CS 2204 - ANALOG AND DIGITAL COMMUNICATION

2 MARKS

1. Define Amplitude Modulation.

   It is the process by which the amplitude of the carrier wave is changed in accordance with the instantaneous value of the message signal.

2. Define Under modulation.

   In this case the modulation index m<1, (i.e)V_m<V_c. The envelope of AM signal does not reach the zero amplitude axis. Hence the message signal is fully preserved i the envelope of the AM wave. This is known as under modulation.

3. Define modulation index for AM

   It is defined as the ratio of the maximum modulating voltage to the maximum carrier voltage. It is also called as 'Depth of modulation'.

   $$m = Vm / Vc$$

4. What is the relation between total power and carrier power?

   $$Pt = Pc (1 + m^2 /2)$$

   Pt : Total power
   Pc : Carrier power
   m :Modulation index

5. A 400W carrier is modulated to a depth of 75 %. Calculate the total power in the modulated wave?

   Solution:

   Pc = 400 W
   m = 0.75
   Pt=?

   $Pt = Pc (1 + m^2/2)$

   $Pt = 400 (1 + 0.75^2/2)$

   Pt=512.5 W

5. A 400W carrier is modulated to a depth of 75 %. Calculate the total power in the modulated wave?

Solution:

$P_c = 400$ W

$m = 0.75$

P_t=?

$\mathbf{P_t = P_c (1 + m^2/2)}$

$P_t = 400 (1 + 0.75^2/2)$

P_t=512.5 W

6. What is the relation between total power and carrier power?

$I_t = I_c (1+m^2/2)^{1/2}$

7. The antenna current of an AM transmitter is 8A when only carrier is sent. It increases to 8.93A when the carrier is modulated by a single sine wave. Find the percentage modulation.

Given: I_c =8A I_t=8.93A m=0.8

$I_t = I_c (1+m^2/2)^{1/2}$

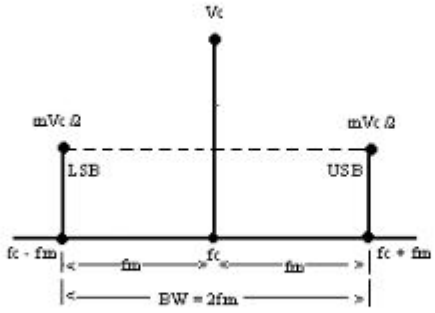
$8.93 = 8(1+m^2/2)^{1/2}$

m=0.701

8. What is the bandwidth of AM?

Bandwidth =2fm

9. Draw the frequency spectrum of DSB



10. Compare AM with DSB-SC and SSB-SC.

AM signal	DSB-SC	SSB-SC
Bandwidth=$2f_m$	Bandwidth=$2f_m$	Bandwidth=f_m
Contains USB, LSB, carrier	Contains USB,LSB	Contains LSB or USB
More power is required for transmission	Power required is less than that of AM.	Power required is less than AM &DSB-SC

11. Define frequency modulation.

Frequency modulation is defined as the process by which the frequency of the carrier wave is changed in accordance with the instantaneous value of the message signals.

12. Define modulation index for FM.

Modulation index is defined as the ratio of maximum frequency deviation to the modulating frequency.

Mf =δ/fm

13. Write the mathematical expression for FM.

V=Vc sin (wc t + mf sin wm t)

14. Define Carson's rule.

According to Carson's rule, the bandwidth is equal to twice the sum of the maximum frequency deviation and the modulating frequency.

Bw=2(δ+fm)

15. What is the effect of increasing modulation index in FM?

In FM, the total transmitted power always remains constant. But with increased depth of modulation, the required bandwidth is increased.

16. How do you get FM using PM system?

The frequency modulated wave can be obtained from PM system. This is done by integrating the modulating signals before applying it to the phase modulators.

