UNIT I
UNIT I Analog Communication

PART-A

1. What is modulation?

Modulation is the process of changing any one parameter (amplitude, frequency or phase) of a relatively high frequency carrier signal in proportion with the instantaneous value of the modulating signal or message signal.

2. Define amplitude Modulation.

Amplitude Modulation is the process of changing the amplitude of a relatively high frequency carrier signal in proportion with the instantaneous value of the modulating signal.

3. Define Modulation index and percent modulation for an AM wave.

Modulation index is a term used to describe the amount of amplitude change present in an AM waveform .It is also called as coefficient of modulation. Mathematically modulation index is

$$m = Em/ Ec$$

Where m = Modulation coefficient

Em = Peak change in the amplitude of the output waveform voltage. Ec = Peak amplitude of the unmodulated carrier voltage.

Percent modulation gives the percentage change in the amplitude of the output wave when the carrier is acted on by a modulating signal.

4. Give the bandwidth of AM?

Bandwidth (B) of AM DSBFC is the difference between highest upper frequency and lowest lower side frequency.

fm(max) – maximum modulating signal frequency.

5. Give the expression for modulation index in terms of Vmax and Vmin.

m = Vmax – Vmin / Vmax + Vmin

6. Give the types of AM Modulation.

DSBSC-Double sideband suppressed carrier. SSBSC- Single sideband suppressed carrier.

DSBFC- Double sideband full carrier

VSBSC-Vestigial sideband suppressed carrier.

7. What are the disadvantages of conventional (or) double side band full carrier system?

In conventional AM, carrier power constitutes two thirds or more of the total transmitted power. This is a major drawback because the carrier contains no information; the sidebands contain the

information. Second, conventional AM systems utilize twice as much bandwidth as needed with single sideband systems.

8. Define Single sideband suppressed carrier AM.

AM Single sideband suppressed carrier is a form of amplitude modulation in which the carrier is totally suppressed and one of the sidebands removed.

9. Define AM Vestigial sideband.

AM vestigial sideband is a form of amplitude modulation in which the carrier and one complete sideband are transmitted, but only part of the second sideband is transmitted.

10. What are the advantages of single sideband transmission?

The advantages of SSBSC are

1. Power conservation
2. Bandwidth conservation
3. Noise reduction

11. What is the advantage of low-level modulation?

An advantage of low-level modulation is that less modulating signal power is required to achieve a high percentage of modulation.

12. Define Low-level Modulation.

In low-level modulation, modulation takes place prior t o t he output element of the final stage of the transmitter. For low level AM modulator class A amplifier is used. It require s less power to achieve a high percentage of modulation.

13. Define High-level Modulation.

In high-level modulators, the modulation takes place in the final element of the final stage where the carrier signal is at its maximum amplitude. For high level modulator class C amplifier is used. It requires a much higher amplitude modulating signal to achieve a reasonable percent modulation.

14. What is the advantage of low-level modulation?

An advantage of low-level modulation is that less modulating signal power is required to achieve a high percentage of modulation.

15. Define Heterodyning.

Heterodyne means to mix two frequencies together in a nonlinear device or to translate one frequency to another, using nonlinear mixing.

16. State Carson rule.

Carson rule states that the bandwidth required to transmit an angle modulated wave as twice the sum of the peak frequency deviation and the highest modulating signal frequency. Mathematically Carson's rule is **B=2(Δf +fm) Hz**.

17. Write down the comparison of frequency and amplitude modulation.

Amplitude modulation	**Frequency modulation**
1. Noise interference is more	Noise interference is less
2. Amplitude Modulation is the process of changing the amplitude of a relatively high frequency carrier signal in proportion with the instantaneous value of the modulating signal.	Frequency Modulation is the process of changing the frequency of a relatively high frequency carrier signal in proportion with the instantaneous value of the modulating signal.
3. The depth of modulation has limitation in AM.	But in FM the depth of modulation can be increased to any value by increasing the deviation.
4. Simple circuits used in transmitter and receiver.	Uses more complex circuits in transmitter and receiver.
5. Power varies in AM depending on depth of modulation.	The amplitude of FM is constant. Hence transmitter power remains constant in FM

18. Define Phase modulation.

Phase of a constant amplitude carrier is varied directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal.

