EC8491: COMMUNICATION THEORY

MCQ

UNIT 1

1. For Amplitude Modulation, Emitter modulator _____

a) Operates in class C mode
b) Has a low efficiency
c) Output power is high
d) Operates in class B mode

Answer: b
Explanation: Emitter Modulator operates in class A region. It has very low efficiency. The output power is low so for modulation at high level, it is not suitable.

2. Why AM is used for broadcasting?
   a) More immune to noise
   b) Less transmitting power is required
   c) It has high fidelity
   d) Avoids Receivers Complexity

Answer: d
Explanation: AM detectors are generally, square law demodulators or envelope detectors at the receiver. As AM detectors at the receiver end are simple circuits and avoid any kind of complex structure, therefore, AM used for broadcasting.

3. Singletone amplitude modulation _____
   a) consists of only one frequency component
   b) contains a large number of frequency components
   c) contains no frequency components
   d) contains infinite number of frequency components

Answer: a
Explanation: Single tone modulation consists of only one frequency component in the baseband or message signal. Thus, modulation of carrier wave is done by a single frequency component only.

4. AM spectrum consists of _____
   a) Carrier frequency
   b) Upper sideband
   c) Lower sideband
   d) Carrier frequency with both upper and lower sideband

Answer: d
Explanation: Spectrum of Am wave consists of a carrier with upper sideband and lower sideband. If carrier frequency is Wc, then the two sidebands produced by it are (Wc+Wm) and

(Wc-Wm), where Wm is the frequency of the message signal. The amplitude of the carrier is A and that of the two sidebands are mA/2, where m is the modulation index.

5. The minimum channel Bandwidth is used by which modulation technique?
   a) VSB
   b) SSB-SC
   c) DSB-SC
   d) AM

Answer: b
Explanation: A signal has two sidebands which are exactly the mirror images of each other. So we can remove one side band which further reduces its bandwidth. In SSB-SC modulation technique, the carrier is suppressed and only either of the sidebands is transmitted. Thus, SSB-SC has minimum channel Bandwidth.

6. AM broadcast station transmits modulating frequency upto 6KHz. If transmitting frequency is 810KHz, then maximum and lower sidebands are _____
   a) 816KHz and 804KHz
   b) 826KHz and 804KHz
   c) 916KHz and 904KHz
   d) 822KHz and 816KHz

Answer: a
Explanation: Maximum frequency = 810 + 6 = 816KHz and Minimum frequency = 810 – 6 = 804KHz. Moreover it has a bandwidth of (816 – 804) = 12KHz.

(Formula: Fmax = fc + fm,
Fmin = fc-fm,
Bandwidth = 2*fm = Fmax = Fmin,
fc = Carrier frequency, fm = message signal frequency).

7. Find lower frequency component in AM wave, given that highest frequency component is 900KHz and bandwidth is 12KHz?
   a) 832KHz
   b) 600KHz
   c) 868KHz
   d) 888KHz

Answer: d
Explanation: Highest frequency component is 900KHz and bandwidth is 12KHz. So lower frequency component is 900 – 12 = 888KHz.
(Formula: Fmin = Fmax-2*fm = Fmax-Bandwidth, where fm = Message Signal Frequency).

8. Amplitude Modulated wave is _____
   a) Sum of carrier and modulating wave

b) Product of carrier and modulating wave
c) Difference of carrier and modulating wave
d) Sum of carrier and its product with modulating wave

Answer: a
Explanation: The modulation of a carrier wave by varying its amplitude with respect to amplitude of baseband signal is known as amplitude modulation. It is represented as,
$s(t) = [1 + mx(t)]\ c(t)$,
where, x(t) = Modulating Wave, m=Modulating Index
c(t) = Carrier Wave = A_c (Cos ω_c) t
Thus, Amplitude Modulated wave is the Sum of carrier and its product with modulating wave.

