Communication Engineering

B. Tech 2nd year (KEC 401)

Unit I

1. In amplitude modulation, which among the following is constant?
a) Amplitude
b) Frequency
c) Wave length
d) Time period
Answer: b
Explanation: In amplitude modulation, the carrier wave has constant frequency and the modulating wave information is conveyed by the amplitude of the carrier waves.

2. Modern phase techniques are capable of _____
a) Resolving modulation
b) Resolving amplitude
c) Resolving frequency
d) Resolving wave length
Answer: d
Explanation: Modern phase comparison techniques are able to possess a better resolving capacity than the remaining techniques. They can resolve better than 1/1000 part of a wavelength.

3. Lower frequency is not suitable in_____
a) Direct transmission
b) Distance calculation
c) Determination of wavelength
d) Determination of frequency
Answer: a
Explanation: The range of lower frequency is not suitable in case of direct transmission through the atmosphere because it may involve in atmospheric conditions like interference, reflection, fading and scattering. This may decrease the impact of frequency which may reduce the information being transmitted.

4. Which of the following represents the correct set of modulation classification?
a) Frequency, time period
b) Frequency, amplitude
c) Amplitude, wavelength
d) Wavelength, frequency
Answer: b
Explanation: The interference technique can be eradicated by modulation, which involves two classifications. They are amplitude and frequency modulations, which can be super imposed during phase comparison.

5. Which of the following indicates the correct set of frequency employed in measuring process?

a) $7*10^6$ to $5*10^8$ Hz
b) $7.5*10^6$ to $4.5*10^8$ Hz
c) $7.5*10^6$ to $5.9*10^8$ Hz
d) $7.5*10^6$ to $5*10^8$ Hz
Answer: d
Explanation: In general, the present situation needs a frequency range of approximately $7.5*10^6$ to $5*10^8$ Hz. This can be used in order to determine the distance between the points and also employed in EDM instruments.

6. Which of the following is constant in the case of frequency modulation?
a) Modulation
b) Wavelength
c) Amplitude
d) Frequency
Answer: c
Explanation: In frequency modulation, the carrier wave has constant amplitude and the modulating wave information is conveyed by the amplitude of the carrier waves.

7. Which can't be done in high frequency zones?
a) Phase comparison
b) Super imposition of waves
c) Distance measurement
d) Wavelength measurement
Answer: a
Explanation: In high frequency zones, the phase comparison techniques cannot be applied. The high frequency may be determined as $5*10^8$ Hz which may correspond to a wave length of 0.6 m.

8. Modulating wave can also be known as _____
a) Total wave
b) Measuring wave
c) Super wave
d) Incubation wave
Answer: b
Explanation: Modulation involves the overcoming of the problems raised due to the interference, scattering, etc. In this, the measuring wave is super imposed on a carrier wave of high frequency, so it is also known as measuring wave.

9. If 10mm is the accuracy considered, what will be the maximum value of λ for 1/1000 part?
a) 10000 m
b) 10 cm
c) 10 m
d) 10000 cm
Answer: c
Explanation: The maximum value of the wave length can be determined by multiplying assumed wave length with the accuracy considered, which means, $\lambda = 10*1000 = 10$ m.

10. Frequency modulation is equipped in all EDM instruments.
a) True
b) False
Answer: a
Explanation: In frequency modulation, the carrier wave has constant amplitude and frequency varies in proportion to the amplitude of the modulating wave. Frequency modulation is used in all EDM instruments, while amplitude modulation is done in visible light instruments and infrared instruments.

11. In Amplitude Modulation, the instantaneous values of the carrier amplitude changes in accordance with the amplitude and frequency variations of the modulating signal.
a) True
b) False
Answer: a
Explanation: In Amplitude Modulation, the amplitude of the carrier sine wave is varied by the value of the information signal. The instantaneous value of the carrier amplitude changes in accordance with the amplitude and frequency variations of the modulating signal. The carrier frequency remains constant during the modulation process, But its amplitude varies in accordance with the modulating signal.

12. What is the line connecting the positive and negative peaks of the carrier waveform called?
a) Peak line
b) Maximum amplitude ceiling
c) Modulation index
d) Envelope
Answer: d
Explanation: An imaginary line connecting the positive peaks and negative peaks of the carrier waveform gives the exact shape of the modulating information signal. This line is known as the envelope.

13. What is the reference line for the modulating signal?
a) Zero line
b) Carrier peak line
c) Modulated peak line
d) Un-modulated peak line
Answer: b
Explanation: The modulating signal uses the peak value of the carrier rather than zero as its reference point. The envelope varies above and below the peak carrier amplitude. The zero reference line of the modulating signal coincides with the peak value of the unmodulated carrier.

14. What happens when the amplitude of the modulating signal is greater than the amplitude of the carrier?
a) Decay
b) Distortion
c) Amplification
d) Attenuation

Answer: b
Explanation: The zero reference line of the modulating signal coincides with the peak value of the unmodulated carrier. Because of this, the relative amplitudes of the carrier and modulating signal are important. When the amplitude of the modulating signal is greater than the amplitude of the carrier, distortion will occur.

15. What is the effect of distortion?
a) Total information loss
b) Error information
c) Attenuated information
d) Amplified information
Answer: b
Explanation: Distortion occurs when the modulating signal amplitude is greater than the amplitude of the carrier, causing incorrect information to be transmitted. In amplitude modulation, it is particularly important that the peak value of the modulating signal be less than the peak value of the carrier.

16. What is the circuit used for producing AM called?
a) Modulator
b) Transmitter
c) Receiver
d) Duplexer
Answer: a
Explanation: The circuit used for producing AM is called a modulator. It has two inputs, the carrier and the modulating signal, and the resulting output is the modulated signal. Amplitude modulators compute the product of the carrier and modulating signals.

17. The ratio between the modulating signal voltage and the carrier voltage is called?
a) Amplitude modulation
b) Modulation frequency
c) Modulation index
d) Ratio of modulation
Answer: c
Explanation: For undistorted modulation to occur, the voltage of modulating signal Vm must be less than the carrier voltage Vc. Therefore, the relationship between the amplitude of the modulating signal and the amplitude of the carrier signal is important. This relationship, known as the modulation index m, is the ratio $m = {}^{V_m}\!/_{Vc}$.

18. When does over-modulation occur?
a) Modulating signal voltage < Carrier voltage
b) Modulating signal voltage > Carrier voltage
c) Modulating signal voltage = Carrier voltage
d) Modulating signal voltage =0
Answer: b
Explanation: Over-modulation is a condition in which the modulating signal voltage is much greater than the carrier voltage. The received signal will produce an output waveform in the shape of the envelope, whose negative peaks have been clipped off.

19. What is the condition for greatest output power at the transmitter without distortion?
a) Modulating signal voltage > Carrier voltage
b) Modulating signal voltage < Carrier voltage
c) Modulating signal voltage = Carrier voltage
d) Modulating signal voltage = 0
Answer: c
Explanation: When the modulation index is 1 or the percentage of modulation is 100, modulating signal voltage is equal to the carrier voltage. This results in the greatest output power at the transmitter and the greatest output voltage at the receiver, with no distortion.

20. Which of the following modulating signal voltage would cause over-modulation on a carrier voltage of 10v?
a) 9.5
b) 9.99
c) 10
d) 12
Answer: d
Explanation: When the voltage of the modulating signal exceeds the voltage of the carrier signal over-modulating occurs. Here, 12/10 = 1.2 which is greater than 1 and hence would cause over-modulation.

26. What is the circuit used for producing AM called?
a) Modulator
b) Transmitter
c) Receiver
d) Duplexer
Answer: a
Explanation: The circuit used for producing AM is called a modulator. It has two inputs, the carrier and the modulating signal, and the resulting output is the modulated signal. Amplitude modulators compute the product of the carrier and modulating signals.

27. The ratio between the modulating signal voltage and the carrier voltage is called?
a) Amplitude modulation
b) Modulation frequency
c) Modulation index
d) Ratio of modulation

28. What is the percentage of modulation if the modulating signal is of 7.5V and carrier is of 9V?
a) 100
b) 91
c) 83.33
d) 0
Answer: c
Explanation: modulation index m = V_m/V_c = $7.5/9$* 100 = 83.33.

29. When does over-modulation occur?
a) Modulating signal voltage < Carrier voltage

b) Modulating signal voltage > Carrier voltage
c) Modulating signal voltage = Carrier voltage
d) Modulating signal voltage =0
Answer: b
Explanation: Over-modulation is a condition in which the modulating signal voltage is much greater than the carrier voltage. The received signal will produce an output waveform in the shape of the envelope, whose negative peaks have been clipped off.

