MULTIPLE CHOICE QUESTIONS in COMMUNICATIONS ENGINEERING

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1. An amplifier operating over a 2 MHz bandwidth has a 80 ohms input resistance. It is operating at 27 degree Celsius, has a voltage gain of 200 and input signal of 6 microvolts rms. Calculate the output rms noise.
   a. 325.6 millivolts
   b. 0.326 millivolts
   c. 32.55 microvolts
   d. 0.3255 microvolts

2. Man-made noise is caused by
   a. Lightning discharge
   b. Solar eruptions
   c. Distant stars
   d. Arc discharges in electrical machines

3. Cosmic noise is produced by
   a. Lightning discharge
   b. Solar eruption
   c. Distant stars
   d. Industrial electrical discharges

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

5. Indicate the false statement
   a. HF mixers are generally noisier than HF amplifiers
   b. Impulse noise voltage is independent of bandwidth
   c. Thermal noise is independent of the frequency at which it is measured
   d. Industrial noise is usually of the impulse type

6. The value of a resistor creating noise is doubled. The noise power generated is therefore
   a. Halved
   b. Quadrupled
   c. Doubled
   d. Unchanged

7. 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

8. Indicate the noise whose source is in a category different from that
   a. Solar noise
   b. Cosmic noise
   c. Atmospheric noise
   d. Galactic noise

9. Considered as the main source of an internal noise
   a. Flicker
   b. Thermal agitation
   c. Device imperfection
   d. Temperature change
10. Convert noise factor of 4.02 to equivalent noise temperature. Use 300 k for environmental temperature
   a. 876 K
   b. 900 K
   c. 906 K
   d. 875 K

11. Atmospheric noise is less severe at frequencies above
   a. 10 GHz
   b. 30 MHz
   c. 1 GHz
   d. Audio level

12. The most common unit of noise measurement in white noise voltage testing
   a. NPR
   b. dBrn
   c. dBW
   d. dBm

13. What is the major cause of atmospheric or static noise?
   a. Meteor showers
   b. Sunspots
   c. Airplanes
   d. Thunderstorms

14. Background noise is the same as the following EXCEPT
   a. Impulse noise
   b. Thermal noise
   c. White noise
   d. Gaussian noise

15. Noise is caused by the thermal agitation of electrons in resistance
   a. All of these
   b. Thermal noise
   c. Johnson’s noise
   d. White noise

16. The unit of noise power of psophometer
   a. dBa
   b. pWp
   c. dBm
   d. dBm0

17. 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

18. What signal-to-noise ratio is required for satisfactory telephone services?
   a. 50 dB
   b. 30 dB
   c. 40 dB
   d. 20 dB
19. 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

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

   a. 0.4 A
   b. 298 mA
   c. 0.35 A
   d. 300 mA

21. 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

22. The random unpredictable electric signals from natural causes, both internal and external to the system is known as

   a. Distortion
   b. Noise
   c. Distortion
   d. Interference

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

   a. 20 dB
   b. 10 dB
   c. 50 dB
   d. 40 dB

24. The signal in a channel is measured to be 23 dBm while noise in the same channel is measured to be 9 dBm. The signal to noise ratio therefore is

   a. 32 dB
   b. 5 dB
   c. -14 dB
   d. 14 dB

25. If voltage is equal to twice its original value, what is its corresponding change in dB?

   a. 3 dB
   b. 6 dB
   c. 9 dB
   d. 12 dB

26. NIF stand for

   a. Non-intrinsic noise figure
   b. Narrow interference figure
   c. Noise improvement factor
   d. Noise interference figure
27. Two resistors rated 5 ohms and 10 ohms are connected in series and are at 27 degrees Celsius. Calculate their combined thermal noise voltage for a 10 KHz bandwidth.
   a. 0.05 millivolts
   b. 0.5 millivolts
   c. **0.05 microvolts**
   d. 0.005 microvolts

28. What is the reference frequency of CCITT psophometric noise measurement?
   a. 800 Hz
   b. 1500 Hz
   c. 3400 Hz
   d. 1000 Hz

29. A three-stage amplifier is to have an overall noise temperature no greater than 70 K. 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

30. A transistor has measured S/N power of 60 at its input and 19 at its output. Determine the noise figure of the transistor.
   a. 5 dB
   b. 10 dB
   c. 2.5 dB
   d. 7.5 dB

31. Which does not affect noise in a channel?
   a. None of these
   b. Bandwidth
   c. Temperature
   d. **Quantizing level**

32. Reference noise temperature
   a. 70 deg F
   b. 30 deg C
   c. **290 Kelvin**
   d. 25 deg C

33. Industrial noise frequency is between
   a. 200 to 3000 MHz
   b. **15 to 160 MHz**
   c. 0 to 10 kHz
   d. 20 GHz

34. Noise from random acoustic or electric noise that has equal per cycle over a specified total frequency band
   a. Thermal noise
   b. White noise
   c. Gaussian noise
   d. **All of these**
35. A transistor amplifier has a measured S/N power of 100 at its input and 20 at its output. Determine the noise figure of the transistor.
   a. 14 dB
   b. 7 dB
   c. -6 dB
   d. -3 dB

36. What does the noise weighing curve show?
   a. Noise signals measured with a 144 handsets
   b. Power levels of noise found in carrier systems
   c. The interfering effect of other frequencies in a voice channel compared with a reference frequency of one kilohertz
   d. Interfering effects of signals compared with a 3-KHz tone

37. The signal power of the input to an amplifier 100 microW and the noise power is 1 microW. At the output, the signal power is 1 W and the noise power is 40 mW. What is the amplifier noise figure?
   a. -6 dB
   b. 9 dB
   c. 6 dB
   d. -3 dB

38. In measuring noise in a voice channel at a -4 dB test point level, the meter reads -70 dBm (F1A weighted), convert the reading into pWp.
   a. 53
   b. 93
   c. 63
   d. 83

39. An amplifier with 20 dB gain is connected to another with 10 dB gain by means of a transmission line with a loss of 4 dB. If a signal with a power level of -14 dBm were applied to the system, calculate the power output.
   a. 14 dBm
   b. -12 dB
   c. -20 dB
   d. 12 dBm

40. Two resistors, R1 and R2 have temperatures of 300 K and 400 K, 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

41. Determine the shot noise for a diode with a forward bias of 1.40 mA over an 80 kHz bandwidth. (q = 1.6x10 raised to minus 9 C)
   a. 6 nA
   b. 3 mA
   c. 12 nA
   d. 15 nA

42. The total noise power present in a 1 – Hz bandwidth
   a. Noise density
   b. Noise figure
   c. Noise limit
43. An amplifier with an overall gain of 20 dB is impressed with a signal whose power level is 1 watt. Calculate the output power in dBm.
   a. 50 dBm
   b. 150 dB
   c. 80 dBm
   d. 100 dBm

44. What is the effect on the signal to noise ratio of a system (in dB) if the bandwidth is doubled considering all other parameters to remain unchanged except the normal thermal noise only. The S/N will be
   a. Increased by a factor of 2
   b. Decreased by ½ its value
   c. Increased by a factor of 4
   d. Decreased to ¼ its value

45. Express the ratio in decibels of noise power ratio 50 is to 10 watts.
   a. 7 dB
   b. 21 dB
   c. 14 dB
   d. 3.5 dB

46. What do you call the noise coming from the sun and stars?
   a. Black-body noise
   b. Space noise
   c. Galactic noise
   d. All of these

47. A satellite has a noise figure of 1.6 dB. Find its equivalent noise temperature.
   a. 139 K
   b. 192 K
   c. 291 K
   d. 129 K

48. What is the primary cause of atmospheric noise?
   a. Thunderstorm
   b. Lightning
   c. Thunderstorm and lightning
   d. Weather condition

49. In a microwave communications system, determine the noise power in dBm for an equivalent noise bandwidth of 10 MHz.
   a. -104 dBm
   b. -114 dBm
   c. -94 dBm
   d. -174 dBm

50. The solar cycle repeats the period if great electrical disturbance approximately every
   a. 11 years
   b. 10 years
   c. 9 years
   d. 8 years

51. One of the following refers to an output of a balanced modulator
   a. SSB
   b. ISB
c. AM  
**d. DSB**

52. Which of the following components is used to produce AM at very high frequencies?  
   a. Cavity resonator  
   **b. PIN diode**  
   c. Varactor  
   d. Thermistor

53. A third symbol emission which represent data transmission including telemetry, and telecommand  
   a. B  
   **b. D**  
   c. C  
   d. N

54. In an AM wave, useful power is carried by  
   a. None of these  
   **b. Sidebands**  
   c. Both the sidebands and the carrier  
   d. Carrier

55. Determine the modulation index of an standard FM broadcast having a hypothetical maximum carrier frequency deviation of ±12 kHz and a maximum modulating frequency of 4kHz.  
   a. 9  
   b. 6  
   **c. 3**  
   d. 4

56. The process by which the intelligence signals normally at lower frequency are removed from the transmission frequency after it is received in the receiver station.  
   a. Detection  
   **b. Demodulation**  
   c. Amplification  
   d. Modulation

57. What is meant by the term modulation?  
   a. The squelching of a signal until a critical signal-to-noise ratio is reached  
   b. Carrier rejection through phase nulling  
   c. A linear amplification mode  
   **d. A mixing process whereby information is imposed upon a carrier**

58. What is a balanced modulator?  
   a. An FM modulator that produces balance deviation  
   **b. A modulator that produces a DSBSC signal**  
   c. A modulator that produces a SSBSC signal  
   d. A modulator that produces a full carrier signal

59. What is a reactance modulator?  
   a. A circuit that acts as a variable resistance or capacitance to produce FM signals  
   b. A circuit that acts as a variable resistance or capacitance to produce AM signals  
   **c. A circuit that acts as a variable inductance or capacitance to produce FM signals**  
   d. A circuit that acts as a variable inductance or capacitance to produce AM signals

60. How can an SSB phone signal be generated?  
   a. By dividing product detector with a DSB signal
b. By using a reactance modulator followed by a mixer
  c. By using a loop modulator followed by a mixer
  d. By using a balanced modulator followed by a filter

61. How can a DSB phone signal be generated?
  a. By feeding a phase modulated signal into a low pass filter
  b. By using a balanced modulator followed by a filter
  c. By detuning a Hartley oscillator
  d. By modulating the plate voltage of a class C amplifier

62. First symbol in the designation of radio signals emission which refers to use of an
  unmodulated carrier.
  a. J
  b. N
  c. H
  d. A

63. One of the following is a communications filter generally used in the transceiver of a single
  sideband generator.
  a. Lowpass filter
  b. Crystal filter
  c. Bandpass filter
  d. Mechanical filter

64. What is the modulation index for an AM signal having Vmax and Vmin of 2.6 and 0.29, respectively?
  a. 0.799
  b. 0.111
  c. 0.894
  d. 0.639

65. What is the bandwidth of an AM signal modulated by a 15-kHz intelligence signal?
  a. 7.5 kHz
  b. 15 kHz
  c. 30 kHz
  d. 60 kHz

66. If a transmitter supplies 10 kW to the antenna when it is unmodulated, determine the total
  radiated power when it is modulated at 30%
  a. 10.45 watts
  b. 10750 watts
  c. 11.5 kilowatts
  d. 10450 watts

67. Which of the following waveform characteristics determines the wavelength of a sine wave?
  a. Phase
  b. Amplitude
  c. Period
  d. Phase angle

68. In the F3E signal, what is the term for the ratio between the deviation of a frequency
  modulated signal and the modulating frequency?
  a. FM compressibility
  b. Quieting index
  c. Modulation index
  d. Percentage of modulation
69. Which frequency band is the standard AM radio broadcast?
   a. HF
   b. UHF
   c. MF
   d. VHF

70. The letter-designation B8E is a form of modulation also known as
   a. Pilot carrier system
   b. Independent sideband emission
   c. Lincompex
   d. Vestigial sideband transmission

71. What are the two general categories of methods for generating emission F3E?
   a. The only way to produce an emission F3E signal is with reactance modulator on the oscillator
   b. The only way to produce an emission F3E signal is with a balanced modulator on the oscillator
   c. The only way to produce an emission F3E signal is with a balanced modulator on the audio amplifier
   d. The only way to produce an emission F3E signal is with a reactance modulator on the final amplifier

72. 100% modulation in AM means a corresponding increase in total power by ____.
   a. 25%
   b. 75%
   c. 100%
   d. 50%

73. How does the SSB transmitter output power normally expressed?
   a. Average power
   b. In terms of peak envelope power
   c. In terms of peak-to-peak power
   d. Peak power

74. Determine from the following the common use of DSB in broadcast and telecommunications
   a. Satellite communication
   b. FM/TV stereo
   c. Two-way communications
   d. Telephone systems

75. What is the source of sidebands in frequency modulation?
   a. Oscillator
   b. Baseband frequency
   c. Mixer
   d. Carrier harmonics

76. What is the source of sidebands in frequency modulated voice?
   a. A3F
   b. A3J
   c. F3E
   d. J3E

77. The third symbol in the designation of radio emission under the ITU refers to
   a. Type of modulation of the main carrier
   b. Nature of signals
   c. Type of information to be transmitted
78. An AM transmission of 3 kW is 100% modulated. If it is transmitted as an SSB signal, what would be the total power transmitted?

a. 500 W  
b. 1000 W  
c. 1500 W  
d. 2000 W

79. This circuit has the function of demodulating the frequency-modulated signal. It is a

a. Automatic gain control  
b. Automatic frequency control  
c. Envelope detector  
d. Foster-Seeley discriminator

80. Calculate the power in one sideband of an AM signal whose carrier power is 50 watts. The unmodulated current is 2 A while the modulated current is 2.4 A.

a. 22 W  
b. 33 W  
c. 11 W  
d. 44 W

81. The method of generating FM used by broadcasting station is

a. Direct  
b. All of these  
c. Indirect  
d. Insertion

82. Deviation ratio of an FM transmitter is the ratio of the

a. Maximum frequency swing to the highest modulating frequency  
b. Operating frequency of the assigned frequency  
c. Frequency swing to the modulating frequency  
d. Highest modulating frequency to the minimum frequency

83. An AM transmitter is modulated by two sine waves at 1.5 kHz and 2.5 kHz with modulations of 20 percent and 80 percent respectively. Calculate the effective modulation index.

a. 0.7776  
b. 0.6  
c. 0.8246  
d. 1.0

84. A DSBSC system must suppress the carrier by 50 dB for its original value of 10 W. To what value must the carrier be reduced?

a. 1 milliwatt  
b. 10 microwatts  
c. 0.10 milliwatts  
d. 0.01 microwatts

85. Which circuit in the AM transmitter does the frequency translation?

a. Synthesizer  
b. Modulator  
c. Mixer  
d. Booster

86. A phase modulator has $K_p = 2$ rad/V. What RMS voltage of a sine wave would cause a peak phase deviation of 30 degrees?

a. 0.158 V
b. 0.185 V  
c. 0.518 V  
d. 0.815 V  

87. In a phase-locked loop, VCO stands for  
   a. Variable capacitor oscillator  
   b. Varactor-capacitor oscillator  
   c. **Voltage-controlled oscillator**  
   d. VHF control oscillator  

88. Diagonal clipping in envelope detection will result in  
   a. **Distortion**  
   b. Diagonal clipping  
   c. Phase reversal  
   d. Amplitude damage  