9. AM waves is represented by which equation?
   a) [1 + m(t)].c(t)
   b) [1 – m(t)].c(t)
   c) [1 + m(t)].2c(t)
   d) [1 + 2m(t)].c(t)

Answer: a
Explanation: Amplitude wave is represented by [1 + um(t)].c(t), where c(t) is carrier signal, m(t) is message signal, u is Modulation Index.
Generally, $c(t) = A_c\cos(w_ct)$, A_c = Amplitude of Carrier Signal.

10. The radiation at right angles is zero means _____
    a) l = ʎ
    b) l = ʎ/4
    c) l = 2 ʎ
    d) l = ʎ/2

Answer: a
Explanation: Antenna is used for converting electromagnetic radiation into electric currents or vice-versa. If the length of antenna is equal to the whole wavelength then the radiation at right angles is zero.

11. If the modulating frequency of a carrier wave varies between 700Hz and 7KHz, find it's bandwidth?
    a) 10 KHz
    b) 23 KHz
    c) 17.3 KHz
    d) 12.6 KHz

Answer: d
Bandwidth = $2f_m$ = 2 x 6.3 = 12.6 KHz.

12. A 1000 KHz carrier is modulated with 300 Hz, 8000 Hz and 2 KHz waves. Determine the frequencies whose chances of occurring in output is least?

a) 1000 KHz
b) 1002 KHz
c) 998 KHz
d) 999.2 KHz

Answer: a
Explanation: Frequencies present in output are of the form $f_c \pm f_m$, $f_c \pm 2f_m$, $f_c \pm 3f_m$. And 1000 KHz is a multiple of none in the range. Whereas, rest options are one of the multiples in the range.

13. If modulation index of an AM wave is increased from 1.5 to 2, then the transitted power _____
a) remains same
b) increases by 20%
c) increases by 41%
d) increases by 50%

Answer: c
Explanation: When m=1.5, transmitted power

$$(P_t) = P_c\ (1 + \frac{1.5^2}{2}) = 2.125P_c \text{ and when m} = 2, P_t = P_c\ (1 + \frac{2^2}{2}) = 3P_c.$$

$$\text{So increase} = \frac{3P_c - 2.125P_c}{2.125P_c} = 0.41$$

= 0.41 x 100
= 41%
Therefore, there is an increase in total power by 41%.

14. What is the use of SSB?
a) It has lesser bandwidth
b) It has large bandwidth
c) It has infinite bandwidth
d) It has zero bandwidth

Answer: a
Explanation: In SSB-SC(Single Side Band Suppressed Carrier), the carrier is suppressed and either of the upper side-band and lower-sideband, are transmitted. This reduces it's bandwidth to the frequency of the message signal.

15. Envelope Detector is a/an _____
a) Coherent detector
b) Asynchronous Detector
c) Synchronous Detector
d) Product Demodulator

Answer: b
Explanation: An envelope detector is used to demodulate a previously modulated signal by

removing all high frequency components of the signal. The capacitor and resistor form a low-pass filter to filter out the carrier frequency. Envelope detectors are asynchronous in nature. The advantage of asynchronous over synchronous is that it is simple, cheap and setup is faster.

16. What is the need of doing Pre emphasis?
    a) For boosting of modulating signal voltage
    b) For boosting of modulating signal frequency
    c) For removing amplitude variations due to noise
    d) For removing frequency variations

Answer: a
Explanation: Pre-emphasis is vastly applied in communication systems to improve signal strength before transmission. It refers to boosting the amplitudes of the weak modulating voltages for high audio frequencies in the range of 2 to 15KHz.

17. A superheterodyne receiver receives signal within frequency range of 120 to 180 MHz. Then the required Intermediate frequency is _____
    a) 30MHz
    b) 60MHz
    c) 90MHz
    d) 50MHz

Answer: a
Explanation:

$f_{if} \geq \frac{f_{max} - f_{min}}{2}$. So $f_{if} \geq \frac{180-120}{2} = 30$ MHz.

18. Signal and its Hilbert transform have _____
    a) same energy density spectrum
    b) same power
    c) a phase difference of 60°
    d) a phase difference of 120°

Answer: a
Explanation: Properties of Hilbert transform states that the signal and its Hilbert transform :
i) have same energy density spectrum
ii) are mutually orthogonal
iii) have same auto correlation function
iv) have same magnitude
v) have a phase difference of "-90" degree.

