Ques: Define signals and give its classificatio

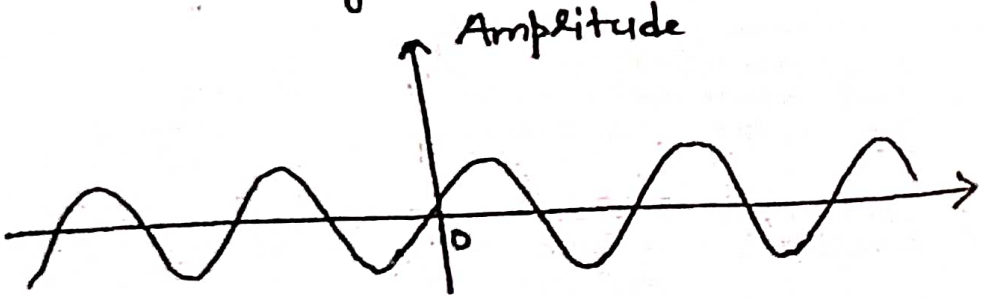
Ans: Signal: A sign, message or sound that sends a particular message is called 'Signal'. In electronics, a signal is an electric current, volt or an electromagnetic wave used to convey informa It is function of one or more independent varia

Classification of Signal :-

* Continuous time and discrete time signals
* Deterministic and nondeterministic signals.
* Even and odd signals.
* Periodic and Aperiodic signals.

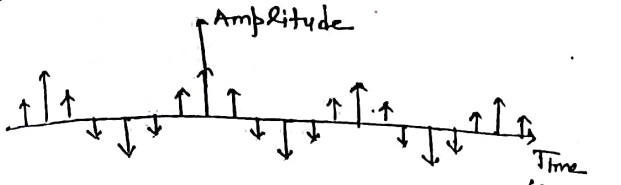
* Continuous Time and Discrete Time Signa

A signal is said to be continuous if it is defined at every instant of time.



Continuous Time Signal

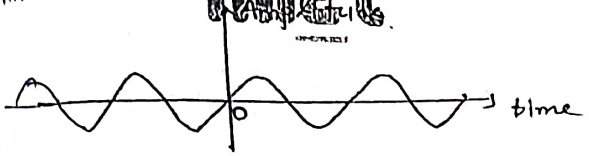
A signal is said to be discrete if it is defined only at discrete instants of time.



Discrete Time Signal

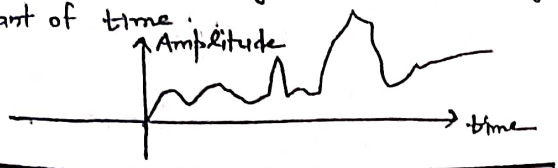
* Deterministic and Nondeterministic Signals :-

A signal is called deterministic if there is no uncertainty of its value at any instant of time.



Deterministic Signal

A signal is called nondeterministic (random) if there is uncertainty of its value at any instant of time.

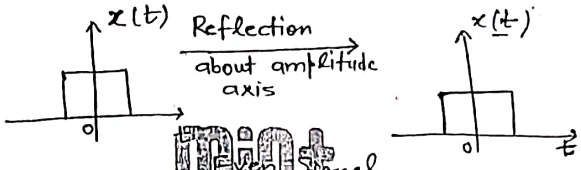


* Even and Odd Signals :-

A signal is said to be even if it satisfy the condition,

$$x(t) = x(-t)$$
$$x[n] = x[-n]$$

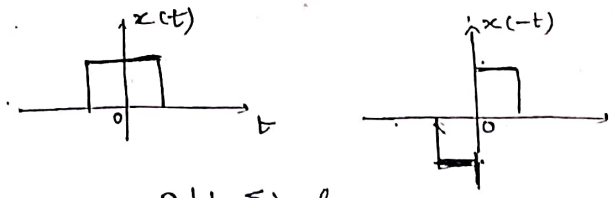
* Signals having same mirror image about amplitude axis are even signals.



Even Signal

A signal is odd if it satisfies the condition

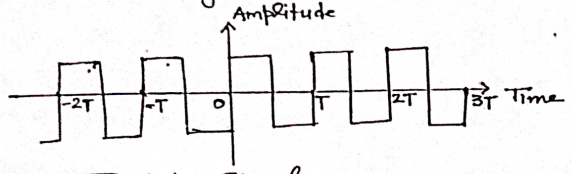
$$x(t) = -x(-t)$$
$$x[n] = -x[-n]$$



Odd Signal

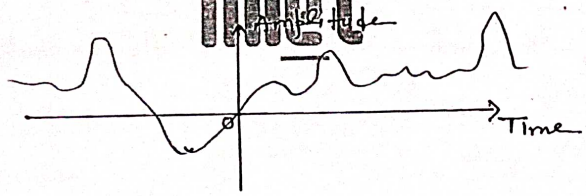
Periodic and Aperiodic Signals:

A signal is said to be periodic if it repeat itself after a regular interval of time.



Periodic Signal

A signal is said to be aperiodic if it does not repeat itself after a regular interval of time.