30. What is the condition for greatest output power at the transmitter without distortion?
a) Modulating signal voltage > Carrier voltage
b) Modulating signal voltage < Carrier voltage
c) Modulating signal voltage = Carrier voltage
d) Modulating signal voltage = 0
Answer: c
Explanation: When the modulation index is 1 or the percentage of modulation is 100, modulating signal voltage is equal to the carrier voltage. This results in the greatest output power at the transmitter and the greatest output voltage at the receiver, with no distortion.

31. What is the purpose of peak clipper circuits in radios?
a) prevent overmodulation
b) reduce bandwidth
c) increase bandwidth
d) regulate oscillator input voltage
Answer: a
Explanation: Clipper is used to prevent the output of a circuit from exceeding a predetermined voltage. It does not distorted the remaining part of the applied waveform.

32. In FM receiver, role of amplitude limiter is to reduce the amplitude of signals.
a) True
b) False
Answer: b
Explanation: Role of amplitude limiter in frequency modulation is to eliminate any change in amplitude of received FM signals.

33. Balanced modulator is used to suppress carrier signal to create an SSB or DSB.
a) True
b) False
Answer: b
Explanation: Balanced modulator is used to produce 100% modulation.

34. What is the main function of a balanced modulator?
a) to limit the noise picked by a receiver
b) to produce balanced modulation of a carrier wave
c) to suppress carrier signal
d) to produce 100% modulation
Answer: d
Explanation: For achieving 100% modulation, balanced modulator is mainly used in circuits.

35. For classifying a modem as low speed its data rate is _____
a) upto 100bps
b) upto 200bps
c) upto 400bps
d) upto 600bps
Answer: d
Explanation: According to standard data for modem, if the data rate is upto 600bps then modem is classified as having a low speed.

36. Varacter diode modulator is an indirect way of generating FM.
a) True
b) False
Answer: b
Explanation: Varacter diode modulator is not an indirect way of generating FM. It is a Armstrong modulator which is an indirect way of generating FM.

37. Which of the following is an indirect way of generating FM?
a) By reactance modulator
b) By bipolar transistor
c) By varacter diode
d) By armstrong modulator
Answer: d
Explanation: Armstrong modulator which is the only way for indirect generating of frequency modulation.

28. Convex lens has negative focal power and concave lens have positive focal power.
a) True
b) False
Answer: b
Explanation: Convex lens has positive focal power and concave lens have negative focal power.

39. All lens have positive focal power.
a) True
b) False
Answer: b
Explanation: Convex lens has negative focal power and concave lens have positive focal power.

40. Which of the following modulating signal voltage would cause over-modulation on a carrier voltage of 10v?
a) 9.5
b) 9.99
c) 10
d) 12
Answer: d
Explanation: When the voltage of the modulating signal exceeds the voltage of the carrier signal over-modulating occurs. Here, 12/10 = 1.2 which is greater than 1 and hence would cause over-modulation.

41. What is the reason of "envelope" in an amplitude modulated signal?
a) noise signal
b) carrier signal
c) nematic signal
d) baseband signal
Answer: d
Explanation: Envelope is basically a smooth curve that outlines the extremes of any baseband signal. So basically it is message or baseband signal that determines the envelope.

42. AM stands for _____
a) Amplitude Modulation
b) Audio Modulation
c) Antenna Modulation
d) Amplified Modulation
Answer: a
Explanation: AM stands for amplitude modulation. Amplitude modulation is the change in the amplitude of carrier wave in proportion to the instantaneous amplitude of the message signal.

43. What is the equation for full-carrier AM?
a) $V(t) = (E_c + E_m) \times (\sin \omega_c t)$
b) $V(t) = (E_c + E_m) \times (\sin \omega_m t) + (\sin \omega_c t)$
c) $V(t) = (E_c \times E_m) \times (\sin \omega_m t) \times (\sin \omega_c t)$
d) $V(t) = (E_c + E_m \sin \omega_m t) \times (\sin \omega_c t)$
Answer: d
Explanation: Amplitude modulation is the change in the amplitude of carrier wave in proportion to the instantaneous amplitude of the message signal. A carrier can be seen as a waveform with frequency higher than the message signal frequency, that is modulated with respect to input signal for the purpose of transmitting information. The equation for full-carrier AM is $V(t) = (E_c + E_m \sin \omega_m t) \times (\sin \omega_c t)$.

44. What is the cause of Overmodulation?
a) distortion
b) splatter
c) both distortion and splatter
d) half reception of signals
Answer: c
Explanation: Overmodulation is the process in which the modulation index is greater than 1 such that the modulating signal voltage exceeds the required voltage to produce 100% modulation. It results out of both distortion and splatter of waveform and causes distortion and overlapping

45. If AM radio station increases its modulation index then the audio gets louder at the receiver.
a) True
b) False
Answer: a
Explanation: Modulation index tells us the amount by which the carrier wave is varied with

respect to the message signal. If we increase the modulation index then audio signal gets louder.

46. The modulation index can be derived from _____
a) frequency-domain signal
b) time-domain signal
c) both frequency and time domain signal
d) a highly modulated carrier wave
Answer: c
Explanation: Modulation index tells us the amount by which the carrier wave is varied with respect to the message signal. It can be derived for frequency-domain signals as well as for time-domain signals.

47. A single sideband modulation system is more efficient than a plain amplitude modulated system.
a) True
b) False
Answer: a
Explanation: In Single Sideband transmission, the carrier is suppressed and only either of the two sidebands is transmitted. Thus, it reduces the total power consumption and also reduces the bandwidth required. Whereas, in AM, the carrier being transmitted along with both the sidebands entails more power and larger bandwidth.

48. At peak modulation an SSB transmitter radiate 1000W, what will it radiate with no modulation?
a) 1000 watts
b) 500 watts
c) 250 watts
d) 0 watts
Answer: d
Explanation: Power of a modulated wave is directly proportional to modulation index. Thus, if there is no modulation in any SSB transmitter than, it will not radiate. So it will radiate 0 watts when there is no modulation.

49. Why AM stations has “low-fidelity”?
a) AM is susceptible to noise
b) Commercial AM stations use low power
c) Commercial AM stations have a narrow bandwidth
d) High quantization to noise ratio
Answer: c
Explanation: Fidelity is the ability of receivers to reproduce all modulating signals eually. Low fidelity can be seen as sound recording that contain technical flaws to make sound better compared with the sound that is recorded live. High fidelity refers to the equipment that very accurately produces without any harmonic or resonance. AM stations have low fidelity to have narrow bandwidth.

50Calculate the power in one of the side band in SSBSC modulation when the carrier power is 124W and there is 80% modulation depth in the amplitude modulated signal.
a.) 89. 33 W

b.) 64. 85 W
c.) 79.36 W
d.) 102 W
Answer: c) 79.36 W
Explanation:
Modulation Index= 0.8
Pc = 124W
Power in sidebands may be calculated as = m2 Pc/4
= (0.8)2 * 124/4
= 79.36 W

51Calculate the total modulation Index when a carrier wave is being modulated by two modulating signals with modulation indices 0.8 and 0.3.
a.) 0.8544
b.) 0.6788
c.) 0.9999
d.) 0.5545
Answer: a) 0.8544
Explanation:
Here, m1 = 0.8
m2 = 0.3

total modulation index mt = √(m12 + m22)
= √(0.82 + 0.32)
= √ 0.73
= 0.8544 = 85.44%

52..Calculate the frequencies available in the frequency spectrum when a 2MHz carrier is modulated by two sinusoidal signals of 350Hz and 600Hz.
a.) 2000.35, 1999.65 and 2000.6, 1999.4
b.) 1999.35, 1999.65 and 2000.6, 2000.4
c.) 2000.35, 2000.65 and 2000.6, 2000.4
d.) 1999.35, 1999.65 and 1999.6, 1999.4
Answer: a) 2000.35, 1999.65 and 2000.6, 1999.4
Explanation:
The frequencies obtained in the spectrum after the amplitude modulation are
fc+fm and fc+fm
therefore,
the available frequencies after modulation by 0.350 KHz are
2000KHz+ .350 KHz = 2000.35 and 2000KHz – 0.350 KHz = 1999.65

the available frequencies after modulation by 0.6 KHz are
2000KHz+0 .6 KHz = 2000.6 and 2000KHz – 0.6 KHz = 1999.4
If an AM signal is represented by
v = (15 + 3 Sin(2Π * 5 * 103 t)) * Sin(2Π * 0.5 * 106 t) volts

i.) Calculate the values of the frequencies of carrier and modulating signals.
ii.) Calculate the value of modulation index.
iii.) Calculate the value of bandwidth of this signal.