19. Image frequency is given by _____
    a) $f_s + f_i$
    b) $f_s \pm f_i$
    c) $f_s + 2f_i$
    d) $f_s \pm 2f_i$

Answer:c
Explanation: In the superheterodyne receiver, during the frequency conversion process, the local oscillator and the mixer often allow an undesired frequency signal, in addition to the incoming frequency signal. This results in the production of image frequency which is equal to the sum of signal frequency and double intermediate frequency.

20. VSB is generally used in _____
    a) television production
    b) radio transmission
    c) telephonic conversations
    d) long distance conversations

Answer: a
Explanation: Vestigial Sideband Modulation (VSB) is a type of amplitude modulation in which the carrier and only one sideband are completely transmitted and the other sideband is partly transmitted. Thus, television production is done using VSB modulation.

UNIT 2

1. If a FM signal having modulation index m_f is passed through a frequency tripler, then the modulation index of output of frequency tripler is _____
    a)m_f
    b)$3m_f$
    c) $\frac{1}{3}\ m_f$
    d) $\frac{1}{9}\ m_f$

Answer: b
Explanation: A frequency tripler is a frequency multiplier in which an electronic circuit generates an output signal whose output frequency is a harmonic (multiple) of its input frequency. When a FM signal is passed through a frequency tripler, it increases its modulation index 3 times. So the modulation index of output is $3m_f$.

2. Carson's rule is used to calculate _____
    a) Bandwidth of FM signal
    b) SNR
    c) Modulation index of FM signal
    d) Figure of merit

Answer: a
Explanation: Carson's rule states that only (β+1) (where β = modulation index) upper and lower

sidebands along with the carrier, have significant magnitude and contain 99% of total power. Thus, as per Carson's rule, required bandwidth is equal to the twice of sum of the maximum frequency deviation (f_d) and the maximum modulating frequency(f_m), B = 2(f_d + f_m)Hz.

3. What is the bandwidth of a FM wave when maximum allowed deviation is 50KHz and the modulating signal has a frequency of 15KHz?
   a) 130 KHz
   b) 260 KHz
   c) 65 KHz
   d) 50 KHz

Answer:a
Explanation: According to Carson s rule, B = 2(f_d +f_m) = 2 (50 + 15) = 130 KHz.

4. **Frequency deviation in FM is**

a. Change in carrier frequency to the frequency above and below the centre frequency
b. Formation of side bands
c. The variation of the instantaneous carrier frequency in proportion to the modulating signal
d. All of the above
ANSWER: (d) All of the above

5. **Carrier swing is defined as**
   a. The total variation in frequency from the lowest to the highest point
   b. Frequency deviation above or below the carrier frequency
   c. Width of the side band
   d. None of the above

ANSWER: (a) The total variation in frequency from the lowest to the highest point

6. **The amount of frequency deviation in FM signal depends on**

a. Amplitude of the modulating signal
b. Carrier frequency
c. Modulating frequency
d. Transmitter amplifier
ANSWER: (a) Amplitude of the modulating signal

7. **Drawbacks of using direct method for generation of FM signal are**
   a. Does not give high stability to FM signal frequency
   b. Distorted FM signal is generated due to harmonics of modulating signal
   c. Cannot be used for high power FM generation
   d. Both a and b
   ANSWER: (d) Both a and b

8. **Advantage of using direct method for generation of FM signal is**
   a. It gives high stability to FM signal frequency
   b. Distortion free FM signal is generated

c. High power FM generation is possible
d. None of the above
ANSWER: (c) High power FM generation is possible

9. **What are the disadvantages of using balanced slope detector for demodulation of FM signal?**
a. The detector operates only for small deviation in frequency
b. Low pass filter of the detector produces distortion in the detection
c. Both a and b
d. None of the above
ANSWER: (c) Both a and b

10. **Pre emphasis is done**
a. For boosting of modulating signal voltage
b. For modulating signals at higher frequencies
c. In FM before modulation
d. All of the above
ANSWER: (d) All of the above

