DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

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PRINCIPLES OF COMMUNICATION

(FOR THIRD SEMESTER IT)

TWO MARK QUESTIONS-ANSWERS

PREPARED BY

G. Sofia (L/ECE)

DEPARTMENT OF INFORMATION TECHNOLOGY

IT1202 PRINCIPLES OF COMMUNICATION

TWO MARK QUESTIONS AND ANSWERS

1. **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.

2. **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

   $$m = \frac{Em}{Ec}$$

   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.

3. **Define Low level Modulation.**

   In low level modulation, modulation takes place prior to the output element of the final stage of the transmitter. For low level AM modulator class A amplifier is used.

4. **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.

5. **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.

6. **Distinguish between low level and high level modulation.**

   In low level modulation, modulation takes place prior to the output element of the final stage of the transmitter.It requires less power to achieve a high percentage of 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 and thus ,requires a much higher amplitude modulating signal to achieve a reasonable percent modulation.

7. Define image frequency.

An image frequency is any frequency other than the selected radio frequency carrier that ,if allowed to enter a receiver and mix with the local oscillator ,will produce a cross product frequency that is equal to the intermediate frequency.

8. Define Local Oscillator tracking.

Tracking is the ability of the local oscillator in a receiver to oscillate either above or below the selected radio frequency carrier by an amount equal to the intermediate frequency throughout the entire radio frequency band.

9. Define High side injection tracking.

In high side injection tracking , the local oscillator should track above the incoming RF carrier by a fixed frequency equal to $f_{RF} + f_{IF}$.

10. **Define Low side injection tracking**.

In low side injection tracking ,the local oscillator should track below the RF carrier by a fixed frequency equal to $f_{RF} - f_{IF}$.

11. Define tracking error.How it is reduced.

The difference between the actual local oscillator frequency and the desired frequency is called tracking error.It is reduced by a technique called three point tracking.

12. Define image frequency rejection ratio.

The image frequency rejection ratio is the measure of the ability of preselector to reject the image frequency.

Mathematically ,IFRR is

$$IFRR = (1+Q^2\rho^2)^{1/2}$$

Where $\rho = (f_{im}/f_{RF}) - (f_{RF}/f_{im})$

13. Define Heterodyning.

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

14. 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 transmotted 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.

15. 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.

16. 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.

17. 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.

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

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

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

19. Define direct frequency modulation.

In direct frequency modulation , frequency of a constant amplitude carrier signal is directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal.

20. Define indirect frequency Modulation.

In indirect frequency modulation ,phase of a constant amplitude carrier directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal.

21. Define instantaneous frequency deviation.

The instantaneous frequency deviation is the instantaneous change in the frequency of the carrier and is defined as the first derivative of the instantaneous phase deviation.

22. Define frequency deviation.

Frequency deviation is the change in frequency that occurs in the carrier when it is acted on by a modulating signal frequency.Frequency deviation is typically given as a peak frequency shift in Hertz(Δf).The peak to peak frequency deviation (2Δf) is sometimes called carrier swing.The peak frequency deviation is simply the product of the deviation sensitivity and the peak modulating signal voltage and is expressed mathematically as Δf=K1 Vm Hz

23. 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.

24. Define Deviation ratio.

Deviation ratio is the worst case modulation index and is equal to the maximum peak frequency deviation divided by the maximum modulating signal frequency. Mathematically ,the deviation ratio is

$$DR = \frac{\Delta f\ (max)}{fm(max)}$$

25. What is multiplexing?

Multiplexing is the transmission of information from one or more source to one or more destination over the same transmission mediam.

26. 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.

27.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.

28.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.

29.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.

30.What is the Nyquist sampling rate?

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

31.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” .

32.Define overload distortion.

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

33.Define quantization.

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

34.Define dynamic range.

Dynamic range is the ratio of the largest possible magnitude to the smallest possible magnitude. Mathematically, dynamic range is

$$DR = \frac{Vmax}{Vmin}$$

35.Define peak frequency deviation for FSK.

Peak frequency deviation (Δf) is the difference between the carrier rest frequency and either the mark or space frequency and either the mark or space frequency.

$$(\Delta f) = \frac{|fm - fs|}{2}$$

36.Define modulation index for FSK.

The modulation index in FSK is defined as

$$h = \frac{(\Delta f)}{fa}$$

where h= FM modulation index called the h factor in FSK

fa = fundamental frequency of the binary modulating signal

(Δf) = Peak frequency deviation (hertz)

37.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).