a.) 1.6MHz and 8KHz, 0.6, 16 MHz
b.) 1.9MHz and 18KHz, 0.2, 16 KHz
c.) 2.4 MHz and 18KHz, 0.2, 16 KHz
d.) 1.6MHz and 8KHz, 0.2, 16 KHz
Answer: d) 1.6MHz and 8KHz, 0.2, 16 KHz

Explanation:

The amplitude modulated wave equation is
v = (10 + 2 Sin(2Π * 8 * 103 t)) * Sin(2Π * 1.6 * 106 t) volts

Instantaneous value of AM signal is represented by the equation
v = {Vc + Vm Sin (ωm t)} * Sin (ωc t)
comparing it with the given equation,

Vc = 10 V
Vm = 2V
ωc (= 2Π fc) = 2Π * 1.6 * 106
ωm (= 2Π fm) = 2Π * 8 * 103

(i) The carrier frequency fc is = 1.6 * 106 = 1.6 MHz
The modulating frequency fm is = 8* 103 = 8 kHz

(ii) The modulation index m = Vm/Vc = 2/10 = 0.2

(iii) The bandwidth BW = 2 fm = 16 kHz

53.An AM signal has a total power of 48 Watts with 45% modulation. Calculate the power in the carrier and the sidebands.

a.) 39.59 W, 4.505W
b.) 40.59 W, 4.205W
c.) 43.59 W, 2.205W
d.) 31.59 W, 8.205W
Answer: c) 43.59 W, 2.205W
Explanation:

Given that Pt = 48 W

Modulation index m= 0.45

The total power in an AM is given by

Pt= Pc (1 + m2/2)
= Pc (1 +0.452/2)
48 = Pc * 1.10125

Therefore, Pc = 48/ 1.10125
= 43.59 W

The total power in two sidebands is 48 – 43.59 = 4.41 W

So the power in each sideband is 4.41/2 = 2.205 W

54.Calculate the power saved in an Amplitude Modulated wave when it is transmitted with 45% modulation
– Without carrier
– Without carrier and a sideband

a.) 90%, 95%
b.) 82%, 91%
c.) 82%, 18%
d.) 68%, 16%
Answer: a) 90%, 95%
Explanation:
The total power in an AM is given by
Pt= Pc (1 + m2/2)

Given: m= 0.45
Therefore Pt= Pc (1 +0.452/2)
Pt= Pc *1.10125
Pc/ Pt = 1/1.10125
= 0.908
= 90%
This shows that the carrier occupies 90% of total power. So 90% of total power may be saved if carrier is suppressed in the AM signal.
(ii) If one of the sidebands is also suppressed, half of the remaining power will be saved i.e., 10/2 = 5 %. So a total of 95% (90% + 5%) will be saved when carrier and a side band are suppressed.

55.Calculate the power saved in an Amplitude Modulated wave when it is transmitted with 45% modulation
– Without carrier
– Without carrier and a sideband
a.) 90%, 95%
b.) 82%, 91%
c.) 82%, 18%
d.) 68%, 16%
Answer: a) 90%, 95%

Explanation:
The total power in an AM is given by
Pt= Pc (1 + m2/2)
Given: m= 0.45
Therefore Pt= Pc (1 +0.452/2)
Pt= Pc *1.10125
Pc/ Pt = 1/1.10125
= 0.908
= 90%

This shows that the carrier occupies 90% of total power. So 90% of total power may be saved if carrier is suppressed in the AM signal.

(ii) If one of the sidebands is also suppressed, half of the remaining power will be saved i.e., 10/2 = 5 %. So a total of 95% (90% + 5%) will be saved when carrier and a side band are suppressed.

56.What is the carrier frequency in an AM wave when its highest frequency component is 850Hz and the bandwidth of the signal is 50Hz?

a.) 80 Hz
b.) 695 Hz
c.) 625 Hz
d.) 825 Hz
Answer: d) 825 Hz
Explanation:
Upper frequency = 850Hz
Bandwidth = 50Hz
Therefore lower Frequency = 850-50= 800 Hz
Carrier Frequency = (850-800)/2
= 825 Hz

57.Noise figure of merit in SSB modulated signal is
a.) 1
b.) Less than 1
c.) Greater than 1
d.) None of the above
Answer: a) 1
Explanation:

A figure of merit used to describe the performance of a system. The figure of merit 'γ' is the ratio of output signal to noise ratio to input signal to noise

ratio of a receiver system. Figure of merit for SSB modulation is always 1.

58.For low level modulation , amplifier used is
a.) Class A
b.) Class C
c.) Class A and C
d.) None of the above
Answer: a) Class A
Explanation:
When the modulation takes place prior to the output element of the final stage of the amplifier, it is low level modulation. Class A amplifiers are used for this purpose.

59.For high level modulation , amplifier used is
a.) Class A
b.) Class C
c.) Class A and C
d.) None of the above
Answer: b) Class C

Explanation:
When the modulation takes place in the final element of the final stage of the amplifier, it is high level modulation. Class C amplifiers are used for this purpose.

60.The antenna current of the transmitter is 10A. Find the percentage of modulation when the antenna current increases to 10.4A.

a.) 32%
b.) 28.5%
c.) 64%
d.) 40%
Answer: b) 28.5%
Explanation:
It= Ic √(1+ m2/2)
10.4= 10 √(1+ m2/2)
√ (1+ m2/2) = 1.04
Therefore m= 0.285
= 28.5%

61.Demodulation is:

a.) detection
b.) recovering information from modulated signal
c.) a) and b)
d.) none of the above
Answer: c.) a) and b)
Explanation:
Demodulation is the process of recovering the original information from a modulated carrier wave. Systems are designed to be used as demodulators that detect the information signal from the carrier. The envelope detector and product detector are few of the AM detectors.

61.Calculate the side band power in an SSBSC signal when there is 50% modulation and the carrier power is 50W.

a.) 50W
b.) 25 W
c.) 6.25 W
d.) 12.5 W
Correct Answer : 6.25 W
Explanation:
The side band power is given by
Pc m2/2
= 50* (0.5) 2/2
=6.25W

62.Calculate the modulation index when the un modulated carrier power is 15KW, and after modulation, carrier power is 17KW.

a.) 68%
b.) 51.63%
c.) 82.58%
d.) 34.66%

answer: b.) 51.63%
Explanation:
The total power in an AM is given by
Pt= Pc (1 + m2/2)
17= 15(1 + m2/2)
m2/2= 0.134
m=0.5163
= 51.63%

63.Calculation of modulation index using antenna current

An AM transmitter has an antenna current changing from 5 A un modulated to 5.8 A. What is the percentage of modulation?
a.) 38.8%
b.) 83.14 %
c.) 46.8%
d.) 25.2%
Correct Answer: 83.14 %
Explanation:
Modulation index m is given by
m= √ (2{It/Ic}2-1)
= √ (2 (5.8/5)2 -1)
= √ (2 (5.8/5)2 -1)
= 0.8314
= 83.14%

64.The antenna current of the transmitter is 10A. Find the percentage of modulation when the antenna current increases to 10.4A.

a.) 32%
b.) 28.5%
c.) 64%
d.) 40%
Answer: b) 28.5%

Explanation:
It= Ic √(1+ m2/2)
10.4= 10 √(1+ m2/2)
√ (1+ m2/2) = 1.04
Therefore m= 0.285
= 28.5%

65.What is the change in the value of transmitted power when the modulation index changes from 0 to 1?

a.) 100%
b.) Remains unchanged
c.) 50%
d.) 80%
Answer: c) 50%
Explanation:

Pt= Pc (1 + m2/2)
Pt= Pc (1 + 02/2) = Pc……..(1)
New total power Pt1= Pc (1 + 12/2)
= Pc *3/2……..(2)
(2) / (1),
We get , Pt1/ Pt= 3/2= 1.5
Pt1= 1.5 Pt
i.e. there is increase in total power by 50%

66.An AM signal has a total power of 48 Watts with 45% modulation. Calculate the power in the carrier and the sidebands.
a.) 39.59 W, 4.505W
b.) 40.59 W, 4.205W
c.) 43.59 W, 2.205W
d.) 31.59 W, 8.205W
Answer: c) 43.59 W, 2.205W
Explanation:
Given that Pt = 48 W
Modulation index m= 0.45
The total power in an AM is given by
Pt= Pc (1 + m2/2)
= Pc (1 +0.452/2)
48 = Pc * 1.10125
Therefore, Pc = 48/ 1.10125
= 43.59 W
The total power in two sidebands is 48 – 43.59 = 4.41 W
So the power in each sideband is 4.41/2 = 2.205 WNumerical – Power saving in AM when carrier and side band are suppressed

67.Calculate the power saved in an Amplitude Modulated wave when it is transmitted with 45% modulation
– Without carrier
– Without carrier and a sideband
a.) 90%, 95%
b.) 82%, 91%
c.) 82%, 18%
d.) 68%, 16%
Answer: a) 90%, 95%
Explanation:
The total power in an AM is given by
Pt= Pc (1 + m2/2)
Given: m= 0.45
Therefore Pt= Pc (1 +0.452/2)
Pt= Pc *1.10125
Pc/ Pt = 1/1.10125
= 0.908
= 90%

This shows that the carrier occupies 90% of total power. So 90% of total power may be saved if carrier is suppressed in the AM signal.
(ii) If one of the sidebands is also suppressed, half of the remaining power will be saved i.e., 10/2 = 5 %. So a total of 95% (90% + 5%) will be saved when carrier and a side band are suppressed.