17. Differentiate between narrow band and wide band FM signal.

S.No	WBFM	NBFM
1.	Modulation index is greater than one.	Modulation index is less than one
2.	Frequency deviation=75KHz	Frequency deviation=5KHz
3.	Modulating frequency range from 30 Hz to 15 KHz.	Modulating frequency=3KHz.
4.	Bandwidth 15 times NBFM.	Bandwidth = 2 FM.
5.	Noise is more suppressed.	Less suppressing of noise.
6.	Use: Entertainment and broadcasting.	Use: Mobile communication.

18. Why is FM superior to AM in performance?

i). In AM system the bandwidth is finite. But FM system has infinite number of sidebands in addition to a single carrier.

ii). In FM system all the transmitted power is useful whereas in AM most of the transmitted power is used by the carrier.

iii). Noise is very less in FM, hence there is an increase in the signal to noise ratio.

19. What is VSB?

VSB is vestigial side band. VSB modulation is derived by filtering DSB-SC AM or AM with carrier signals in such a fashion that one sideband is almost passed completely while only a trace of other side band is added.

20. What are synchronous detectors?

The synchronous or coherent detector uses exact carrier synchronization for retrieving the message signal from the modulated signal. These detectors are mainly used for detecting DSB-SC or SSB-SC signals because of their complicated nature.

21.State sampling theorem.

- If a finite energy signal g(t) contains no frequencies higher than W hertz ,it is completely determined by specifying its coordinates at a sequence of points spread 1/2W seconds apart.

- If a finite energy signal g(t) contains no frequencies higher than W hertz, it may be completely recovered from its coordinates at a sequence of points spread 1/2W seconds apart

22.What is aliasing? What is the effect of aliasing?

The phenomenon of a high-frequency in the spectrum of the original signal g(t) seemingly taking on the identity of a lower frequency in the spectrum of the sampled signal g(t) is called aliasing or fold over.

The effect of aliasing as the output of the reconstruction filter depends on both the amplitude and phase component of the original spectrum G (f), making an exact analysis of the output difficult resulting in distortion.

23. Define quantizing process.

The conversion of analog sample of the signal in to digital form is called quantizing process. Graphically the quantizing process means that a straight line representing the relation between the input and the output of a linear analog system.

24. What are the two fold effects of quantizing process?

1. The peak-to-peak range of input sample values subdivided into a finite set of decision levels or decision thresholds
2. The output is assigned a discrete value selected from a finite set of representation levels are reconstruction values that are aligned with the treads of the staircase.

25. Define quantization error?

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

26.What is nyquist rate?

The minimum sampling rate of 2W sample per second for a signal bandwidth of W hertz is called the nyquist rate.

27.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.

28.What is single tone and multi tone modulation?

If modulation is performed for a message signal with more than one frequency component then the modulation is called multi tone modulation.

If modulation is performed for a message signal with one frequency component then the modulation is called single tone modulation.

29. Define demodulation.

Demodulation or detection is the process by which modulating voltage is recovered from the modulated signal. It is the reverse process of modulation.

30. What are the degrees of modulation?

Under modulation. m<1

Critical modulation m=1

Over modulation m>1

31.Define instantaneous phase deviation

The instantaneous phase deviation is the instantaneous change in phase of the carrier at a given instant of time and it indicates how much the phase of the carrier is changing with respect to the reference phase.

instantaneous phase deviation = $\theta(t)$

32.What is a limiter?

A limiter a circuit that produces a constant amplitude output for all input signals above a prescribed minimum input level called the threshold ,quieting or capture level.

33. How will you obtain PM demodulator from FM demodulator?

PM demodulator is obtained from FM demodulator by placing an integrator followed by FM modulator.

34. How will you obtain PM modulator from FM modulator?

PM modulator is obtained from FM modulator by placing an differentiator followed by an FM modulator.

35. How will you obtain FM demodulator from PM demodulator?

FM demodulator is obtained from PM demodulator by placing a differentiator after the PM modulator.

36. How will you obtain FM modulator from PM modulator

FM modulator is obtained from PM modulator by placing an integrator followed by a PM modulator

37. Define percent modulation for angle modulation

The percent modulation for angle modulation is the ratio of frequency deviation actually produced to the maximum frequency deviation allowed in percent form.

percent modulation = Δf (actual)/ Δf(max)

38. Define carrier swing.

The peak to peak frequency deviation ($2\Delta f$) is called carrier swing.