38.Define Baud rate.

The rate of change at the output of the modulator is called baud.

39.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.

40.Write the relationship between the minimum bandwidth required for an FSK system and the bit rate.

The minimum bandwidth can be approximated as

$B=2\Delta f +2fb$

Where B=minimum bandwidth (hertz)

Δf=minimum peak frequency deviation (hertz)

Fb=bitrate

41 . What do you understand by narrowband FM?

When the modulation index is less than 1, the angle modulated systems are called low index. The bandwidth requirement of low index systems is approximately twice of the modulating signal frequency. Therefore low index systems are called narrowband FM

42. Why Armstrong method of FM is superior to reactance modulator?

Reactance modulator is direct FM, where as Armstrong method is indirect FM. Armstrong method generates FM from PM. Hence crystal oscillators can be used in Armstrong method. Therefore frequency stability is better than reactance modulator.

43. Differentiate between narrow band FM and wideband FM

In narrow band FM, the frequency deviation is very small. Hence the frequency spectrum consists of two major sidebands like AM. Other sidebands are negligible and hence they can be neglected. Therefore the bandwidth of narrowband FM is limited only to twice of the highest modulating frequency.

If the deviation in carrier frequency is large enough so that other sidebands cannot be neglected, then it is called wideband FM. The bandwidth of wideband FM is calculated as per Carson's rule.

44. What are the advantages of FM over AM?

FM has following advantages over AM.

i) The amplitude of FM is constant. It is independent of depth of modulation. Hence transmitter power remains constant in FM whereas it varies in AM.

ii) Since amplitude of FM constant, the noise interference is minimum in FM. Any noise superimposing an amplitude can be removed with the help of amplitude limits. Whereas it is difficult to remove amplitude variations due to noise in AM.

iii) The depth of modulation have limitation in AM. But in FM the depth of modulation can be increased to any value by increasing the deviation. This does not cause any distortion in FM signal.

iv) Since guard bands are provided in FM, there is less possibility of adjacent channel interference.

v) Since space waves are used for FM, the radius of propagation is limited to line of sight. Hence it is possible to operate several independent transmitters on same frequency with minimum interference.

vi) Since FM uses UHF and VHF ranges, the noise interference is minimum compared to AM which uses MF and HF ranges.

45. State Carson's rule of FM bandwidth.

Carson's rule of FM bandwidth is given as,

$$BW = 2(\delta + f_{m\,(max)})$$

Here δ is the maximum frequency deviation and $f_{m\,(max)}$) is the maximum signal frequency.

46. What is direct FM?

In this type of angle modulation, the frequency of the carrier is varied directly by the modulating signal. This means; an instantaneous frequency deviation is directly proportional to amplitude of the modulating signal

47. What is indirect FM?

In this type of angle modulation, FM is obtained by phase modulation of the carrier. This means, an instantaneous phase of the carrier directly proportional to amplitude of the modulating signal

48.What is the error probability of a binary FSK System?

Error probability of binary FSK is given as,

$$P_e = \frac{1}{2} \text{erfc} \sqrt{\frac{0.6E}{N_0}}$$

Where $E = PT_b$ is energy of one bit
and $\frac{N_0}{2}$ is the psd of white noise.

49. Compare binary PSK with QPSK.

SI.No	BPSK	QPSK
1.	One bit forms a symbol.	Two bits form a symbol.
2.	Two possible symbols.	Four possible symbols.
3.	Minimum bandwidth is twice of f_b.	Minimum bandwidth is equal to f_b.
4.	Symbol duration $= T_b$.	Symbol duration $= 2T_b$.

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

1. M-ary signaling schemes transmit bits at a time.
2. Bandwidth requirement of M-ary signaling schemes is reduced.

51. What happens to the probability of error in M-ary FSK as the value of M-increase?

As the value of 'M' increases, the Euclidean distance between the symbols reduces. Hence the symbols come closer to each other. This increases the probability of error in M-ary systems.

52. What is meant by correlative coding?

Correlative coding allows the signaling rate of $2B_0$ in the channel of bandwidth B_0. This is made physically possible by allowing ISI in the transmitted signal in controlled manner. This ISI is known to the receiver. Hence effects of ISI are eliminated at the receiver. Correlative coding is implemented by duobinary signaling and modified duobinary signaling.