89. An AM transmitter supplies a 10 kW of carrier power to a 50 ohm load. It operates at a carrier frequency of 1.2 MHz and is 85% modulated by a 3 MHz sine wave. Calculate the RMS voltage of the signal.  
   a. 825 W  
   b. 262.61 V  
   c. 1166.7 V  
   d. **825 V**  

90. What will be the total sideband power of the AM transmitting station whose carrier power is 1200W and a modulation of 95%?  
   a. 270.75 W  
   b. 900 watts  
   c. 1.8 kW  
   d. **542 W**  

91. Which among the following is capable of generating frequency conversion?  
   a. **Balanced modulator**  
   b. Low-Q LC Circuit  
   c. Transmitter  
   d. Circulator  

92. The most commonly used AM demodulator  
   a. **Envelope detector**  
   b. PLL  
   c. Mixer  
   d. Balanced modulator  

93. Which is a disadvantage of direct FM generation?  
   a. **The need for an AFC circuit**  
   b. The need for an AGC circuit  
   c. Two balanced modulators are used  
   d. The use of Class A amplifier which is very inefficient  

94. Frequency division is useful in the implementation of a/an  
   a. AM demodulator  
   b. **Frequency synthesizer**  
   c. AGC circuit  
   d. FM demodulator  

95. A particular synthesizer which contains only a single crystal is  
   a. Direct
b. Crystal-modulated  
c. **Indirect**  
d. Exact

96. Type of emission most affected by selective fading  
   a. **FM and DSB AM**  
   b. SSB and TV  
   c. CCTV and CW  
   d. CW and SSB

97. Which major element will not be found in every superheterodyne receiver?  
   a. RF amplifier  
   b. IF amplifier  
   c. LO  
   d. Mixer

98. A system uses a deviation of 100 kHz and a modulating frequency of 15 kHz. What is the approximate bandwidth?  
   a. 115 kHz  
   b. **230 kHz**  
   c. 170 kHz  
   d. 340 kHz

99. A quadrature detector requires that  
   a. **The inputs are coherent**  
   b. Four gates are provided  
   c. The inputs are in phase  
   d. The inputs are similar

100. What is the power in one sideband of an AM signal whose carrier power is 300 W, with 80 percent modulation?  
   a. 396 W  
   b. Zero  
   c. **48 W**  
   d. 96 W

101. Determine the resonant frequency of a series combination of a 0.001 microfarad capacitor and a 2 – milihenry inductor  
   a. **112.5 kHz**  
   b. 35.59 kHz  
   c. 1125.4 MHz  
   d. 3.26 MHz

102. Which of the following is not a typical part of every radio transmitter?  
   a. Carrier oscillator  
   b. Driver amplifier  
   c. **Mixer**  
   d. Final power amplifier

103. What is the approximate magnitude of the impedance of a parallel RLC circuit at resonance?  
   a. **Approximately equal to the circuit resistance**  
   b. Approximately equal to \( X_L \)  
   c. Low, as compared to the circuit resistance  
   d. Approximately equal to \( X_C \)

104. What are the three major oscillator circuits often used in radio equipment?
105. How is a positive feedback coupled to the input in a Hartley oscillator?
   a. Through a neutralizing capacitor
   b. Through a capacitive divider
   c. Through a link coupling
   d. Through a tapped coil

106. How is the positive feedback coupled to the input in a Colpitts oscillator?
   a. Through a tapped coil
   b. Through link coupling
   c. Through a capacitive divider
   d. Through a neutralizing capacitor

107. How is a positive feedback coupled to the input in a Pierce oscillator?
   a. Through a tapped coil
   b. Through link coupling
   c. Through a capacitive divider
   d. Through a neutralizing capacitor

108. Which of the three major oscillator circuits used in radio equipment utilizes a quartz crystal?
   a. Negative feedback
   b. Hartley
   c. Colpitts
   d. Pierce

109. What is the piezoelectric effect?
   a. Mechanical vibration of a crystal by the application of a voltage
   b. Mechanical deformation of a crystal by the application of a magnetic field
   c. The generation of electrical energy by the application of light
   d. Reversed conduction states when pn-junction is exposed to light

110. What is the major advantage of a Pierce oscillator?
    a. It is easy to neutralize
    b. It doesn’t require an LC tank circuit
    c. It can be tuned over a wide range
    d. It has high output power

111. Which type of oscillator circuit is commonly used in a VFO?
    a. Pierce
    b. Colpitts
    c. Hartley
    d. Negative feedback

112. Why is the Colpitts oscillator circuit commonly used in a VFO?
    a. The frequency is a linear function of the load impedance
    b. It can be used with or without crystal lock-in
    c. It is stable
    d. It has high output power

113. How is the efficiency of a power amplifier determined?
    a. Efficiency = (RF power out / dc power in) x 100%
    b. Efficiency = (RF power in / RF power out) x 100%
c. Efficiency = (RF power in / dc power in) x 100%

d. Efficiency = (dc power in / RF power in) x 100%

114. For reasonably efficient operation of a transistor amplifier, what should be the load resistance be with 12 volts at the collector and a 5 watts power output?
   a. 100.3 ohms
   b. 14.4 ohms
   c. 10.3 ohms
   d. 144 ohms

115. What order of Q is required by a tank circuit sufficient to reduce harmonics to an acceptable level?
   a. Approximately 120
   b. Approximately 12
   c. Approximately 1200
   d. Approximately 1.2

116. What is the flywheel effect?
   a. The continued motion of a radio wave through space when the transmitter is turned off
   b. The back and forth oscillation of electrons in an LC circuit
   c. The use of a capacitor in a power supply to filter rectified AC
   d. The transmission of a radio signal to a distant station by several hops through the ionosphere

117. How can parasitic oscillations be eliminated from a power amplifier?
   a. By tuning for maximum SWR
   b. By tuning for maximum power output
   c. By neutralization
   d. By tuning the output

118. If the spectrum is shifted in frequency with no other changes, this is known as
   a. Frequency multiplication
   b. Sideband movement
   c. Baseband orientation
   d. Frequency translation

119. A device which is capable of causing frequency translation
   a. High-Q tank circuit
   b. Balanced modulator
   c. Low-Q tank circuit
   d. IF strip

120. If the frequency of each component in a signal spectrum is increased by the same fixed amount, this is known as
   a. Up conversion
   b. Demodulation
   c. Frequency translation
   d. Both a and c

121. A particular amplifier is designed to be a frequency doubler. If the input signal frequency is 15.4 MHz, a circuit in the output will be tuned to
   a. 7.7 MHz
   b. 15.4 MHz
   c. 30.8 MHz
   d. 61.6 MHz
122. Any device to be used as a frequency multiplier must be
   a. Active
   b. Passive
   c. Linear
   d. Nonlinear

123. A particular amplifier circuit used for frequency coupling is known as
   a. Push-push
   b. Push-pull
   c. Pull-push
   d. Pull-pull

124. Frequency division is useful in the implementation of a
   a. AM demodulation
   b. Frequency synthesizer
   c. FM demodulator
   d. AGC circuit

125. Indirect frequency synthesizers will include
   a. phase-locked loop
   b. voltage-controlled oscillators
   c. multiple bank crystals
   d. both A and B

126. A particular frequency synthesizer contains only a single crystal. What words describe this synthesizer?
   a. Crystal modulated
   b. Inexact
   c. Indirect
   d. Deficient

127. A recognizable feature of a CW transmitter is
   a. Keyed transmitter
   b. Power amplification
   c. Frequency generation
   d. All of the above

128. The term “pulling” refers to
   a. The change of the crystal oscillator frequency by loading
   b. One-half cycle operation of a push-pull amplifier
   c. Loading on the transmitter caused by the antenna connection
   d. Reduction of the power supply terminal voltage as the transmitter is keyed

129. An AM broadcast transmitter in the multikilowatt operating range will have what form of final amplifier?
   a. Solid-state devices
   b. Vacuum tubes
   c. Travelling wave tubes
   d. Both a and b

130. In a broadcast station, the AGC is referred to as
   a. Automatic gain control limiter
   b. Compression amplifier
   c. Loudness controller
   d. All of the above

131. Class C amplifiers are not used in which type of transmitter?
a. AM  
b. SSB  
c. CW  
d. FM  

132. A circuit that isolates the carrier oscillator from load changes is called a  
a. Final amplifier  
b. Driver amplifier  
c. Linear amplifier  
d. Buffer amplifier  

133. Bias for class c amplifier produced by an input RC network is known as  
a. Signal bias  
b. Self-bias  
c. Fixed external bias  
d. Threshold bias  

134. Collector current in a class C amplifier is  
a. Sine wave  
b. Half-sine wave  
c. Pulse  
d. Square wave  

135. Neutralizing is the process of  
a. Cancelling the effect of internal device capacitance  
b. Bypassing undesired alternating current  
c. Reducing gain  
d. Eliminating harmonics  

136. In an AM transmitter, a clipper circuit eliminates  
a. Harmonics  
b. Splatter  
c. Over-deviation  
d. Excessive gain  

137. The final power amplifier in an FM transmitter usually operates class  
a. A  
b. B  
c. C  
d. D  

138. A transistor RF power amplifier can be tuned for  
a. Minimum $I_C$ in the next stage  
b. Zero signal in the next stage  
c. Minimum $I_C$ in the same stage  
d. Maximum $I_C$ in the same stage  

139. The purpose of a balanced modulator circuit is to eliminate the  
a. Carrier  
b. Upper sideband  
c. Lower sideband  
d. Baseband signal  

140. A frequency multiplier circuit  
a. Operates class A  
b. Is tuned to a harmonic of the input signal  
c. Needs parasitic oscillations
141. An IF transformer of a radio receiver operates at 456 kHz. The primary circuit has a Q of 50 and the secondary has a Q of 40. Find the bandwidth using the optimum coupling factor.
   a. 10.192 kHz
   b. 15.288 kHz
   c. 152.88 kHz
   d. 101.92 kHz

142. A varactor has a maximum capacitance of 80pF and is used in a tuned circuit with a 100 microhenry inductor. Find the tuning voltage necessary for the circuit to resonate at twice its resonant frequency with no tuning voltage applied.
   a. 5 V
   b. 2.5 V
   c. 7.5 V
   d. 4.25 V

143. A phase-locked loop has a VCO with a free-running frequency of 14 MHz. As the frequency of the reference input is gradually raised from zero, the loop locks at 12 MHz and comes out of lock again at 18 MHz. Calculate the capture range.
   a. 4 MHz
   b. 2 MHz
   c. 12 MHz
   d. 8 MHz

144. If the frequency fed to the pre-amplifier of a basic transmitter with multipliers is composed of a pair of triplers and a doubler is 198 MHz, what frequency should the oscillator operate?
   a. 11 MHz
   b. 33 MHz
   c. 22 MHz
   d. 66 MHz

145. A phase-locked loop has a VCO with a free-running frequency of 14 MHz. As the frequency of the reference input is gradually raised from zero, the loop locks at 12 MHZ and comes out of lock again at 18 MHz. Calculate the lock range.
   a. 4 MHz
   b. 2 MHz
   c. 12 MHz
   d. 8 MHz

146. A crystal oscillator is accurate within 0.0005%. How far off frequency could its output be at 37 MHz?
   a. 135 Hz
   b. 150 Hz
   c. 185 Hz
   d. 224 Hz

147. A transmitter has a carrier power output of 10 W at an efficiency of 80%. How much power must be supplied by the modulating amplifier for 100% modulation?
   a. 6.25 W
   b. 7.14 W
   c. 12.5 W
   d. 14.3 W
148. A transmitter operates from a 16 V supply, with a collector current of 2 A. The modulation transformer has a turns ratio of 4:1. What is the load impedance seen by the audio amplifier?
   a. 96 ohms
   b. **128 ohms**
   c. 6 ohms
   d. 8 ohms

149. A collector-modulated class C amplifier has a carrier output power of 150 W and an efficiency of 80%. Calculate the transistor power dissipation with 100% modulation.
   a. 93.75 W
   b. 120 W
   c. 64 W
   d. **56.25 W**

150. An AM transmitter is required to produce 20 W of carrier power when operating from a 25 V supply. What is the required load impedance as seen from the collector?
   a. **15.625 ohms**
   b. 22.5 ohms
   c. 11.25 ohms
   d. 31.25 ohms

151. What is receiver desensitizing?
   a. A burst of noise when the squelch is set to low
   b. A burst of noise when the squelch is set to high
   c. **A reduction in receiver sensitivity because of a strong signal on a nearby frequency**
   d. A reduction in receiver sensitivity is turned down

152. What is the term used to refer to the reduction of receiver gain caused by the signals of a nearby station transmitting in the same frequency band?
   a. **Desensitizing**
   b. Quieting
   c. Cross-modulation interference
   d. Squelch gain roll back

153. What is the term used to refer to a reduction in receiver sensitivity caused by unwanted high-level adjacent channel signals?
   a. Intermodulation distortion
   b. **Quieting**
   c. Desensitizing
   d. Overloading

154. How can receiver desensitizing be reduced?
   a. **Ensure good RF shielding between the transmitter and receiver**
   b. Increase the transmitter audio gain
   c. Decrease the receiver squelch gain
   d. Increase the receiver bandwidth

155. What is cross-modulation interference?
   a. Interference between two transmitters of different modulation types
   b. Interference caused by audio rectification in the receiver preamp
   c. Decrease the receiver squelch gain
   d. **Modulation from an unwanted signal is heard in addition to the desired signal**
What is the term used to refer to the condition where the signals from a very strong station are super imposed on the other signals being received?

a. Intermodulation distortion
b. Cross-modulation interference
c. Receiver quieting
d. Capture effect

How can cross-modulation in a receiver be reduced?

a. By installing a filter at the receiver
b. By using a better antenna
c. By increasing the receiver’s RF gain while decreasing the AF gain
d. By adjusting the passband tuning

What is the result of cross-modulation?

a. Decrease in modulation level of transmitted signals
b. Receiver quieting
c. The modulation of an unwanted signal is heard on the desired signal
d. Inverted sidebands in the final stage of the amplifier

What is the capture effect?

a. All signals on a frequency are demodulated by an FM receiver
b. All signals on a frequency are demodulated by an AM receiver
c. The loudest signal received is the only demodulated signal
d. The weakest signal received is the only demodulated signal

What is a product detector?

a. A detector that provides local oscillator for input to the mixer
b. A detector that amplifies and narrows the bandpass frequencies
c. A detector that uses mixing process with a locally generated carrier
d. A detector used to detect cross-modulation products

What is the term used to refer to the reception blockage of one FM-phone signal?

a. Desensitization
b. Cross-modulation interference
c. Capture effect
d. Frequency discrimination

What is the process of detection?

a. The process of masking out the intelligence on a received carrier to make an S-meter operational
b. The recovery of intelligence from the modulated RF signal
c. The modulation of a carrier
d. The mixing of noise with the received signal

What is the principle of detection in a diode detector?

a. Rectification and filtering of RF
b. Breakdown of the Zener voltage
c. Mixing with the noise in the transition region of the diode
d. The change of reactance in the diode with respect to frequency

How are FM phone signals detected?

a. By a balanced modulator
b. By a frequency discriminator
c. By a product detector
d. By a phase splitter

What is the mixing process?
a. The elimination of noise in a wideband receiver by phase comparison
b. The elimination of noise in a wideband receiver by phase differentiation
c. Distortion caused by aural propagation
d. The combination of the two signals to produce sum and difference frequencies

166. What is a frequency discriminator?
   a. A circuit for detecting FM signals
   b. A circuit for filtering two closely adjacent signals
   c. An automatic band switching circuit
   d. An FM generator