39. Define angle modulation

Angle modulation is defined as the process by which the frequency or phase of the carrier wave is changed in accordance with the instantaneous value of the message signals.

40. Define frequency deviation.

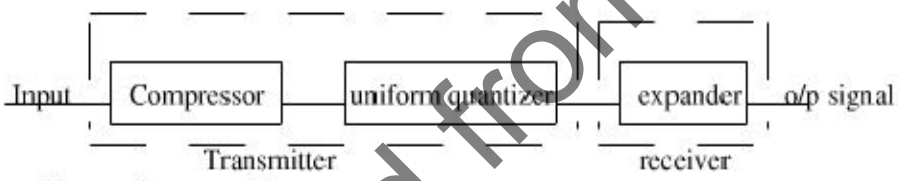
Frequency deviation is the change in frequency that occurs in the carrier when it is acted on by a modulating signal frequency. The frequency deviation is typically given as the peak frequency shift in Hertz (Δf).

41. What do you mean by companding? Define compander.

The signal is compressed at the transmitter and expanded at the receiver. This i called as *companding*. The combination of a compressor and expander is calle *compander*.

42. Draw the block diagram of compander? Mention the types of companding?

Block diagram:



Types of companding:

1. μ law companding
2. A law companding

43. What is an eye pattern?

Eye Pattern is used to study the effect of intersymbol interference.

44. What is the width of the eye?

It defines the time interval over which the received waveform can be sampled without error from intersymbol interference.

45. What is sensitivity of an eye?

The sensitivity of the system to timing error is determined by the rate of closure of the eye as the sampling time is varied.

46. What is Inter symbol interference?

The transmitted signal will undergo dispersion and gets broadened during its transmission through the channel. So they happen to collide or overlap with the adjacent symbols in the transmission. This overlapping is called Inter Symbol Interference.

47. How eye pattern is obtained?

The eye pattern is obtained by applying the received wave to the vertical deflection plates of an oscilloscope and to apply a saw tooth wave at the transmitted symbol rate to the horizontal deflection plate.

48. What do you mean bit rate and baud rate?

The rate at which data (bits) are transmitted is called bit rate. That is number of bits transmitted per second. Unit is bps(bits per second).

The rate at which signal elements(pulses) are transmitted is called baud rate(modulation rate). This means number of signal elements(pulses) transmitted per second. Unit is bauds.

49. 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.

$$S(t) = \begin{cases} A\cos 2\pi ft & \text{binary 1} \\ 0 & \text{binary 0} \end{cases}$$

50. What do you mean by FSK?

FSK (Frequency Shift Keying) also a modulation technique which converts digital data to analog signal. In FSK, the two binary values are represented by two different frequencies near the carrier frequency.

$$S(t) = \begin{cases} A\cos 2\pi f_1 t & \text{binary 1} \\ A\cos 2\pi f_2 t & \text{binary 0} \end{cases}$$

51. Differentiate Binary PSK and QPSK.

Binary PSK	QPSK
1. Two different phases are used to represent two binary values.	1. Four different phases are used to represent two binary values.
2. Each signal element represents only one bit.	2. Each signal element represents two bits.

52. What is bandwidth efficiency?

The ratio of data rate to transmission bandwidth is referred as bandwidth efficiency. It is denoted as RBR.

Bandwidth efficiency = R / B

Where,

R – data rate

B – bandwidth

53. Find the bandwidth for a 4-PSK signal transmitting at 2000 bps. Transmission is half- duplex mode.

Given, data rate R = 2000 bps.

For 4-PSK baud rate = R/2 = 1000 bauds.

For PSK signal bandwidth is equal to baud rate.