11. De-emphasis is
a. is restoring of original signal power
b. is done at the detector output of the receiver
c. is the inverse process of Pre emphasis
d. All of the above
ANSWER: (d) All of the above

12. **What is the effect on the deviation d of an FM signal when it is passed through a mixer?**
a. Doubles
b. Reduces
c. Becomes half
d. Remains unchanged
ANSWER: (d) Remains unchanged

13. **Armstrong method is used for the generation of**
a. Direct FM
b. Indirect FM
c. SSB-SC
d. DSB-SC
ANSWER: (b) Indirect FM

14. The modulation index of FM is given by
a. μ = frequency deviation/ modulating frequency
b. μ = modulating frequency /frequency deviation
c. μ = modulating frequency/ carrier frequency
d. μ = carrier frequency / modulating frequency
ANSWER:(a) μ = frequency deviation/ modulating frequency

15.Disadvantages of FM over AM are

a. Prone to selective fading
b. Capture effect
c. Poorer signal to noise ratio at high audio frequencies
d. All of the above
ANSWER: (d) All of the above

16. What is the required bandwidth according to the Carson's rule, when a 100 MHz carrier is modulated with a sinusoidal signal at 1KHz, the maximum frequency deviation being 50 KHz.
a. 1 KHz
b. 50 KHz
c. 102 KHz
d. 150 KHz
ANSWER: (c) 102 KHz
Explanation:
According to Carson's rule, bandwidth of FM is given by 2(Δf+ fm) where Δf is the deviation in frequency and fm is the frequency of sinusoidal signal. The required bandwidth is therefore calculated as
2 * (50KHz + 1KHz)
= 2 * 51 KHz
= 102 KHz

17. **The audio signal having frequency 500Hz and voltage 2.6V, shows a deviation of 5.2KHz in a Frequency Modulation system. If the audio signal voltage changes to 8.6V, calculate the new deviation obtained.**
a. 17.2 KHz
b. 19.6 KHz
c. 25.6 KHz
d. 14.6 KHz
ANSWER: (a) 17.2 KHz
Explanation:
Deviation in FM is given by $\Delta f = k_f * A_m$
Therefore, $k_f = \Delta f / A_m$
= 5.2/2.6
= 2
When voltage changes to 8.6V = A_m
New frequency deviation $\Delta f = k_f * A_m$
= 2* 8.6
= 17.2 KHz

18. **According to Carson's rule, Bandwidth B and modulating frequency f_m are related as**
a. $B = 2(\Delta f + f_m)$ Hz
b. $B = f_m$ Hz
c. $B < 2f_m$ Hz
d. $B > 2f_m$ Hz
ANSWER: (a) $B = 2(\Delta f + f_m)$ Hz

19.What is the change in the bandwidth of the signal in FM when the modulating frequency increases from 12 KHz to 24KHz?
a. 40 Hz
b. 58 Hz

c. 24 Hz
d. Bandwidth remains unaffected
ANSWER: (c) 24 Hz
Explanation:
According to Carson's rule, the bandwidth required is twice the sum of the maximum frequency deviation and the maximum modulating signal frequency. Or,
$B=2(\Delta f + f_m)$ Hz
$B= 2(\Delta f +12)$ Hz $= 2\ \Delta f + 24$ Hz (1)
Assuming Δf to be constant,
$B = 2\ \Delta f + 48$ Hz (2)
(2)-(1),
= 24Hz
Therefore the bandwidth changes by 24Hz.