69.The antenna current of the transmitter is 10A. Find the percentage of modulation when the antenna current increases to 10.4A.
a.) 32%
b.) 28.5%
c.) 64%
d.) 40%
Answer: b) 28.5%
Explanation:
It= Ic √(1+ m2/2)
10.4= 10 √(1+ m2/2)
√ (1+ m2/2) = 1.04
Therefore m= 0.285
= 28.5%

69.What is the change in the value of transmitted power when the modulation index changes from 0 to 1?
a.) 100%
b.) Remains unchanged
c.) 50%
d.) 80%
Answer: c) 50%
Explanation:
Pt= Pc (1 + m2/2)
Pt= Pc (1 + 02/2) = Pc……..(1)
New total power Pt1= Pc (1 + 12/2)
= Pc *3/2……..(2)
(2) / (1),
We get , Pt1/ Pt= 3/2= 1.5
Pt1= 1.5 Pt
i.e. there is increase in total power by 50%

70.An AM broadcast station transmits modulating frequencies up to 6 kHz. If the AM station is transmitting on a frequency of 894 kHz, the values for maximum and minimum upper and lower sidebands and the total bandwidth occupied by the AM station are:
a.) 900 KHz, 888KHz, 12 KHz
b.) 894 KHz, 884 KHz, 12 KHz
c.) 894 KHz, 888 KHz, 6 KHz
d.) 900 KHz, 888 KHz, 6 KHz
Correct Answer: a) 900 KHz, 888KHz, 12 KHz
Explanation:
Maximum Frequency fUSB = 894 + 6 = 900 kHz

Minimum Frequency fLSB = 894 – 6 = 888 kHz
Bandwidth BW = fUSB fLSB = 900 888 = 12 kHz OR = 2(6 kHz) = 12 kHz

Communication Engineering

B. Tech 2nd year (KEC 401)

Unit II

1. Baseband compression produces _____
a) a small range of frequencies from low to high
b) a small range of different phases
c) a small range of angles
d) a small range of amplitude
Answer: d
Explanation: A signal compression method in a wireless network provides efficient transfer

of compressed signal samples over serial data links in the system. Baseband compression produces a small range of amplitude.

2. Automatic Level Control (ALC) is used to keep the modulation index close to 100%.
a) True
b) False
Answer: a
Explanation: ALC stands for Automatic Level Control. It is a technology which is used for automatic control of output power. It helps in maintaining the output when there are varying changes in the input.

3. A signal that _____ must have linear power amplifier.
a) is complex
b) has variable frequency
c) is linear
d) has variable amplitude
Answer: d
Explanation: If any signal has variable amplitude then its amplifier must be linear. Others may or may not have the same but can possess non-linear amplifiers.

4. Transmitters are designed usually to derive a load impedance of _____
a) 50 ohms resistive
b) 150 ohms resistive
c) 250 ohms resistive
d) 500 ohms resistive
Answer: a
Explanation: Transmitter is an electronic device that produces radio waves with an antenna. The transmitter itself generates a radio frequency alternating current, which is applied to the antenna. Transmitters are usually designed to derive a load impedance of 50 ohms resistive.

5. What we called a resistor if a transmitter is connected to a resistor instead of an antenna?
a) a test load
b) a temporary load
c) a dummy load
d) a heavy load
Answer: c
Explanation: If a transmitter is connected to resistor not antenna than it is called dummy load. Such a load is used for testing purposes to set the parameters of the transmitter, as it would have behaved in presence of an actual antenna.

6. A class D amplifiers is very efficient than other amplifiers.
a) True
b) False
Answer: a
Explanation: Class D amplifier is also known as a switching amplifier. It is operate as electronic switches, and not an electric gain device which is commonly used in most amplifiers. It also has high power conversion efficiency unlike other amplifiers.

7. The carrier is suppressed in _____
a) a mixer
b) a frequency multiplier
c) a transducer
d) a balance modulator
Answer: d
Explanation: A mixer is the one which mixes the audio frequency with the carrier frequency. A transducer converts a signal from one form to another. Balance modulator suppresses the carrier and leaves only the sidebands.

8. What is the full form of AFC?
a) Amplitude to frequency conversion
b) Automatic frequency conversion
c) Automatic frequency control
d) Audio frequency control
Answer: c
Explanation: AFC stands for Automatic frequency control. It is a method to automatically keep a resonant circuit tuned to a frequency of an incoming radio signal. It is used in receivers to tune to the desired frequency.

9. Mixing is used in communication to _____
a) raise the carrier frequency
b) lower the carrier frequency
c) to altered the deviation
d) to change the carrier frequency to any required value
Answer: d
Explanation: Mixing is used to change the frequency of carrier by mixing it with a radio frequency signal or audio signal. The frequency can be changed to any required value in communication.

10. On which factor the bandwidth required for a modulated carrier depends?
a) baseband frequency range
b) signal to noise ratio
c) carrier frequency
d) amplitude of carrier frequency
Answer: a
Explanation: Bandwidth can be seen as a range of frequencies within a band, that is used for transmitting a signal. A signal bandwidth depends on the baseband frequency range.

21. When two or more signals share a common channel, it is called _____
a) sub-channeling
b) channeling
c) switching
d) multiplexing
Answer: d
Explanation: Multiplexing is a method by which multiple analog or digital signals are combined to form a single complex signal. In multiplexing, many signals are combined into one signal and passed through a single channel, thus sharing the same medium.

22. One of the reason of distortion is shift in phase relationships between baseband frequencies.
a) True
b) False
Answer: a
Explanation: Phase distortion is the change in shape of the waveform. Thus, if we shift the phase relationships between baseband frequencies, it will ultimately result in distortion.

23. Miller effect can cause an amplifier to oscillate.
a) True
b) False
Answer: a
Explanation: Miller effect is responsible for limiting the gain of an amplifier at higher frequencies due to Miller capacitance between the output and input. Also, oscillations in amplifier occur due to input/output feedback.

24. How can we successfully avoid Miller effect?
a) using a common-base amplifier
b) using a common-emitter amplifier
c) by increasing the Q factor
d) by decreasing the Q factor
Answer: a
Explanation: Miller effect is responsible for the increase in equivalent input capacitance of an inverting voltage amplifier. The increase equivalent input capacitance is given by, $C_M = C(1 + A_V)$. Miller effect can be avoided by using a common-base amplifier

25. What is the two basic specifications of a receiver?
a) sensitivity and selectivity
b) superious response and tracking
c) signal and noise
d) number of convertors and number of IFs
Answer: a
Explanation: Sensitivity and selectivity are the two key specifications for any receiver, which is used for the purpose in communication. Sensitivity is the ability of the receiver to amplify weak signals, whereas Selectivity is the ability of the receiver to reject unwanted signals.**26. Who invented the superheterodyne receivers?**
a) Hertz
b) Armstrong
c) Foster
d) Seeley
Answer: b
Explanation: Superheterodyne uses frequency mixing to convert a received RF signal to a fixed IF(intermediate frequency). This method is known as heterodyning. This IF can be processed more easily than the original carrier frequency. It was invented by Armstrong.

27. Skin effect refers _____
a) the increase of wire resistance with frequency
b) the decrease of wire resistance with frequency

c) the uniform nature of wire resistance with frequency
d) the way radio signals travel across a flat surface
Answer: a
Explanation: Skin effect becomes more and more apparent as frequency increases as skin depth becomes smaller. It is due to alternating current flowing through the outer surface of conducting material. It refers to the increase of wire resistance with frequency.

28. The frequency of local oscillator _____
a) can be either below or above the RF frequency
b) is below the RF frequency
c) is above the RF frequency
d) is fixed typically at 450KHz
Answer: c
Explanation: The frequency of the local oscillator is not fixed. It is mostly above the RF frequency.