167. What are the principal frequencies which appear at the output of a mixer circuit?
   a. Two and four times the original frequency
   b. The sum, difference and square root of the input frequencies
   c. The original frequencies and the sum and difference frequencies
   d. 1.414 and 0.707 times the frequency

168. What occurs in a receiver when an excessive amount of signal energy reaches the mixer circuit?
   a. Spurious mixer products are generated
   b. Mixer blanking occurs
   c. Automatic limiting occurs
   d. A beat frequency is generated

169. How much gain should be used in the RF amplifier stage of a receiver?
   a. As much as possible short of self oscillation
   b. Sufficient gain to allow weak signals to overcome noise generated in the first mixer
   c. Sufficient gain to keep weak signals below the noise of the first mixer stage
   d. It depends on the amplification factor of the first IF stage

170. Why should the RF amplifier stage of a receiver only have sufficient gain to allow weak signals to overcome noise generated in the first mixer stage?
   a. To prevent the sum and difference frequencies from being generated
   b. To prevent bleed-through of the desired signal
   c. To prevent generation of spurious mixer products
   d. To prevent bleed-through of the local oscillator

171. What is the primary purpose of an RF amplifier in a receiver?
   a. To provide most of the receiver gain
   b. To vary the receiver image rejection by utilizing the AGC
   c. To improve the receiver’s noise figure
   d. To develop the AGC voltage

172. What is an IF amplifier stage?
   a. A fixed-tuned passband amplifier
   b. A receiver demodulator
   c. A receiver filter
   d. A buffer oscillator

173. What factors should be considered when selecting an intermediate frequency?
   a. A cross-modulation distortion and interference
   b. Interference to other services
   c. Image rejection and selectivity
   d. Noise figure and distortion

174. What is the primary purpose of the first IF amplifier stage in a receiver?
a. A noise figure performance
b. Tune out cross-modulation distortion
c. Dynamic response
d. Selectivity

175. What is the primary purpose of the final IF amplifier stage in a receiver?
   a. Dynamic response
   b. Gain
   c. Noise figure performance
d. Bypass undesired signals

176. Which stage of a receiver primarily establishes its noise figure?
   a. The audio stage
   b. The IF stage
c. The RF stage
d. The local oscillator

177. What is meant by the term noise figure in a communications receiver?
   a. The level of noise entering the receiver from the antenna
   b. The relative strength of a strength of a received signal 3 kHz removed from the carrier frequency
c. The level of noise generated in the front end and succeeding stages of a receiver
d. The ability of a receiver to reject unwanted signals at frequencies close to the desired one

178. The ability of a communications receiver to perform well in the presence of strong signals outside the band of interest is indicated by what parameter?
   a. Noise figure
   b. Blocking dynamic range
c. Signal-to-noise ratio
d. Audio output

179. What type problems are caused by poor dynamic range in a communications receiver?
   a. Cross-modulation of the desired signal and desensitization from strong adjacent signals
   b. Oscillator instability requiring frequent returning, and loss of ability to recover the opposite sideband should it be transmitted
c. Cross-modulation of the desired signal and insufficient audio power to operate the speaker
d. Oscillator instability and severe audio distortion of all but the strongest signal received signals

180. What is the term for the ratio between the largest tolerable receiver input signal and the minimum discernible signal?
   a. Intermodulation distortion
   b. Noise floor
c. Noise figure
d. Dynamic range

181. What occurs during CW reception if too narrow a filter bandwidth is used in the IF stage of a receiver?
   a. Undesired signals will reach the audio stage
   b. Output-offset overshoot
c. Cross-modulation distortion
d. Filter ringing

182. How can selectivity be achieved in the front and circuitry of a communications receiver?
   a. By using an audio filter
   b. **By using a preselector**
   c. By using an additional RF amplifier stage
   d. By using an additional IF amplifier stage

183. How should the filter bandwidth of a receiver IF section compare with the bandwidth of a received signal?
   a. **Filter bandwidth should be slightly greater than the received signal bandwidth**
   b. Filter bandwidth should be approximately half the received signal bandwidth
   c. Filter bandwidth should be approximately two times the received signal bandwidth
   d. Filter bandwidth should be approximately four times the received signal bandwidth

184. How can receiver selectivity be achieved in the IF circuitry of a communications receiver?
   a. Incorporate a means of varying the supply voltage to the local oscillator circuitry
   b. Replace the standard JFET mixer with a bipolar transistor followed by a capacitor of the proper value
   c. Remove AGC action from the IF stage and confine it to the audio stage only
   d. **Incorporate a high-Q filter**

185. A receiver has a sensitivity of 0.6 microvolts and a blocking dynamic range of 60 dB. What is the strongest signal that can be present along with a 0.6 microvolt signal without blocking taking place?
   a. 600 millivolts
   b. **600 microvolts**
   c. 300 millivolts
   d. 300 microvolts

186. An AM receiver is tuned to broadcast station at 600 kHz. Calculate the image rejection in dB assuming that the input filter consists of one tuned circuit with a Q of 40?
   a. 19.28 dB
   b. 39.65 dB
   c. **38.57 dB**
   d. 19.83 dB

187. A receiver has two uncoupled tuned circuits before the mixer, each with a Q of 75. The signal frequency is 100.1 MHz. The IF is 10.7 MHz. The local oscillator uses high-side injection. Calculate the image rejection ratio.
   a. 23.69 dB
   b. 58.66 dB
   c. **29.33 dB**
   d. 11.84 dB

188. What oscillator frequency is needed to heterodyne 626 kHz up to 3.58 MHz?
   a. **2.954 MHz**
   b. 4.832 MHz
   c. 4.210 MHz
   d. 2.328 MHz

189. What is the undesirable effect of using too wide a filter bandwidth in the IF section of a receiver?
   a. Output-offset overshoot
b. **Undesired signals will reach the audio stage**
c. Thermal noise distortion
d. Filter ringing

190. What is the limiting condition for sensitivity in a communications receiver?
   a. **the noise floor of the receiver**
   b. the power supply output ripple
c. the two-tone intermodulation distortion
d. the input impedance to the detector

191. What parameter must be selected when designing an audio filter using an op-amp?
   a. **Bandwidth characteristics**
   b. Desired current gain
c. Temperature coefficient
d. Output-offset overshoot

192. What two factors determine the sensitivity of a receiver?
   a. Dynamic range and third-order intercept
   b. Cost and availability
c. Intermodulation distortion and dynamic range
d. **Bandwidth and noise figure**

193. How can unwanted ringing and audio instability be prevented in a multisection op-amp RC audio filter circuit?
   a. Restrict both gain and Q
   b. Restrict gain, but increase Q
c. Restrict Q but increase gain
d. Increase both gain and Q

194. What is meant by the dynamic range of a communications receiver?
   a. The number of kHz between the lowest and the highest frequency to which the receiver can be tuned
   b. The maximum possible undistorted audio output of the receiver referenced to one milliwatt
c. **The ratio between the minimum discernible signal and the largest tolerable signal without causing audible distortion products**
d. The difference between the lowest frequency signal detectable without moving the tuning knob

195. Where is the noise which primarily determines the signal-to-noise ratio in a VHF (150 MHz) marine band receiver generated?
   a. **In the receiver front end**
   b. Man-made noise
c. In the atmosphere
d. In the ionosphere

196. An AM receiver uses a diode detector for demodulation. This enables it satisfactorily to receive
   a. Single-sideband, suppressed carrier (J3E)
   b. Single-sideband, reduced carrier (R3E)
c. ISB(B8E)
d. **Single-sideband, full carrier (H3E)**

197. Three-point tracking is achieved with
   a. Variable selectivity
   b. **The padder capacitor**
c. Double spotting
d. Double conversion

198. A receiver has poor IF selectivity. It will therefore also have poor
a. Blocking
b. Double-spotting
c. Diversity reception
d. Sensitivity

199. If a FET is used as the first AF amplifier in a transistor receiver, this will have the
effect of
a. Gain variation over the frequency coverage range
b. Insufficient gain and selectivity
c. Inadequate selectivity at high frequencies
d. Instability

200. The image frequency of a superheterodyne receiver
a. Is created within the receiver itself
b. Is due to insufficient adjacent channel rejection
c. Is not rejected by the IF tuned circuits
d. Is independent of the frequency to which receiver is tuned

201. ASK, PSK, FSK, and QAM are examples of ________ encoding.
a. Digital-to-digital
b. Digital-to-analog
c. Analog-to–analog
d. Analog-to-digital

202. Unipolar, bipolar, and polar encoding are types of ________ encoding.
a. Digital-to-digital
b. Digital-to-analog
c. Analog-to-analog
d. Analog-to-digital

203. PCM is an example of ________ encoding.
a. Digital-to-digital
b. Digital-to-analog
c. Analog-to–analog
d. Analog-to-digital

204. AM and FM are examples of ________ encoding.
a. Digital-to-digital
b. Digital-to-analog
c. Analog-to–analog
d. Analog-to-digital

205. In QAM, both phase and ________ of a carrier frequency are varied.
a. Amplitude
b. Frequency
c. Bit rate
d. Baud rate

206. Which of the following is most affected by noise?
a. PSK
b. ASK
c. FSK
d. QAM
207. If the frequency spectrum of a signal has a bandwidth of 500 Hz with the highest frequency at 600 Hz, what should be the sampling rate according to the Nyquist theorem?
   a. 200 samples/sec
   b. 500 samples/sec
   c. 1000 samples/sec
   d. **1200 samples/sec**

208. If the baud rate is 400 for a 4-PSK, the bit rate is ______ bps.
   a. 100
   b. 400
   c. **800**
   d. 1600

209. Determine the channel capacity of a 4 kHz channel with S/N = 10 dB.
   a. 8.02 kbps
   b. 4.17 kbps
   c. **13.74 kbps**
   d. 26.58 kbps

210. If the bit rate for an ASK signal is 1200 bps, the baud rate is
   a. 300
   b. 400
   c. 600
   d. **1200**

211. Which encoding method uses alternating positive and negative values for 1’s?
   a. NRZ-I
   b. RZ
   c. Manchester
   d. **AMI**

212. If the maximum value of a PCM signal is 31 and the minimum value is -31, how many bits were used for coding?
   a. 4
   b. 5
   c. **6**
   d. 7

213. Deliberate violations of alternate mark inversion are used in which type of digital-to-digital encoding?
   a. AMI
   b. **B8ZS**
   c. RZ
   d. Manchester

214. RZ encoding involves ______ levels of signal amplitude.
   a. 1
   b. **3**
   c. 4
   d. 5

215. If the transmission rate of a digital communication system of 10 Mbps modulation scheme used in 16-QAM, determined the bandwidth efficiency.
   a. 16 bits/cycle
   b. **4 bits/cycle**
   c. 8 bits/cycle
216. In ______ transmission, bits are transmitted simultaneously, each across its own channel.
   a. Asynchronous serial
   b. Synchronous serial
   c. Parallel
   d. A and B

217. Data are sent over pin ______ of the EIA-RS-232 interface.
   a. 2
   b. 3
   c. 4
   d. All of the above

218. In the EIA-RS-232 standard what does -12V on a data pin represent?
   a. 1
   b. 0
   c. Undefined
   d. Either 1 or 0 depending on the coding scheme

219. The majority of the pins of the EIA-RS-232 interface are used for _____ purpose.
   a. Control
   b. Timing
   c. Data
   d. Testing

220. X-21 uses a _____ connector.
   a. DB-15
   b. DB-25
   c. DB37
   d. DB-9

221. If you have two close, compatible DTEs that can communicate data that do not need to be modulated. A good interface would be _______.
   a. A null modem
   b. An EIA-RS-232 modem
   c. A DB-45 connector
   d. A transceiver

222. What is the object of trellis coding??
   a. To narrow bandwidth
   b. To simplify encoding
   c. To increase data rate
   d. To reduce the error rate

223. In trellis coding. The number of the data bits is _____ the number of transmitted bits.
   a. Equal to
   b. Less than
   c. More than
   d. Double that of

224. Which ITU-T modem uses trellis coding?
   a. V.33
   b. V.34
   c. V.39
   d. V.37
225. The signal between two modems is always
   a. Digital
   b. **Analog**
   c. PSK
   d. QAM

226. For digital communications, determine the signal to noise ratio in dB which would be required for an ideal channel with a bandwidth of 2500 Hz.
   a. 5
   b. 9.54 dB
   c. **4.77 dB**
   d. 3.4

227. For a PCM system with a maximum decoded voltage at the receiver of ±2.55 V and minimum dynamic range of 46 dB, determine the maximum quantization error.
   a. 5.0 V
   b. 0.5 V
   c. **0.005 V**
   d. 0.05 V

228. Determine the bandwidth efficiency for QPSK modulation scheme at a transmission rate of 10 Mbps.
   a. 2 bits/cycle
   b. 4 bits/cycle
   c. 8 bits/cycle
   d. 16 bits/cycle

229. A modulator converts a (an) _______ signal to a (an) __________ signal.
   a. Digital, analog
   b. Analog, digital
   c. PSK, FSK
   d. FSK, PSK

230. Which of the following modulation techniques are used by modems?
   a. 16-QAM
   b. FSK
   c. 8-PSK
   d. **All of the above**

231. A broadcast TV channel has a bandwidth of 6 MHz. Ignoring noise, calculate the maximum data rate that could be carried in a TV channel using a 16-level code and determine the minimum possible signal-to-noise ratio in dB for the calculated data rate.
   a. 24 Mbps, 48 dB
   b. **48 Mbps, 24 dB**
   c. 24 Mbps, 24 dB
   d. 48 Mbps, 48 dB

232. Which of the following modems uses FSK modulation?
   a. Bell **103**
   b. Bell 201
   c. Bell 212
   d. All of the above

233. A maximum length of 50 feet is specified in standard __________.
   a. EIA-RS-449
   b. **EIA-RS-232**
234. A cable range of 40 to _____ feet is possible according to the EIA-RS-449 standard.
   a. 50
   b. 400
   c. 500
   d. 4000

235. What is the bandwidth required to transmit at a rate of 10Mbits/sec in the presence of a 28 dB S/N ratio?
   a. 107.5 kHz
   b. 3.57 MHz
   c. 357.14 kHz
   d. 1.075 MHz

236. The maximum data rate for RS-442 is ________ times that of the maximum RS-423 data rate.
   a. 0.1
   b. 10
   c. 100
   d. 500

237. For an Ethernet bus that is 500 meters in length using a cable with a velocity factor of 0.66, and a communication rate of 10 Mb/s, calculate the total number of bits that would be sent by each station before it detects a collision, if both stations begin to transmit at the same time.
   a. 25 bits
   b. 30 bits
   c. 19 bits
   d. 41 bits

238. A ______ is a device that is a source of or a destination for binary digital data.
   a. Data terminal equipment
   b. Data transmission equipment
   c. Digital terminal encoder
   d. Data-circuit terminating equipment

239. An asynchronous communications system uses ASCII at 9600 bps with eight bits, one start bit, one stop bit and no parity bit. Express the data rate in words per minute. (Assume a word has five characters and one space).
   a. 9600 wpm
   b. 57600 wpm
   c. 160 wpm
   d. 11520 wpm

240. A telephone line has a bandwidth of 3.2 kHz and a signal-to-noise ratio of 34 dB. A signal is transmitted down this line using a four-level code. What is the maximum theoretical data rate?
   a. 12.8 kbps
   b. 6.4 kbps
   c. 36.144 kbps
   d. 18.072 kbps

241. For a binary phase shift keying (BPSK) modulation with a carrier frequency of 80 MHz and an input bit rate of 10 Mbps. Determine the minimum Nyquist bandwidth.
a. 40 MHz  
b. **10 MHz**  
c. 20 MHz  
d. 50 MHz

**242.** The EIA standard specified in the EIA-232 standard is ______ volts.

a. Greater than -15  
b. Less than -15  
c. Between -3 and -15  
d. **Between 3 and 15**

**243.** For a quarternary phase shift keying (QPSK) modulation, data with a carrier frequency of 70 MHz, and input bit rate of 10 Mbps, determine the minimum Nyquist bandwidth.

a. 10 MHz  
b. **5 MHz**  
c. 20 MHz  
d. 40 MHz

**244.** 12 voice channels are sampled at 8000 sampling rate and encoded into 8-bit PCM word. Determine the rate of the data stream.

a. **768 kbps**  
b. 12 kbps  
c. 12.8 kbps  
d. 46.08 kbps

**245.** The encoding method specified in the EIA-232 standard is _________.

a. NRZ-I  
b. **NRZ-L**  
c. Manchester  
d. Differential Manchester

**246.** A binary digital signal is to be transmitted at 10 kbits/s, what absolute minimum bandwidth is required to pass the fastest information change undistorted?

a. **5 kHz**  
b. 10 kHz  
c. 20 kHz  
d. 2.5 kHz

**247.** A coherent binary phase shift keyed (BPSK) transmitter operates at a bit rate of Mbps with a carrier to noise ratio C/N of 8.8 dB. Find Eb/No.

a. **8.8 dB**  
b. 16.16 dB  
c. 21.81 dB  
d. 18.8 dB

**248.** The EIA-RS-232 interface has _______ pins.

a. 20  
b. 36  
c. **25**  
d. 19
249. The EIA-RS-232 standard defines _________ characteristics of the DTE-DCE interface.
   a. Mechanical
   b. Electrical
   c. Function
   d. All of the above

250. For sample rate of 30 kHz in a PCM system, determine the maximum analog input frequency.
   a. 30 kHz
   b. 15 kHz
   c. 60 kHz
   d. 45 kHz.