19. What are the advantages of single sideband transmission?

The advantages of SSBSC are

1.Power conservation: Normally ,with single side band transmission ,only one sideband is transmitted and the carrier is suppressed. So less power is required to produce essentially the same quality signal.

2.Bandwidth conservation: Single sideband transmission requires half as much bandwidth as conventional AM double side band transmission.

3.Noise reduction: Because a single side band system utilizes half as much bandwidth as conventional AM,the thermal noise power is reduced to half that of a double side band system.

20. What are the disadvantages of single side band transmission?

Complex receivers: Single side band systems require more complex and expensive receivers than conventional AM transmission .

4. Tuning Difficulties: Single side band receivers require more complex and precise tuning than conventional AM receivers.

PART–B

1. Discuss the Communication Process in detail.
2. Derive the expression for AM wave
3. Derive the expression for power distribution in AM wave
4. Discuss the difference between high level and low level modulator.
5. Discuss the frequency analysis of Angle modulated wave
6. Define phase and frequency modulation and derive the expression for AM and PM wave.
7. Explain in detail about the SSB modulation techniques.
8. Explain about DSB modulation and Demodulation.
9. Differentiate AM, FM, PM
10. Explain the generation of FM.

UNIT II -- DATA AND PULSE COMMUNICATION

PART-A

1. State the sampling theorem for band-limited signals of finite energy.

If a finite energy signal g(t) contains no frequency higher than W Hz, it is completely determined by specifying its ordinates at a sequence of points spaced 1/2W seconds apart.

2. What are the advantages of digital transmission?

The advantage of digital transmission over analog transmission is noise immunity.

- Digital pulses are less susceptible than analog signals to variations caused by noise.
- Digital signals are better suited to processing and multiplexing than analog signals.
- Digital transmission systems are more noise resistant than the analog transmission systems.
- Digital systems are better suited to evaluate error performance.

3. What are the disadvantages of digital transmission?

- The transmission of digitally encoded analog signals requires significantly more bandwidth than simply transmitting the original analog signal.
- Analog signal must be converted to digital codes prior to transmission and converted back to analog form at the receiver, thus necessitating additional encoding and decoding circuitry.

4. Define pulse code modulation.

In pulse code modulation, analog signal is sampled and converted to fixed length, serial binary number for transmission. The binary number varies according to the amplitude of the analog signal.

5. What is the purpose of the sample and hold circuit?

The sample and hold circuit periodically samples the analog input signal and converts those samples to a multilevel PAM signal.

6. What is the Nyquist sampling rate?

Nyquist sampling rate states that, the minimum sampling rate is equal to twice the highest audio input frequency.

7. What is the principle of pulse modulation?

Pulse modulation consists essentially of sampling analog information signal and then converting those discrete pulses and transporting the pulses from a source to a destination over a physical transmission medium.

8. List the four predominant methods of pulse modulation. i. Pulse width modulation (PWM)

ii. Pulse position modulation (PPM) iii. Pulse amplitude modulation (PAM) iv. Pulse duration modulation (PDM)

9. Define and state the causes of fold over distortion.

The minimum sampling rate (fs) is equal to twice the highest audio input frequency (fa). If fs is less than two times fa, distortion will result. The distortion is called aliasing or fold over distortion. The side frequencies from one harmonic fold over into the sideband of another harmonic. The frequency that folds over is an alias of the input signal hence, the names "aliasing" or "fold over distortion".

10. Define overload distortion.

If the magnitude of sample exceeds the highest quantization interval, overload distortion occurs.

11. Define quantization.

Quantization is a process of approximation or rounding off. Assigning PCM codes to absolute magnitudes is called quantizing.

12. What is the advantage and disadvantage of midtread quantization?

Advantage: less idle channel noise

Disadvantage: largest possible magnitude for Qe

13. Give the concept of delta modulation PCM.

Rather than transmit a coded representation of the sample, only single bit is transmitted, which indicates whether the sample is larger or smaller than the previous sample.