29. Phase distortion is important in _____
a) voice communication systems
b) color video receivers
c) audio receivers
d) radio reception
Answer: b
Explanation: Phase distortion is a change in the shape of the waveform. It occurs when filter's do not have a sharp cut off frequency thus not properly filtering a wave. Thus, phase distortion is important in color video receivers.

30. What is the full form of ASCII?
a) American Standard Character for Information Interchange
b) American Standard Class for Information Interchange
c) American Standard Code for Information Interchange
d) Alphanumeric Standard Code for Information Interchange
Answer: c
Explanation: ASCII is the most common format for text files in computers. In an ASCII file each symbol is represented by a 7 bit binary number. In this 128 possible characters are defined.

31. The transmitter and receiver are not synchronized at all, in asynchronous transmission.
a) True
b) False
Answer: b
Explanation: In Asynchronous transmission, each character is signified by start and stop bits. Thus, the transmitter and receiver are synchronized frame-by-frame using the start and stop bits, not by data bits.

32. In synchronous transmission, receiver is able to sync with the transmitter by using _____
a) Clock bits
b) Start and Stop bits

c) CRC bits
d) Data bits
Answer: d
Explanation: In synchronous transmission both sender and receiver access the data according to same clock. It has no start and stop bits and thus it has more efficient. Receiver and transmitter are in sync with each other by using data bits.

33. FEC stands for _____
a) Forward Error Correction
b) Fixed Error Correction
c) Forward Error Communication
d) Fixed Error Communication
Answer: a
Explanation: FEC is a method of obtaining error control in data transmission. It stands for Forward Error Correction.

34. Run-length encoding is used to _____
a) correct data
b) segregate data
c) encrypt data
d) compress data
Answer: d
Explanation: Run length encoding is a very simple form of lossless data compression in which runs of data are stored as a single value data, rather than as original run.

35. The term CD in CSMA/CD stands for _____
a) Collision Detection
b) Collision Delay
c) Compact Detection
d) Compact Delay
Answer: a
Explanation: CSMA/CD stands for Carrier Sense Multiple Access with Collision Detection. It is mostly used in early Ethernet technology for local area networking.

36. Dumb terminals are used in token-passing networks.
a) True
b) False
Answer: b
Explanation: A dumb terminal is an output that accepts data from CPU. It has no processing capabilities. Dumb terminals are used in networks that require central monitoring. Thus, dumb terminals are used for token-passing networks. However, smart terminals to exist which has its own processor.

37. In networks, long messages are divided into “chunks” called _____
a) packets
b) bits
c) parts
d) tokens
Answer: a

Explanation: For any long message to be transmitted, it is first divided into many small parts called packets. Individual packets belonging to a long message may arrive out of order at the destination.

38. What is the full form of LF?
a) Line Feed
b) Link Feed
c) Line Forward
d) Link Forward
Answer: a
Explanation: Line feed means moving one line forward. It is basically a control character, coded upto 10 decimal places, respective to ASCII Character Set.

39. In synchronous transmission, frames are about the same length as in asynchronous transmission.
a) True
b) False
Answer: b
Explanation: In synchronous transmission both sender and receiver access the data according to same clock. It has no start and stop bits and thus it has more efficient. However, it is more expensive than asynchronous transmission and has highly complex circuit.

40. What is the full form of UART?
a) Universal Asynchronous Receiver Transmitter
b) Universal Automatic Receiver Transmitter
c) Unaltered Asynchronous Receiver Transmitter
d) Unaltered Automatic Receiver Transmitter
Answer: a
Explanation: UART is a computer hardware device. It is mainly used for asynchronous serial communication. It is used in modules like Bluetooth etc. It stands for Universal Asynchronous Receiver Transmitter, where the receiver and transmitter communicate in absence of any clock pulse.

41. To maintain synchronization in synchronous transmission _____
a) long strings of 1s and 0s must not be allowed
b) transmission must stop periodically
c) clock circuits must be precisely adjusted
d) channel must be noise free
Answer: a
Explanation: In synchronous transmission both sender and receiver access the data according to same clock. It has no start and stop bits and thus it has more efficient. However, it is more expensive than asynchronous transmission and has highly complex circuit. To maintain synchronization long strings of 1s and 0s are not allowed.

42. CRC stands for _____
a) Cyclic Redundancy Check
b) Cyclic Repeat Check
c) Cyclic Redundancy Character
d) Cyclic Redundancy Code

Answer: a
Explanation: CRC is an error detecting code. It is generally used in digital network. It was invented by W. Wesley Peterson. CRC stands for Cyclic Redundancy Check.

43. What do you understand by the term Internet?
a) a network of networks
b) a very large client-server network
c) a very large CSMA/CD network
d) local area network
Answer: a
Explanation: Internet is a global network providing us a variety of information. It is a network of networks that consists of public, private, business, and government networks of local to a global scope.

44. Which statement is correct about circuit-switched network?
a) each channel can carry only one data stream
b) usually uses a bus topology
c) usually uses a star topology
d) implemented at network layer
Answer: a
Explanation: In circuit switching a circuit is applied for the duration of the transmission. Its example is a telephone. In it each channel can carry only one data stream.

45. When two or more PCs try to access a baseband network cable at the same time, it is called _____
a) contention
b) collision
c) excess traffic
d) switching
Answer: a
Explanation: Contention is a term of networks, used when two or more PCs try to access a baseband network cable at the same time.

46. When two PCs send data over a baseband network cable at the same time, it is called _____
a) contention
b) collision
c) excess traffic
d) switching
Answer: b
Explanation: Collision is a term of networks, used when two PCs send data over a baseband network cable at the same time.

Multiple-Choice Questions

Each of the following multiple-choice questions consists of an incomplete statement followed by four choices (a, b, c and d). Circle the letter preceding the line that correctly completes each sentence.

1. The basic motivation behind the development of digital modulation techniques is
   a. to develop digital communication field
   b. to have methods for translating digital message from baseband to passband
   c. to have digitized version of analog modulation schemes
   d. to improve upon pulse modulation schemes
2. Baseband transmission of digital message involves
   a. message in baseband and channel in passband
   b. both message and channel in passband
   c. message may be in passband, but channel in baseband
   d. both message and channel in baseband
3. Amplitude shift keying refers to
   a. keying in amplitude values to the carrier
   b. amplitude modulation of digital carrier
   c. shifting amplitude of digital message according to carrier
   d. shifting amplitude of carrier between two levels according to digital message
4. Frequency shift keying refers to
   a. keying in frequency values to the carrier
   b. shifting frequency of carrier between two levels according to digital message
   c. shifting frequency of digital message according to carrier
   d. frequency modulation of digital carrier
5. Phase shift keying refers to
   a. keying in phase values to the carrier
   b. shifting phase of digital message according to carrier
   c. shifting phase of carrier between two levels according to digital message
   d. phase modulation of digital carrier
6. The difference between binary and M-ary digital modulation process is
   a. message will be binary in the former and will have M levels in the latter
   b. choice of carrier is two in the former and M in the latter
   c. both message and carrier will be binary in both the cases
   d. none of the above
7. M-ary amplitude shift keying refers to
   a. entering array of M amplitude values to the carrier
   b. shifting amplitude of carrier among M levels according to digital message
   c. shifting amplitude of digital message into M levels according to carrier
   d. M-level amplitude modulation of digital carrier
8. M-ary frequency shift keying refers to
   a. entering array of M frequency values to the carrier

b. shifting frequency of digital message into M levels according to carrier
c. shifting frequency of carrier among M levels according to digital message
d. M-level frequency modulation of digital carrier

9. M-ary phase shift keying refers to
   a. entering array of M phase values to the carrier
   b. M-level phase modulation of digital carrier
   c. shifting phase of digital message into M levels according to carrier
   d. shifting phase of carrier among M levels according to digital message
10. Coherent detection involves
    a. need of reference carrier in the receiver that is in synchronism with carrier at the transmitter
    b. simultaneous detection of modulated signal as soon as generated
    c. detection of more than two modulated signls in coherent fashion
    d. demodulated message is in sychronism with transmitted message
11. Non-coherent detection involves
    a. detection of carrier and then demodulation of message
    b. detection of more than two modulated signls in a non-coherent fashion
    c. demodulated message is in not in sychronism with transmitted message
    d. no need of reference carrier in the receiver
12. Quadrature amplitude modulation involves
    a. two message signals which are in phase quadrature
    b. two carrier signals which are in phase quadrature
    c. both message and carrier signals are in phase quadrature
    d. all of the above
13. M-arm quadrature amplitude modulation is a
    a. M-ary version of ASK
    b. M-ary version of QAM
    c. M-ary version of PSK
    d. hybrid of QAM and M-ary of PSK

Communication Engineering

B. Tech 2nd year (KEC 401)

Unit IV

1)Calculate the minimum sampling rate to avoid aliasing when a continuous time signal is given by x(t) = 5 cos 400πt

a.100 Hz
b.200 Hz
c.400 Hz
d.250 Hz
ANSWER:400 Hz
Explanation:In the given signal, the highest frequency is given by f = 400 π/ 2π = 200 Hz
The minimum sampling rate required to avoid aliasing is given by Nyquist rate. The nyquist rate is = 2 * f
= 2 * 200
= 400 Hz.