Therefore, bandwidth = 1000 Hz

54. What is the Bandwidth efficiency for QPSK for a bit error rate of 10^{-7} on a channel with an SNR of 12 dB?

First find for PSK.

$$\frac{E_b}{N_0} = \frac{S}{N}\frac{B}{R}$$

Given S/N as 12 dB and E_b/N_0 value for PSK at error rate 10^{-7} is 11.2 dB,

So $11.2 = 12 - (R/B)_{dB}$

$(R/B)_{dB} = 0.8$ dB

$R/B = 1.2$

In QPSK we can represent 2 bits in single signal element. So

For QPSK $R/B = 2 * 1.2$

$= 2.4$

55. Differentiate Digitizer and modulator.

- Digitizer converts analog data to digital data. This process is called digitization.
- Modulator converts analog / digital data to analog signal. This process is called modulation

56. Define Quantization noise.

The difference between original signal and Quantized signal is called Quantization noise/error.

$e = m(t) - m_q(t)$

57. Compare Quantization and Sampling operations.

Quantzation is a process by which an analog signal is divided into number of levels on amplitude.

Sampling is a process by which an analog signal is divided into sequence of samples (pulses) on regular interval of time.

58. List the errors in delta modulation.

1. Quantizing noise – When the analog waveform is changing very slowly, there will be Quantizing noise.
2. Slope overloads noise – When the analog waveform is changing very rapidly, there will be Slope overload noise.

59. What do you mean by DC component?

If a signal includes a component of zero frequency, that component is called DC (Direct Current) component or constant component.

With no DC component, a signal has an average amplitude of zero. With a DC component, a signal has nonzero average amplitude.

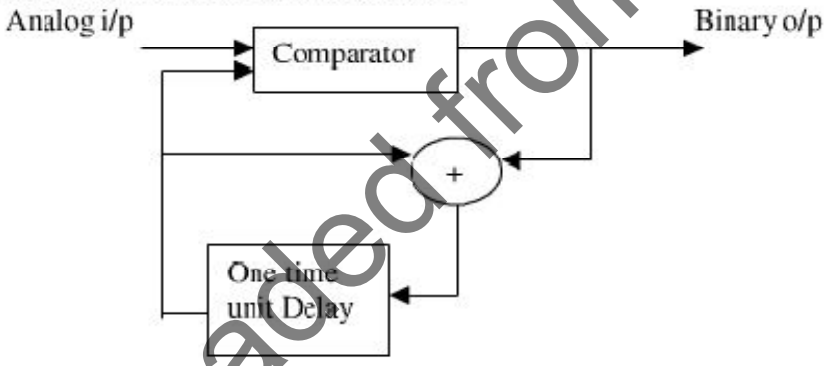
60. What is PCM?

PCM (Pulse Code Modulation) is a process used to convert analog signal to digital data. In PCM, the analog signal is first sampled then quantized then each sample is replaced with n bits binary data.

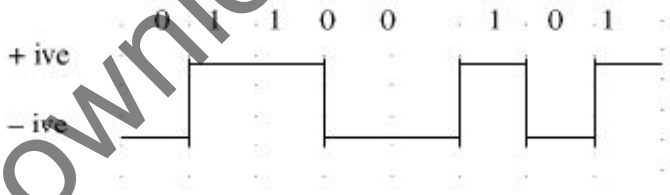
61. What do you mean by nonlinear encoding in PCM system?

Nonlinear encoding is a technique used to increase the performance of PCM system. In Nonlinear encoding the Quantization levels are not equally spaced. That is greater number of Quantization levels for signals of low amplitude, and smaller number of Quantization levels for signals of high amplitude.

62. Draw a Delta Modulation transmitter.



63. For the given digital data 01100101, draw the NRZ encoding format.



64. Define Dibit.

A unique pair of bits is called a dibit. Gray encoded set of dibits 10, 00, 01 & 11.

65. Define pseudo-noise (PN) sequence.

A pseudo-noise sequence is defined as a coded sequence of 1s and Os with certain autocorrelation properties. It is used in spread Spectrum communications. It is periodic in that a sequence of 1s and 0s repeats itself exactly with a known period.

66. What does the term catastrophic cyclic code represent ?

'000' is not a state of the shift register sequence in PN sequence generator, since this results in a catastrophic cyclic code i.e once the 000 state is entered, the shift register sequence cannot leave this state.