251. Two-state (binary) communications systems are better because
   a. They can interface directly with the analog telephone network
   b. The components are simpler, less costly, and more reliable
   c. People think better in binary
   d. Interstate calls are less costly

252. Codes are always
   a. Eight bits per character
   b. Either seven or eight bits per character
   c. Agreed upon in advance between sender receiver
   d. The same in all modern computers

253. DCE and DTE
   a. Means “digital communications equipment” and “digital termination equipment”
   b. Are connected by either two or four wires
   c. Refer to the modem and the computer or terminal, respectively
   d. Any one of the above

254. The correctness and the accuracy of the transmitted message content is
   a. Verified by the modem
   b. Determined by the sender and receiver, not by the communications system
   c. Ensured by use of digital techniques
   d. None of the above

255. Serial printers
   a. Are used to transmit grain prices
   b. Are faster than CRT terminals, and offer more flexibility
   c. Print one character at a time
   d. Usually use serial interfaces

256. Ergonomics
   a. Involves the interface between people and machines, such as terminals
   b. Is the application of ergo-economics to communications
   c. Utilizes three-level ergo-coding for transmission over certain channels
   d. All of the above

257. Serial and parallel transmission
   a. Differ in how many bits are transferred per character
   b. Are used in synchronous and asynchronous systems, respectively
   c. Both a and b
   d. Differ in whether the bits are on separate wires or on one

258. Asynchronous transmission
a. Is less efficient than synchronous, but simpler
b. Is much faster than synchronous transmission
c. Is another name for isochronous transmission

259. The amount of uncertainty in a system of symbols is also called
a. Bandwidth
b. Loss
c. **Entropy**
d. Quantum

260. Redundancy measures
a. Transmission rate of a system
b. **How likely symbols are to be repeated**
c. Time between failures
d. System cost

261. Loading refers to the addition of
a. Resistors
b. Capacitors
c. Bullets
d. **Inductance**

262. Transmission of binary signals requires
a. Less bandwidth than analog
b. **More bandwidth than analog**
c. The same bandwidth as analog
d. Cannot be compared with the transmission of analog signals

263. RS-232, RS-449, RS-530, V.24, and X.21 are examples of
a. Standard for various types of transmission channels
b. **Standard for interfaces between terminal and modems**
c. Standards for between modems and transmission facilities
d. Standards for end-to-end performance of data communications system

264. What is one principal difference between synchronous and asynchronous transmission?
 a. The bandwidth required is different
 b. The pulse heights are different
c. The clocking is mixed with the data in asynchronous
d. **The clocking is derived from the data in synchronous transmission**

265. Synchronous modems cost more than asynchronous modems because
a. They are larger
b. **They must contain clock recovery circuits**
c. The production volume is larger
d. They must operate on a larger bandwidth

266. The scrambler in a synchronous modem is in the
a. Control section
b. Receiver section
c. **Transmitter section**
d. Terminal section

267. Binary codes are sometimes transformed in modems into
a. Hexadecimal
b. Huffman codes
c. **Gray code**
d. Complementary codes

268. The digital-to-analog converter in a synchronous modem sends signals to the
   a. Modulator
   b. Transmission line
   c. Terminal
   d. Equalizer

269. The transmission signal coding method for T1 carrier is called
   a. Binary
   b. NRZ
   c. Bipolar
   d. Manchester

270. The receiver equalizer in a synchronous modem is called
   a. A compromise equalizer
   b. A statistical equalizer
   c. An adaptive equalizer
   d. An impairment equalizer

271. Communications protocols always have a
   a. Set of symbols
   b. Start of header
   c. Special flag symbol
   d. BCC

272. The Baudot code uses how many bits per symbol?
   a. 9
   b. 7
   c. 5
   d. 8

273. How many messages may be acknowledged on a BiSync link?
   a. 1
   b. 2
   c. 4
   d. 8

274. Which code set is used to BiSync when using VRC/LRC but not operating in transparency mode
   a. EBCDIC
   b. ASCII
   c. SBT
   d. Fielddata

275. One primary difference between Digital Data Communications Message Protocol (DDCMP) and Synchronous Data Link Control (SDLC) is
   a. DDCMP does not have a transparent mode
   b. SDLC does not use a CRC
   c. DDCMP has a message header
   d. DDCMP does not require special hardware to find the beginning of a message

276. Which of the following transmission systems provides the highest data rate to an individual device?
   a. Voiceband modem
   b. Local area network
   c. Computer bus
d. Digital PBX

277. Which of the following systems provides the longest digital transmission distances?
   a. Voiceband modem  
   b. Local area network  
   c. Computer bus  
   d. Digital PBX

278. Which of the following is a characteristic of a LAN?
   a. Parallel transmission  
   b. Unlimited expansion  
   c. Low cost access for low bandwidth channels  
   d. Application independent interfaces

279. Which of the following transmission media is not readily suitable to CSMA operation?
   a. Radio  
   b. Optical fibers  
   c. Coaxial cable  
   d. Twisted pair

280. Which of the following functions is not provided as part of the basic Ethernet design?
   a. Access control  
   b. Addressing  
   c. Automatic retransmission of a message  
   d. Multiple virtual networks

281. Which of the following is not a useful property of a Manchester line code for an Ethernet?
   a. Continuous energy  
   b. Continuous clock transmissions  
   c. No dc component  
   d. No signal change at a 1 to 0 transition

282. Which of the following data communications functions is generally provided for in a LAN?
   a. Data link control  
   b. Applications processing  
   c. Flow control  
   d. Routing

283. The purpose of a preamble in an Ethernet is
   a. Clock synchronization  
   b. Error checking  
   c. Collision avoidance  
   d. Broadcast

284. Which of the following is possible in a token-passing bus network?
   a. Unlimited number of stations  
   b. Unlimited distances  
   c. Multiple time division channels  
   d. In-service expansion

285. Which of the following is not possible in a token-passing loop network?
   a. Unlimited number of stations  
   b. Unlimited distances  
   c. Multiple time division channels
286. Which of the following LAN architectures can be expanded to the greatest total system bandwidth?
   a. Digital PBX
   b. CSMA/CD baseband system
   c. Token-passing network
   d. Broadband cable system

287. Which of the following systems is the most capable of servicing a wide range of applications?
   a. Digital PBX
   b. CSMA/CD baseband system
   c. Token-passing network
   d. Broadband cable system

288. Which of the following cannot be provided in a broadband LAN?
   a. Frequency agile modems
   b. Closed-circuit TV
   c. Voice circuits
   d. Fiber optics transmission

289. Which of the following is not possible in a digital PBX using twisted pair transmission?
   a. Computer port concentration
   b. 64-kbps data circuits
   c. High-speed file transfers
   d. Transmission up to several thousand feet

290. Which of the following is not a motivation in digitizing a voice signal in the telephones of a digital PBX?
   a. Simplified control signalling
   b. Lower cost telephones
   c. Fewer wire pairs
   d. Multiplexed voice and data channels

291. The electrical state of the control leads in a serial interface is a concern of
   a. The physical layer protocol
   b. The data link-layer protocol
   c. The network-layer protocol
   d. None of the above

292. The X.25 standard specifies a
   a. Technique for dial access
   b. Technique for start-stop data
   c. Data bit rate
   d. DTE/DCE interface

293. The X.25 standard is
   a. Required for all packet switching networks
   b. A recommendation of the CCITT
   c. A complete description of a public data network
   d. Used by all packet terminals

294. A protocol is a set of rules governing a time sequence of events that must take place
   a. Between peers
   b. Between nonpeers
c. Across an interface
   d. None of the above

295. The X.25 standard for packet networks is analogous to
   a. PBX standards for a telephone network
   b. Handset standards for a telephone
   c. **Local loop standards for a telephone network**
   d. Switching standards for a telephone network

296. The OSI reference model defines the functions for seven layers of protocols
   a. Including the user and communications medium
   b. **Not including the user or communications medium**
   c. Including the communications medium but not the user
   d. Including the user but not the communications medium

297. The X.25 standard covers how many OSI layers?
   a. Three
   b. Four
   c. Seven
   d. None

298. A data packet is a packet header together with
   a. A network layer
   b. An administrative layer
   c. **User data**
   d. A packet switch

299. The X.25 standard specifies how many separate protocol layers at the serial interface
    gateway?
   a. 8
   b. 2
   c. 4
   d. 3

300. In X.25 network layer protocol, the data packets normally contain
    a. One octet of header plus data
    b. Two octets of header plus data
    c. **Three octets of header plus data**
    d. Four octets of header plus data

301. What is the characteristic impedance of a single wire with diameter d=0.25mm placed
    at the center between parallel planes separated by 1mm apart? The wire is held by a material
    with a velocity factor of 0.75?
    a. 75 ohms
    b. 120 ohms
    c. 100 ohms
    d. 300 ohms

302. There is an improper impedance match between a 30 W transmitter and the antenna
    and 5 W is reflected. How much power is actually transmitted?
    a. 35 W
    b. 25 W
    c. **30 W**
    d. 20 W

303. What is the actual length in feet of a one quarter-wavelength of a coax with a velocity
    factor of 0.69 at 40 MHz?
304. A quarter-wave line is connected to an RF generator and is shorted out at the far end. What is the input impedance to the line at the generator?
   a. A low value of resistance
   b. A high value of resistance
   c. A capacitive reactance which is equal in value to the line’s surge impedance
   d. A value of resistance equal to the characteristic impedance of the line

305. A coaxial cable has a capacitance of 90pF/m and a characteristic impedance of 75 ohms. Find the inductance of a 2m length.
   a. 1.013 uH
   b. 450 nH
   c. 506.25 nH
   d. 225 nH

306. If the SWR on a transmission line has high value, the reason could be
   a. An impedance mismatch between the line and the load
   b. That the line is nonresonant
   c. A reflection coefficient of zero at the load
   d. A high degree of attenuation between the load and the position where the SWR is measured

307. Calculate the velocity factor of a coaxial cable used as a transmission line with the characteristic impedance of 50 ohms; capacitance is 40 pF/m and an inductance equal to 50 microH/m.
   a. 0.7450
   b. 0.7504
   c. 0.0745
   d. 0.0475

308. If a quarter-wave transmission line is shorted at one end
   a. There is minimum current at the shorted end
   b. The line behaves as a parallel-tuned circuit in relation to the generator
   c. The line behaves as a series tuned circuit in relation to the generator
   d. There is a maximum voltage at the shorted end

309. What is the velocity factor for a cable with a Teflon dielectric (relative permittivity = 2.1)?
   a. 0.69
   b. 0.476
   c. 2.1
   d. 1.449

310. A 50-ohm transmission line is feeding an antenna which represents a 50-ohm resistive load. To shorten the line, the length must be
   a. Any convenient value
   b. An odd-multiple of three-quarters of a wavelength
   c. An even multiple of a quarter of a wavelength
   d. An odd multiple of an eighth of a wavelength

311. A feature of an infinite transmission line is that
   a. Its input impedance at the generator is equal to the line’s surge impedance
b. Its phase velocity is greater than the velocity of light
c. The impedance varies at different positions on the line
d. The input impedance is equivalent to a short circuit

312. The outer conductor of the coaxial cable is usually grounded
a. **At the beginning and at the end of the cable**
b. Only at the beginning of the cable
c. Only at the end of the cable
d. The outer conductor must never be grounded

313. What is the impedance of a balance 4-wire with a diameter of 0.25 cm and spaced 2.5 cm apart using an insulator with a dielectric constant of 2.56?
   a. **100 ohms**
   b. 160.5 ohms
c. 88.93 ohms
d. 25.8 ohms

314. An attenuator has a loss of 26 dB. If a power of 3 W is applied to the attenuator, find the output power.
   a. 1.65 watts
   b. **7.54 milliwatts**
c. 1194 watts
d. 5.459 watts

315. When surge impedance of a line is matched to a load, the line will
   a. Transfer maximum current to the load
   b. Transfer maximum voltage to the load
c. **Transfer maximum power to the load**
d. Have a VSWR equal to zero

316. A lossless line is terminated by a resistive load which is not equal to the surge impedance. If the value of the reflection coefficient is 0.5, the VSWR is
   a. 2
   b. **3**
c. 1.5
d. 5

317. The best insulation at UHF is
   a. Black rubber
   b. Bakelite
   c. Paper
d. **Mica**

318. Neglecting line losses, the RMS voltage along an RF transmission line having no standing waves
   a. Is equal to the impedance
   b. Is one-half of the surge impedance
c. **Is the product of the surge impedance and the line current**
d. Varies sinusoidally along the line

319. What length of standard RG-8/U coaxial cable would be required to obtain a 30 degree-phase shift at 250 MHz?
   a. 0.792 m
   b. 0.99 m
c. **0.066 m**
d. 0.124 m
320. Nitrogen is placed in transmission lines to
   a. Improve the skin-effect of microwaves
   b. Reduce arcing in the line
   c. Reduce the standing wave ratio of the line
   d. **Prevent moisture from entering the line**

321. Referred to the fundamental frequency, a shorted stub line attached to the transmission line to absorb even harmonics could have a wavelength of
   a. 1.41 wavelength
   b. $\frac{1}{2}$ wavelength
   c. $\frac{1}{4}$ wavelength
   d. $\frac{1}{6}$ wavelength

322. Nitrogen gas in concentric RF transmission lines is used to
   a. Keep moisture out
   b. Prevent oxidation
   c. Act as insulator
   d. **Both A and B**