2)In Pulse Position Modulation, the drawbacks are

a. Synchronization is required between transmitter and receiver
b. Large bandwidth is required as compared to PAM
c. None of the above
d. Both a and b
ANSWER:Both a and b
Explanation:In Pulse Position Modulation, the position of the pulse of the carrier is varied with reference to the position of a reference pulse. The position is varied in accordance with the sampled modulating signal. In PPM, synchronization is required between the transmitter and the receiver. Large bandwidth is required in Pulse position Modulation as compared to the Pulse amplitude modulation.

3)In PWM signal reception, the Schmitt trigger circuit is used

a. To remove noise
b. To produce ramp signal
c. For synchronization
d. None of the above
ANSWER: To remove noise
Explanation:In pulse width modulation, the width of the carrier varies with the amplitude of the modulating signal at the time of sampling. In PWM signal reception, the received PWM signal is applied to the Schmitt trigger circuit. The Schmitt trigger circuit is used to remove noise in the PWM waveform. This output is the supplied further for detection of the original information.

4)In pulse width modulation

a. Synchronization is not required between transmitter and receiver
b. Amplitude of the carrier pulse is varied
c. Instantaneous power at the transmitter is constant
d. None of the above
ANSWER: Synchronization is not required between transmitter and receiver
Explanation: In pulse width modulation, the width of the carrier varies with the amplitude of the modulating signal at the time of sampling. Pulse width modulation is a type of Pulse Time Modulation. As there is no variation in the amplitude of the carrier, the noise may be easily removed at the receiver. It does not require synchronization between the transmitter and the receiver.

5)In different types of Pulse Width Modulation,
a. Leading edge of the pulse is kept constant
b. Tail edge of the pulse is kept constant
c. Centre of the pulse is kept constant
d. All of the above
ANSWER: All of the above
Explanation: There are types of Pulse Width Modulation. In one of the variations, leading edge of the pulse is kept constant and pulse width is measured with respect to leading edge. In second type, tail edge of the pulse is kept constant and pulse width is measured with respect to it. And the third type has a constant centre of the pulse and the pulse width changes on both the sides of the centre of the pulse.

6)In Pulse time modulation (PTM),
a. Amplitude of the carrier is constant
b. Position or width of the carrier varies with modulating signal
c. Pulse width modulation and pulse position modulation are the types of PTM
d. All of the above
ANSWER: All of the above
Explanation:In Pulse time modulation (PTM), amplitude of the carrier is kept constant and the Position or width of the carrier varies with the amplitude of the modulating signal at the time of sampling. Pulse width modulation and pulse position modulation are the types of Pulse Time Modulation.
As there is no variation in the amplitude of the carrier, the noise may be easily removed at the receiver.

7)Drawback of using PAM method is
a. Bandwidth is very large as compared to modulating signal
b. Varying amplitude of carrier varies the peak power required for transmission
c. Due to varying amplitude of carrier, it is difficult to remove noise at receiver
d. All of the above
8) Pulse time modulation (PTM) includes
ANSWER: All of the above
Explanation:In PAM, Bandwidth is very large as compared to modulating signal frequency. In PAM, the amplitude of the rectangular pulse train is varied according to the instantaneous value of the modulating signal. Due to this, the required power for transmission is also varied. Due to varying amplitude of carrier, the interference of noise is very high in PAM. So it is difficult to remove noise at receiver.

8)Pulse time modulation (PTM) includes
a. Pulse width modulation
b. Pulse position modulation
c. Pulse amplitude modulation
d. Both a and b
ANSWER: Both a and b
Explanation:In pulse modulation systems, the carrier is a train of pulses rather than a continuous signal. The parameters of the pulses are varied according to the instantaneous value of the modulating signal. The carrier is a train of pulses rather than a continuous signal. In PTM, the timing of the pulses of the carrier is varied in accordance with modulating signal.

PTM includes:
– Pulse width modulation
– Pulse position modulation

9)In pulse amplitude modulation,
a. Amplitude of the pulse train is varied
b. Width of the pulse train is varied
c. Frequency of the pulse train is varied
d. None of the above
ANSWER: Both a and b
Explanation:
In pulse modulation systems, the carrier is a train of pulses rather than a continuous signal. The parameters of the pulses are varied according to the instantaneous value of the modulating signal. The carrier is a train of pulses rather than a continuous signal. In PTM, the timing of the pulses of the carrier is varied in accordance with modulating signal. PTM includes:
– Pulse width modulation
– Pulse position modulation

10)Types of analog pulse modulation systems are
a. Pulse amplitude modulation
b. Pulse time modulation
c. Frequency modulation
d. Both a and b
ANSWER: Both a and b
Explanation:In pulse modulation systems, the carrier is a train of pulses rather than a continuous signal. The parameters of the pulses are varied according to the instantaneous value of the modulating signal. There are two types of pulse modulation systems:
– Pulse amplitude modulation
– Pulse time modulation

11)The sampling technique having the minimum noise interference is
a. Instantaneous sampling
b. Natural sampling
c. Flat top sampling
d. All of the above
ANSWER: Natural sampling
Explanation:The natural sampling is the technique that has the minimum noise interference to the sampled signal. It is obtained by multiplying the input signal with the sampling function. It is a practical method used for sampling of signals. Chopping principle is used to sample the signal in natural sampling and it satisfies the Nyquist criteria for sampling of signals.

12)The instantaneous sampling
a. Has a train of impulses
b. Has the pulse width approaching zero value
c. Has the negligible power content
d. All of the above
ANSWER: All of the above

Explanation:The instantaneous sampling is also called ideal sampling or impulse sampling. The instantaneous sampling has a train of impulses. The pulse width of the samples has almost zero value. Therefore it has negligible power content and thus may not be used for transmission purpose.

13)The techniques used for sampling are
a. Instantaneous sampling
b. Natural sampling
c. Flat top sampling
d. All of the above
ANSWER: All of the above
Explanation:The techniques used for sampling are:
a) Instantaneous sampling
b) Natural sampling
c) Flat top sampling
The natural sampling and the flat top sampling techniques are used practically to sample a signal.

14)A low pass filter is
a. Passes the frequencies lower than the specified cut off frequency
b. Rejects higher frequencies
c. Is used to recover signal from sampled signal
d. All of the above
ANSWER: All of the above
Explanation:The low pass filter should have the cut off frequency equal to wm so that it allows only lower frequencies up to the cut off frequency to pass through. The other higher frequencies in the sampled signal are rejected by the low pass filter. The original or desired signal may be recovered from the sampled signal by passing the signal through a low pass filter.

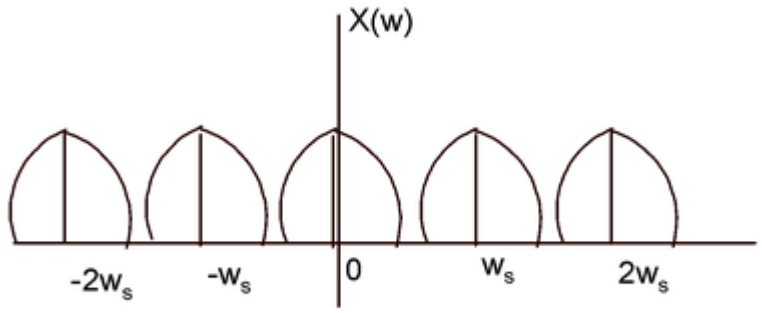
15)Calculate the Nyquist rate for sampling when a continuous time signal is given by
$x(t) = 5 \cos 100\pi t + 10 \cos 200\pi t - 15 \cos 300\pi t$
a. 300Hz
b. 600Hz
c. 150Hz
d. 200Hz
ANSWER: 300Hz
Explanation:For the given signal,
$f1 = 100\pi/2\pi = 50Hz$
$f2 = 200\pi/2\pi = 100Hz$
$f3 = 300\pi/2\pi = 150Hz$
The highest frequency is 150Hz. Therefore fmax = 150Hz
Nyquist rate = 2 fmax
= 2 * 150
= 300Hz.