53. 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. The different digital modulation techniques are used for specific application areas. The choice is made such that the transmitted power and channel bandwidth are best exploited.

54. What are antipodal signals?

In BPSK, the two symbols are transmitted with the help of following signals,

Symbol '1' $\rightarrow s_1(t) = \sqrt{2P}\cos(2\pi f_0 t)$

Symbol '0' $\rightarrow s_2(t) = \sqrt{2P}\cos(2\pi f_0 t + \pi)$

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

55. Under what circumstances M-ary signaling schemes are preferred over binary schemes?

Binary schemes transmit only one bit at a time. M-ary schemes transmit $\log_2 M$ bit at a time. When available channel bandwidth is less, then M-ary schemes are used. M-ary schemes require less bandwidth compared to binary schemes. For example binary PSK requires a bandwidth of $2f_b$. But M-ary PSK requires a bandwidth of $\frac{2f_b}{N}$.

Here N is the number of bits transmitted simultaneously. Since more symbols are transmitted in same amplitude range, the error probability of M-ary schemes is more compared to binary schemes.

56. Compare bandwidth efficiency of M-ary PSK signals and FSK signals.

For N-bit symbol, M-ary PSK requires a bandwidth of,

M-ary PSK, $BW = \frac{2f_b}{N}$

And M-ary FSK requires a bandwidth of,

M-ary FSK, $BW = \frac{2^{N+1}}{N} f_b$

Thus for N = 4,

M-ary PSK: $BW = \frac{2f_b}{4} = \frac{f_b}{2}$

M-ary FSK: $BW = \frac{2^{4+1}}{N} fb = 8 f_b$

Thus FSK requires more bandwidth compared to PSK.

57. What is baseband signal receiver?

A baseband signal receiver increases the signal to noise at the instant of sampling. This reduces the probability of error. The baseband signal receiver is also called optimum receiver.

58. What is matched filter?

The matched filter is a baseband signal receiver, which works in presence of white Gaussian noise. The impulse response of the matched filter is matched to the shape of the input signal.

59. What is the impulse response of matched filter?

Impulse response is given as,

$$h(t) = \frac{2k}{N_0}\{x_1(T - t)\}$$

Here T is the period of sampling x_1 (t) and x_2 (t) are the two signals used for transmission.

60. What is the value of maximum signal to noise ratio of the matched filter?

Maximum signal to noise ratio of the matched filter is the ratio of energy of the signal to psd of white noise. i.e.,

$$\rho_{max} = \frac{E}{N_0/2}$$

61. On what factor, the error probability of matched filter depends?

Error probability of matched filter is given as,

$$P_e = \frac{1}{2}\,\text{erfc}\,\sqrt{\frac{E}{N_0}}$$

This equation shows that error probability depends only on energy of the signal. It does not depend upon shape (waveform) of the signal.

62. What is correlator?

Correlator is the coherent receiver. It correlates the received noisy signal f (t) with the locally generated replica of the known signal x (t). Its output is given as,

$$r(t) = \int_0^T f(t)\ x(t)\,dt$$

Matched filter and correlator are functionally same.

63. Which digital modulation technique gives better error probability?

Binary PSK gives reduced error probability compared to ASK and FSK. It is given as,

$$P_e = \frac{1}{2}\,\text{erfc}\,\sqrt{\frac{E}{N_0}}$$

64. What are the advantages of QPSK as compared tp BPSK?

1. For the same bit error rate, the bandwidth required by QPSK Is reduced to half as compared to BPSK.

2. Because of reduced bandwidth, the information transmission rate of QPSK is higher.

3. Variation in QPSK amplitude is not much. Hence carrier power almost remains constant.

65.What are the requirements for a digital modulation scheme?

1.Maximum data rate
2.Minimum probability of symbol error
3.Minimum transmitted power
4.Minimum channel bandwidth
5.Maximum resistance to interfering signals
6.Minimum circuit complexity

66.State Nyquist criterion for zero ISI.

The spectra of the transmitted pulse should satisfy following equation,

$$\sum P(f - nf_b) = T_b$$

Where P (f) is the spectrum of the transmitted pulse p (t) and $f_b = \frac{1}{T_b}$ is the rate at which pulses are transmitted.

Above equation is called Nyquist pulse shaping criterion for zero ISI.