Aperiodic Signal

Ques Draw and explain the block diagram of communication system. (2019-20)

Ans: **Communication:** It can be defined as the transfer of information from one point to other. Communication can be divided into three parts —

i) Transmitter (ii) Channel (iii) Receiver

(i) **TRANSMITTER:** The transmitter section consists of —

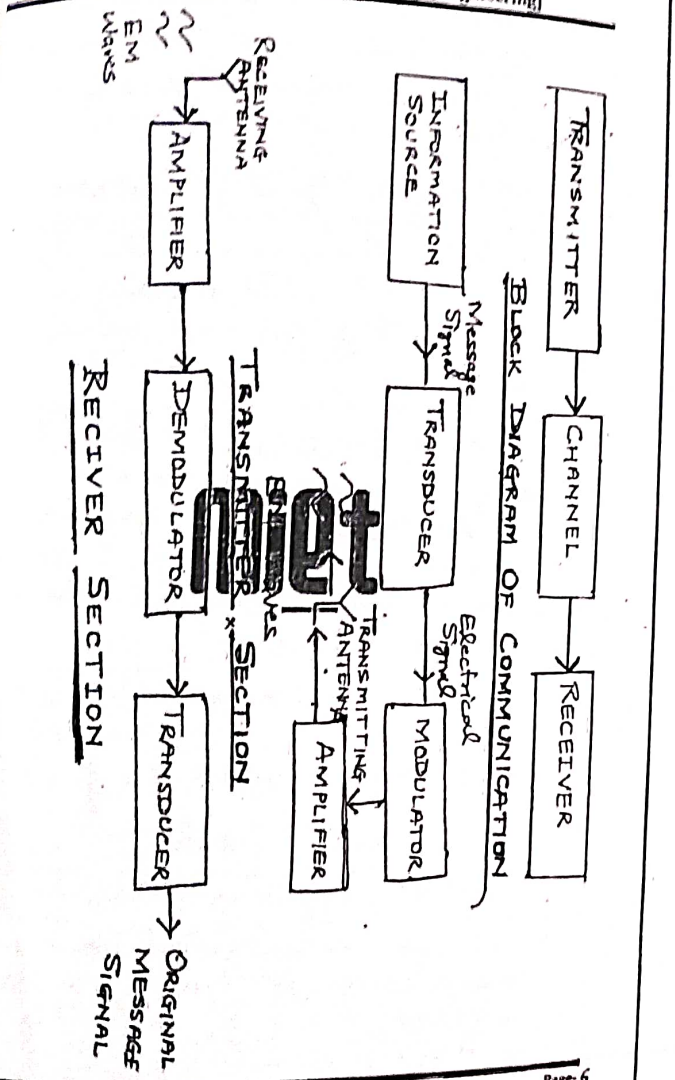
(A) **INFORMATION SOURCE:** It is used to generate message signal which may be in the form of audio, video or data.

(B) **TRANSUDUCER:** Transducer is a device which convert one form of signal into other. Here it converts raw message signal into electrical signal.

(C) **MODULATOR:** Here low frequency message signal is superimposed on high frequency signal so that it can cover long distance.

(D) **AMPLIFIER:** This block is used to enhance strength of the signal before transmission.

(E) **TRANSMITTING ANTENNA:** It is used to convert electrical signal into electromagnetic wave, which travel in the atomsphere.



(ii) CHANNEL :- The em waves radiated from the transmitting antenna travels through a path or medium to reach receiver. This path or medium is called, channel. There are two types of channel :-

A) Wired Channel :- Here the medium is physical i.e, optical fibre, coaxial cable etc.

B) Wireless Channel :- Here, medium is air.

(iii) NOISE :- It is unwanted signal which will mix with the transmitted signal when it is in channel. Noise affects the performance of communication system. There are two types of noise :-

(i) Natural Noise :- The source of natural noise is radiation from sun and stars.

(ii) Man Made Noise :- The source of man made noise are automobiles, motors etc.

(iii) RECEIVER :- This section consists of ;

(A) RECEIVING ANTENNA :- It is used to convert received em waves from the channel into the electrical signal.

(B) AMPLIFIER :- The signal received at the receiver has suffered various types of losses in the

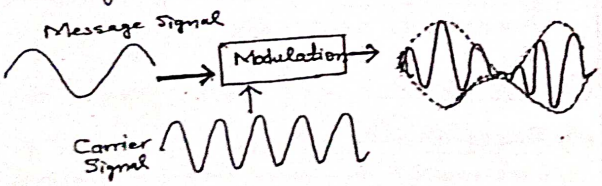
atmosphere. So an amplifier is needed to increase its strength.

(C) DEMODULATOR: It is used to separate carrier from the message signal.

(D) TRANSDUCER: Finally this circuit is used to convert received message signal in the electrical form to original form (it may be text, audio, data)

Ques What is modulation? Why modulation is needed in communication system? (2019-20) (2020-21) (2015-16)

Ans:- MODULATION: It is a process in which low frequency message signal is superimposed on the high frequency carrier wave. In this process one of the parameters of the carrier varies according to the message signal.



NEED OF MODULATION: There are several factors due to which modulation is needed in communication.

(i) INTERFERENCE OR MIXING PROBLEM: As message signals are low frequency signals, there large probability of mixing with other signals of the same frequency. So low frequency signals are superimposed on high frequency carrier to av such problems.

(ii) HEIGHT OF ANTENNA: Practical height of transmitting or receiving antenna $= \frac{\lambda}{4}$, where λ is the wavelength of the signal being used. If we use low frequency signal, the height of required an is of the order of kilometers. It can be explain through following example:

Ex1: Let the signal to be transmitted has the frequ $f = 10\,KHz$.

Then wavelength of the signal, $\lambda = \frac{C}{f} = \frac{3 \cdot 10^8}{10 \times 10^3}$

or $\lambda = 3 \times 10^4\,m = 30\,Km$

So height of transmitting antenna, $h = \frac{\lambda}{4} =$

Ex2: If the above message signal of frequency is sent through carrier of frequency 1 MHz

Then wavelength, $= \lambda = \frac{C}{f} = \frac{3 \times 10^8\,m/s}{1 \times 10^6\,/s} =$

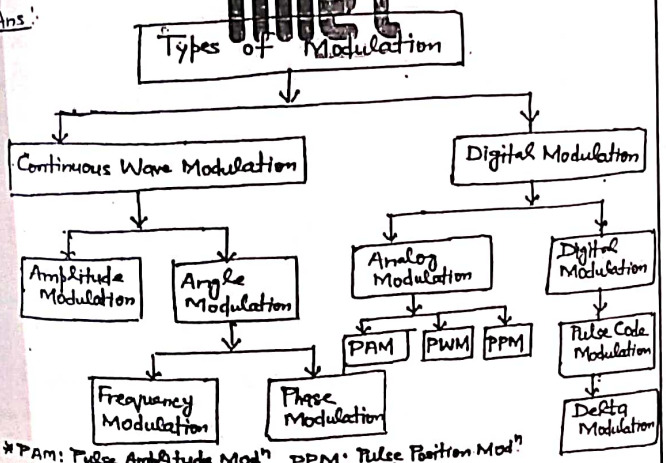
& Required height of antenna, $h = \lambda/4 =$

Thus it is clear that without modulation, the transmission of signal is not practically feasible due to extremely large height of transmitting or receiving antenna.