16)A distorted signal of frequency fm is recovered from a sampled signal if the sampling frequency fs is

a. fs > 2fm
b. fs < 2fm
c. fs = 2fm
d. fs ≥ 2fm
ANSWER: fs < 2fm
Explanation: If the signal of frequency fm is sampled at the rate fs ≥ 2fm only then the spectrum of the sampled signal is obtained without overlapping. For fs < 2fm the sampled signal spectrum overlap each other, and therefore the signal cannot be recovered easily. For reconstruction of signal to be free from distortion, the important condition is
fs ≥ 2fm

17)The desired signal of maximum frequency wm centered at frequency w=0 may be recovered if
a. The sampled signal is passed through low pass filter
b. Filter has the cut off frequency wm
c. Both a and b
d. None of the above
ANSWER: Both a and b
Explanation:The original or desired signal may be recovered from the sampled signal by passing the signal through a low pass filter. The low pass filter should have the cut off frequency equal to wm so that it allows only low frequencies up to the cut off frequency to pass through. The other higher frequencies in the sampled signal are rejected by the low pass filter.

18)The spectrum of the sampled signal may be obtained without overlapping only if
a. fs ≥ 2fm
b. fs < 2fm
c. fs > fm
d. fs < fm
ANSWER: fs ≥ 2fm
Explanation:
If the signal of frequency f_m is sampled at the rate $f_s \geq 2f_m$ only then the spectrum of the sampled signal is obtained without overlapping. The spectrum obtained is repetitive in nature and is completely without overlapping.



spectrum of sampled signal

19)The process of using a pulse signal to represent information is called _____
a)Pulse modulation
b)Frequency modulation
c)Amplitude modulation
d)Phase modulation
Answer:a
Explanation:In pulse modulation, the information to be transmitted is represented by a series of binary pulses. Since the pulse information is binary in nature analog signal shave to be converted to digital before transmitting.

20)Which of the following is false with respect to pulse modulation?
a)Less power consumption
b)Low noise
c)Degraded signal can be regenerated
d)Can transmit analog as well as digital waves
Answer:d
Explanation:Analog values cannot be transmitted as such by pulse modulation since it can only transmit binary data. However, the analog signal can be converted into digital using an ADC and then transmitted via pulse modulation.

21)Which of the following is not a form of pulse modulation?
a)Pulse amplitude modulation
b)Pulse width modulation
c)Pulse position modulation
d)Pulse frequency modulation
Answer:d
Explanation:There are four basic forms of pulse modulation. They are: pulse amplitude modulation, pulse width modulation, pulse position modulation pulse code modulation. In any form of pulse modulation, the frequency of the signal is not changed.

22)How many voltage levels are present in a PWM signal?
a)0
b)1
c)2
d)3
Answer:c
Explanation: The amplitude of PWM is binary in nature meaning that it has only two levels. The amplitude of the modulating signals varies the width of the pulses generated.

23)Power consumption is low in pulse modulation.
a)True
b)False
Answer:a
Explanation:In pulse modulation, the carrier is not transmitted continuously but in pulses whose width is determined by the amplitude of the modulating signal. The duty cycle is made in such a way that the carrier is off for a longer time than it bursts hence the average power consumption is low.

Video Player is loading.
PauseUnmute
Fullscreen
VDO.AI

24)Which pulse modulation technique is least expensive?
a)Pulse amplitude modulation
b)Pulse width modulation
c)Pulse position modulation
d)Pulse code modulation
Answer:a
Explanation:Out of all the pulse modulation techniques, Pulse amplitude modulation is the least expensive and simplest to implement. In pulse amplitude modulation, the amplitude of the pulse varies with the amplitude of the modulating signal.

25)Which of the following is false with respect to pulse position modulation?
a)Can be transmitted in broadband
b)Modulates a high frequency carrier
c)Pulse is narrow
d)Pulse width changes in accordance with the amplitude of modulating signal
Answer:d
Explanation:In PPM, the pulses change position according to the amplitude of the analog signal. The pulses are very narrow. These pulse signals may be transmitted in a baseband form, but in most applications, they modulate a high-frequency radio carrier.

26)Pulse modulation is not used in which of the following?
a)Telemetry systems
b)Remote control models
c)Switch power modes
d)Communication of airplane with ATC
Answer:d
Explanation:Pulse modulation is used in telemetry systems to monitor spacecraft or missile, RC models, for switching power supplies like regulators and also as audio switching power amplifiers. Communication of airplane with ATC is amplitude modulated waves.

27)The process of signal compression and expansion used to reduce distortion and noise is called _____
a)Amplification
b)Companding
c)Compressing
d)Modulating
Answer: b
Explanation:To reduce the effects of noise and distortion in pulse modulation, a process called companding is done. Companding is a process of signal compression and expansion.

28)What type of digital modulation is widely used for digital data transmission?
a)Pulse amplitude modulation
b)Pulse width modulation
c)Pulse position modulation

d)Pulse code modulation
Answer: d
Explanation:The most widely used technique for digitizing information signals for electronic data transmission is pulse code modulation. It has uniform transmission quality and also can be used when the signal traffic is high.

31)Flat top sampling of low pass signals
a)Gives rise to aperture effect
b)Implies over sampling
c)Leads to aliasing
d)Introduces delay distortion
Answer:a
Explanation:Flat top sampling of low pass signals gives rise to aperture effect.

32)In a delta modulation system, granular noise occurs when the
a)Modulating signal increases rapidly
b)Pulse rate decreases
c)Pulse amplitude decreases
d)Modulating signal remains constant
Answer:d
Explanation:In a delta modulation system, granular noise occurs when the modulating signal remains constant.

33)A PAM signal can be detected using
a)Low pass filter
b)High pass filter
c)Band pass filter
d)All pass filter
Answer:a
Explanation:A PAM signal can be detected by using low pass filter.

34)Coherent demodulation of FSK signal can be performed using
a)Matched filter
b)BPF and envelope detectors
c)Discriminator
d)None of the mentioned
Answer:a
Explanation:Coherent demodulation of FSK signal can be performed using matched filter.

35)The use of non uniform quantization leads to
a)Reduction in transmission bandwidth
b)Increase in maximum SNR
c)Increase in SNR for low level signals
d)Simplification of quantization process
Answer:c
Explanation:The use of non uniform quantization leads to increase in SNR for low level signals.

Fullscreen
VDO.AI

36)Which of the following requires a synchronizing signal?
a)Single channel PPM system
b)PAM
c)DM
d)All of the mentioned
Answer:b
Explanation:PAM requires a synchronizing signal.

37)A PWM signal can be generated by
a)An astable multi vibrator
b)A monostable multi vibrator
c)Integrating a PPM signal
d)Differentiating a PPM signal
Answer:b
Explanation:A PWM signal can be generated by a mono stable multi vibrator.

38)TDM is less immune to cross-talk in channel than FDM.
a)True
b)False
Answer: b
Explanation:False because different message signals are not applied to the channel simultaneously.

39)In an ideal TDM system, the cross correlation between two users of the system is
a)1
b)0
c)Infinity
d)-1
Answer: b
Explanation: In an ideal TDM system, the cross correlation between two users of the system is 0.

40)TDM requires
a)Constant data transmission
b)Transmission of data samples
c)Transmission of data at random
d)Transmission of data of only one measured
Answer:b
Explanation:TDM requires transmission of data samples.

Explanation: Gain Margin is always inverse of the point which cuts the Nyquist on the real axis.

