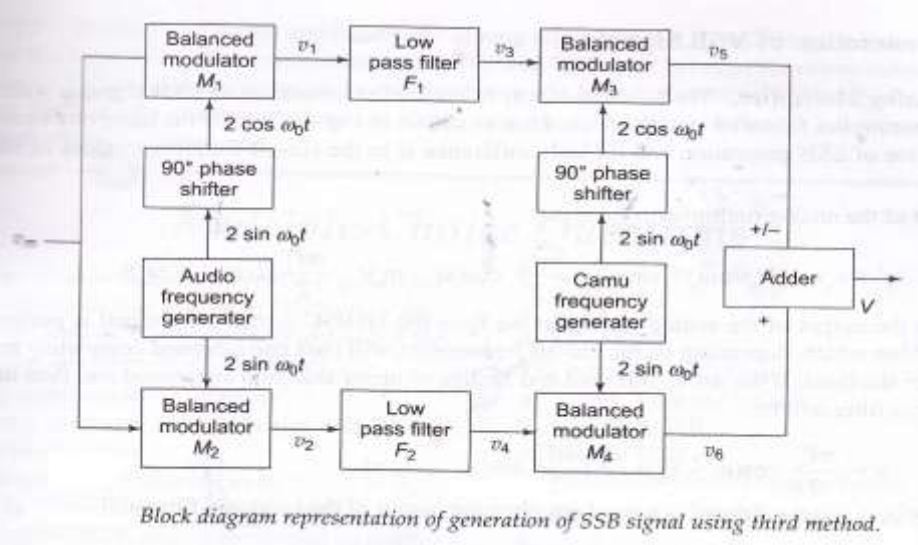
**iv) Handle Bass or treble**

**Ans:-** **(01M each parameter)**

| Parameters | Woofer | tweeter |
|---|---|---|
| Operating Frequency | 50Hz – 500Hz | 5KHz – 15KHz |
| Size | Large | Small |
| Connectivity with 'L' filter | LPF | HPF |
| Handle Bass or treble | Bass | Treble |

**f) With neat diagram, describe generation of SSB AM signal using third method.**

**Ans:- Diagram:-** **2M**




*Block diagram representation of generation of SSB signal using third method.*

**Working:-** **2M**

IN this method instead of trying to phase shift the whole range of audio frequencies, they are combined with audio frequency carrier $w_0$. This is a fixed frequency in the middle of audio frequency band. Then a phase shift is applied to this frequency only afterwards the resulting voltages are applied to first pair of balanced pair of modulator $M_1$ and $M_2$. The low pass filters with cutoff frequency $w_0$ ensure that the input to last pair of balanced modulators results in proper side band separations.

**OR**

The output of $M_1$ is

$$v_1 = 2\sin \omega_m t \cos \omega_0 t = \cos(\omega_m + \omega_0)t + \cos(\omega_m - \omega_0)t$$

The output of $M_2$ is

$$v_2 = 2\sin\omega_m t \sin \omega_0 t = \cos(\omega_m - \omega_0)t - \cos(\omega_m + \omega_0)t$$

The output of the low pass filter $F_1$ is

$$v_3 = \sin(\omega_m - \omega_0)t$$

The output of the low pass filter $F_2$ is

$$v_4 = \cos(\omega_m - \omega_0)t$$

The output of $M_3$ is

$$v_5 = 2\cos\omega_c t \sin(\omega_m - \omega_0)t = \sin(\omega_c + (\omega_m - \omega_0))t - \sin(\omega_c - (\omega_m - \omega_0))t$$

The output of $M_4$ is

$$v_6 = 2\sin\omega_c t \cos(\omega_m - \omega_0)t = \sin(\omega_c + (\omega_m - \omega_0))t + \sin(\omega_c - (\omega_m - \omega_0))t$$