(iii) POWER DISSIPATION: When an electromagnetic wave is travelling through atmosphere, it suffers from various losses which are inversly proportional to the frequency of the signal. So, low frequency signals are more affected by the losses occuring in the channel and with the help of modulation, these losses can be reduced.

Ques: Give the classification of modulation techniques.

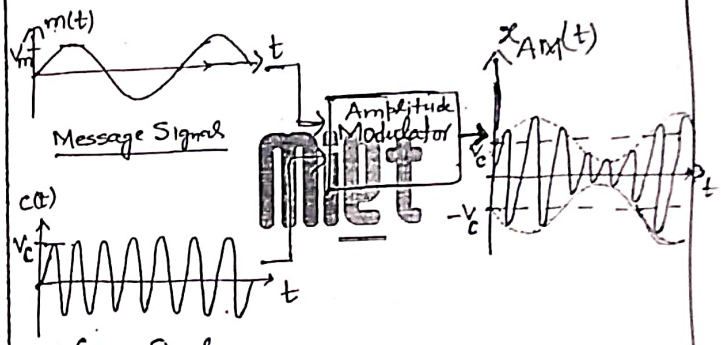
Ans:



*PAM: Pulse Amplitude Mod^n, PPM: Pulse Position Mod^n
PWM: Pulse width Mod^n

Ques: What is amplitude modulation (AM)? Derive its expression and also draws its frequency spectrum. (2019-20)/(2020-21)

Ans: AMPLITUDE MODULATION (AM): In amplitude modulation, the amplitude of the carrier signal is modulated according to the instantaneous amplitude of the message signal. In this process frequency and phase of the carrier remains constant.



Expression of Amplitude Modulated (AM) Signal:

Let the message signal is given as: $m(t) = V_m \sin \omega_m t$

Let the carrier signal is given as: $c(t) = V_c \sin \omega_c t$

Then the expression of AM signal can be given as,

$$x_{AM}(t) = [V_c + m(t)] \sin \omega_c t$$

$$\text{or, } s_{AM}(t) = [V_c + V_m \sin\omega_m t]\sin\omega_c t$$

$$= V_c\left[1 + \frac{V_m}{V_c}\sin\omega_m t\right]\sin\omega_c t$$

$$= V_c\,[1 + m\sin\omega_m t]\sin\omega_c t$$

Here, m is modulation index and it is given as:

$$\boxed{m = \frac{V_m}{V_c}}$$

$$\text{So, } s_{AM}(t) = V_c \sin\omega_c t + mV_c \sin\omega_m t \sin\omega_c t$$

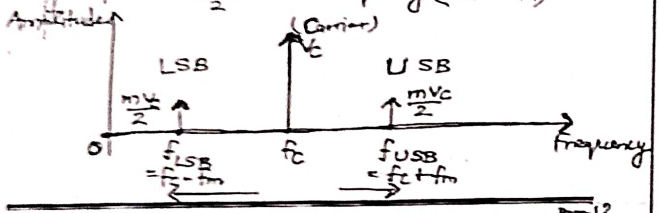
$$\text{or } s_{AM}(t) = V_c \sin\omega_c t + \frac{mV_c}{2}\cos(\omega_c+\omega_m)t - \frac{mV_c}{2}\cos(\omega_c-\omega_m)t$$

Here, AM signal contains three time components:

(i) $V_c \sin\omega_c t$:- This is carrier having amplitude V_c and frequency ω_c.

(ii) $\frac{mV_c}{2}\cos(\omega_c+\omega_m)t$: This is upper side band (USB) having amplitude $\frac{mV_c}{2}$ and frequency $(\omega_c+\omega_m)$.

(iii) $\frac{mV_c}{2}\cos(\omega_c-\omega_m)t$:- This is lower side band (LSB), having amplitude $\frac{mV_c}{2}$ and frequency $(\omega_c-\omega_m)$.



Ques:- Define modulation index in amplitude

Ans:- Modulation Index:- In AM, modulation index is the % in amplitude variation. It is known as percentage of modulation. It can be given the ratio of maximum amplitude of message to amplitude of carrier wave.

$$m = \frac{V_m}{V_c} \quad (0 < m < 1)$$

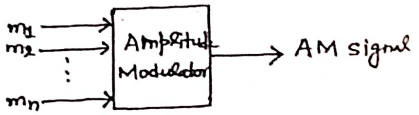
$$\%\text{ modulation} = \frac{V_m}{V_c} \times 100$$

AM can be classified into two parts on the basis of value of modulation index.

i) Linear Modulation: If the $m < 1$, then AM is linear.

ii) Over Modulation: If $m > 1$, then AM is over modulation. It introduces distortion, so should be avoided.