14. What is ISI and give its causes.

The ringing tails of several pulses have overlapped, thus interfering with major pulse lobe. This interference is commonly called as intersymbol interference or ISI. The four primary causes of ISI are

i.Timing inaccuracies

ii.Insufficient bandwidth

iii.Amplitude distortion

15. Define quantization error?

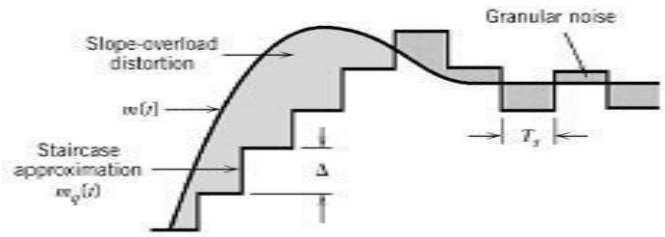
Quantization is the value of which equals the difference between the output and input values of quantizer.

16. What is PAM?

PAM is the pulse amplitude modulation. In pulse amplitude modulation, the amplitude of a carrier consisting of a periodic train of rectangular pulses is varied in proportion to sample values of a message signal.

17. What do you mean by slope overload distortion in delta modulation?

Slope of analog signal is greater than delta modulator can maintain. Caused when the step size is small



18. Define Data

Information is the knowledge or intelligence that can be processed, organized and stored is called data.

19. What is ISO?

ISO is International Organization for standardization. It creates set of rules and standards for graphics, document exchange and related technologies.

20. Define DTE?

DTE is the Data communication equipment used at the stations to adapt the digital signals to analog signals from the computers and terminals to a form suitable for transmission

21. Define DCE?

DCE is the Data communication Equipment that converts digital signal to analog signal and interfaces the DTE to the analog transmission medium.

22. Define Serial by bit?

There is a single transmission line and only one bit can be transmitted at a time is called serial by bit

23. Define Full duplex?

Transmissions are possible in both directions but they must be within the same two stations.

24. What is mean by error detection?

Error detection is the process of monitoring the received data and determining when the transmission error has occurred.

PART-B

1. Explain PCM with a neat block diagram.
2. Explain PCM sampling with necessary diagrams and circuits. Write a note on aliasing and quantization.
3. What is companding? Explain in detail Analog and digital companding.
4. With a neat block diagram explain Delta modulation. How slope over and granular noise can be minimized and discuss in detail about Adaptive delta modulation.
5. With a neat block diagram explain DPCM transmitter and receiver.
6. Write notes on ISI and eye pattern.
7. Explain the types of data communication codes?
   1.Baudot code

   2.ASCII code

   3.EBCDIC code

   4.Bar code
8. Explain Data communication hardware in detail? Line control unit

   UART transmitter & receiver
   USRT transmitter & receiver
9. Explain PPM with its block diagram.
10. Explain in detail the types of PAM and sampling,

UNIT III--Digital Communication

PART-A

1. What is digital modulation?

When the information signal is digital and any one of the parameters (amplitude, phase or frequency) of the analog carrier is varied proportional to the information signal is called ad digital modulation.

2. Compare QASK and QPSK.

QPSK	QASK
1.Quadrature phase modulation	Quadrature phase and amplitude modulation
2.All signal points placed on circumference of circle	Signal points are replaced symmetrically about origin
3. Circuit is simple.	Relatively complex
4.Noise immunity better then QASK	Poor than QPSK.
5. Error probability less then AQSK	Higher than QPSK

3. What are Antipodal signals?

In BPSK, the two symbols are transmitted with the help of following signals,
Symbol '1' => $s1(t) = \sqrt{2}P \cos(2\pi f0\, t)$ Symbol '0' => $s2(t) = \sqrt{2}P \cos(2\pi f0\, t + \pi)$

Here observe that above two signals differ only in a relative phase shift of 180^0. Such signals are called antipodal signals.

4. **What are the advantages of M-ary signaling scheme?**

i. M-ary signaling schemes transmit bits at a time.

ii. Bandwidth requirement of M-ary signaling schemes is reduced.

5. What does correlative coding mean?

Correlative coding allows the signaling rate of 2B0 in the channel of bandwidth B0. This is made physically possible by allowing ISI in the transmitted signal in controlled manner. The receiver knows this ISI. Hence effects of ISI are eliminated at the receiver . Correlative coding is implemented by duobinary signaling and modified duobinary signaling.

6. Give the difference between standard FSK and MSK.

FSK	MSK
1. The two frequencies are integer multiple of base band frequency and at the same time orthogonal.	Difference between two frequencies minimum and at the same time they are orthogonal.
2. Bandwidth (BW) = $4f_b$	BW = $f_b/2$
3. Has discontinuities when phase changes from 0 to 1 or 1 to 0.	Phase discontinuities are removed by smooth phase transition.