323. If a transmission line has a power loss of 6 dB per 100 feet, what is the power at the feed point to the antenna at the end of a 200 foot-transmission line fed by a 100 watt transmitter?
   a. 70 watts
   b. 50 watts
   c. 25 watts
   d. **6 watts**

324. Two adjacent minima on a slotted line are 20 cm apart. Find the wavelength assuming a velocity factor of 95%.
   a. 38 m
   b. **43.7 m**
   c. 46 cm
   d. 40 cm

325. What would be the approximate series impedance of a quarter-wave matching line used to match a 600 ohm feed to 70 ohm antenna?
   a. 205 ohms
   b. 210 ohms
   c. 25.88 ohms
   d. 102.5 ohms

326. Which of the following represents the best SWR?
   a. 1:1
   b. 1:2
   c. 1:15
   d. 2:1

327. An optical domain reflectometer display shows a discontinuity 1.4 microseconds from the start. If the line has a velocity factor of 0.92, how far is the fault from the reflectometer?
   a. 168 m
   b. **193.2 m**
   c. 210 m
   d. 386 m
328. A high SWR creates losses in a transmission line. A high standing wave ratio might be caused by
   a. Improper turns ratio between primary and secondary in the plate tank transformer
   b. Screen grid current flow
   c. An antenna electrically too long for its frequency
   d. **An impedance mismatch**

329. A properly connected transmission line
   a. Is grounded at the transmitter end
   b. Is cut to a harmonic of the carrier frequency
   c. Is cut to an odd harmonic of the carrier frequency
   d. **Has a standing wave ratio as near as 1:1 as possible**

330. If a ¾ wavelength transmission is shorted at one end, the impedance at the open will be
   a. Zero
   b. **Infinite**
   c. Decreased
   d. Increased

331. The characteristic impedance of a transmission line does not depend upon its
   a. **Length**
   b. Conductor diameter
   c. Conductor spacing
   d. None of the above

332. Which of the following is not a common transmission line impedance?
   a. 50 ohms
   b. 75 ohms
   c. **120 ohms**
   d. 300 ohms

333. A ratio expressing the percentage of incident voltage reflected on a transmission line is known as the
   a. Velocity factor
   b. Standing wave ratio
   c. **Reflection coefficient**
   d. Line efficiency

334. A series tuned circuit operating at a frequency of 1 GHz is to be constructed from a shorted section of Teflon-dielectric coaxial cable. What length should be used? (relative dielectric = 2.1)
   a. 0.325 m
   b. **0.10 m**
   c. 0.217 m
   d. 0.143 m

335. A 75 ohm line is terminated in a 30 ohm resistance. Find the SWR.
   a. 0.6
   b. 0.429
   c. **2.5**
   d. 0.4

336. A generator sends 50 mW down a 50 ohm line. The generator is matched to the line but the load is not. If the coefficient of reflection is 0.6, how much power is reflected?
   a. **18 mW**
b. 20 mW  
c. 30 mW  
d. 32 mW  

337. At very high frequencies, transmission lines are used as  
a. Tuned circuits  
b. Antennas  
c. Insulators  
d. Resistors  

338. Transmission line shielding is grounded  
a. At the input only  
b. At both the input and output  
c. At the output only  
d. If the antenna is a Marconi design  

339. A shorted quarter-wave line at the operating frequency acts like a(an)  
a. Series resonant circuit  
b. Parallel resonant circuit  
c. Capacitor  
d. Inductor  

340. A transmitter is required to deliver 100 W to an antenna through 5 m of coaxial cable with a loss of 3 dB / 100 m. What must be the output power of the transmitter, assuming the line is matched?  
a. 136 W  
b. 153 W  
c. 151 W  
d. 116.815 W  

341. A generator sends 50 mW down a 50 ohm line. The generator is matched to the line but the load is not. If the coefficient of reflection is 0.25, how much power is dissipated in the load?  
a. 46.9 mW  
b. 37.5 mW  
c. 3.125 mW  
d. 12.5 mW  

342. Determine the Q of an antenna if it has a bandwidth of 0.06 MHz and is cut to a frequency of 30 MHz.  
a. 50  
b. 100  
c. 150  
d. 250  

343. The main disadvantage of the two-hole directional coupler is  
a. Low directional coupling  
b. Poor directivity  
c. High SWR  
d. Narrow bandwidth  

344. A shorted half-wave line at the operating frequency acts like a(an)  
a. Capacitor  
b. Inductor  
c. Series resonant circuit  
d. Parallel resonant circuit
345. A load impedance of 100+j25 ohms is normalized on a 100 ohm-line. The normalized value is
   a. 2+j0.5 ohms
   b. 0.25-j1 ohms
   c. 0.94-j24 ohms
   d. 1+j0.25 ohms

346. A pattern of voltage and current variations along a transmission line not terminated in its characteristic impedance is called
   a. Electric field
   b. Radio waves
   c. Standing waves
   d. Magnetic field

347. A 75-j50 ohms is connected to a coaxial transmission line of \( Z_0 = 75 \) ohms, at 10 GHz. The best method of matching consists in connecting
   a. A short-circuited stub at the load
   b. An inductance at the load
   c. A capacitance at some specific distance from the load
   d. A short-circuited stub at some specific distance from the load

348. Calculate the impedance seen looking into a 75 ohm line 1 m long terminated in a load impedance of 100 ohms, if the line has a velocity factor of 0.8 and operates at a frequency of 30 MHz.
   a. 72-j21 ohms
   b. 75-j25 ohms
   c. 40-j30 ohms
   d. 50-j25 ohms

349. The velocity factor of a transmission line
   a. Depends on the dielectric of the material used
   b. Increases the velocity along the transmission line
   c. Is governed by the skin effect
   d. Is higher for a solid dielectric than for air

350. A transmitter supplies 50 W to a load through a line with an SWR of 4:1. Find the power absorbed by the load.
   a. 32 W
   b. 5.6 W
   c. 44.4 W
   d. 18 W

351. An ungrounded antenna near the ground
   a. Acts as a single antenna of twice the height
   b. Is unlikely to need an earth mat
   c. Acts as an antenna array
   d. Must be horizontally polarized

352. One of the following consists of nonresonant antennas
   a. Rhombic antenna
   b. Folded dipole
   c. End-fire array
   d. Broadside array

353. One of the following is very useful as a multiband HF receiving antenna. This is the:
   a. Conical horn
b. Folded dipole  
c. **Log-periodic**  
d. Square loop

354. Which of the following antennas is best excited from a waveguide?  
   a. Biconical  
   b. **Horn**  
   c. Helical discone

355. Indicate which of the following reasons for using a counterpoise with antennas is false:  
   a. Impossibility of a good ground connection  
   b. **Protection of personnel working underneath**  
   c. Provision of an earth for the antenna  
   d. Rockiness of the ground itself

356. One of the following is not a reason for the use of an antenna coupler:  
   a. To make the antenna look resistive  
   b. To provide the output amplifier with the correct load impedance  
   c. To discriminate against harmonics  
   d. **To prevent reradiation of the local oscillator**

357. Indicate the antenna that is not wideband:  
   a. Discone  
   b. Folded dipole  
   c. Helical  
   d. **Marconi**

358. Indicates which of the following reasons for the use of an earth mat with antennas is false:  
   a. Impossibility of a good ground connection  
   b. Provision of an earth for the antenna  
   c. **Protection of personnel working underneath**  
   d. Improvement of the radiation pattern of the antenna

359. Which of the following terms does not apply to the Yagi-Uda array?  
   a. Good bandwidth  
   b. Parasitic elements  
   c. Folded dipole  
   d. **High gain**

360. An antenna that is circularly polarized is the  
   a. **Helical**  
   b. Small circular loop  
   c. Parabolic reflector  
   d. Yagi-Uda

361. The standard reference antenna for the directive gain is the  
   a. Infinitesimal dipole  
   b. **Isotropic antenna**  
   c. Elementary doublet  
   d. Half-wave dipole

362. Top loading is sometimes used with an antenna in order to increase its  
   a. **Effective height**  
   b. Bandwidth  
   c. Beamwidth
d. Input capacitance

363. Cassegrain feed is used with a parabolic reflector to
   a. Increase the gain of the system
   b. Increase the beamwidth of the system
   c. Reduce the size of the main reflector
d. **Allow the feed to be placed at a convenient point**

364. Zoning is used with a dielectric antenna in order to
   a. **Reduce the bulk of the lens**
   b. Increase the bandwidth of the lens
   c. Permit pin-point focusing
d. Correct the curvature if the wavefront from a horn that is too short

365. A helical antenna is used for satellite tracking because of its
   a. Circular polarization
   b. Manoeuvrability
   c. Broad bandwidth
d. Good front-to-back ratio

366. The discone antenna is
   a. A useful direction-finding antenna
   b. Used as a radar receiving antenna
   c. Circularly polarized like other circular antennas
d. **Useful as a HF receiving antenna**

367. One of the following is not an omnidirectional antenna:
   a. Half-wave dipole
   b. Log-periodic
   c. Discone
   d. Marconi

368. How is it possible to lower the resonant frequency of a Hertz dipole antenna?
   a. Reduce the frequency at the transmitter
   b. Connect a capacitor in series with the antenna
c. **Connect an inductor in series with the antenna**
d. Reduce the length of the antenna

369. Which of the following antennas receives signals in the horizontal plane equally well from all directions?
   a. Horizontal Hertz antenna
   b. Vertical loop antenna
   c. Vertical Yagi antenna
d. **A vertical antenna which is a quarter-wavelength long**

370. A one-quarter-wavelength shut-fed vertical Marconi antenna:
   a. Has maximum radiation in a vertical direction
   b. Must have a horizontal receiving antenna for the best reception
c. Must use a receiving antenna which has an electric field in a horizontal direction
d. **Must have a vertical receiving antenna for the best reception**

371. A shunt-fed quarter-wavelength Marconi antenna:
   a. Has maximum RF impedance to ground at its feedpoint
   b. Has a current null at its feedpoint
c. **Has zero dc resistance to ground**
d. Uses balanced twin line as its feeder cable

372. The parasitic element of an antenna system will:
a. Decrease its directivity
b. Increase its directivity
c. Give the antenna unidirectional properties
d. **Both B and C**

373. If the length of the antenna is changed from 2.5 meters to 2.8 meters, its resonant frequency will
a. Increase
b. **Decrease**
c. Depend on the velocity factor so the resonant frequency can either be increased or decreased
d. Will be unchanged

374. What is the effect of adding a capacitor in series with an antenna?
   a. **The antenna’s resonant frequency will increase**
   b. The antenna’s resonant frequency will decrease
c. A capacitor is never added in series with an antenna
d. The purpose is to block dc from being applied to the antenna

375. How does the electric field strength of a broadcast station vary with the distance from the antenna?
   a. The field strength varies inversely proportional to the distance from the antenna
   b. The field strength is directly proportional to the square of the distance from the antenna
c. The field strength varies directly proportional to the square of the distance from the antenna
d. **The field strength varies inversely as the distance from the antenna**

376. Stacking elements in a transmitting antenna system
   a. Increases the field strength at the receiving antenna
   b. Increases the directivity of the transmitter antenna
c. Decreases the size of the major lobe in the radiation pattern
d. **Both a and b**

377. The rhombic antenna is primarily used for
   a. Ground wave propagation
   b. **Skywave propagation**
   c. Space wave propagation
d. Tropospheric propagation

378. If the antenna current is doubled, the field strength at a particular position is
   a. **Doubled**
   b. Halved
c. Multiplied by a factor of four
d. Multiplied by a factor of 1.414

379. A vertical loop antenna has a
   a. Unidirectional radiation pattern in the horizontal plane
   b. Unidirectional radiation pattern in the vertical plane
c. **Bidirectional radiation pattern in the horizontal plane**
d. Omnidirectional radiation pattern in the horizontal plane

380. In order to get maximum radiation to all surrounding points in the horizontal plane, the antenna used is a(an)
   a. Vertical loop
   b. **Vertical quarter-wavelength rod**
c. Array which includes parasitic elements
d. Horizontal Hertz dipole

381. The physical length of a Hertz dipole resonant at a 100 MHz is
a. 9.84 ft
b. 4.92 ft
c. 4.68 ft
d. 2.46 ft

382. What is meant by the term antenna gain?
   a. The numerical ratio relating the radiated signal strength of an antenna to that of another antenna
   b. The ratio if the signal in the forward direction to the signal in the back direction
   c. The ratio of the amount of power produced by the antenna compared to the output power of the transmitter
   d. The final amplifier gain minus the transmission losses

383. What is meant by the term antenna bandwidth?
   a. Antenna length divided by the number of elements
   b. The frequency range over which an antenna can be expected to perform well
   c. The angle between the half-power radiation points
   d. The angle formed between two imaginary-lines drawn through the ends of the elements

384. What is the wavelength of a shorted stub used to absorb even harmonics?
   a. ½ λ
   b. 1/3 λ
   c. ¼ λ
   d. 1/8 λ

385. What is a trap antenna?
   a. An antenna for rejecting interfering signals
   b. A highly sensitive antenna with maximum gain in all directions
   c. An antenna capable of being used on more than one band because of the presence of parallel LC networks
   d. An antenna with a large capture area

386. What is the disadvantage of using a trap antenna?
   a. It has a high directivity in the high-frequency bands
   b. It has a high gain
   c. It minimizes harmonic radiation pattern
   d. It may be used for multi-band operation

387. What is the disadvantage of using a trap antenna?
   a. It will radiate harmonics
   b. It can only be used for single band operation
   c. It is too sharply directional at lower frequencies
   d. It must be neutralized

388. What is the principle of a trap antenna?
   a. Beamwidth may be controlled by nonlinear impedance
   b. The traps form a high impedance to isolate parts of the antenna
   c. The effective radiated power can be increased if the space around the antenna sees a high impedance
   d. The traps increase the antenna gain

389. What is a parasitic element of an antenna?
a. An element polarized 90 degrees opposite the driven element
b. An element dependent on the antenna structure for support
c. **An element that receives its excitation from mutual coupling rather than from a transmission line**
d. A transmission line that radiates radio-frequency energy

390. How does a parasitic element generate an electromagnetic field?
   a. By the RF current received from a connected transmission line
   b. By interacting with the earth’s magnetic field
   c. By altering the phase of the current on the driven element
d. **By currents induced into the element from a surrounding electric field**

391. How much power will an antenna having a radiation resistance of 50 Ω radiate when fed with a 20 A current?
   a. 20,000 W
   b. 1000 W
   c. 2 kW
   d. 10 kW

392. Determine the Q of an antenna if it has a bandwidth of 0.06 MHz and is cut to a frequency of 30 MHz.
   a. 50
   b. 100
   c. 150
   d. 250

393. How does the length of the reflector element of a parasitic element beam antenna compare with that of the driven element?
   a. **It is about 5% longer**
   b. It is about 5% shorter
   c. It is twice as long
   d. It is one-half as long

394. How does the length of the director element of a parasitic element beam antenna compare with that of the driven element?
   a. It is about 5% longer
   b. **It is about 5% shorter**
   c. It is twice as long
   d. It is one-half as long

395. What is meant by the radiation resistance for an antenna?
   a. Losses in the antenna elements and feedline
   b. The specific impedance of the antenna
   c. **An equivalent resistance that would dissipate the same amount of power as that radiated from an antenna**
   d. The resistance in the trap coils to received signals

396. What are the factors that determine the radiation resistance of an antenna?
   a. Transmission line length and height of antenna
   b. **The locations of the antenna with respect to nearby objects and the length/diameter ratio of the conductors**
   c. It is a constant for all antennas since it is a physical constant
   d. Sunspot activity and the time of day