Modulation Index for Multitone Amplitude Modulation:



If $m_1(t)$, $m_2(t)\ldots m_n(t)$ are message signals of amplitudes $V_{m1}, V_{m2}, \ldots V_{mn}$. Then total amplitude of modulating (message) signal is —

$$V_t^2 = V_{m1}^2 + V_{m2}^2 + \cdots + V_{mn}^2$$

So, $$\frac{V_t^2}{V_C^2} = \frac{V_{m1}^2}{V_C^2} + \frac{V_{m2}^2}{V_C^2} + \cdots + \frac{V_{mn}^2}{V_C^2}$$

or $$m_t^2 = m_1^2 + m_2^2 + \cdots + m_n^2$$

So, $$\boxed{m_t = \sqrt{m_1^2 + m_2^2 + \cdots + m_n^2}}$$

Ques Derive the relation of power, current and efficiency of AM wave.

Ans: Amplitude modulated signal have three components :- [Expression: $x_{AM}(t) = V_C \sin\omega_c t + \frac{mV_C}{2}\sin(\omega_c + \omega_m)t + \frac{mV_C}{2}\sin(\omega_c - \omega_m)t$]

(1) Carrier (2) USB (3) LSB.

So total power of AM wave is sum of carrier power and power of two sidebands.

$$P_T = P_C + P_{USB} + P_{LSB} \quad \text{— (1)}$$

Here, $$P_C = \frac{(V_C/\sqrt{2})^2}{R} = \frac{V_C^2}{2R} \quad \text{— (2)}$$

and, $$P_{USB} = P_{LSB} = \frac{\left(\frac{mV_C}{2\sqrt{2}}\right)^2}{R} = \frac{m^2 V_C^2}{8R}$$

$$P_{USB} = P_{LSB} = \frac{m^2}{4} P_C \quad \text{— (3)}$$

Putting values from equations (2) and (3) into equation (1).

$$P_t = P_C + \frac{m^2}{4} P_C + \frac{m^2}{4} P_C$$

or $$\boxed{P_t = P_C\left(1 + \frac{m^2}{2}\right)}$$

Current Relation:

$$P_t = P_C\left(1 + \frac{m^2}{2}\right)$$

$$I_t^2 \cdot R = I_C^2 R\left(1 + \frac{m^2}{2}\right)$$

or $$\boxed{I_t = I_C\sqrt{\left(1 + \frac{m^2}{2}\right)}}$$

Q AM radio transmitter radiates 6 KW power when modulation % is 70%. Determine the carrier power. (2019-20) (2 marks)

Ans: For AM signal, power relation is -

$$P_t = P_C\left(1 + \frac{m^2}{2}\right)$$

Here, $P_t = 6$ KW, $m = 0.70$

So, $$P_C = \frac{6 \times 10^3}{1 + \frac{(0.49)}{2}}$$

$$= 4.82 \text{ KW} \quad \text{Ans}$$

Q: A 320 W carrier is simultaneously modulated by two audio waves with modulation % of 45 and 60 respectively. What is the radiated sideband power? (2019-20)

Ans: For multitone AM, total modulation index,

$$m_t = \sqrt{m_1^2 + m_2^2} = \sqrt{.45^2 + .6^2}$$

$$= 0.75$$

From power relation of AM, we can see that sideband power is: $P_{SB} = P_C \frac{m^2}{2}$

So, sideband power $= \frac{P_c m^2}{2}$

$= \frac{320 \times .75 \times .75}{2}$

$= 90W$ Ans

Q: An audio frequency signal $5\sin 2\pi \times 500t$ is used to amplitude modulate a carrier of $25\sin 2\pi \times 10^5 t$, calculate: (i) Modulation Index (ii) Sideband frequency (iii) Amplitude of each sideband (iv) Bandwidth required. (2019-20)

Ans: Given: $m(t) = 5\sin 2\pi \times 500t$

$c(t) = 25\sin 2\pi \times 10^5 t$

(i) Modulation Index, $m_a = \frac{V_m}{V_c} = \frac{5}{25} = 0.2$ Ans

(ii) Sideband frequency $f_c + f_m$ & $f_c - f_m$

Here $f_c = 10^5$ Hz $= 100$ KHz

& $f_m = 500$ Hz $= 0.5$ KHz

So, $f_c + f_m = 100 + 0.5 = 100.5$ KHz

& $f_c - f_m = 100 - 0.5 = 99.5$ KHz. } Ans

(iii) Amplitude of sidebands $= \frac{m \cdot V_c}{2}$

$= \frac{0.2 \times 25}{2}$

$= 2.5$ V Ans

(iv) Bandwidth $= 2f_m = 2 \times 500$ Hz

$= 1$ KHz Ans

Ques Derive the expression for transmission effici... AM signal.

Ans: Efficiency of any system can be given as ... ratio of desired output to total input. In AM, ... be defined as,

$$\eta = \frac{\text{Useful power (Power of Sideband)}}{\text{Total power (Carrier Power + USB Power + LSB Power)}}$$

$$= \frac{\frac{m^2}{2} \cdot P_c}{P_c\left(1 + \frac{m^2}{2}\right)}$$

$$= \frac{\frac{m^2}{2}}{1 + \frac{m^2}{2}}$$

$$= \frac{m^2}{2 + m^2}$$

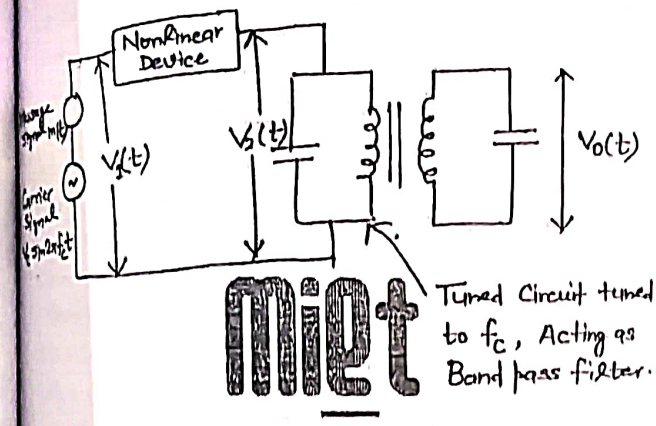
For max^m efficiency, $m = 1$

So $\eta = \frac{1}{2+1} = \frac{1}{3}$

or % Efficiency $\eta = 33.33\%$

Ques Explain the working principle of amplitude modulator.