20. **What is the maximum frequency deviation allowed in commercial FM broadcasting?**
a. 100 KHz
b. 75 KHz
c. 15 KHz
d. 120 KHz
ANSWER: (b) 75 KHz

21. **The ratio of actual frequency deviation to the maximum allowable frequency deviation is called:**
a. Multi tone modulation
b. Percentage modulation
c. Phase deviation
d. Modulation index
ANSWER: (b) Percentage modulation

22. **The range of modulating frequency for Narrow Band FM is**
a. 30 Hz to 15 KHz
b. 30 Hz to 30 KHz
c. 30 Hz to 3 KHz
d. 3 KHz to 30 KHz
ANSWER: (c) 30 Hz to 3 KHz

23. **Change in instantaneous phase of the carrier with change in amplitude of the modulating signal generates**
a. Direct FM
b. Indirect FM
c. SSB-SC
d. DSB-SC
ANSWER: (b) Indirect FM
24. **Calculate the maximum frequency deviation for the FM signal**
v(t) = 10 cos (6000t+ 5sin2200t)
a. 2200 Hz
b. 6000 Hz
c. 1750 Hz
d. 11000 Hz
ANSWER: (c) 1750 Hz

Explanation:
A standard FM signal is represented by
$v(t) = A_c \cos(2\pi f_c t + k_f \sin 2\pi f_m t)$
A_c = carrier amplitude
f_c = carrier frequency
k_f = modulation index
f_m = modulating frequency = $2200/2\pi = 350$ Hz
k_f = frequency deviation/modulating frequency
5 = freq deviation/ 350
Therefore, deviation = 5 * 350
= 1750Hz

25. **Calculate the dissipation in power across 20Ω resistor for the FM signal**
v(t)= 20 cos(6600t+ 10sin2100t)
a. 5W
b. 20W
c. 10W
d. 400W
ANSWER: (a) 5W
Explanation:
A standard FM signal is represented by
$v(t) = A_c \cos(2\pi f_c t + k_f \sin 2\pi f_m t)$
A_c = carrier amplitude
f_c = carrier frequency
k_f = modulation index
f_m = modulating frequency
k_f = frequency deviation/modulating frequency
the power dissipated across 20Ω resistor is given by
V_{rms}^2/R
$=(20/\sqrt{2})^2/R$
= 5W

26. **What is the value of carrier frequency in the following equation for the FM signal?**
v(t)= 5 cos(6600t+ 12sin2500t)
a. 1150 Hz
b. 6600 Hz
c. 2500 Hz
d. 1050 Hz
ANSWER: (d) 1050 Hz
Explanation:
A standard FM signal is represented by
$v(t) = A_c \cos(2\pi f_c t + k_f \sin 2\pi f_m t)$
A_c = carrier amplitude
f_c = carrier frequency
k_f = modulation index
f_m = modulating frequency
k_f = frequency deviation/modulating frequency
therefore, $f_c = 6600/2\pi$
= 1050Hz

27. **After passing the FM signal through mixer, what is the change in the frequency deviation Δ when the modulating frequency is doubled?**
a. Becomes 2 Δ
b. Becomes Δ /2
c. Becomes Δ^2
d. Remains unchanged
ANSWER: (d) Remains unchanged

28.For a FM signal v(t) = 15 cos (10 * 10^8t + 10 sin 1220t), calculate
1. Carrier frequency
2. Modulating frequency
a. 159.1MHz, 194.1Hz
b. 185.5MHz, 200.15Hz
c. 350.1MHz, 200.1Hz
d. 159.1Hz, 194.1Hz
ANSWER: 1 (a) 59.1MHz, 194.1Hz

29. **For a FM signal v(t) = 25 cos (15 * 10^8t + 10 sin 1550t), calculate:**
1. **Modulation index**
2. **Maximum frequency deviation**

a. 10, 3000.1Hz
b. 20, 1550.9Hz
c. 10, 2465.9Hz
d. 10, 2000.0Hz
ANSWER: (c) 10, 2465.9Hz

30. 100MHz carrier is frequency modulated by 5 KHz wave. For a frequency deviation of 100 KHz, calculate the carrier swing of the FM signal.
a. 2000 KHz
b. 100 KHz
c. 105 KHz
d. 200 KHz
ANSWER: (d) 200 KHz
Explanation:
Carrier frequency f_c = 100MHz
Modulating frequency f_m = 5 KHz
Frequency deviation Δf = 100 KHz
Carrier swing of the FM signal = 2 * Δf
= 2 * 100
= 200 KHz

UNIT III

1. Random variables give relationship between _____
   a) Two random events
   b) Probability of occurence of two random events
   c) Random event and a real number
   d) Random event and its probability of occurrence
   Answer: c
   Explanation: A random variable gives a functional relationship between a random event and a real number.