7. Differentiate coherent and noncoherent methods.

Coherent (synchronous) detection: In coherent detection, the local carrier generated at the receiver is phase locked with the carrier at the transmitter. The detection is done by correlating received noisy signal and locally generated carrier. The coherent detection is a synchronous detection.

Non - coherent (envelope) detection: This type of detection does not need receiver carrier to be phase locked with transmitter carrier. The advantage of such a system is that the system becomes simple, but the drawback is that error probability increases.

8. Define peak frequency deviation for FSK.

Peak frequency deviation (Δf) is the half the difference between either the mark and space frequency. **(Δf)=|fm-fs|/2.**

9. Define bit rate.

In digital modulation, the rate of change at the input to the modulator is called the bit rate (fb) and has the unit of bits per second (bps).

10. Define Baud rate.

The rate of change at the output of the modulator is called baud rate. Baud= 1/ts, where, ts- time of one signaling element (seconds).

11. Define QAM.

Quadrature amplitude modulation is a form of digital modulation where the digital information is contained in both the amplitude and phase of the transmitted carrier.

12. What is a constellation diagram?

It is also called as signal state-space diagram, similar to phasor diagram where, the relative position of peaks of phasors is shown.

13. What is bandwidth efficiency?

It is also called as information density or spectral efficiency, is the ratio of the transmission bit rate to the minimum bandwidth required for particular modulation scheme.

14. What is an Offset QPSK?

Offset QPSK (OQPSK) is a modified form of QPSK where the bit waveforms on the I and Q channels are offset or shifted in phase from each other by one-half of a bit time.

15. Bring out the difference between DPSK and BPSK.

DPSK	BPSK
1. It does not need a carrier at its receiver	It needs a carrier at receiver
2.Bandwidth reduced compared to BPSK	More bandwidth
3.Probability of error or bit error rate more than BPSK	Comparatively low
4. Error propagation more, since it uses two bits for its reception	Comparatively low, since it uses only single bit
5. Noise interference more	Comparatively low

16.Mention any four advantage of digital modulation over analog modulation.

i. Maximum data rate ii. Minimum probability of symbol error iii. Minimum transmitted power.

iv. Minimum channel bandwidth. v. Minimum circuit complexity

vi.Maximum resistance to interfering signals

17. What is DPSK?

Differential phase-shift keying (DPSK) is an alternative form of digital modulation where the binary input information is contained in the difference between successive signaling elements rather than the absolute phase. It is not necessary to recover phase-coherent carrier.

18. What do you mean by ASK?

ASK (Amplitude Shift Keying) is a modulation technique which converts digital data to analog signal. In ASK, the two binary values(0,1) are represented by two different amplitudes of the carrier signal.

19. Define peak frequency deviation for PSK.

Peak frequency deviation (Δf) is the half the difference between either the mark and space frequency. **(Δf)=|fm-fs|/2.**

20. Mention some merits of MSK.

Merits of MSK: Constant envelope

ii Spectral efficiency

iii Good BER performance iv. Self-synchronizing capability

v. MSK is a spectrally efficient modulation scheme and is particularly attractive for use in mobile radio communication systems.

PART-B

1. Explain FSK bit rate, baud, bandwidth and modulation index.
2. Explain on-off keying (OOK) or ASK, DPSK
3. Explain QPSK transmitter and receiver and bandwidth consideration.
4. Explain BPSK (transmitter and receiver) and also discuss about the bandwidth.
5. Discuss the operation of 8-QAM transmitters and receivers.
6. Explain in detail about carrier recovery and its types.
7. Discuss in detail about Balanced modulator or Balanced ring modulator
8. Explain about FSK transmitter & receiver.
9. Explain Mary QAM in detail.
10. Compare ASK, FSK, and PSK

UNIT IV - SOURCE AND ERROR CONTROL CODING

PART A

1. **What is the use of error control coding?**

The main use of error control coding is to reduce the overall probability of error, which is also known as channel coding.

2. **What is the difference between systematic code and non-systematic code?**

In the systematic block code the message bits appears at the beginning of the codeword. That is the message bits appears first and then the check bits are transmitted. In non systematic block code it is not possible to identify the message bits and check bits. They are mixed in block.