397. In a half-wave dipole, where are the current nodes?
   a. At the ends
b. At the feedpoint
c. Three-quarters of the way from the feedpoint towards the end
d. One-half of the way from the feedpoint toward the end

398. What is the advantage of using top loading in a shortened HF vertical antenna?
   a. Lower Q
   b. Greater structural strength
   c. Higher losses
   d. Improved radiation efficiency

399. What is the beamwidth of a symmetrical pattern antenna with a gain of 30 dB as compared to an isotropic radiator?
   a. 3.2 degrees
   b. 6.4 degrees
   c. 37 degrees
   d. 60.4 degrees

400. A microwave communications uses plane reflectors as passive repeaters. The diameter of the parabolic antenna is 18 ft while the effective area is 310 sq ft. Determine the reflector coupling factor.
   a. 0.76
   b. 0.906
   c. 0.92
   d. 0.706

401. The telephone was invented by
   a. Watson
   b. Bell
   c. Strowger
   d. Edison

402. The central office detects a request for service from a telephone by
   a. A flow of loop current
   b. No loop current
   c. A ringing signal
   d. Dial pulses

403. Which office local is the local central office?
   a. 2
   b. 3
   c. 4
   d. 5

404. Which exchange is used to connect between central offices when a direct trunk is not available?
   a. Local
   b. Tandem
   c. Toll
   d. Any of the above

405. Which of the following is a type of dc signaling?
   a. Loop current
   b. Reverse battery
c. E and M  
d. All of the above

406. The voice frequency channel pass band is  
a. 0 to 4000 Hz  
b. 300 to 3000 Hz  
c. 8140 to 8188 Hz  
d. None of the above

407. What is used to transmit more than one conversation over a path?  
a. Hybrid  
b. Tandem  
c. Multiplexing  
d. All of the above

408. The common channel signaling method  
a. Uses the same channel for signaling as for the related conversation  
b. Uses a separate channel for signaling only  
c. Carries the signaling for only one related conversation  
d. Is used on local loops

409. Telephone switching is accomplished by  
a. Manual switchboard  
b. Step-by-step switches  
c. Crossbar switches  
d. Any of the above

410. The step-by-step switch  
a. Was invented by Strowger  
b. Generates much noise  
c. Cannot operate directly from DTMF tones  
d. All of the above

411. Time division multiplexing is used for  
a. Analog transmission  
b. Digital transmission  
c. Both of the above  
d. None of the above

412. What type of transmitter is most commonly used in a conventional telephone handset?  
a. Carbon  
b. Electromagnetic  
c. Electret  
d. Ceramic

413. Which component in the telephone set has the primary function of compensating for the local loop length?  
a. Resistor  
b. Varistor  
c. Capacitor  
d. Induction coil
414. What type of receiver is most commonly used in a conventional telephone handset?
   a. Carbon
   b. **Electromagnetic**
   c. Electret
   d. Ceramic

415. Which component in the telephone set has the primary function of interfacing the handset to the local loop?
   a. Resistor
   b. Varistor
   c. Capacitor
   d. **Induction coil**

416. How many unique tones are used for the 12-key dual-tone multi-frequency keypad?
   a. 2
   b. 3
   c. 7
   d. 12

417. Which of the following are important for the proper interface of a DTMF generator to the telephone line?
   a. Impedance
   b. Tone amplitude
   c. Loop current
   d. **All of the above**

418. The anti-tinkle circuit
   a. Prevents tampering with the telephone
   b. **Prevents dial pulsing from ringing the bell**
   c. Prevents speech signals from ringing the bell
   d. All of the above

419. The sidetone is
   a. A type of feedback
   b. Determined by the balancing network
   c. Permits the talker to hear his/her own voice
   d. **All of the above**

420. On-hook current must be kept low so that the
   a. **Line relays in the central office will not mistake it for off-hook current**
   b. Comparatively small wires in the cables will not overheat
   c. Ringer will not ring incorrectly
   d. Carbon microphone will not be damaged

421. Overvoltage protection is
   a. Needed in the telephone set because of the high ringing voltage
   b. Is nearly always incorporated in the IC chip
   c. Is primarily a central office function
d. Needed because of transients from dial pulsing, lightning, induction or short circuit

422. A special rectifier bridge is used in electronic telephone because
a. The ac power must be converted to dc to simulate a battery
b. it is necessary to shunt the speech frequencies and keep them off of the loop
c. the voltage drop across conventional bridges leaves too little voltage to operate the set
d. All of the above

423. Voltage and current regulation
a. Is provided by the central office
b. Is needed to ensure proper IC operation
c. Can be performed by circuits built into the IC
d. B and c above

424. Memory is added to the telephone set to
a. Allow more digits to be dialed
b. Allow faster dialing
c. Allow automatic redialing of the last number dialed
d. None of the above

425. What is the function of the diode rectifier bridge in the line circuit?
  a. Lower the voltage to the telephone electronics
  b. Raise the voltage to the telephone electronics
  c. Short out the line when the set is on-hook
d. Protect the set against polarity reversals on the line

426. What bad electrical effect happens when the switchhook is opened?
  a. A high voltage transient is generated
  b. The line is shorted out
  c. The line is opened
  d. No bad effects happen

427. Pulse dialing occurs at the rate of
  a. 20 pulses per minute
  b. 10 pulses per minute
  c. 10 pulses per second
  d. 80 pulses per second

428. How many different tones may be produced by a four-column DTMF keypad?
  a. 2
  b. 8
  c. 4
d. 16

429. What is the advantage of electronic ringers?
  a. Louder volume
  b. Smaller size
  c. Good directionality
d. Greater weight

430. What function are provided in a multitone ringing generator?
a. Anti-tinkle circuitry  
b. Tone generation  
c. Output amplifier  
d. **All of the above**

431. The DTMF generator in an electronic phone produces tones using a(an) 
   a. LC circuit  
b. RC circuit  
c. Digital divider circuit  
d. **Digital multiplier circuit**

432. Which function is not required in an integrated telephone circuit? 
   a. Regulator  
b. Dialer  
c. **Visual display**  
d. Speech network

433. Transient protection is provided for integrated telephone circuits is typically provided by 
   a. Bridge rectifiers  
b. **Zener diodes**  
c. Inductors  
d. Capacitors

434. Speakerphones operate in 
   a. Full-duplex mode  
b. **Half-duplex mode**  
c. Open-duplex mode  
d. Computer mode

435. Sampling the analog wave produces 
   a. Impulse noise  
b. Phase distortion  
c. **Pulse amplitude modulation**  
d. Frequency coherence

436. The simplest form of coding is 
   a. Diphase  
b. Hybrid  
c. Compressed  
d. **Linear**

437. In digital multiplexing systems, bit interleaving is used in 
   a. Lower level systems  
b. **Higher level systems**  
c. To interleave a code word  
d. All of the above

438. Synchronous multiplexed systems have the time placement of bits 
   a. **Dedicated**  
b. Unassigned  
c. Random
439. A synchronous multiplexed systems are used
   a. Mostly for voice transmission
   b. Mostly for data transmission
   c. To carry only speech information
   d. All of the above

440. Foldover distortion or aliasing is
   a. Eliminated by filtering out the frequencies below 300 Hz
   b. Another name for crosstalk
   c. The presence of spurious frequencies caused by having too high
      frequencies in the sampled signal
   d. None of the above

441. Multiplexer systems used in the public network are of the ___ type.
   a. Synchronous
   b. Plesiochronous
   c. Asynchronous
   d. Isochronous

442. The line coding scheme used for the DS-1 signal is
   a. Non-return-to-zero
   b. Binary 3 zero-substitutions
   c. Ternary
   d. Bipolar

443. Modems are required to connect to telephone lines because
   a. The telephone network bandwidth is too high
   b. The telephone network will not pass direct current
   c. Telephone company rules require them
   d. None of the above

444. The most common technique for binary data transmission
   a. Bisynchronous transmission
   b. Synchronous transmission
   c. Asynchronous transmission
   d. Plesiochronous transmission

445. Asynchronous data transmission requires a clock
   a. At the transmitter end
   b. At the receiver end
   c. At neither end
   d. At both ends

446. What kind of modulation is used in modems?
   a. Phase modulation
   b. Frequency modulation
   c. Amplitude modulation
   d. All of the above

447. The parameter that most affects transmission of the high speed modem data is
   a. Phase distortion
b. Amplitude distortion
c. Frequency shift
d. Impulse noise

448. Protocols may be
   a. Bit oriented
   b. Byte oriented
   c. Character oriented
   a. **All of the above**

449. The telephone network is being converted to digital operation primarily to
   a. Carry digital computer data
   b. **Reduce costs**
   c. Improve speech quality
   d. Increase system capacity

450. A code for a 64-interval must produce how many bits?
   a. 2
   b. 10
   c. 8
   d. **7**

451. The MTSO searches the location of a mobile phone. This is called __
   a. Handoff
   b. Hand on
   c. **Paging**
   d. Receiving

452. Mobile cellular transmitter have a maximum output power of
   a. 1 mW
   b. 10 W
   c. **3 W**
   d. 500 mW

453. A province in the Philippines has an area of 2000 sq km. it has to be covered by cellular mobile telephone service using cells with a radius of 2 km. assuming hexagonal cells, find the number of cellsites needed.
   a. 154
   b. 144
   c. **145**
   d. 132

454. IS-95 system uses direct sequence spread spectrum with a chipping rate of
   a. **1.23 MHz**
   b. 200 kHz
   c. 500 MHz
   d. 10.7 MHz

455. Modulation scheme used by cellular CDMA system
   a. **BPSK**
   b. QPSK
   c. QAM
d. GFSK

456. How often will hand-offs occur when vehicle travels through a CMTS at 100 km per hour speed if the distance between cellsites is 10 km?
   a. 6 mins
   b. **12 mins**
   c. 395 sec
   d. 10 hrs

457. The TACS base station frequency range of operation
   a. 821-849 MHz and 869-894 MHz
   b. **890-915 MHz and 935-960 MHz**
   c. 870-885 MHz and 925-940 MHz
   d. 825-890 MHz and 925-970 MHz

458. The antenna separation required in a cellular system when the antenna height at the base is 15 m is
   a. 5.477 m
   b. **1.364 m**
   c. 4.869 m
   d. 2.434 m

459. What type of modulation is used by a standard analog cordless telephone?
   a. AM
   b. **FM**
   c. PSK
   d. WAM

460. Cellular communication began in
   a. 1977
   b. 1956
   c. **1983**
   d. 1999

461. When calculating the data rates for LMDS, capacity is the number of cell sites multiplied by which of the following?
   a. The capacity per cell site
   b. The number of cells
   c. The number of sectors in the cell site
   d. The sector capacity

462. The name for an alternative form of cellular communication which operates in specialized mobile radio band just adjacent to the cellular frequency band. It is a blend of wireless interconnects and dispatch services which makes it very unique compared to existing cellular and PCS systems
   a. iDEN
   b. CDMA
   c. JTACS
   d. PDC

463. The MTSO is responsible for __
   a. Connecting the cell with the telephone central office
b. Assigning channels for retransmission  
c. Billing function  
d. All of the above

464. The master control center for a cellular telephone system is the  
a. Cell site  
b. **Mobile telephone switching office**  
c. Central office  
d. Branch office

465. The IS-54 system uses TDMA with three calls per 30 kHz channel. The modulation used is  
a. PSK  
b. FM  
c. **DQPSK**  
d. QAM

466. Which of the following is used to estimate the distance that a subscriber can be located while still achieving acceptable reliability?  
a. Call-size selection  
b. **Link budget**  
c. Capital cost model  
d. Cell design

467. It is a spread spectrum technology that relies on time-division duplexing  
a. **IS-661**  
b. IS-136  
c. PCS 1900  
d. PDC

468. Which of the following is not a 3G system?  
a. IMT-2000  
b. WCDMA  
c. UMTS  
d. **TDMA IS-136**

469. The unlicensed national information infrastructure band  
a. **5 GHz**  
b. 54 GHz  
c. 2.4 GHz  
d. 880MHz

470. Cellular radios use FM with a maximum deviation of plus or minus __  
a. **12 kHz**  
b. 20 kHz  
c. 15 kHz  
d. 30 kHz

471. IS-136, IS-95 and iDEN belong to  
a. 1 G  
b. **2 G**  
c. 2.5 G
472. A wireless data communication service, standard or technology in which data packets are transmitted
   a. EDGE
   b. **GPRS**
   c. CDMAOne
   d. IS-136

473. IEEE standard pertaining to wireless networks
   a. 802.6
   b. **802.11**
   c. 802.11
   d. 802.15

474. Soft handoff is a flawless handoff which normally takes ____., which is imperceptible to voice telephone users.
   a. 300 ms
   b. 600 ms
   c. **200 ms**
   d. 500 ms

475. A Bluetooth network can have ___ master(s).
   a. One
   b. Two
   c. Three
   d. Eight

476. The GSM system uses the 890- to 915- and 935- to 960-MHz frequency range. There are 124 25 kHz channels spaced 200 kHz intervals. The modulation is ___.
   a. GMSK
   b. QPSK
   c. MSK
   d. GFSK

477. Which of the following is not included in the LMDS network management?
   a. Fault management
   b. Configuration management
   c. Accounting management
   d. **Tower management**

478. A ___ is a computerized center that is responsible for connecting calls, recording call information and billing
   a. Base station
   b. **Mobile switching center**
   c. Cell
   d. Mobile station

479. What determine the size of the cell?
   a. The area terrain
   b. **The area population**
   c. The number of MTSOs
d. All of the above
480. LDMS is an acronym for which of the following?
   a. Link multipoint digital service
   b. Local multipoint distribution service
   c. Low-speed multiple data streams
   d. **Local multimedia distribution service**
481. In ____, a mobile station always communicates with just one base station.
   a. Roaming
   b. **A hard handoff**
   c. A soft handoff
   d. A roaming handoff
482. LDMS optimizes frequency reuses by optimizing which of the following?
   a. Minimizing multipathing
   b. Cross polarization
   c. Sectoring the distribution system
   d. **All of the above**
483. In cellular telephony, a service area is divided into small regions called ____.  
   a. Cells
   b. Cell offices
   c. MTSOs
   d. Relay sites
484. ____ is a first generation cellular phone system
   a. AMPS
   b. D-AMPS
   c. GSM
   d. IS-95
485. ____ is a cellular telephone system popular in Europe.
   a. AMPS
   b. D-AMPS
   c. **GSM**
   d. IS-95
486. IS-95 has a frequency reuse factor of
   a. **1**
   b. 5
   c. 7
   d. 95
487. ____ base stations use GPS for synchronization.
   a. AMPS
   b. D-AMPS
   c. GSM
   d. **IS-95**
488. NMT is a cellular standard developed by the Nordic countries of Sweden, Denmark, Finland, and Norway in ____.  
   a. 1983
b. 1989
c. 1981
d. 1980

489. Cellular receiver sensitivity
   a. **50 dB**
   b. 40 dB
   c. 20 dB
   d. 35 dB

490. When a single cell is subdivided into smaller cells, the process is called
   a. Cell division
   b. Cell sharing
   c. **Cell splitting**
   d. Cell reuse

491. What modulation technique uses digital modulation technique?
   a. BPSK
   b. QPSK
   c. GFSK
   d. **GMSK**

492. Supervisor audio tone frequency
   a. **6000 Hz**
   b. 6010 Hz
   c. 5960 Hz
   d. 6040 Hz

493. Spacing between the simultaneously used transmit and receive frequencies is
   a. **45 MHz**
   b. 30 kHz
   c. 12kHz
   d. 200 kHz