67. State Sampling theorem for bandpass signals.

The bandpass signal x (t) whose maximum bandwidth is 2W can be completely represented into and recovered from its samples if it is sampled at the minimum rate of twice the bandwidth. This means, if the maximum bandwidth is 2W, the sampling rate must be 4W samples/sec.

68.State sampling theorem for stationary message process.

Let the maximum frequency content of wide sense stationary process be W Hz. Then such process can be completely represented in its samples and reconstructed back with zero mean square error if the samples are taken at the rate of 2W or higher.

69.What is ISI?

The transmitted pulse is given as,

$$y(t_i) = \mu A_i + \mu \sum A_k \, p[(i - k) T_b] \qquad \text{and } i = 0, \pm 1, \pm 2, \ldots\ldots..$$

The first term μA_i is due to the i^{th} transmitted bit. The second term represents the residual effect of all other bits transmitted before and after the sampling instant t_i.

Such presence of outputs due to other bits interfere with the output of required bit. This effect is called Intersymbol Interference (ISI).

70.What is eye pattern?

When the sequence is transmitted over a baseband binary data transmission system, the output is a continuous time signal. If this signal is out at each interval (T_b)

and all such pieces are placed over one another, then we obtain eye pattern. It looks like eye. Eye pattern is particularly useful in studying ISI problem.

71.What is adaptive equalization?

In adaptive equalization filters adapt themselves to the dispersive effects of the channe. That is the coefficients of the filters are changed in such a way that the distortion in the data is reduced.

72.State sampling theorem.

A band limited signal of finite energy, which has no frequency components higher than 'W' Hz can be completed in its samples and recovered back if the sampling frequency $f_s \geq 2W$.

73.What is aliasing?

When the signals are sampled at the rate less than nyquist (i.e. $f_s > 2W$), then aliasing takes place. Frequencies higher than 'W' takes of lower frequencies in sampled spectrum. This is called aliasing. Aliasing can be reduced by sampling at a rate higher than nyquist rate.

74. State the sampling theorem for band pass signals

The band pass signal whose maximum bandwidth is 2W can be completely represented into and recovered from its samples if it is sampled at the minimum rate of twice the bandwidth.

75.Define Nyquist rate

When the sampling rate becomes exactly equal to 2W samples per second , for a signal bandwidth of W Hertz , then it is called Nyquist Rate.

76.What is line coding?

The analog waveforms are converted to digital signals by PCM, DM ,ADM and DPCM techniques.This digital data can be representedby different formats or waveforms.These waveforms are commonly known as digital data formats or their representation is called is called as line coding.

77.What is unipolar format?

In the unipolar format , Binary 1 is represented by a high amplitude and binary 0 is represente by a zero value.

78.What is bipolar format?

In the bipolar format , Binary 1 is represented by a positive voltage polarity and binary 0 is represented by a negative voltage polarity

79.What is bipolar RZ format?

In the bipolar format , Binary 1 is represented by a positive voltage polarity and binary 0 is represented by a negative voltage polarity.Since this is RZ format,the pulse is transmitted only for half duration.

78.What is bipolar NRZ format?

In the bipolar format , Binary 1 is represented by a positive voltage polarity and binary 0 is represented by a negative voltage polarity.Since this is NRZ format,these polarities are maintained over the complete pulse duration.

79.What is Pseudo ternary signalling?

In this format ,successive 1's are represented by pulses with alternate polarity and 0's are represented by no pulses

80.What is split phase manchestor coding?

Symbol 1 is represented by a positive half interval pulse followed by a negative half interval pulse and symbol 0 is represented by a negative half interval pulse followed by a positive half interval pulse

81.What are the properties of PAM signals?

1. The PAM signal should have adequate timing content,so that clock information can be extruded from the waveform

2.The PAM signal should be immune to channel noise and interference

3.The PAM signal should allow error detection and correction

82.What is an equalizer?

When the signal is passed through the channel , distortion is introduced in terms of amplitude and delay.This distortion creates the problems of ISI. The detection of the signal also becomes difficult.This distortion can be compensated with the help of equalizers.

83.What is M-ary coding?

In polar quaternary coding, we combine two successive bits.In M-ary coding , we combine k successive message bits.Hence we get $M=2^k$ symbols or levels.Therefore ,this type of coding is called M-ary coding.