Ans: AM signal can be generated with the help of square law modulator circuit as shown—



This circuit consists of —

1) A nonlinear device
2) A bandpass filter
3) Carrier source and modulating signal.

Here message (modulating) signal and carrier signal are connected in series & their sum $V_1(t)$ is applied at the input of the nonlinear device. (it may be diode or transistor). So,

$$V_1(t) = m(t) + V_c \sin 2\pi f_c t \quad \text{—— (1)}$$

The input- output relation of a nonlinear device is:

$$V_2(t) = aV_1(t) + bV_1^2(t) \quad \text{—— (2)}$$

Substitute $V_1(t)$ from eqn^n (1) into eqn^n (2),

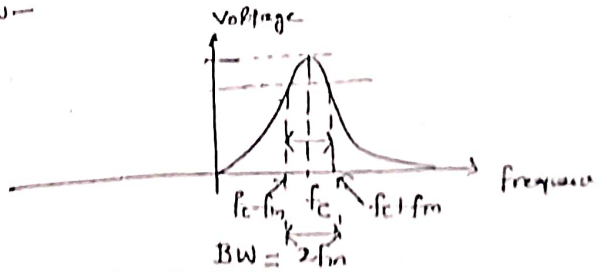
$$V_2(t) = a[m(t) + V_c \sin 2\pi f_c t] + b[m(t) + V_c \sin 2\pi f_c t]^2$$

or $V_2(t) = a\,m(t) + aV_c \sin 2\pi f_c t + b[m^2(t) + V_c^2 \sin^2 2\pi f_c t + 2V_c m(t) \sin 2\pi f_c t]$

The terms present in the above expression are —

i) $am(t)$: Message Signal
ii) $aV_c \sin 2\pi f_c t$: Carrier Signal.
(iii) $bm^2(t)$: Square of message Signal
(iv) $bV_c^2 \sin^2 2\pi f_c t$: Squared Carrier Signal
(v) $2bV_c m(t) \sin 2\pi f_c t$: AM wave with only sidebands.

Out of above five terms only term (i ii) and (v) are useful. Here a LC tuned circuit is used acting as band pass filter. It frequency response is shown below—



The output of this bandpass filter:

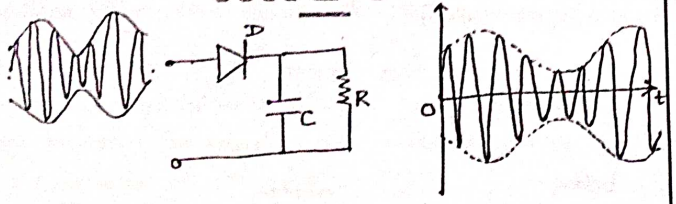
$$V_o(t) = a V_c \sin 2\pi f_c t + 2b V_c m(t) \sin 2\pi f_c t$$

$$V_o(t) = [aV_c + 2bm(t)] \sin 2\pi f_c t$$

Above expression is similar to the expression of an AM signal. Thus, square law modulator can be used to generate AM signal.

Ques: Explain working of AM demodulator or detector circuit.

Ans: Linear diode detector or envelope detector can be used for detection of AM signal.



Here diode is working as main detecting component, so sometimes this circuit is also called diode detector. During positive cycle of the input (modulated) signal diode conducts and capacitor charges to its peak value. During negative cycle, the diode gets reverse

biased and capacitor discharge through resistor. So, the output voltage across capacitor is a envelope of the AM wave, which is same as message signal.

Q/ What is wireless Communication?

Ans:- Wireless Communication involves the transmission of information over a distance without the helps of wires, cables, or any other forms of electrical Conductors.

Wireless Communication is a broad term that incorporates all procedures and forms of Connecting and Communicating between two or more devices using a wireless signal through wireless Communication technologies and devices.

Features of Wireless Communication:- The evolution of Wireless technology has brought many advancements with its effective features:

→ The transmitted distance can be anywhere between a few meters (for example, a television's remote control) and thousands of kilometers (for example, radio Communication).

→ Wireless Communication can be used for cellular telephony, wireless access to the internet, wireless home networking, and so on.

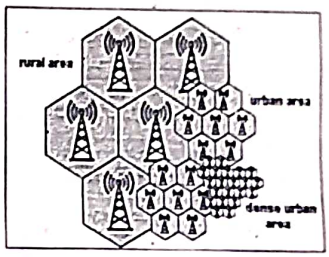
→ Other examples of applications of radio wireless technology include GPS units, garage door openers, wireless Computer mice, keyboards and headsets, headphones, radio receivers, Satellite television, broadcast television and Cordless telephones.

Advantages of Wireless Communication:-

1. Cost effectiveness.
2. Flexibility.
3. Convenience.
4. Speed.
5. Accessibility.
6. Constant Connectivity.

Q/ Explain Cellular Communication Systems.

Ans:- Cellular Communications systems are wireless mobile Communications systems that divide a large geographic area into smaller sections or cells, each with a low-power wireless transmitter, for the purpose of optimising the use of a limited number of frequencies.



A Basic Cellular network has following Components.

1. Mobile Unit.
2. Cell Site (Base Station).
3. MTSO (Mobile telephone Switching office).
4. System interconnects and
5. Communication protocol.

Mobile Unit:- A mobile unit is a portable, low weight handset Carried by the user which has wireless Connectivity with nearest base station. A simple mobile unit Contains a radio transceivers and an antenna System.