494. Each cell site contains a
   a. **Repeater**
   b. Control computer
   c. Direct link to a branch exchange
   d. Touch-tone processor

495. Cellular telephones use what type of operation?
   a. Simplex
   b. Half-duplex
   c. **Full-duplex**
   d. Triplex

496. In a cellular radio, the duplexer is a
   a. Ferrite isolator
   b. Waveguide assemble
   c. Pair of TR/ATR tubes
   d. **Pair of sharp bandpass filters**

497. The output of a cellular radio is controlled by the
498. What is the system used by Personal Communications Network?
   a. PCS 1900
   b. Modified GSM
   c. AMPS
   d. MTSO

499. Multiple access scheme used by DECT
   a. CDMA
   b. FDMA/CDMA
   c. TDMA
   d. FDMA

500. Voted cellular digital standard at TIA
   a. IS-136
   b. AMPS
   c. PCS 1900
   d. PDC

501. Attenuator is used in the travelling wave tube to
   a. Help bunching
   b. Prevent oscillations
   c. Prevent saturation
   d. Increase gain

502. The multicavity klystron
   a. Is not a good low-level amplifier because of noise
   b. Has a high repeller voltage to ensure a rapid transmit time
   c. Is not suitable for pulsed operation
   d. Needs a long transit time through the buncher cavity to ensure current modulation

503. What is the effective radiated power of a repeater with 450 W transmitting power output, 4 dB feedline loss, 6dB duplexer loss, and 7 dB circulator and feedline loss and antenna gain of 25 dB?
   a. 2893.31 W
   b. 2523.83 W
   c. 2839.31 W
   d. 2425.38 W

504. Magnetron oscillator are used for
   a. Generating SHF signals
   b. Multiplexing
   c. Generating rich harmonics
   d. FM demodulation

505. A microwave tube which has the advantage of having a high efficiency
   a. Cross-field amplifier
b. Helix traveling wave tube
c. Klystron
d. Gridded tube
506. What term is used to describe the variation in a microwave oscillator frequency caused by power supply voltage or current changes?
   a. Frequency pulling
   b. **Frequency pushing**
   c. Post-tuning drift
d. Tuning sensitivity
507. A rectangular waveguide has a width of 1.2 in and a height of 0.7 in. the waveguide will pass all signals above __ GHz.
   a. 4 GHz
   b. 8.44 GHz
c. 10 GHz
d. **4.92 GHz**
508. Waveguides are
   a. A hollow tube that carries HF
   b. Solid conductors of RF
   c. Coaxial cables
d. Copper wire
509. A TWT is sometimes preferred to the multicavity klystron amplifier because the former
   a. Is more efficient
   b. **Has a greater bandwidth**
c. Has a higher number of modes
d. Produces a higher output power
510. Variation in oscillator frequency with changes in load SWR
   a. **Frequency pulling**
b. Frequency pushing
c. Post-tuning drift
d. Tuning sensitivity
511. It is the frequency change of an electronically tuned oscillator at a specified time after it has reached its desired frequency
   a. Frequency pulling
   b. Frequency pushing
c. **Post-tuning drift**
d. Tuning sensitivity
512. What is the power level of the smallest signal that can be detected above the noise by a Schottky diode?
   a. -20 dBm
   b. 0 dBm
c. **-60 dBm**
d. -100 dBm
513. A line-of-sight radio link operating at a frequency of 6GHz has a separation of 0 km between antennas. An obstacle in the path is located 10 km from the transmitting antenna. By how much must the beam clear the obstacle?
   a. 11.6 m  
   b. 13.4 m  
   c. 19.34 m  
   d. 22.33 m

514. AM isolator
   a. Acts a buffer between microwave oscillators coupled to a waveguide  
   b. Acts as a buffer to protect a microwave oscillator from variations in the load changes  
   c. Shields UHF circuits from RF transmitter  
   d. Both a and b

515. What is the effective earth’s radius when Ns=300?
   a. 8500 km  
   b. 9320 km  
   c. 5600 km  
   d. 4850 km

516. What is the power level of the largest signal that will still be in the square-law range of a Schottky diode?
   a. -20 dBm  
   b. 0 dBm  
   c. -60 dBm  
   d. -100 dBm

517. A component that combines microwave signals from separate transmission lines into one common transmission line and allows no coupling between the separate lines
   a. Isolator  
   b. Circulator  
   c. Directional coupler  
   d. Combiner

518. Telemetry is a microwave communications system which operates at
   a. 600 MHz  
   b. 3.9 GHz  
   c. 4 GHz  
   d. 2 GHz

519. What is the maximum power that can be obtained from a microwave semiconductor?
   a. 1 W  
   b. 500 mW  
   c. 10 W  
   d. 4 W

520. The cavity magnetron uses strapping to
   a. Prevent mode-jumping
b. Prevent cathode back-heating  
c. Ensure bunching  
d. Improve the phase-focusing effect

521. As a result of reflections from a plane conducting wall, electromagnetic waves acquire an apparent velocity greater than the velocity of light in space. This is called the
   a. Velocity of propagation  
   b. Normal velocity  
   c. Group velocity  
   d. Phase velocity

522. Which of the following is a method of modulating digital signals onto a microwave carrier?
   a. FSK  
   b. Biphase  
   c. Quadraphase  
   d. All of the above

523. Suppose that the transmitter and receiver towers have equal height. How high would they have to be to communicate over a distance of 34 km?
   a. 23.5 m  
   b. 28.47 m  
   c. 17m  
   d. 8.47 m

524. In microwave communications system, for a carrier frequency of 6 GHz and a distance of 40 km, determine the free-space path loss in dB.
   a. 80 dB  
   b. 84.2 dB  
   c. 140 dB  
   d. 144.2 dB

525. A microwave relay repeater that receives the modulated microwave carrier and obtains the baseband signal from it, and them modulates the baseband signal onto another carries and retransmit the new carrier with the baseband modulated onto it
   a. Heterodyne repeater  
   b. Baseband repeater  
   c. RF repeater  
   d. Regenerative repeater

526. Which is the frequency range of the most common industrial microwave relay band?
   a. 6.575-6.875 GHz  
   b. 3.7-4.2 GHz  
   c. 5.925-6.425 GHz  
   d. 10.7-11.7 GHz

527. When a particular mode is excited in a waveguide, there appears an extra electric component, in the direction of propagation. The resulting mode is
   a. Transverse-electric
b. Transverse-magnetic
c. Longitudinal
d. Transverse-electromagnetic

528. Waveguide construction
a. Should not use silver plating
b. Should not use copper
c. Should not have short vertical runs
d. Should not have long horizontal runs

529. In a microwave system, the antenna sees a sky temperature of 120 K, and the antenna feedline has a loss of 3 dB. Calculate the noise temperature of the antenna/feedline system, referenced to the receiver input.
   a. 205 K
   b. 233.33 K
   c. 182 K
   d. 210 K

530. A choke flange may be used to couple two waveguides
a. To help in the alignment of the waveguides
b. Because it is simpler than any other join
c. To compensate for discontinuities at the join
d. To increase the bandwidth of the system

531. A PIN diode is
a. A metal semiconductor point-contact diode
b. A microwave mixer diode
c. Often used a microwave detector
d. Suitable for use as a microwave switch

532. For some applications, circular waveguides may be used preferred to rectangular ones because
a. The smaller cross section needed at any frequency
b. Lower attenuation
c. Freedom from spurious modes
d. Rotation of polarization

533. A circulator
a. Cools dc motors during heavy loads
b. Allows two or more antennas to feed one transmitter
c. Allows one antenna to feed two separate microwave transmitters and receivers at the same time
d. Insulates UHF frequencies on transmission lines

534. What is the free-space loss in dB between two microwave parabolic antennas 38 km apart operating at 7 GHz?
   a. 85.10 dB
   b. 80.90 dB
   c. 140.90 dB
   d. 145.10 dB

535. A ruby maser amplifier must be cooled
a. Because the maser amplification generates a lot of heat
b. To increase bandwidth
   c. **Because it cannot operate at room temperature**
   d. To improve the noise performance

536. The glass tube of a TWT may be coated with aquadag to
   a. Help focusing
   **b. Provide attenuation**
   c. Improve bunching
   d. Increase gain

537. An antenna covering that the transmitted or receives microwave power can pass through, used to protect the antenna and the antenna feed from weather
   a. Shroud
   b. Sub-reflector
   **c. Radome**
   d. Offset antenna

538. Waveguide are
   a. Used exclusively in high frequency power supplies
   b. Ceramic couplers attached to the antenna terminals
   c. High-pass filters used at low radio frequencies
   **d. Hollow metal conductors used to carry high-frequency current**

539. A microwave device which is unlikely to be used a pulsed device. It is based on the principle of operation of a traveling wave tube.
   a. Multicavity klyston
   b. Cross-field amplifier (CFA)
   **c. Backward wave oscillator (BWO)**
   d. Coaxial magnetron

540. A magnetic field is used in the cavity magnetron to
   a. Prevent anode current in the absence of oscillations
   b. Ensure that the oscillations are pulsed
   c. Help in focusing the electron beam thus preventing spreading
   **d. Ensure that the electors will orbit around the cathode**

541. In a micro wave communications system, if the minimum carrier-to-noise (C/N) requirements for a receiver with a 10MHz bandwidth is 22 dB, the minimum receive carrier power is…
   a. -82 dB
   b. 76 dBm
   c. 84 dB
   **d. -82 dBm**

542. A rectangular waveguide used for microwave transmission has a width of 1.4 inches and a height of 0.8 inches. All signals above __ GHz will be passed by the waveguide.
   a. **4.3 GHz**
   b. 2 GHz
   c. 4.2 GHz
A pyramidal horn has an aperture (opening) of 58 mm in the E plane and 78 mm in the H plane. It operates at 14 GHz. Calculate the gain in dBi.

a. 19.29  
b. 24.14  
c. 15.8  
d. 19.31

A magnetron whose oscillating frequency is electronically adjustable over a wide range is called a

a. Coaxial magnetron  
b. Dither-tuned magnetron  
c. Frequency agile magnetron  
d. VTM

Conductance takes place in a waveguide

a. By inter-electron delay  
b. Through electrostatic field reluctance  
c. In the same manner as a transmission line  
d. Through electromagnetic and electrostatic fields in the walls of the waveguide

Indicate the false statement. Klystron amplifiers may use intermediate cavities to

a. Prevent the oscillations that occurs in two-cavity klystrons  
b. Increase the bandwidth of the device  
c. Improve power gain  
d. Increase the efficiency of the klystron

The primary purpose of the helix in a traveling wave tube is to

a. Prevent the electron beam from spreading in the long tube  
b. Reduce the axial velocity of the RF field  
c. Ensure broadband operation  
d. Reduce the noise figure

A microwave device which allows RF energy to pass through in one direction with very little loss, but absorbs RF power in the opposite direction

a. Circulator  
b. Wave trap  
c. Multiplexer  
d. Isolator

A parametric amplifier must be cooled

a. Because parametric amplification generates a lot of heat  
b. To increase bandwidth  
c. Because it cannot operate at room temperature  
d. To improve the noise performance

For low attenuation, the best transmission medium is

a. Flexible waveguide  
b. Ridged waveguide
c. **Rectangular waveguide**
d. Coaxial line

551. What propagation condition is usually indicated when a VHF signal is received from a station 500 miles away?
   a. D-layer absorption
   b. Faraday rotation
   c. **Tropospheric ducting**
   d. Moonbounce

552. How does the bandwidth of the transmitted signal affect selective fading?
   a. **It is more pronounced at wide bandwidths**
   b. It is more pronounced at narrow bandwidths
   c. It is equally pronounced in both narrow and wide bandwidth
   d. The receiver bandwidth determines the selective fading effect

553. How much farther does the radio-path horizon distance exceed the geometric horizon?
   a. **By approximately 15% of the distance**
   b. By approximately twice the distance
   c. By approximately one-half the distance
   d. By approximately four times the distance

554. Determine the dB gain of a receiving antenna which delivers a microvolt signal to a transmission line over that of an antenna that delivers a 2 microvolt signal under identical circumstances.
   a. -6
   b. -3
   c. 6
   d. 3

555. What is transequatorial propagation?
   a. **Propagation between two points at approximately the same distance north and south of the magnetic equator**
   b. Propagation between two points on the magnetic equator
   c. Propagation between two continent by way of ducts along the magnetic equator
   d. Propagation between any two station at the same latitude

556. Knife edge diffraction:
   a. Is the bending of UHF frequency radio waves around a building, mountain or obstruction
   b. Causes the velocity of wave propagation to be different than the original wave
   c. **Both a and b above**
   d. Attenuate UHF signal

557. The average range for VHF communications is
   a. 5 miles
   b. 15 miles
   c. **30 miles**
   d. 100 miles
558. A 500 kHz radiates 500 W of power. The same antenna produces a field strength equal 10 1.5 mV/\text{m}. If the power delivered by the antenna is increased to 1 kW, what would be the expected field intensity?
   a. 3 mV/m
   b. 1.732 mV/m
   c. \textbf{2.12 mV/m}
   d. 1.456 mV/m

559. The earth’s layer is struck by a meteor; a cylindrical region of free electron is formed at what layer of the ionosphere?
   a. F1 layer
   b. \textbf{E layer}
   c. F2 layer
   d. D layer

560. What happens to a radio wave as it travels in space and collides with other particles?
   a. Kinetic energy is given up by the radio wave
   b. Kinetic energy is gained by the radio wave
   c. Aurora is created
   d. Nothing happens since radio waves have no physical substance

561. Find the characteristic impedance of polyethylene, which has a dielectric constant of 2.4.
   a. 163.9 ohms
   b. 377 ohms
   c. \textbf{243 ohms}
   d. 250 ohms

562. What is the maximum range for signals using transequatorial propagation?
   a. About 1000 miles
   b. About 2500 miles
   c. \textbf{About 5000 miles}
   d. About 7500 miles

563. Calculate the electric field intensity in millivolts per meter at 30 kW from a 5 km source.
   a. \textbf{190 mV/m}
   b. 95.49 uV/m
   c. 0.189 W/m
   d. 13.416 V/m

564. What is the index of refraction of a certain substance if light travels through the substance at 100 meters at a time it is 140 meter to air?
   a. 1.183
   b. \textbf{1.4}
   c. 0.714
   d. 0.845

565. What is selective fading?
a. A fading effect caused by small changes in beam heading at the receiving station

b. **A fading caused by phase difference between radio wave components of the same transmission as experienced at the receiving station**

c. A fading caused by large changes in the height of the ionosphere as experienced at the receiving station
d. A fading effect caused by the time difference between the receiving and transmitting stations

566. To what distance is VHF propagation ordinarily limited?
   a. Approximately 100 miles
   b. **Approximately 500 miles**
   c. Approximately 1500 miles
d. Approximately 2000 miles

567. Why does the radio path horizon distance exceed the geometric horizon?
   a. E-layer skip
   b. D-layer skip
   c. Auroral skip
d. **Radio waves may be bent**

568. Determine the effective radiated power of 20kW TV broadcast transmitter whose antenna has a field gain of 2.
   a. 40 kW
   b. **80 kW**
c. 20 kW
d. 10 kW

569. What is the major cause of selective fading?
   a. Small changes in beam heading at the receiving station
   b. Large changes in the height of the ionosphere as experienced in the receiving station
   c. Time difference between the receiving and transmitting station
d. **Phase differences between the radio waves components of the same transmission as experienced in the receiving station**