3. **What is error detection?**

The decoder accepts the received sequence and checks whether it matches a valid message sequence. If not, the decoder discards the received sequence and notifies the transmitter (over the reverse channel from the receiver to the transmitter) that errors have occurred and the received message must be retransmitted. This method of error control is called error detection

4. **Define linear block code?**

If each of the 2k code words can be expressed as linear combination of 'k' linearly independent code vectors then the code is called linear block code. A code is linear if sum of any two code vectors produces another code vector

5. **Give the properties of syndrome in linear block code.**

The syndrome depends only on the error patterns and not on the transmitted code word. All error patterns that differ by a code word have the same syndrome.

6. **What is Hamming code?**

This is a family of (n, k) linear block code. Block length: $n= 2^q – 1$

Number of message bits: k =
n-q Number of parity bits:

7. When a code is said to be cyclic?

Linearity property The sum of any two code words in the code is also a code word. Cyclic property Any cyclic shift of a code word in the code is also a code word.

8. Give the difference between linear block code and cyclic code.

Linear block code can be simply represented in matrix form Cyclic code can be represented by **polynomial form**

9. What is generator polynomial?

Generator polynomial g (x) is a polynomial of degree n-k that is a factor of X n

+ 1, where g (x) is the According to this expansion the polynomial g (x) has two terms with coefficient 1 separated by n-k-1 terms.

10. What is parity check polynomial?

Parity check polynomial h (x) is a polynomial of degree 'k' that is a factor of X n+ 1, where h (x) is the polynomial of least degree in the code.

According to this expansion the polynomial h (x) has two terms with coefficient 1 separated by k-1 terms.

11. How a syndrome polynomial can be calculated?

The syndrome polynomial is a remainder that results from dividing r(x) by the generator polynomial g(x). R(x) = q(x) b(x) + S (x)

12. Give two properties of syndrome in cyclic code.

The syndrome of a received word polynomial is also the syndrome of the corresponding error polynomial. The syndrome polynomial S(x) is identical to the error polynomial e(x).

13. Define Hamming distance (HD)?

The number of bit position in which two adjacent code vectors differs is known as Hamming

distance. (e.g) if c1 = 1 0 0 1 0 1 1 0 and c2 = 1 1 0 0 1 1 0 1 then HD=5

14. Define Weight of a code vector?

The number of non-zero components in a code vector is known as weight of a code vector. (e.g)

if c1= 1 0 0 1 0 1 1 0 then W(c1) = 4

15. Define minimum distance?

The minimum distance of a linear block code is the smallest hamming distance between any

pairs of code words in a code. (e.g) if c1= 0 0 1 1 1 0 c2 = 0 1 1 0 1 1 = 1 1 0 1 1 0 d min= 3

16. Why cyclic codes are extremely well suited for error detection?

Cyclic codes are well suited for error detection because of the following reasons They are easy to encode

They have well defined mathematical structure.

17. What is syndrome?

Syndrome gives an indication of errors present in received vector Y. If YH^T =0, then there are no errors in 'Y' and it is a valid code vector. The non zero value of YH^T is called syndrome. It's non zero value indicates that 'Y' is not a valid code vector and it contains errors.

18. Write the syndrome properties of linear block codes.

Syndrome is obtained by $S= YH^T$.

If Y=X, then S=0 ie no error in output

If $y \neq x$, then $S \neq 0$ ie there is error in output
Syndrome depends upon the error pattern only,
$S=EH^T$

19. What is convolutional code?

A convolutional code in which parity bits are continuously interleaved by information (or)

message bits.

20. Define constraint length?

The constraint length (K) of a convolutional code is defined as the number of shifts a single message bit to enter the shift register and finally comes out of the encoder output. K= M + 1

21. Give two properties of information.

a. Information must be Non-negative (i.e.) I (sk)≥ 0
b. If probability is less then information is more and if probability is more then

Information is less

If (I (sk) > I (si)) then p(sk) < p(si)

22. What is entropy?

Entropy can be defined as the average amount of information per source symbol. K-1 H(K) = - ∑ pk log pk , k=0, k=0 4.

23. Give two properties of entropy.

H(K) = 0 if and only if p

k =1 and the remaining probabilities in the set is equal to 0.The lower bound on entropy corresponds to no uncertainty.

H(K) = log 2K if and only if p

k= 1/ K then all the probabilities in the set is equiprobable. The upper bound on entropy corresponds to maximum uncertainty.