Cell Site:- It provides an interface between the mobile unit and the MTSO. It is also known as base station & Consists of Control unit (base station Controller), radio Cabinets, antennas, a power plant and data terminals.

MTSO (Mobile Telephone Switching office):- It is the heart of the mobile System. Its processor provides Cellular

administration and central coordination. It contains the cellular processor and the cellular switch.
The cellular switch is an analog or digital telephone exchange which controls switching between landline subscriber unit to base station for landline to mobile connectivity and vice versa. It controls switching between a base station to another base station for mobile to mobile conversation. The cellular processor processes the data received from base station controllers regarding the status of mobile unit. It also processes the diagnostic data and billing information.

System Interconnects :- The radio connectivity, voice grade four wire-line connectivity, optical fiber connectivity, microwave link, data link, etc., can be used to connect mobile unit, base station, MTSO and public switched telephone network (PSTN).

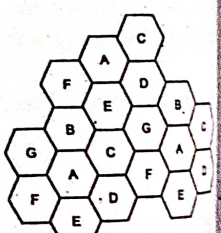
Communication Protocols :- The protocols govern the process of call connection and disconnection at the end of the conversation. Example :- IS-54, IS-95, GSM, etc.

Advantages of cellular Communication System :-
1). Higher Capacity :- Smaller the size of the cell more the number of concurrent users i.e., huge cells do not allow for more concurrent users.
2). Less transmission Power :- Huge cell require a greater transmission power than small cells.
3). Local interference only :- For huge cells there are a number

of interfering signals, while for small cells there is limited interference only.
4). Robustness :- As cellular systems are decentralized, are more robust against the failure of single compone

Disadvantages of Cellular Systems :-
1). Infrastructure needed :- Small cells require a complex structure to connect all base station. The infrastructure includes switches for call forwarding, location register
2). Handover needed :- The mobile station has to perform handover when changing from one cell to another very fe
3). Frequency planning :- To avoid interference, frequency should be distributed properly with a very less range frequency spectrum.

Q). Explain frequency reuse.
Ans :- Frequency Reuse :- It is a technique for using a spe range of frequencies more than once in the same system so that the total capacity of the system is increased without increasing its allocated band. Frequency reuse schemes require sufficient isolation among the signals that use the same frequencies so that mutual interference among them is controlled at an acceptable level.



Cell with the same letter same set of channels or frequencies sub-band

Topic: Different generations and Standards in Cellular Communication Systems.

Evolution of Mobile Communication:

Mobile wireless communication system has gone through several evolution stages in the past few decades after the introduction of first generation mobile network in early 1980s. Due to huge demand for more connection worldwide, mobile communication standards advanced rapidly to support more users.

1G (First Generation Mobile Network) :- The first generation of mobile network was deployed in Japan by Nippon Telephone and Telegraph company in 1979. In 1980, it gained popularity in US, Finland, UK and Europe. This system used analog signals and it had many drawbacks due to technology limitations.

2G (Second Generation) :- This generation saw the introduction of GSM (Global System for Mobile Communication) technology in the early 90's. It allowed digital voice and data to be sent across the network and allowed users to roam

for the first time. 2G System also ensured faster communication with voice & data security and privacy. Many of the fundamental services like, SMS, internal roaming, conference call, call hold and real time billing etc. were introduced in this generation of mobile communication.

2.5G :- In the beginning of 2000, an upgradation in technology introduced the packet network which provided high speed data transfer and internet and this generation is called 2.5G.

Here the technologies used are GPRS (General Packet Radio Service) and EDGE (Enhanced Data Rate for GSM). GPRS supports flexible data transmission rates and provides continuous connection with the network.

3G (Third Generation Mobile Communication) :- It was introduced commercially in 2001. The major aims of third generation mobile network were to facilitate greater voice and data capacity, support a wider range of applications and increase data transmission rate at lower cost.

For the first time this generation provided high speed wideband internet access as

well as fixed wireless internet access. Various new facilities are introduced such as, video calls, chatting and conferencing, mobile TV, video on demand services, navigational maps, mobile gaming etc. Along with these new features, security is also increased in 5G mobile communication network.

4G (Fourth Generation Mobile Communication):

Started in 2010, it is enhanced version of 3G networks developed by IEEE, offers higher data rate and capable to handle more advanced multimedia services. LTE (Long term evolution) and LTE advanced wireless technologies are used in 4G systems. Simultaneous transmission of voice and data is possible with LTE system which significantly improve data rate. Wireless transmission technologies like WiMax are introduced in 4G system to enhance data rate and network performance.

5G (Fifth Generation Mobile Communication):

This generation is using advanced technologies to deliver ultra fast internet and multimedia experience for customers. In order to achieve higher data rate, 5G Technology will use millimeter waves

and unlicensed spectrum for data transmiss
Complex modulation techniques has been d
to support massive data rate.

Year	1981 - 1990	1991 - 2000	2001 - 2004	2005 - 2010	2011 - 2020	2021 Onwards
Multiplexing	FDMA	TDMA	TDMA CDMA	CDMA	OFDMA	NOMA
Standard	AMPS	GSM	IMT-2000	UMTS	LTE-A, WiMax	IMT-2020
Bandwidth	30 KHz	200 KHz	5 MHz	5-20 MHz	100 MHz	1-2 GHz
Data Rate	2.4 Kbps	14.4 Kbps	1 Mbps	7.2 Mbps	100 Mbps	1 Gbps
Mobility	-	-	-	-	250 Kmph	500 Kmph
Application	Voice (Analog)	Voice + SMS (Digital)	Voice, SMS & MMS	Voice, SMS MMS & Video Calling	HD & UHD Streaming, Real-time Gaming, Weather Forecasting	Enhanced Mobile Broadband, Ultra Reliable Low Latency, Massive Machine Type Communication

Q. What is multiplexing, define different multiplexing techniques using communication.

Ans. In communication, multiplexing is the process of sharing a single communication channel for transmission of multiple signals. There are two types of multiplexing techniques:

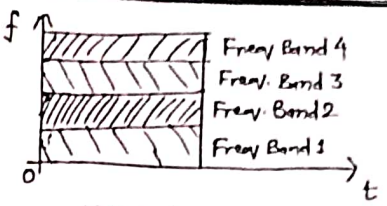
i) Analog Multiplexing: It uses analog signals only. Example: Frequency division multiplexing

ii) Digital Multiplexing: It uses digital signals only. Some of its types are: Time division multiplexing (TDM) and Code division multiple access (CDMA).