The output of the adder is

$$v = v_6 \pm v_5$$

In one case we have

$$v = \sin(\omega_c + (\omega_m - \omega_0))t$$

In the othercase we have

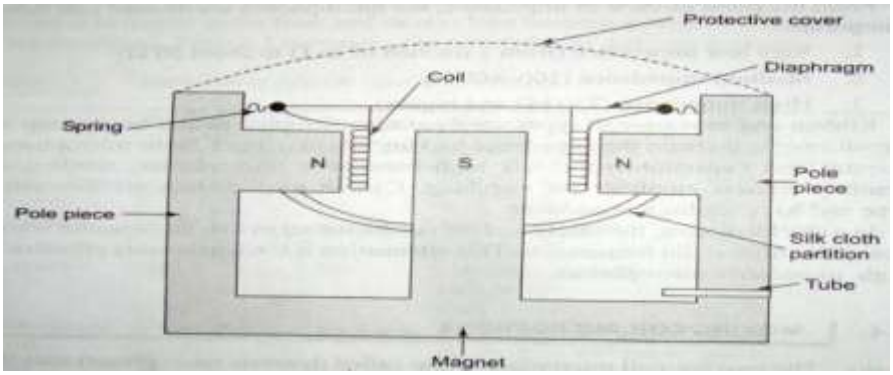
$$v = \sin(\omega_c - (\omega_m - \omega_0))t$$

Thus resulting in the generation of SSB signal by the third method.

**Q6 Attempt any four of the following: 16M**

**a) Draw neat diagram of moving coil cone type loudspeaker. Write its operating principle.**

**Ans:- Diagram:- 2M**




**Operating principle: 2M**

- When the sound waves strikes the diaphragm, it moves and hence, the coil moves in & out in the magnetic field. This motion changes the flux through the coil, which results in an EMF being induced in the coil due to electromagnetic induction.
- The value of this EMF depends on the rate of change of flux and hence on the motion of the coil. The displacement of the coil depends on the pressure of sound waves on the diaphragm. Thus it is a pressure microphone.
- The induced voltage e across the coil of the microphone is given by the equation
  $e = d\varphi/dt = B *$ change of area per second
  $= B *$ length of conductor * distance moved per second
  $= B * l * v$

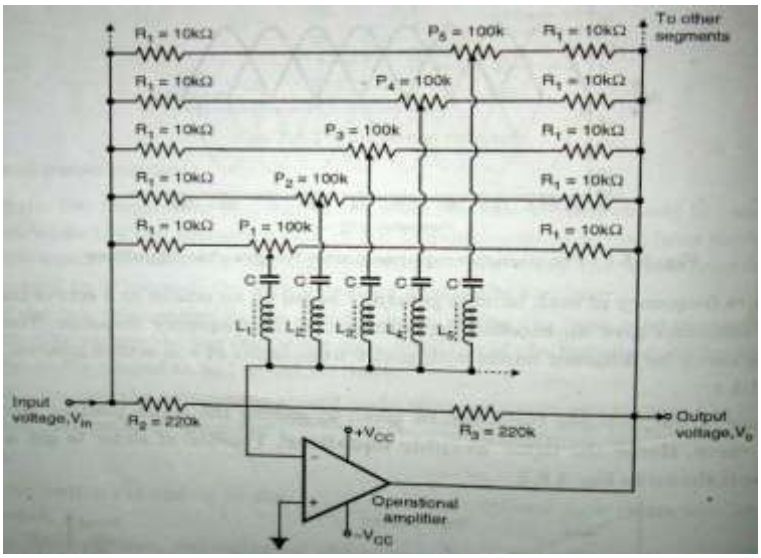
**b) What is graphic equalizer? Draw it.**

**Ans:-**

**Graphic Equalizer:- 2M**

Graphic equalizer is used to eliminate unwanted breaks in the frequency response of audio system. Here complete audio system is segmented into narrow bands. Each band has an individual slider control which can boost or cut the signals from -15db to +15db.

**Diagram:-** **2M**




**c) Enlist the necessity of public address system.**

**Ans:-**

**Necessity of PA system:- (any two points ) 2M each**

- PA system is used in sports meets, public meetings, auditoriums, concerts & function.
- It is also used to convey information to isolated locations as at railway station, airports, hospitals, factories etc.
- Audibility to mass public.