67. Define a random binary sequence.

A random binary sequence is a sequence in which the presence of a binary symbol 1 or 0 is equally probable.

68. State the balance property of random binary sequence.

In each period of a maximum length sequence, the number of 1s is always one more than the number of 0s. This property is called the balance property.

69. Mention about the run property.

Among the runs of 1s and 0s in each period of a maximum length sequence, one half the runs of each kind are of length one, one fourth are of length two, one eighth are of length three, and so or as long as these function represent meaningful numbers of runs. This property is called the run property.

70. Give the correlation property of random binary sequence.

The autocorrelation function of a maximum length sequence is periodic and binary valued. This property is called the correlation property.

71. Mention the significance of spread spectrum modulation.

An important attribute of spread-spectrum modulation is that it can provide protection against externally generated interfering (jamming) signals with finite power. The jamming signal may consist of a fairly powerful broadband noise or multitone waveform that is directed at the receiver for the purpose of disrupting communications. Protection against jamming waveforms is provided by purposely making the information bearing signal occupy a bandwidth far in excess of minimum bandwidth necessary to transmit it.

72. What is called processing gain?

Processing Gain (PG) is defined as the ratio of the bandwidth of spread message signal to the bandwidth of unspreaded data signal ie).

$$\text{Processing Gain} = \frac{\text{BW (spreaded signal)}}{\text{BW (Unspreaded signal)}}$$

73. What is called jamming effect?

In the frequency band of the interest, somebody else transmits the signals intentionally since these signals the in the frequency band of transmission, they interface the required signal. Hence it becomes difficult to detect the required signals. This is called jamming effect.

74. What is Anti jamming?

With the help of spread spectrum method, the transmitted signals are spread over the mid frequency band. Hence these signals appear as noise. Then it becomes difficult for the jammers to send jamming signals. This is called antijamming.

75. What are the three codes used for the anti jamming application?

1. Golay code (24, 12)
2. Expurgated Golay (24, 11)
3. Maximum length shift register code.

76. What is called frequency hop spread spectrum?

In frequency hop spread spectrum, the frequency of the carrier hops randomly from one frequency to another frequency.

77. What is slow frequency hopping?

If the symbol rate of MFSK is an integer multiple of hop rate (multiple symbols per hop) then it is called slow frequency hopping

78. What is fast frequency hopping?

If the hop rate is an integer multiple of symbol rate (multiple hops per symbol) then it is called fast frequency hopping.

79. What are the two function of fast frequency hopping?

1. Spread Jammer over the entire measure of the spectrum of Txed signal.
2. Retuning the Jamming signal over the frequency band of Txed signal.

80. What are the features of code Division multiple Accesses?

1. It does not require external synchronization networks.
2. CDMA offers gradual degradation in performance when the no. of users is increased But it is easy to add new user to the system.
3. If offers an external interference rejection capability.

81. What is called multipath Interference?

The interference caused by the interfacing of the signal form the indirect path with the signal of direct path is called multipath interference.

82. What is the advantage of a spread spectrum technique?

The main advantage of spread spectrum technique is its ability to reject interference whether it be the unintentional interference of another user simultaneously attempting to transmit through the channel (or) the intentional interference of a hostile transmitter to jam the transmission.

83. What is called frequency hop spread spectrum?

In frequency hop spread spectrum, the frequency of the carrier hops randomly from one frequency to another frequency.

84. What is slow frequency hopping?

If the symbol rate of MFSK is an integer multiple of hop rate (multiple symbols per hop) then it is called slow frequency hopping.

85. Define instantaneous phase?

It is the precise phase of the carrier at a given instant of time.

Instantaneous phase = $\omega_c t + \theta(t)$ rad

where, $\omega_c t$ = carrier reference phase (radians)

f_c = carrier frequency (Hz)

$\theta(t)$= instantaneous phase deviation (radians)

86. Define instantaneous frequency?

It is the precise frequency of the carrier at a given instant of time and is the first time derivative of the instantaneous phase.