2. Random process is a function of _____
   a) Random event and time
   b) Random event and frequency
   c) Random event and real number
   d) None of the mentioned
   Answer: a
   Explanation: Random process is a function of two variables: a random event and its time of occurrence.

3. For a stationary process, autocorrelation function depends on
   a) Time
   b) Time difference
   c) Does not depend on time
   d) None of the mentioned

Answer: b
Explanation: Autocorrelation function depends on the time difference between t1 and t2.

4. The autocorrelation function is maximum at
   a) Origin
   b) Infinity
   c) Origin & Infinity
   d) None of the mentioned

Answer: a
Explanation: On substituting different values in the formula for autocorrelation function it wil be maximum at the origin.

5. A random process is called as stationary in strict sense if
   a) Its statistics vary with shift in time origin
   b) Its statistics does not vary with shift in time origin
   c) Its autocorrelation vary with shift in time
   d) Its autocorrelation does not vary with shift in time
   View Answer

Answer: a

Explanation: A random process is defined to be stationary in a strict sense if its statistics varies with a shift in time origin.

6. Gaussian process is a
   a) Wide sense stationary process
   b) Strict sense stationary process
   c) All of the mentioned
   d) None of the mentioned

Answer: c

Explanation: If Gaussian process is a wide sense stationary process then it will also be strict sense stationary process.

7. For random process X = 6 and Rxx (t, t+t) = 36 + 25 exp(|t|). Consider following statements:
   (i) X(t) is first order stationary.
   (ii) X(t) has total average power of 36 W.
   (iii) X(t) is a wide sense stationary.
   (iv) X(t) has a periodic component.
   Which of the following is true?
   a) 1, 2, and 4
   b) 2, 3, and 4
   c) 2 and 3
   d) only 3

Answer: c

Explanation: X Constant and Rxx() is not a function of t, so X(t) is a wide sense stationary. So (i) is false & (iii) is true. Pxx = Rxx(0) 36+25 = 61. Thus (ii) is false if X(t) has a periodic component, then RXX(t) will have a periodic component with the same period. Thus (iv) is false.

8. The mean value E[X(t)] is
   a) 1/2
   b) 1/4
   c) 1
   d) 0

Answer: d

Explanation: E[X(t)] = A P(A) – (-A)P(-A) which is zero.

9. A stationary random process X(t) is applied to the input of a system for which $h(t) = u(t)\, t^2\, e^{(-8t)}$. If E[X(t)] = 2, the mean value of the system's response Y(t) is
   a) 1/128
   b) 1/64
   c) 3/128
   d) 1/32

Explanation: The mean value of Y(t) is integral of h(t)dt over negative infinity to positive infinity which gives the value equal to 3/128.

10. A random process is defined by X(t) + A where A is continuous random variable uniformly distributed on
(0,1). The auto correlation function and mean of the process is
a) 1/2 & 1/3
b) 1/3 & 1/2
c) 1 & 1/2
d) 1/2 & 1

Answer: b
Explanation: E[X(t)X(t+t)] = 1/3 and E[X(t)] = 1/2 respectively.

11. The mean value E[X(t)] is
a) 50
b) sqrt(50)
c) 20
d) sqrt(20)
Answer: d
Explanation: Lim |t| tends to infinity, Rxx(t) = 20 = X^2. hence X is sqrt(20).

12. The E[$X^{2(t)}$] is
a) 10
b) sqrt(10)
c) 50
d) sqrt(50)
Answer: c
Explanation: Rxx(0) = X^2 = 50.

13. The power spectral density function of the stochastic process is
a) Real
b) Odd
c) Real & odd
d) None of the mentioned

Answer: a
Explanation: The power spectral density function of a stochastic function is real and even.

14. For a periodic function, the spectral density and auto correlation functions form
a) Fourier transform pair
b) Laplace transform pair
c) Hilbert transform pair
d) Z transform pair

Answer: a
Explanation: For a periodic function, the spectral density and auto correlation function forms fourier transform pair.