**d) Compare push- pull amplifier and complementary symmetry push – pull amplifier. (any four point)**

**Ans:- (Any four point) 01M each**

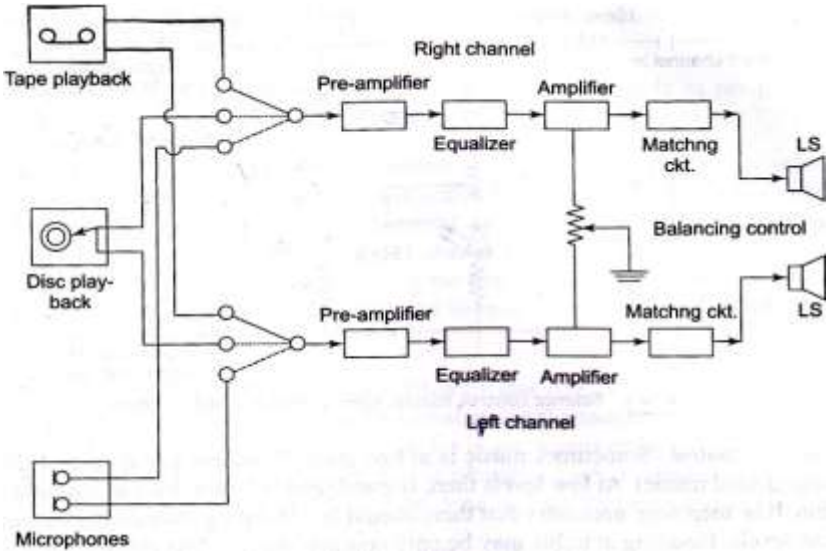
| Push – pull amplifier | Complementary symmetry push – pull amplifier |
|---|---|
| 1. Uses two similar NPN (or PNP) transistors | 1. Uses one PNP & one NPN transistor. |
| 2. Two power transformers are used (one at input & one at output) | 2. Needs no transformers. |
| 3. Circuit is bulky & heavy | 3. Circuit is compact & light weight |
| 4. It picks up hum from AC mains | 4. No hum is present |
| 5. Output is distorted due to high losses in | 5. Less distortion in output |

| | |
|---|---|
| transformers | |
| 6. It gives resonance effect to a particular frequency due to inductance of coil at output transformer | 6. No such effect is observed |

**e) Draw block diagram of HI-FI system. List any two applications.**

**Ans:-**

**Diagram :-** **3M**



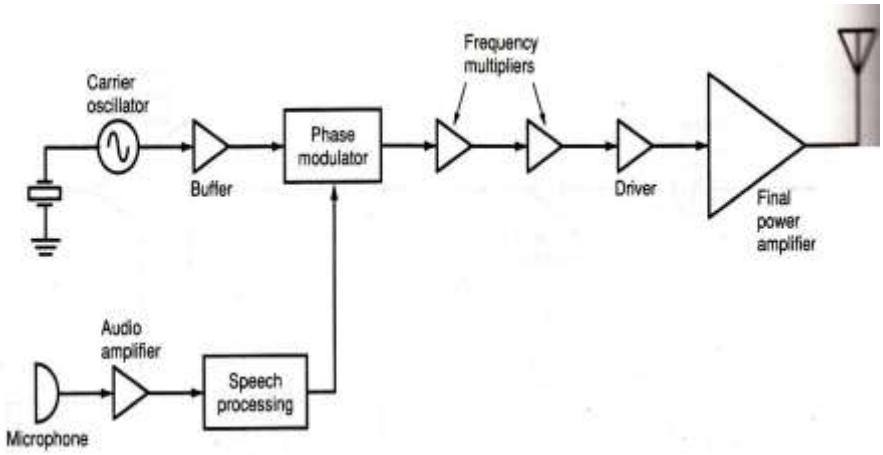

**Application:- (Any two application from above can be mentioned):-** **1M**

HI – FI system is used in various audio systems PA system, Tape recorders, CD players etc, which are used for domestic purpose as well as in concerts, auditoriums etc.