$\omega_i(t) = \omega_c + \theta'(t)$ rad/s

87. What is aliasing?

The phenomenon of a high-frequency in the spectrum of the original signal seemingly taking on the identity of a lower frequency in the spectrum of the sampled signal is called aliasing or foldover.

88. What is meant by PCM?

Pulse code modulation (PCM) is a method of signal coding in which the message signal is sampled, the amplitude of each sample is rounded off to the nearest one of a finite set of discrete levels and encoded so that both time and amplitude are represented in discrete form.. This allows the message to be transmitted by means of a digital waveform.

89. Define quantizing process.

The conversion of analog sample of the signal into digital form is called quantizing process.

90. Define delta modulation.

Delta modulation is the one-bit version of differential pulse code modulation.

91. Define adaptive delta modulation.

The performance of a delta modulator can be improved significantly by making the step size of the modulator assume a time- varying form. In particular, during a steep segment of the input signal the step size is increased. Conversely, when the input signal is varying slowly, the step is reduced , In this way, the step size is adapting to the level of the signal. The resulting method is called adaptive delta modulation (ADM).

92. Define quantization error?

Quantization error is the difference between the output and input values of quantizer.

93. What you mean by non-uniform quantization?

Step size is not uniform. Non-uniform quantizer is characterized by a step size that increases as the separation from the origin of the transfer characteristics is increased. Non-uniform quantization is otherwise called as *robust quantization*.

94. Define Pulse Position modulation?

The position of a constant-width pulse within a prescribed time slot is varied according to the amplitude of the sample of the analog signal. This is pulse position modulation (PPM).

95. What is a single-bit error?

Single-bit errors are when only one bit within a given data string is in error. These errors affect only one character within a message.

96. What is a multiple-bit error?

A multiple-bit error is when two or more non-consecutive bits within a given data string are in error. These errors can affect one or more characters within a message.

97. What is a burst error?

A burst error is when two or more consecutive bits within a given data string are in error. These errors can affect one or more characters within a message.

98. Define Pulse Width modulation (PWM)?

The width of a constant-amplitude pulse is varied proportional to the amplitude of the analog signal at the time the signal is sampled. This is PWM. PWM is also called as pulse duration modulation (PDM) or pulse length modulation (PLM).

99. What are the types of sampling?

i) Natural sampling
ii) Flat-top sampling

100. State the advantages of angle modulation over amplitude modulation.

i) Noise immunity
ii) Noise performance & signal-to-noise improvement(SNR)
iii) Capture effect
iv) Power utilization & efficiency

16 Marks Questions

1. **Expression for AM & its Power and Efficiency calculation:**

AM – Definition

Let $m(t) = Vm \sin \omega_m t$

$c(t) = Vc \sin \omega_c t$

$V_{AM} = Vc + Vm \sin \omega_m t$

$= Vc [1 + (Vm/ Vc \sin \omega_m t]$

$m = Vm/Vc$

$v(t)_{AM} = V_{AM \sin} \omega_c t$

$= Vc (1 + m \sin \omega_m t \sin \omega_c t$

$= Vc \sin \omega_c t + mVc \sin \omega_m t \sin \omega_c t$

$= Vc \sin \omega_c t + \frac{mVc}{2} [\sin (\omega_c + \omega_m)t + \sin(\omega_c - \omega_m)t]$

= Carrier + USB + LSB

Power relation in AM:

Total Power, $P_t = P_C + P_{USB} + P_{LSB}$

P_C - Carrier power

P_{USB} - Upper Side Band power

P_{LSB} - Lower Side Band power

$P_C = \frac{V^2_{rms}}{R}$

$= \frac{Vc^2}{2R}$

$P_{USB} = P_{LSB}$

$= \frac{m^2 \, V \, c^2}{8R}$

$P_t = P_C (1 + m^2/2)$

Current relation in AM:

$$P_t = I_t^2 R$$

$$P_C = I_c^2 R$$

$$I_t = I_c \text{Sqrt}\,(1 + m^2/2)$$

Efficiency:

$$\% \eta = \frac{\text{Power in side band}}{\text{Total Power}} \times 100$$

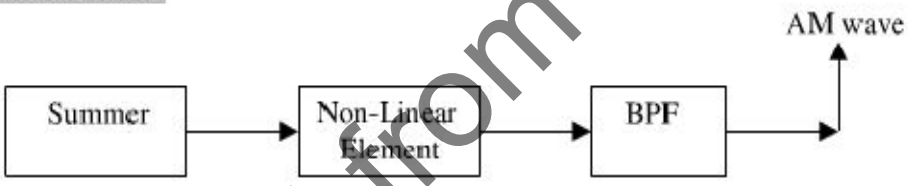
$$= \frac{m^2}{2+m^2} \times 100$$

$$m = 1$$

$$\eta = 33.33\ \%$$

2. Explain how AM is generated using square law modulator.

Square law modulator:



Summer – to add carrier & modulating signal.

Non-Linear element – active element (Diode)

BPF - extracting desired modulating products

To operate diode under Non-Linear region, magnitude of carrier component is higher during positive cycle of the modulating voltage and lesser during negative half cycle of the modulating voltage.

The resulting current is,

$$I_o = a_1 V_1 + a_2 V_1^2 + \ldots\ldots$$

$$V_1 = Vm \sin \omega_m t + Vc \sin \omega_c t$$

Neglecting second and higher order terms,

$$I_o = a_1 Vm \sin \omega_m t + a_1 Vc \sin \omega_c t + 2a_2 EmEc \sin \omega_m t \sin \omega_c t$$

After passing through BPF,

$$I_o = a_1 Vc \sin \omega_c t + a_2 VmVc \sin \omega_c t \sin \omega_m t$$

3. Explain how DSB is generated using balance modulator

Diagram – Refer Book

Input to the transistor T1,

$$Vbe_1 = Vm \sin \omega_m t - Vc \sin \omega_c t$$

Input to the transistor T2,

$$Vbe_2 = Vm \sin \omega_m t - Vc \sin \omega_c t$$

$$ic_1 = a_1 Vbe_1 + a_2 Vbe_1^2 + \ldots\ldots$$

$$ic_2 = a_1 Vbe_2 + a_2 Vbe_2^2 + \ldots\ldots$$

The output is given by,

$$V_o = K[ic_1 - ic_2]$$

4. De Modulation of AM wave:

De Modulation – definition

Types:

1. Envelope detector
2. Square law detector

Envelope detector:

Requirements to use envelope detector:

1. AM wave has to be narrow band
2. Percentage of modulation should be less than 100%

During positive half cycle of the input signal, diode is forward biased and capacitor C charges to peak value, when the input signal fall below the peak value, the diode is reverse biased and the capacitor C discharges. The discharging process continues until the next positive half cycle.

When the input signal is greater than the voltage across the capacitor, the diode conducts again and the process is repeated.

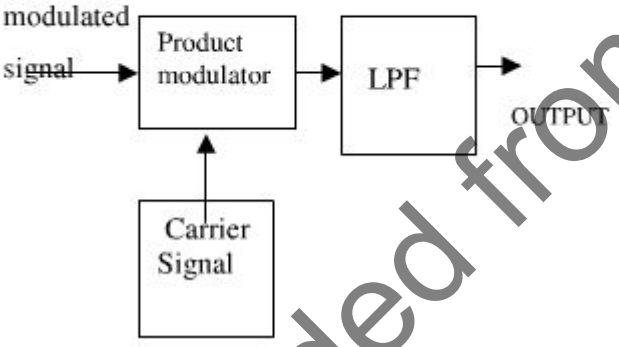
The charging time constant ($r_f + R_S$) << $1/f_c$

r_f – diode resistance

R_S – source resistance

5. Explain the principle of operation of square law detector with necessary diagrams.
   Diagram.
   Principle of operation.