The sharing of channel by different signals is known as channelization. Here the available bandwidth of the channel is shared in time, frequency or code in between the different stations. Channelization protocols are broadly classified as:

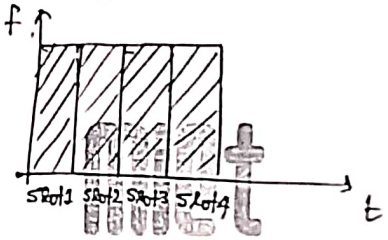
i) FDMA (Frequency Division Multiple Access)
ii) TDMA (Time Division Multiple Access)
iii) CDMA (Code Division Multiple Access)

i) FDMA: Here available bandwidth of the channel is divided into frequency bands. Each station is allocated a band to send its data if it belongs to the station all the time. It is usually used for analog data.



FDMA

(ii) TDMA: Here, the stations share the bandwidth of channel in Time. Each station is allocated a time slot during which it can send data.



(iii) CDMA: The CDMA technique simply means communication with different codes. There is only one channel that carries all the information simultaneously. CDMA differs from FDMA as only one channel occupies all the bandwidth. It differs from TDMA because all the stations can send data simultaneously.

Advantages of CDMA:

→ Provide high voice quality
→ Operates at low power level
→ Capacity of the system is higher than TDMA or FDMA
→ CDMA is better cost effective.

Q.4 Compare GSM & CDMA (2020-21)

Ans

S.No	GSM	CDMA
1	It stands for Global System for mobile comm^n	It stands for Code division multiple access.
2.	It uses TDMA & FDMA technique for voice & data transmission	It uses CDMA technique for voice & data transmission
3.	The transmission rate is slow compared to CDMA	The transmission rate is fast as compared to GSM.
4.	It uses EDGE data transfer technology	It uses EVDO data transfer technology
5.	It is SIM specific & so require SIM card for communication.	It is handset specific & so does not require SIM for communication
6.	During transmission electromagnetic radiation is more.	It is much prone to electromagnetic radiation during transmission.
7.	It offers less secure comm^n than CDMA	It offers more secure comm^n than GSM.
8.	It enables worldwide roaming.	It enables limited roaming

Q. Write notes on Satellite Communication. (2019-2

Ans A satellite is a smaller object that revol around a larger object in space. For example, m is a natural satellite of earth. When communic takes place between two earth stations throug satellite, then it is called as satellite commun In this communication, em waves are used as ca signals. These signals carry the information su as voice, audio, video or any other data betwee ground and space and viceversa.

There are two types of satellite :

i) Artificial ii) Natural.

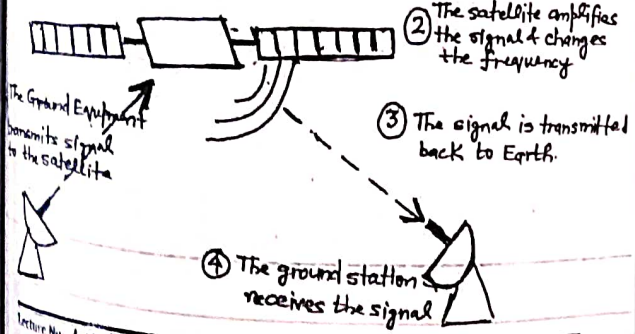
Artificial satellites are specially designed launched into space for different applications as: weather monitoring, navigation, tv & mo communication, planetary research etc. Ex:- IN IRS, GSAT etc.

A natural satellite is any celestial in space that orbits around a larger body. E revolves around sun, so it is a satellite. Similarly moon revolves around earth, so it also a natural satellite.

Need of Satellite Communication :- In communication process, transmission of signals used to occur in two different ways in earlier days. These are - ground wave propagation and sky wave propagation But maximum distance of communication is limited to 1500 Km in both propagations. Satellite comm^{n}. overcomes this limitation. Here communication beyond line of sight distance is possible.

Working :- Satellite communication involves four steps :-

1) An uplink earth station or other ground equipment transmits the desired signal to the satellite. The frequency with which the signal is transmitted is called Uplink frequency.
2) The satellite amplifies the incoming signal and changes the frequency.
3) The satellite transmits the signal back to Earth. The freq of the signal sent back to earth is called Downlink freq.
4) The ground equipments receives the signal.



Applications of Satellite Communication

* Radio broadcasting & voice communication.
* TV broadcasting such as Direct to Home (DTH).
* Internet applications such as providing Internet connection for data transfer, GPS applications, Internet surfing etc.
* Military applications & navigations.
* Weather condition monitoring & forecasting.

Ques Write notes on Radar communication.