**f) Draw block diagram of Armstrong frequency modulator state its operating principle.**

**Ans:-**

**Diagram:-** **2M**



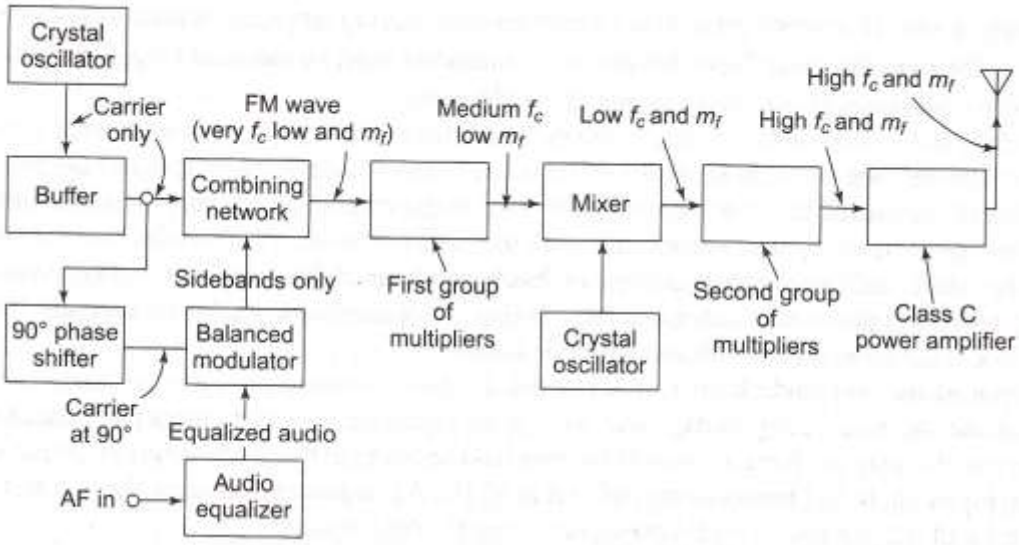

**Explanation:** **2M**

The indirect method of frequency modulation generation is used.

- A stable crystal oscillator is used to generate the carrier signal and a buffer amplifier is used to isolate it from the remainder of the circuitry
- The carrier signal is then applied to a phase modulator.
- The voice input is then amplified and processed to limit the frequency range & prevent over deviation. The modulator output is desired FM signal.
- Most FM transmitter are used in the VHF and UHF range and crystal are not available to generate those frequencies directly as result, the carrier is usually generated at frequency considerably lower than the final output frequency.
- To achieve the desired output frequency one or more frequency multipliers stage are used.
- A frequency multiplier is class C amplifier whose output frequency is some integer multiple of the input frequency by a factor 2, 3, 4 & so on. Because of class C amplifier provides a modest amount of power amplification.
- The frequency multiplier not only increases the carrier frequency to the desired output frequency but is also multiplies the frequency deviation produced by the modulator.
- After the frequency multipliers, a class C driver amplifier is used to increase the power level sufficiently to operate the final power amplifier.

**OR**

**Diagram:-** **2M**




**Explanation:-** **2M**

- The crystal oscillator generates the carrier at low frequency typically at 1 MHz this is applied to the combining network at 90 degrees phase shifter
- The modulating signal is passed through to an audio equalizer to boost the low modulating frequency. For the reason, high frequency modulating signals are attenuated but there is no change in the amplitudes of low frequencies modulating signals. Because in FM the frequency deviation is proportional to the modulating voltage regardless of its frequency.
- The balanced modulator produces two sidebands such that their resultant is 90 degrees phase shifted with respect to the un-modulated carrier.
- The un-modulated carrier and 90 degrees phase shifted side band are added in the combining network to generate FM wave. This FM wave has low carrier frequency F c and low value of modulation index mf.
- The carrier frequency & modulation index are raised by passing through FM to the first group of multipliers.
- The FM signal with high Fc and high m f is then passed through class C power amplifier to raise the power level **of FM signal.**

**Note : (Brief explanation can be considered)**