24. What is discrete source? If a source emits symbols

Ψ= {s0, s1, s2… s k-1} from a fixed finite alphabet then the source is said to be discrete source.

25. What is decision tree? Where it is used?

The decision tree is a tree that has an initial state and terminal states corresponding to source symbols s0, s1, s2… s k-1.

Once each terminal state emits its symbol, the decoder is reset to its initial state. Decision tree is used for decoding operation of prefix codes.

The channel is said to be discrete when both the alphabets and have finite sizes.

26. What is memory less channel?

The channel is said to be memory less when the current output symbol depends only on the current input symbol and not any of the previous choices.

27.State Shannon's third theorem (or) Information capacity theorem

The information capacity of a continuous channel of bandwidth B hertz perturbed by additive white Gaussian noise of power spectral density No/2 and limited in bandwidth to B is given by $C = B \log_2 (1 + P)$ bits per second

28.What are the two important points while considering a code word?

The code words produced by the source encoder are in binary form. The source code is uniquely decodable.

29. State the channel coding theorem for a discrete memory less channel.

Given a source of „M" equally likely messages, with M>>1, which is generating information t a rate R. Given channel with capacity C. Then if,

$$R \leq C$$

There exists a coding technique such that the output of the source may be transmitted over the channel with probability of error in the received message which may be made arbitrarily small.

30. Define channel capacity of the discrete memory less channel.

The channel capacity of the discrete memory less channel is given as maximum average mutual information. The maximization is taken with respect to input probabilities

$$C = \max I(X:Y)$$

$$P(xi)$$

31. Define code redundancy.

It is the measure of redundancy of bits in the encoded message sequence. It is given as,

Redundancy = 1 – code efficiency

= It should be as low as possible.

PART B

1. The generator matrix for a (6,3) block code is given below. Find all the code vectors of this code.

$$G = \begin{matrix} 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{matrix}$$

Considering (7,4) Code defined by generator polynomial $g(x)=1+x+x^3$ the codeword 0111001 is sent over a noisy Channel producing a received word 0101001 that has a single error. Determine Syndrome Polynomial S(x) and error polynomial e(x).

2. For a (6,3) systematic linear block code, the three parity check bits c4,c5,c6 are formed from the following equations

$$_i = {}_1 + {}_2 + {}_3 ; \ 5 = {}_1 + {}_2 ; 6 = {}_1 + {}_3$$

i) Write down the generator matrix ii)Construct all possible codeword

ii) Determine the dmin for the above code. Comment on error correction and detection capabilities. If the received sequence is 1 0 1 1 0 1 , determine the message bit sequence.

3. How is syndrome calculated in cyclic codes?

4. For a linear block code, prove with examples that

The syndrome depends only on error pattern and not on transmitted codeword All error patterns that differ by a codeword have the same syndrome

5. What is the use of syndromes and explain syndrome decoding
6. Find the generator matrix of a systematic (7,4) cyclic codes if $G(p)= p^3+p+1$. Also find out the parity check matrix
7. Design the encoder for (7,4) cyclic code generated by $G(P)= p^3+p+1$ and verify its operation for any message vector
8. By block diagrams explain the operation of syndrome calculator for cyclic codes
9. Design a syndrome calculator for (7,4) cyclic hamming code generated by the polynomial $G(p)=p^3+p+1$. Calculate the syndrome for Y= (1001101)
10. Find the (7,4) cyclic code to encode the message sequence (1011) using generator matrix $g(x)=1+x+x^3$
11. Verify whether $g(x)=1+x+x^2+x^4$ is a valid generator polynomial for generating a cyclic code of message (111)
12. Determine the encoded message for the following 8 bit data codes using the following CRC generating polynomial $P(x)=x^4+x^3+x^0$ 1. 11001100 2.01011111

UNIT-V -- MULTI-USER RADIO COMMUNICATION

PART-A

1. Define orbit.

The satellite can be rotated around the earth through various paths. These paths are called orbits of the satellite. These orbits are u-sed to cover the specific application areas.

2. What is a satellite system?

A satellite system consists of one or more satellite space vehicles, a ground – based station to control the operation of the system, and a user network of earth stations.