15. Which mathematical notation specifies the condition of periodicity for a continuous time signal?
a. $x(t) = x(t + T_0)$
b. $x(n) = x(n+ N)$
c. $x(t) = e^{-\alpha t}$
d. None of the above
ANSWER: (a) $x(t) = x(t + T_0)$

16. Which condition determines the causality of the LTI system in terms of its impulse response?

a. Only if the value of an impulse response is zero for all negative values of time
b. Only if the value of an impulse response is unity for all negative values of time
c. Only if the value of an impulse response is infinity for all negative values of time
d. Only if the value of an impulse response is negative for all negative values of time
ANSWER: (a) Only if the value of an impulse response is zero for all negative values of time

17. A LTI system is said to be initially relaxed system only if ____
a. Zero input produces zero output
b. Zero input produces non-zero output
c. Zero input produces an output equal to unity
d. None of the above
ANSWER:(a) Zero input produces zero output

18. A random variable belongs to the category of a uniform PDF only when _____
a. It occurs in a finite range
b. It is likely to possess zero value outside the finite range
c. Both a & b
d. None of the above
ANSWER: (c) Both a & b

19. What would happen if the value of term [(m-x) / (σ √2)] increases in the expression of Guassian CDF?
a. Complementary error function also goes on increasing
b. Complementary error function goes on decreasing
c. Complementary error function remains constant or unchanged
d. Cannot predict
ANSWER: (b) Complementary error function goes on decreasing

20. Which type of standard PDFs has/ have an ability to describe an integer valued random variable concerning to the repeated trials carried /conducted in an experiment?
a. Binomial
b. Uniform
c. Both a & b
d. None of the above
ANSWER: (a) Binomial

21. **Which of the following statement is false?**

a. A stationary process is always a ergodic process

b. A ergodic process is always a stationary random process

c. It is possible to have a stationary random

d. None of the above

Answer: (b).A ergodic process is always a stationary random process

UNIT 4

1. Flicker noise is called as
   a) White noise
   b) Pink noise
   c) Brown noise
   d) None of the mentioned

Answer: b
Explanation: Flicker noise is called as pink noise.

2. Man-made noise is caused by

a. Lightning discharge

b. Solar eruptions

c. Distant stars

d. Arc discharges in electrical machines

Answer: **Option D**

3. Cosmic noise is produced by

a. Lightning discharge

b. Solar eruption

c. Distant stars

d. Industrial electrical discharges

Answer: **Option C**

4. One of the following type of noise becomes of great importance in high frequencies. It is the

a. Shot noise

b. Random noise

c. Impulse noise

d. Transit-time noise

Answer: **Option D**

5. The value of a resistor creating noise is doubled. The noise power generated is therefore

a. Halved

b. Quadrupled

c. Doubled

d. Unchanged

Answer: **Option D**

6. One of the following is not useful for comparing the noise performance of receivers

a. Input noise voltage

b. Equivalent noise resistance

c. Noise temperature

d. Noise figure

Answer: **Option A**

7. Indicate the noise whose source is in a category different from that

a. Solar noise

b. Cosmic noise

c. Atmospheric noise

d. Galactic noise

Answer: **Option C**

8. Considered as the main source of an internal noise

a. Flicker

b. Thermal agitation

c. Device imperfection

d. Temperature change

Answer: **Option B**

9. Convert noise factor of 4.02 to equivalent noise temperature. Use 300K for environmental temperature

a. 876K

b. 900K

c. 906K

d. 875K

Answer: **Option C**

10. Atmospheric noise is less severe at frequencies above

a. 10 GHz

b. 30 MHz

c. 1 GHz

d. Audio level

Answer: **Option B**

11. The most common unit of noise measurement in white noise voltage testing

a. NPR

b. dBrn

c. dBW

d. dBm

Answer: **Option A**

12. Extra-terrestrial noise is observable at frequencies from

a. 0 to 20 KHz

b. Above 2 GHz

c. 8 MHz to 1.43 GHz

d. 5 to 8 GHz

Answer: **Option C**

13. A diode generator is required to produce 12 micro V of noise in a receiver with an input impedance of 75 ohms and a noise power bandwidth of 200 KHz. Determine the current through the diode in milliamperes.