84. What do you mean by direct sequence spread technique?

The data sequence directly modulates the pseudo noise sequence. Let the data signal be b (t) and pseudo-noise signal be c (t). Then the modulated signal is given as,

$$m(t) = b(t)$$

85. What are the advantages of spread spectrum modulation?

Spread spectrum modulation spreads the message signal over wide bandwidth with the help of special code (key). It has following important advantages.

i) Unwanted interference is rejected.

ii) Protection against antijamming signals is also provided.

iii) Multipath interference rejection.

86. Define pseudo noise sequence.

The pseudo noise sequence is a noise like high frequency signal. This signal is binary in nature. It looks like pulses. The sequence is not completely random, but it is generated by a well defined logic. The same logic is used at transmitter and receiver. Hence the sequence is rather 'pseudo' random. Hence it is called pseudo-random (or pseudo-noise) sequence. The pseudo noise sequence can be generated by a feedback shift register and the combinational logic.

87. Explain why FH spread spectrum is not affected by near far problem.

In direct sequence spread spectrum there is single frequency band in which communication takes place. If noise or jamming signal is transmitted in this frequency band, then it is difficult to isolate noise and signal at the receiver. This is called near far problem. In FH spread spectrum, the transmission takes place in multiple interference is present in one frequency band, it does not affect signal in other frequency bands. Hence near-far problem does not exist in FH spread spectrum.

88. What is meant by spectrum?

The spread spectrum modulation can be defined in two parts as follows.

1. The transmitted data sequence occupies a much more bandwidth than the minimum required bandwidth and,
2. The spectrum spreading (i.e. increase of signal bandwidth) at the transmitter and dispreading at the receiver is obtained by 'special code' which is independent of the data sequence (message signal).

The first part of definition given above is satisfied by other modulation techniques like frequency modulation, PCM etc. but they do not satisfy second part. That is they do not use frequency spectrum spreading and dispreading. The bandwidth requirement of spread spectrum modulation techniques is thus very high.

Spread spectrum modulation is used for secured communication like military applications. Noise interference has minimum effect on transmission. Unwanted receivers cannot detect the message.

89. What is frequency hop spreading?

In frequency hop spread spectrum, the carrier frequency randomly changes among different slots. These frequency slots are called hops. The data is transmitted in these hops.

90.What are the applications of Spread spectrum modulation?

1. The spread spectrum has the ability to resist the effect of intentional jamming.Previously this antijam capability was used in military applicationa.Some commercial applications also use spread spectrum because of its antijam capability.

2.Low probability of intercept is an application of spread spectrum in military .In this case, the signal spectral density is kept small such that the presence of the signal is not detected easily.

3. Spread spectrum is used in mobile communications.this is because the spread spectrum signal has tha ability to resist the effects of multipath fading.Because of wide spectrum only small portion of the signals is in fade.

4.spread spectrum is also used in selective calling.In this, the central station communicates with the number of different receiving points.

91. Difference between TDM and TDMA

By TDM,the signals at one earth station are multiplexed into single channel.Such multiple channels from different earth stations share a satellite transponder aith the help of TDMA.

92. List the advantages of direct sequence systems

1.This system has best noise and antijam performance
2.Unrecognised receivers find it most difficult to detect direct sequence signals
3.It has best discrimination against multipath signals

93. List the disadvantages of direct sequence systems

1.It requires wideband channel with small phase distortion
2.It has long acquisition time
3.The pseudo-noise generator should generate sequence at high rates
4.This system is distance relative

94. List the advantages of frequency hopping systems

1.These systems bandwidth are very large
2.They can be programmed to avoid some portions of the spectrum
3.They have relatively short acquisition time.
4.The distance effect is less

95. List the disadvantages of frequency hopping systems

1.Those systems need complex frequency synthesizers
2.They are not useful for range and range –rate measurement
3.They need error correction

96.Define slow frequency hopping

When several symbols are transmitted in one frequency hop (slot) ,then it is called slow frequency hopping.This means the symbol rate is higher than hop rate.

97.Define fast frequency hopping

When several frequency hops take place to transmit one symbol ,then it is called fast frequency hopping.This means the symbol rate is less than hop rate.

98. What is processing gain?

Processing gain is defined as the ratio of the bandwidth of spreaded signal to the bandwidth of the unspreaded signal

99.What are the properties of maximum length sequence?

a. Balance property

The number of 1's is always one more than the number of zeros in each period of a maximum length sequence

b.Run property

The run means subsequence of identical symbols i.e. 1's or 0's within one period of the sequence.The length of the run is equal to the length of the subsequence.

c.Correlation property

The auto correlation function of maximum length sequence is periodic and it is bivary valued.