3. List the satellite orbits.

Satellite orbits about the earth are either circular or elliptical. The satellite orbits are:

Inclined orbit, Polar orbit, Equatorial orbit

4. Define inclined orbit.

Inclined orbits are virtually all orbits except those that travel directly above the equator or directly over the north and south poles.

6. Define polar orbit.

Satellite orbits with inclinations of 90°are called polar orbit. Polar orbits are used for special applications like navigational satellites.

6. Define geostationary orbit.

The circular equatorial orbit is exactly in the plane of equator on earth. All the points in this orbit are at equal distance from earth surface, and a satellite in this orbit appears to be stationary to the point of earth. Therefore this orbit is called geostationary orbit.

7. Define geosynchronous orbit.

When the inclination of the orbit is not zero and eccentricity is not zero, it is called as geosynchronous orbit. The period of geosynchronous orbit is equal to the period of revolution of earth with itself.

8. Define perigee and apogee.

The point in the orbit where the satellite is closest to the earth is called the perigee.

The point in the orbit where the satellite is farthest from the earth is called the apogee.

9. Define angle of inclination and angle of elevation.

Angle of inclination: It is the angle between the earth's equatorial plane and the orbital plane of a satellite measured counter clockwise at the point in the orbit where it crosses the equatorial plane traveling from south to north.

Angle of elevation: It is the vertical angle formed between the direction of travel of an electromagnetic wave radiated from an earth station antenna pointing directly toward a satellite and the horizontal plane.

10. State the laws of planetary motion.

Kepler's law may be simply stated asthe planets move in ellipses with the sun at one focus,the line joining the sun and a planet sweeps out equal areas in equal intervals of time,and the square of the time of revolution of a planet divided by the cube of its mean distance form the sun gives a number that is the same for all planets.

11. How are satellites classified based on elevation?

i. Low earth orbit (LEO): 1 GHz -2.5 GHz

ii. Medium Earth orbit (MEO): 1.2GHz-1.66 GHz

iii. Geosynchronous earth orbit (GEO): 2 GHz -18 GHz

12. Define Azimuth angle.

It is defined as the horizontal pointing angle of an earth station antenna.

13. Define a transponder. What is its basic function?

A satellite radio repeater is called a transponder. It is an RF-RF repeater.

14. What is a footprint?

The geographical representation of a satellite antenna's radiation pattern is called a footprint or footprint map.

15. What is station keeping?

The process of maneuvering a satellite within a pre assigned window is called station keeping.

16. State the uplink frequency and downlink frequency.

A typical uplink frequency is 6 GHz and a common downlink frequency is 4 GHz.

17.What are the techniques for increasing channel capacity?

Two of the techniques for increasing channel capacity are:

Frequency reuse

Spatial isolation

18. What is the basic transponder configuration?

There are three basic transponder configurations used in communication systems. They are

Single conversion transponder

Double conversion transponder

Regenerative transponder

19. State the major subsystems in a satellite earth station.

The major subsystems in a satellite earth station are:

Transmit subsystem

Receive subsystems

Power subsystems

Antenna subsystems

Telemetry tracking and control (TTC) subsystems

Ground control equipment (GCE) subsystems.

20. List the applications of a satellite

Some of the applications of a satellite are:

• Surveillance or observation

• Navigation TV broadcast

• Satellite telephones

21. What are the advantages of cellular systems?

Higher Capacity

Less transmission Power

Local interference only

Robustness

22. What is channel assignment?

Channel assignment refers to the allocation of specific channels to cell sites and mobileunits.

23. Define Multiple Access and what are the major types of Multiple Accesses?

For high quality communication, many mobile users to share simultaneously a finite amount of radio spectrum is called multiple Access. There are four major types of multiple access. These are (i) Frequency Division Multiple Access (FDMA) (ii) Time Division multiple Access (iii) Space Division Multiple Access (iv) Code division Multiple Access.

PART-B

1. Write notes on satellite elevation categories and satellite orbital patterns.
2. Explain the satellite system with a neat block diagram.
3. State and explain the laws of planetary motion.
4. What is a geosynchronous satellite? Discuss its advantages and disadvantages.
5. Explain CDMA and also give the orthogonal condition of the signals in
6. Explain about various multiple access schemes.
7. With neat sketch explain about cellular systems.
8. Draw and explain the architecture of GSM.
9. Explain the various multiple access schemes
10. Explain the features of CDMA over FDMA.