a. 0.4 A

b. 298 mA

c. 0.35 A

d. 300 mA

Answer: **Option A**

14. The equivalent noise temperature of the amplifier is 25K. What is the noise figure?

a. 0.4 A

b. 298 mA

c. 0.35 A

d. 300 Ma

Answer: **Option A**

15. The resistor R1 and R2 are connected in series at 300 K and 400 K temperature respectively. If R1 is 200 ohms and R2 is 300 ohms, find the power produced at the load (RL = 500 ohms) over a bandwidth of 100 KHz.

a. 0.05 nanowatts

b. 0.2 nanowatts

c. 0.5 femtowatts

d. 2.0 femtowatts

Answer: **Option C**

16. Given a factor of 10, what is the noise figure in dB?

a. 20 dB

b. 10 dB

c. 50 dB

d. 40 dB

Answer: **Option B**

16. A three-stage amplifier is to have an overall noise temperature no greater than 70K. The overall gain of the amplifier is to be at least 45 dB. The amplifier is to be built by adding a low-noise first stage with existing characteristics as follows: stage 2 has 20 dB power gain and 3 dB noise figure. Stage 3 has 15 dB power gain and 6 dB noise figure. Calculate the maximum noise figure (in dB) that the first stage can have.

a. 0.267 dB

b. 0.56 dB

c. 1.235 dB

d. 0.985 dB

Answer: **Option B**

17. two resistors, R1 and R2 have temperatures of 300K and 400K, respectively. What is the noise power if the two resistors are connected in series at 10 MHz bandwidth?

a. 96.6 fW

b. 55.2 fW

c. 41.4 fW

d. 88.36 fW

Answer: **Option A**

UNIT V

1. To avoid aliasing
   a) Reduce the bandwidth
   b) Cut out high frequency
   c) Reduce the bandwidth & Cut out high frequency
   d) None of the mentioned

Answer: c
Explanation: To avoid aliasing bandwidth should be reduced and high frequency should be cut out.

2. 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.

3. 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.

4. 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.

5. 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.

6. What is the output voltage if the input voltage of a compander with a maximum voltage range of 1 V and a μ of 255 is 0.25?
   a) 0V
   b) 0.25V

c) 0.5V
d) 0.75V

Answer:d

Explanation: $V_{out} = \frac{V_m \ln(1+\mu V_{in}/V_m)}{\ln(1+\mu)} = \frac{1\ln[1+225(0.25)/1]}{\ln(1+225)} = \frac{4.17}{5.55} = 0.75V$.

7. What is the output voltage if the input voltage of a compander with a maximum voltage range of 1 V and a μ of 255 is 0.8V0?
   a) 0.08V
   b) 0.458V
   c) 1.02V
   d) 1.54V
   Answer: c
   Explanation: $V_{out} = \frac{V_m \ln(1+\mu V_{in}/V_m)}{\ln(1+\mu)} = \frac{1\ln[1+225(0.8)/1]}{\ln(1+225)} = \frac{5.32}{5.55} = 1.02V$.
8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

13. **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: (c) 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.

14. **Calculate the Nyquist rate for sampling when a continuous time signal is given by x(t) = 5 cos 100πt +10 cos 200πt – 15 cos 300πt**
a. 300Hz
b. 600Hz
c. 150Hz
d. 200Hz
ANSWER: (a) 300Hz
Explanation:
For the given signal,
$f_1 = 100\pi/2\pi = 50Hz$
$f_2 = 200\pi/2\pi = 100Hz$
$f_3 = 300\pi/2\pi = 150Hz$
The highest frequency is 150Hz. Therefore $f_{max} = 150Hz$

Nyquist rate= 2 fmax

2*150=300Hz.

15. **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
ANSWER: (d) All of the above

16. **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: (d) All of the above

17. **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: (a) To remove noise

18. **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: (d) Both a and b