51)Nyquist criterion helps in
a)Transmitting the signal without ISI
b)Reduction in transmission bandwidth

c)Increase in transmission bandwidth
d)Both a) and b)
ANSWER:d) Both a) and b)

52)The Nyquist theorem
a)Relates the conditions in time domain and frequency domain
b)Helps in quantization
c)Limits the bandwidth requirement
d)Both a) and c)
ANSWER:d) Both a) and c)

53)The difficulty in achieving the Nyquist criterion for system design is
a)There are abrupt transitions obtained at edges of the bands
b)Bandwidth criterion is not easily achieved
c)Filters are not available
d)None of the above
ANSWER:a)There are abrupt transitions obtained at edges of the bands

54)The digital modulation technique in which the step size is varied according to the variation in the slope of the input is called
a)Delta modulation
b)PCM
c)Adaptive delta modulation
d)PAM
ANSWER:c)Adaptive delta modulation

55)The digital modulation scheme in which the step size is not fixed is
a)Delta Modulation
b)Adaptive delta modulation
c)DPCM
d)PCM
ANSWER:b)Adaptive delta modulation

56)In Adaptive Delta Modulation, the slope error reduces and
a)Quantization error decreases
b)Quantization error increases
c)Quantization error remains same
d)None of the above
ANSWER:b)Quantization error increases

UNIT 3 and 5

1) In uniform quantization process
a. The step size remains same
b. Step size varies according to the values of the input signal
c. The quantizer has linear characteristics
d. Both a and c are correct

ANSWER: (d) Both a and c are correct

2) The process of converting the analog sample into discrete form is called
a. Modulation
b. Multiplexing
c. Quantization
d. Sampling
ANSWER:(c) Quantization
3) The characteristics of compressor in μ-law companding are
a. Continuous in nature
b. Logarithmic in nature
c. Linear in nature
d. Discrete in nature
ANSWER: (a) Continuous in nature

4) The modulation techniques used to convert analog signal into digital signal are
a. Pulse code modulation
b. Delta modulation
c. Adaptive delta modulation
d. All of the above
ANSWER: (d) All of the above
5) The sequence of operations in which PCM is done is
a. Sampling, quantizing, encoding
b. Quantizing, encoding, sampling
c. Quantizing, sampling, encoding
d. None of the above
ANSWER:(a) Sampling, quantizing, encoding

6) In PCM, the parameter varied in accordance with the amplitude of the modulating signal is
a. Amplitude
b. Frequency
c. Phase
d. None of the above
ANSWER: (d) None of the above
7) One of the disadvantages of PCM is
a. It requires large bandwidth
b. Very high noise
c. Cannot be decoded easily
d. All of the above
ANSWER: (a) It requires large bandwidth

8) The expression for bandwidth BW of a PCM system, where v is the number of bits per sample and f_m is the modulating frequency, is given by
a. BW $\geq vf_m$
b. BW $\leq vf_m$
c. BW $\geq 2\ vf_m$
d. BW $\geq 1/2\ vf_m$
ANSWER: (a) BW $\geq vf_m$
9) The error probability of a PCM is

a. Calculated using noise and inter symbol interference
b. Gaussian noise + error component due to inter symbol interference
c. Calculated using power spectral density
d. All of the above
ANSWER: (d) All of the above
10) In Delta modulation,
a. One bit per sample is transmitted
b. All the coded bits used for sampling are transmitted
c. The step size is fixed
d. Both a and c are correct
ANSWER: (d) Both a and c are correct

11) In digital transmission, the modulation technique that requires minimum bandwidth is
a. Delta modulation
b. PCM
c. DPCM
d. PAM
ANSWER: (a) Delta modulation
12) In Delta Modulation, the bit rate is
a. N times the sampling frequency
b. N times the modulating frequency
c. N times the nyquist criteria
d. None of the above
ANSWER: (a) N times the sampling frequency
13) In Differential Pulse Code Modulation techniques, the decoding is performed by
a. Accumulator
b. Sampler
c. PLL
d. Quantizer
ANSWER: (a) Accumulator
14) DPCM is a technique
a. To convert analog signal into digital signal
b. Where difference between successive samples of the analog signals are encoded into n-bit data streams
c. Where digital codes are the quantized values of the predicted value
d. All of the above
ANSWER: (d) All of the above
15) DPCM suffers from
a. Slope over load distortion
b. Quantization noise
c. Both a & b
d. None of the above
ANSWER:(c) Both a & b
16) The noise that affects PCM
a. Transmission noise
b. Quantizing noise
c. Transit noise
d. Both a and b are correct
ANSWER: (d) Both a and b are correct

17) The factors that cause quantizing error in delta modulation are
a. Slope overload distortion
b. Granular noise
c. White noise
d. Both a and b are correct
ANSWER:(d) Both a and b are correct
18) Granular noise occurs when
a. Step size is too small
b. Step size is too large
c. There is interference from the adjacent channel
d. Bandwidth is too large
ANSWER: (b) Step size is too large
19) The crest factor of a waveform is given as –
a. 2Peak value/ rms value
b. rms value / Peak value
c. Peak value/ rms value
d. Peak value/ 2rms value
ANSWER: (c) Peak value/ rms value
20) The digital modulation technique in which the step size is varied according to the variation in the slope of the input is called
a. Delta modulation
b. PCM
c. Adaptive delta modulation
d. PAM
ANSWER: (c) Adaptive delta modulation
21) The digital modulation scheme in which the step size is not fixed is
a. Delta modulation
b. Adaptive delta modulation
c. DPCM
d. PCM
ANSWER:(b) Adaptive delta modulation
22) In Adaptive Delta Modulation, the slope error reduces and
a. Quantization error decreases
b. Quantization error increases
c. Quantization error remains same
d. None of the above
ANSWER: (b) Quantization error increases
23) The number of voice channels that can be accommodated for transmission in T1 carrier system is
a. 24
b. 32
c. 56
d. 64
ANSWER: (a) 24
24) The maximum data transmission rate in T1 carrier system is
a. 2.6 megabits per second
b. 1000 megabits per second
c. 1.544 megabits per second
d. 5.6 megabits per second
ANSWER: (c) 1.544 megabits per second

25) T1 carrier system is used
a. For PCM voice transmission
b. For delta modulation
c. For frequency modulated signals
d. None of the above
ANSWER: (a) For PCM voice transmission
26) Matched filter may be optimally used only for
a. Gaussian noise
b. Transit time noise
c. Flicker
d. All of the above
ANSWER:(a) Gaussian noise
27) Characteristics of Matched filter are
a. Matched filter is used to maximize Signal to noise ratio even for non Gaussian noise
b. It gives the output as signal energy in the absence of noise
c. They are used for signal detection
d. All of the above
ANSWER: (d) All of the above
28) Matched filters may be used
a. To estimate the frequency of the received signal
b. In parameter estimation problems
c. To estimate the distance of the object
d. All of the above
ANSWER: (d) All of the above
29) The process of coding multiplexer output into electrical pulses or waveforms for transmission is called
a. Line coding
b. Amplitude modulation
c. FSK
d. Filtering
ANSWER:(a) Line coding
30) For a line code, the transmission bandwidth must be
a. Maximum possible
b. As small as possible
c. Depends on the signal
d. None of the above
ANSWER: (b) As small as possible
31) Regenerative repeaters are used for
a. Eliminating noise
b. Reconstruction of signals
c. Transmission over long distances
d. All of the above
ANSWER:(d) All of the above
32) Scrambling of data is
a. Removing long strings of 1's and 0's
b. Exchanging of data
c. Transmission of digital data
d. All of the above
ANSWER: (a) Removing long strings of 1's and 0's
33) In polar RZ format for coding, symbol '0' is represented by

a. Zero voltage
b. Negative voltage
c. Pulse is transmitted for half the duration
d. Both b and c are correct
ANSWER: (d) Both b and c are correct
34) In a uni-polar RZ format,
a. The waveform has zero value for symbol '0'
b. The waveform has A volts for symbol '1'
c. The waveform has positive and negative values for '1' and '0' symbol respectively
d. Both a and b are correct
ANSWER: (d) Both a and b are correct
35) Polar coding is a technique in which
a. 1 is transmitted by a positive pulse and 0 is transmitted by negative pulse
b. 1 is transmitted by a positive pulse and 0 is transmitted by zero volts
c. Both a & b
d. None of the above
ANSWER: (a) 1 is transmitted by a positive pulse and 0 is transmitted by negative pulse
36) The polarities in NRZ format use
a. Complete pulse duration
b. Half duration
c. Both positive as well as negative value
d. Each pulse is used for twice the duration
ANSWER: (a) Complete pulse duration
37) The format in which the positive half interval pulse is followed by a negative half interval pulse for transmission of '1' is
a. Polar NRZ format
b. Bipolar NRZ format
c. Manchester format
d. None of the above
ANSWER: (c) Manchester format
38) The maximum synchronizing capability in coding techniques is present in
a. Manchester format
b. Polar NRZ
c. Polar RZ
d. Polar quaternary NRZ
ANSWER: (a) Manchester format
39) The advantage of using Manchester format of coding is
a. Power saving
b. Polarity sense at the receiver
c. Noise immunity
d. None of the above
ANSWER: (a) Power saving
40) Alternate Mark Inversion (AMI) is also known as
a. Pseudo ternary coding
b. Manchester coding
c. Polar NRZ format
d. None of the above
ANSWER:(a) Pseudo ternary coding
41) In DPSK technique, the technique used to encode bits is

a. AMI
b. Differential code
c. Uni polar RZ format
d. Manchester format
ANSWER: (b)Differential code