6. Explain the principle of operation of coherent detector with necessary diagrams



7. How do you generate FM using direct & indirect methods?
   Diagram
   Explanation

8. How do you demodulate FM signal?

   i) Slope detector
   ii) Balance slope detector
   iii) Foster seeley discriminator
   iv) Ratio detector

9. With neat block diagram, explain binary FSK transmitter and receiver.
   i) Definition of Binary FSK
   ii) Block diagram
   iii) Explanation

10. Draw the block diagram of binary PSK system and explain.
   a) Define Binary PSK
   b) Block diagram
   c) Explain in detail

11. Draw the block diagram of PCM transmitter and receiver and explain functions of each.
   a) PCM-Definition
   b) Block diagrams of Txer & Rxer.
   c) Explain

12. Explain delta modulation system with block diagram and discuss the noise in delta modulation.
   a) Delta modulation-Define
   b) Block diagram & explain
   c) Explain Granular noise & Slope overload

13. With neat block diagram, explain binary QPSK transmitter and receiver.
   a) Definition of QPSK
   b) Block diagram & explain

14. What is Spread Spectrum Techniques Explain in detail about Direct Sequence Spread Spectrum Techniques with necessary diagrams?
   i. Concept of Spread Spectrum Techniques
   ii. Block Diagram Representation.
   iii. Waveform at all stages of the system.
   iv. Derivation of processing Gain.

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   - i) Definition of Binary FSK
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   - iii) Explanation

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11. Draw the block diagram of PCM transmitter and receiver and explain functions of each.
   - a) PCM-Definition
   - b) Block diagrams of Txer & Rxer.
   - c) Explain

12. Explain delta modulation system with block diagram and discuss the noise in delta modulation.
   - a) Delta modulation-Define
   - b) Block diagram & explain
   - c) Explain Granular noise & Slope overload

13. With neat block diagram, explain binary QPSK transmitter and receiver.
   - a) Definition of QPSK
   - b) Block diagram & explain

14. What is Spread Spectrum Techniques Explain in detail about Direct Sequence Spread Spectrum Techniques with necessary diagrams?
   - i. Concept of Spread Spectrum Techniques
   - ii. Block Diagram Representation.
   - iii. Waveform at all stages of the system.
   - iv. Derivation of processing Gain.

15. What is Frequency Hopping? Explain the different types of frequency hopping with necessary diagrams.
   - a) Concept of frequency hopping.
   - b) Explanation of slow frequency hopping
   - c) Explanation of Fast frequency hopping
   - d) Block Diagrams and waveform

16. How do you generate PM using direct & indirect methods?
   - a) Definition of Phase modulation
   - b) Circuit diagram
   - c) Explanation
   - d) Derivation (if any)

17. Explain the suppression of noise in detail.
    a) Capture effect
    b) Define Limiters
    c) Limiter circuits

18. Explain Quadrature Amplitude modulation in detail.
    a) Circuit diagram
    b) Explanation

19. Draw the block diagram of Differential PCM transmitter and receiver and explain functions of each.
    a) PCM-Definition
    b) Differential PCM-Definition
    c) Block diagrams of Txer & Rxer.
    d) Explain

20. Explain error control in detail.
    a) Types of errors-single bit, multiple bit, burst error
    b) Error detection-VRC, Checksum, LRC, CRC
    c) Error correction-Retransmission, forward error correction(FEC)

21. Explain Superheterodyne receiver & its operation with a neat block diagram.
    a) Block diagram
    b) Receiver operation
    c) Low-side injection, High-side injection
    d) Explanation of the blocks of receiver

22. With a neat circuit diagram, explain medium power AM modulator in detail.
    a) Draw the circuit diagram
    b) Explain the transistor operation when input modulating signal is applied and not applied.
    c) Draw the waveforms

23. Describe the power consumed by an angle-modulated wave?
    a) Derivation
    b) Significance of the power consumed by the angle modulated wave

24. Explain Crosby Direct FM Transmitter & its operation with a neat block diagram.
    a) Block diagram
    b) Explanation-AFC loop, Automatic frequency control

25. Explain Armstrong Indirect FM Transmitter & its operation with a neat block diagram.
    a) Block diagram
    b) Explanation with phasor diagrams