100.What is SSMA?

In this application, many users transmit their signals on the same channel bandwidth.each transmitter receiver pair has a distinct pseudo-noise sequence.Thus signals of a particular transmitter are received by its intended receiver only,even if many users are transmitting ath the same time.This method is also called spread spectrum multiple access.

16 mark Questions

1.Explain in detail about super heterodyne receiver.

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

There are five sections to a superheterodyne receiver. They are RF section,the mixer/converter section,the IF section,the audio detector section, and the amplifier section.

RF section:

The RF section consists of preselector and an amplifier stage.The primary purpose of the preselector is to provide enough initial bandlimiting to prevent a specific unwanted radio frequency,called the image frequency.

An image frequency is any frequency other than the selected radio frequency carrier that ,if allowed to enter a receiver and mix with the local oscillator ,will produce a cross product frequency that is equal to the intermediate frequency.

Mixer /converter section:

The mixer stage is a nonlinear device and its purpose is to convert radio frequencies to intermediate frequencies.

IF section:

The IF section consists of a series of IF amplifiers and bandpass filters and is often called the IF strip. The receiver gain and selectivity is achieved in IF section.

Detector Section:

The purpose of the detector section is to convert the IF signals back to the original source information.

Audio Amplifier section:

The audio section comprises several cascaded audio amplifiers and one or more speakers.

2.Explain in detail about AM modulator circuits.

The location in a transmitter where modulation occurs determines whether the circuit is a low level or a high level transmitter.

In low level modulation, modulation takes place prior to the output element of the final stage of the transmitter. For low level AM modulator class A amplifier is used.

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.

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

2. **Explain in detail about FM modulators.**

FM modulators are classified into two types.They are

1.Direct FM modulators

2.Indirect FM modulators

Direct FM modulator:

In direct frequency modulation, frequency of a constant amplitude carrier signal is directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal. There are three common methods for producing direct frequency modulation: Varactor diode modulators, FM reactance modulators, and linear integrated circuit direct FM modulators.

Indirect FM modulator:

In indirect frequency modulation ,phase of a constant amplitude carrier directly proportional to the amplitude of the modulating signal at a rate equal to the frequency of the modulating signal.

3.Explain in detail about FM demodulators.

FM demodulators are frequency dependent circuits designed to produce an output voltage that is proportional to the instantaneous frequency.Several circuits are used for demodulating FM signals.The most common are the slope detector, foster seeley discriminator, and ratio detector are forms of tuned circuit frequency discriminators.

4. Explain in detail about AM peak detector.

The function of an AM detector is to demodulate the AM signal and recover or reproduce the original source information.The recovered signal should contain the same frequencies as the original information signal and have the same relative amplitude characteristics.

5.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.

6.Explain in detail about 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.

7.Explain in detail about BPSK. State merits and demerits of BPSK.

In binary phase shift keying, two output phases are possible for a single carrier frequency. One output phase represents logic 1 and the other logic 0.

BPSK transmitter:

8.Explain in detail about QPSK.

QPSK is an Mary encoding scheme where M=4.With QPSK four output phases are possible for a single carrier frequency. Two bits are clocked into the bit splitter. After both bits have been serially inputted, they are simultaneously parallel outputted . One bit is directed to the I channel and the other to the Q channel .The I bit modulates a carrier that is in phase with the reference oscillator and the Q bit modulates a carrier that is 90° out of phase or in quadrature with the reference carrier.

9.Explain in detail about FSK.

Frequency shift keying is a form of constant amplitude angle modulation similar to conventional frequency modulation except that the modulating signal is a binary signal that varies between two discrete voltage levels rather than a continuously changing analog waveform.

10.Explain in detail about 8 phase PSK.

Eight phase PSK is an Mary encoding technique where M=8.With an 8 PSK modulator ,there are eight possible output phases .To encode eight different phases ,the incoming bits are considered in groups of three bits ,called tribits.

11.Eplain about pseudo noise sequence.

The pseudo noise sequence is a noise like high frequency signal. This signal is binary in nature. It looks like pulses. The sequence is not completely random, but it is generated by a well defined logic. The same logic is used at transmitter and receiver. Hence the sequence is rather 'pseudo' random. Hence it is called pseudo-random (or pseudo-noise) sequence. The pseudo noise sequence can be generated by a feedback shift register and the combinational logic.