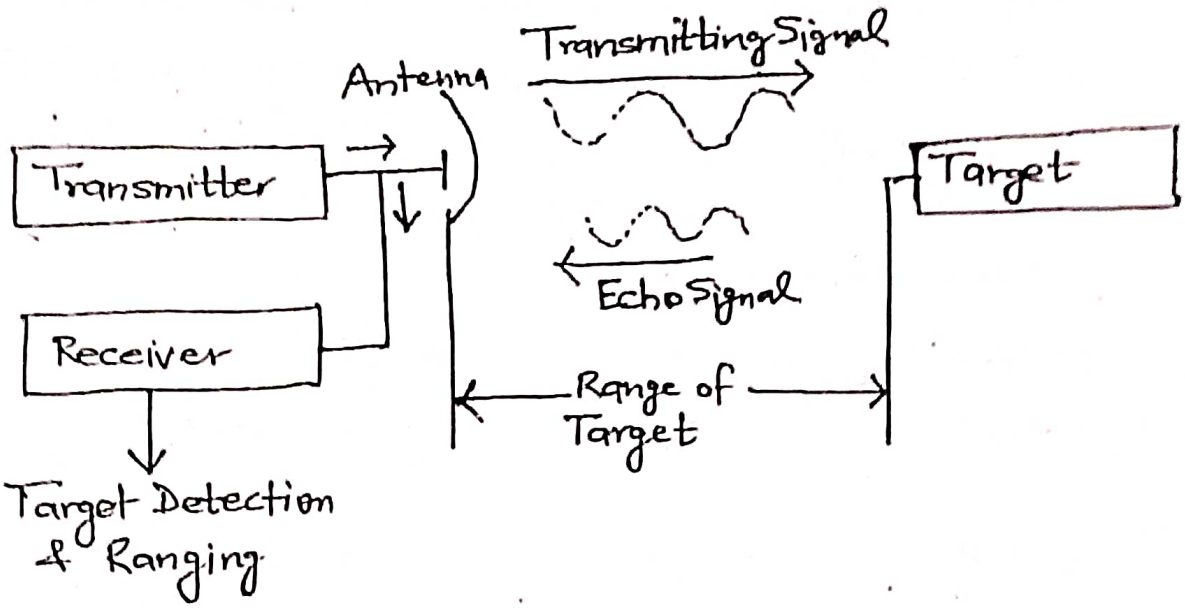
Ans :- Radar is a detection system that uses radio waves to determine the range, angle or velocity of the objects. It can be used to detect aircraft, ships spacecraft, guided missiles, etc.

Elements of Radar Communication System

i) Transmitter : For transmitting signal.
ii) Antenna : Used to transmit or receives signal.
iii) Receiver : Used to receive signal.
iv) Power Supply : Used to provide power

Radio waves from the transmitter reflect off the object & return to the receiver, giving information about the object's location and speed.

Principle of Working:-



Transmitter of the Radar system emits radio waves in predetermined direction. When these signals meets an object, they are usually reflected in many directions. The signal reflected back towards the Radar receiver are used for detection purpose. The time taken by the radar signal to reach the destination & return back to the radar receiver is used for obtaining the range of the object to be detected. If the object is not fixed & moving away or toward the transmitter, there will be slight change in the frequency of received signal due to Doppler effect

5 Years AKTU University Examination Questions		Unit-5	
S. No	Questions	Session	Lecture No
1	Explains the elements of communication system with the help of block diagram	2019-20(1)	35-40
2	A 460 watt carrier is modulated to a depth of 65 percent. Calculate the power in modulated wave	2015-16(1)	35-40
3	(I) Explain Double sideband suppressed Carrier (DSB-SC) Technique (II) Compare Amplitude Modulation (AM), Frequency Modulation (FM) and Phase Modulation (PM)	2017-18(2)	35-40
4	An audio frequency signal 5 sin $2\pi \times 500t$ is used to amplitude modulate a carrier of 25 sin $2\pi \times 10^5 t$. calculate: (I) Modulation Index (II) Sideband Frequency (III) Amplitude of each sideband (iv) Bandwidth required (v) Total Power (vi) Transmission Efficiency	2019-20(1) 2021-22	35-40
5	A 320W carrier is simultaneously modulated by two audio waves with modulation % of 45 and 60 respectively. What is the sideband power radiated?	2019-20(1)	35-40
6	List any two advantages of modulation. Define modulation. List need of modulation	2019-20(1) 2020-21(1)	35-40
7	(I) What do you mean by amplitude modulation? Explain with help of proper waveforms. (II) AM radio transmitter radiates 6 KW power when modulation percentage is 70 %. Determine the carrier power.	2019-20(1) 2020-21(1)	35-40
8	A sinusoidal carrier of 1 MHz and amplitude 100V is amplitude modulated by a sinusoidal modulating signal of frequency 5 KHz ,providing 50 % modulation. Calculate the frequency and amplitude of USB and LSB.	2017-18(2)	35-40
9	(I) Write a short note on satellite communication system. (II) Differentiate between CDMA and GSM?	2020-21(1)	35-40
10	What is RADAR? Write down two applications of RADAR	2021-22(O)	35-40
11	Describe AM modulation and Demodulation technique with adequate diagram.	2021-22(O)	35-40
12	Write Short note on basic elements of communication system.	2021-22(O)	35-40
13	Describe briefly Satellite Communication.	2021-22(O)	35-40
14	Calculate the transmission efficiency if the modulation factor is 0.5.	2021-22(E)	35-40
15	Enlist the merits of satellite.communication.	2021-22(E)	35-40
16	Explain Amplitude modulation. Derive the expression for the total Power radiated by the modulated signal. Also calculate modulation efficiency.	2021-22(E)	35-40
17	Why do we need modulation? The antenna current of an AM, transmitter is 8 A when only the carrier is sent, but it increases to 8.93 A, when the carrier is modulated by a single sine wave. Find percentage modulation. Determine the antenna current when the percent of modulation changes to 0.8.	2021-22(E)	35-40
18	An Audio frequency signal 10 Sin $6\pi \times 400t$ is used to amplitude modulate a carrier of 25 Sin $4\pi \times 10^3 t$. Calculate (I) Modulation Index. (II) Amplitude of each side band. (iii) Total power delivered to the load of 2KΩ (iv) Bandwidth (v) Transmission Efficiency.	2021-22(E)	35-40