570. Determine the critical frequency value of an HF signal if its maximum usable frequency is 7050.50 kHz at 35 degrees incidence.
   a. 4936.8 kHz
   b. **5775 kHz**
c. 4044 kHz
d. 4908.75 kHz

571. What is the propagation effect called when phase difference between radio wave components of the same transmission are experienced at the recovery station?
   a. Faraday’s rotation
   b. Diversity reception
c. **Selective fading**
d. Phase shift

572. What is the best time for transequatorial propagation?
573. The dielectric strength of a certain medium is about 2.85 MV/m. What is the maximum power density of an electromagnetic wave in this medium?

a. 23.9 GW/sq m
b. 67.7 GW/sq m
c. **21.5 GW/sq m**
d. 6.86 GW/sq m

574. What is the knife edge diffraction?

a. **Allows normally line-of-sight signals to bend around sharp edges, mountain ridges, building and other obstructions**
b. Arching in sharp bends of conductors
c. Phase angle image rejection
d. Line-of-sight causing distortion to other signals

575. The total power delivered to the radiator of an isotropic antenna is 200,000 W. Determine the power density at a distance of 100 meters.

a. **1.59 W/sq m**
b. 24.49 W/sq m
c. 3.18 W/sq m
d. 244.95 W/sq m

576. The bending of radio waves passing over the top of a mountain range disperse a weak portion of the signal behind the mountain is

a. Eddy-current phase effect
b. **Knife-edge diffraction**
c. Shadowing
d. Mirror refraction effect

577. A radio wave moves from air ($\varepsilon_r=1$) to glass ($\varepsilon_r=7.8$). Its angle of incidence is 20 degrees. What is the angle of refraction?

a. **7 degrees**
b. 29 degrees
c. 10.3 degrees
d. 72.79 degrees

578. A dipole antenna requires to be feed with 20 kW of power to produce a given signal strength available with an input power of 11 kW. What is the dB gain obtained by the use of the reflector? (gain referred to this particular dipole)

a. -2.6 dB
b. **2.6 dB**
c. 5.19 dB
d. -5.19 dB

579. What is a wavefront?

a. A voltage pulse in a conductor
b. A current pulse in a conductor
c. A voltage pulse across a resistor
   d. **A fixed point in an electromagnetic wave**

580. What is meant by referring to electromagnetic waves as having circular polarization?
   a. The electric field is bent into a circular shape
   b. **The electric field rotates**
   c. The electromagnetic wave continues to circle the earth
   d. The electromagnetic wave has been generated by a quad antenna

581. An automobile travels at 90 km/h, find the time between fades if the car uses a cellphone at 800 MHz
   a. 11.2 ms
   b. 15 ms
   c. **7.5 ms**
   d. 4.7 ms

582. When the electric field is parallel to the surface of the earth, what is the polarization of the electromagnetic wave?
   a. Vertical
   b. **Horizontal**
   c. Circular
   d. Elliptical

583. At what speed do electromagnetic waves travel in space?
   a. **Approximately 300 million meters per second**
   b. Approximately 468 million meters per second
   c. Approximately 186, 300 feet per second
   d. Approximately 300 million miles per second

584. The maximum number of free electrons in a certain ionospheric layer is $3.256 \times 10^{13}$ per cu m. the critical frequency is
   a. **51.355 MHz**
   b. 17.118 MHz
   c. 34.237 MHz
   d. 5.706 MHz

585. What are electromagnetic waves?
   a. Alternating currents in the core of an electromagnet
   b. A wave consisting of two electric fields at right angles to each other
   c. **A wave consisting of an electric field and a magnetic field at right angles to each other**
   d. A wave consisting of two magnetic fields at right angles to each other

586. When the electric field is perpendicular to the surface of the earth, what is the polarization of the electromagnetic wave?
   a. Circular
   b. **Vertical**
   c. Horizontal
   d. Elliptical
587. Determine the refractive index of an ionospheric layer with $1.567 \times 10^6$ free electrons per cu m. The frequency of the radio wave is 32 kHz.
   a. 0.999  
   b. **0.936**  
   c. 0.956  
   d. 0.987

588. What is meant by electromagnetic waves as horizontally polarized?
   a. The electric field is parallel to the earth  
   b. The magnetic field is parallel to the earth  
   c. Both the electric and magnetic field are horizontal  
   d. Both the electric and magnetic field are vertical

589. Why do electromagnetic waves not penetrate a good conductor to any great extent?
   a. The electromagnetic field induces currents in the insulator  
   b. The oxide on the conductor surface acts as a shield  
   c. **Because of eddy currents**  
   d. The resistivity of the conductor dissipates the field

590. A transmitter has a power output of 250 W at a carrier frequency of 325 MHz. It is connected to an antenna with a gain of 12 dBi. The receiving antenna is 10 km away and has a gain of 5 dBi. Calculate the power delivered to the receiver, assuming free-space propagation. Assume that there are no losses or mismatches in the system.
   a. 404 nW  
   b. 2.04 nW  
   c. 960 nW  
   d. **680 nW**

591. What is the frequency to use for skywave propagation if the critical frequency is 15 MHZ and the angle of radiation is 60 degrees?
   a. 17.32 MHz  
   b. 30 MHz  
   c. **25.5 MHz**  
   d. 14.722 MHz

592. When the magnetic field is parallel to the surface of the earth, what is the polarization of the electromagnetic field?
   a. Circular  
   b. Horizontal  
   c. Elliptical  
   d. **Vertical**

593. What is the index of refraction of a certain medium if the velocity of propagation of a radio wave in this medium is $1.527 \times 10^8$ m/s?
   a. **0.509**  
   b. 0.631  
   c. 0.713  
   d. 1.965
594. When the magnetic field is perpendicular to the surface of the earth, what is the polarization of the electromagnetic field?
   a. Circular
   b. Horizontal
   c. Elliptical
   d. Vertical

595. Frequencies most affected by knife-edge refraction are
   a. Low and medium frequencies
   b. High frequencies
   c. Very high and ultra high frequencies
   d. 100 kHz to 3 MHz

596. The ionosphere causes radio signals to be
   a. Diffused
   b. Absorbed
   c. Refracted
   d. Reflected

597. To increase the transmission distance of a UHF signal, which of the following should be done?
   a. Increase antenna gain
   b. Increase antenna height
   c. Increase transmitter power
   d. Increase receiver sensitivity

598. A receiver-transmitter station used to increase the communications range of VHF, UHF and microwave signals is called a(an)
   a. Transceiver
   b. Remitter
   c. Repeater
   d. Amplifier

599. A taxi company uses a central dispatcher with an antenna at the top of a 25 m tower, to communicate with the taxicabs. The taxi antennas are on the roofs of the cars, approximately 1.5 m above the ground. Calculate the maximum communication distance between the dispatcher and a taxi.
   a. 25.7 km
   b. 8.8 km
   c. 21 km
   d. 10.1

600. Microwave propagate by means of
   a. Direct wave
   b. Sky wave
   c. Surface wave
   d. Standing wave

601. What do you call the speed of sound in the study of acoustics?
   a. Rhythm
   b. Tempo
c. Pitch
d. Frequency

602. The term that describes the highness or lowness of a sound in the study of acoustics is called a
   a. Tempo
   b. **Pitch**
   c. Volume
   d. Bass

603. The method of measuring absorption coefficient of sound which considers all angles of incidence is called
   a. Distance method
   b. Bounce back to back method
   c. Impedance method
   d. **Reverberation chamber method**

604. The tendency of a sound energy to spread
   a. Rarefaction
   b. Reflection
   c. Refraction
   d. **Diffraction**

605. _____ is the advantage rate of transmission of sound energy in a given direction through a cross-sectional area of 1 sq m at right angles to the direction of propagation.
   a. Sound pressure
   b. **Sound intensity**
   c. Pressure variation
   d. Loudness

606. The unit of pitch
   a. Decibel
   b. Phon
   c. **mel**
   d. Sone

607. a large speaker having a large diameter(15 cm and above)
   a. coaxial speaker
   b. **woofer**
   c. tweeter
   d. triaxial speaker

608. A method of expressing the amplitude of a complex non-periodic signal such as speech
   a. Frequency
   b. Wavelength
   c. **Volume**
   d. Pitch

609. The lowest frequency produced by an instrument
   a. Harmonic
b. Fundamental
c. Midrange
d. 0 Hz

610. Sound intensity is given as
a. df/dp
b. dE/dP
c. dA/dP
d. dP/dA

611. Which of the following is considered the most commonly used measurable components of sound?
a. its temperature
b. particle displacement
c. softness
d. source

612. _____ is the transmission of sound from one room to an adjacent room thru common walls, floors, or ceilings.
a. Reverberation
b. Refraction
c. Flanking transmission
d. Reflection

613. The midrange frequency range of sound is from
a. 256 to 2048 Hz
b. 2048 to 4096 Hz
c. **512 to 2048 Hz**
d. 16 to 64 Hz

614. Designates the sensation of low or high in the sense of the bass and treble
a. Frequency
b. Intensity
c. **Pitch**
d. SPL

615. Speaker is a device that
a. Converts current variations into sound waves
b. None of these
c. Converts electrical energy to mechanical energy
d. Converts sound waves into current and voltage

616. One-hundred twenty microbars of pressure variation is equal to
a. 120 dBSPL
b. **115.56 dBSPL**
c. 41.58 dBSPL
d. 57.78 dBSPL

617. An instrument for recording waveforms of audio frequency
a. Oscilloscope
b. **Phonoscope**
c. Radioscope
d. Audioscope

618. In the study of acoustics, the velocity of sound is dependent to one of the following:
   a. Temperature
   b. Loudness
   c. Source of sound
   d. **Properties of the medium**

619. How much bigger in storage capacity has digital video disk (DVD) have over the conventional compact disk (CD)?
   a. Around triple
   b. **Around 15 times**
   c. Around twice
   d. Around 5 times

620. A sound intensity that could cause painful sensation in a human ear
   a. Threshold of sense
   b. **Threshold of pain**
   c. Hearing threshold
   d. Sensation intensity

621. A car horn outdoors produces a sound intensity of 90 dB at 10 ft away. At this distance, what is the sound power in watt?
   a. 12 W
   b. **0.12 W**
   c. 0.012 W
   d. 1.2 W

622. Noise reduction system for film sound in movie
   a. **Dolby**
   b. dBx
   c. dBA
   d. dBk

623. Which type of microphone operates on the principle that the electrical resistance of carbon granules varies as the pressure on the granules vary?
   a. Dynamic
   b. Crystal
   c. **Carbon**
   d. Ribbon-type

624. A unit of noisiness related to the perceived noise level
   a. Noy
   b. Sone
   c. dB
   d. Mel

625. Required time for a sound to decay to 60 dB
   a. Echo time
   b. Delay time
   c. **Reverberation time**
626. If the distance between the listener and the source of the sound is doubled, the intensity is reduced to
   a. $1/2$
   b. $1/3$
   c. $2/3$
   d. $1/4$

627. Positioning a loudspeaker near a wall can dramatically alter its frequency response in two distinct ways namely
   a. Gump and dump
   b. **Hump and notch**
   c. Fade and gone
   d. Bad and worst

628. An effect that occurs in the ear where a louder sound can reduce or even stop the nerve voltage generated by a weaker sound
   a. Piezoelectric effect
   b. Doppler effect
   c. Haas effect
   d. **Masking**

629. When the average absorption is greater than 0.2, ____ formula is used to compute the actual reverberation time.
   a. Sabine
   b. Stephen and bate
   c. **Norris-Eyring**
   d. Notch

630. The minimum sound intensity that can be heard
   a. Threshold of feeling
   b. Threshold of pain
   c. Threshold of sensation
   d. **Threshold of hearing**

631. The ____ of a sound is a subjective effect which is a function of the ear and brain.
   a. Pitch
   b. Frequency
   c. Timbre
   d. **Loudness**

632. A term which is subjective but independent mainly on frequency and also affected by intensity
   a. **Pitch**
   b. Frequency
   c. Timbre
   d. Loudness

633. A sound of 18 kHz frequency has a wavelength of
   a. **18.3 mm**
634. At a sensation level of 40 dB 1000 Hz tone is
   a. 1000 mels
   b. 10000 mels
   c. 250 mels
   d. 800 mels

635. What is the velocity of sound in dry air for a temperature change of 45 degrees Celsius?
   a. 249.19 m/s
   b. 331.45 m/s
   c. 357.73 m/s
   d. 358.77 m/s

636. What is the resonant frequency of a Helmholtz resonator whose volume is 2.5 cu m with neck radius of 8 cm?
   a. 13 Hz
   b. 11 Hz
   c. 15 Hz
   d. 14 Hz

637. 40 phons is equivalent to how many sones?
   a. 0 sone
   b. 1 sone
   c. 0.5 sone
   d. 16 sones

638. 80 phons + 80 phons =
   a. 83 phons
   b. 160 phons
   c. 90 phons
   d. 86 phons

639. An early reflection of sound
   a. Echo
   b. Reverberation
   c. Pure sound
   d. Jitter

640. An instrument designed to measure a frequency weighted value of the sound pressure level
   a. Sound level meter
   b. Transducer
   c. Sound pressure meter
   d. Sound analyzer

641. The term used for the deafness of higher frequencies due to old age
   a. Ear deafness
   b. Cortial deafness
c. Tinnitus
d. **Presbycusis**

642. What is the dBSPL of an auditorium with contemporary music?
   a. **95-100 dB**
   b. 40-50 dB
c. 50-60 dB
d. 70-80 dB

643. What principle is used by a carbon type microphone?
   a. Variable capacitance
   b. **Variable resistance**
c. Variable inductance
d. Piezoelectric effect

644. Pressure is measured in terms of Pascal, microbar or
   a. Newtons
   b. Newtons per meter
   c. **Newtons per meter squared**
d. Pascal per meter squared

645. How much power can a human voice possibly produce
   a. 100 milliwatts
   b. 1 watt
c. 10 watts
d. **1 milliwatt**

646. What is the increase in sound pressure level if the pressure is doubled?
   a. **Increase by 6 dB**
   b. Increase by 3 dB
c. Decrease by 6 dB
d. Decrease by 3 dB

647. The frequency limits of audio frequency is
   a. 300-3000 Hz
   b. **20 Hz -20 kHz**
c. 3 – 3 kHz
d. 40 –40 kHz

648. A device that converts sound pressure into electrical energy
   a. **Microphone**
   b. Headphone
c. Headset
d. Speaker

649. An agreed set of empirical curves relating octave-band sound pressure level to
   the center frequency of the octave bands
   a. C-message weighting curve
   b. Psophometric curve
c. **Noise rating curve**
d. F1A weighting curves

650. Pure tone of sound used as standard on testing
a. 1 kHz
b. 300-3400 Hz
c. 100 Hz
d. 800 Hz

651. In the sawtooth waveform for linear scanning the
a. Linear rise is for flyback
b. **Complete cycle includes trace and retrace**
c. Sharp reversal in amplitude produces trace
d. Beam moves faster during trace than retrace

652. With vertical retrace time of 635 us, the number of complete horizontal lines scanned during vertical flyback is
a. 10
b. 20
c. 30
d. 63

653. One-half line spacing between the start positions for scanning even and odd fields produces
a. Linear scanning
b. Linear pairing
c. Fishtailing
d. **Exact interlacing**

654. In facsimile transmission, if the drum diameter is 60 mm and scanning pitch is 0.1 mm, calculate the index of cooperation using IEEE recommendation.

a. **1885**
b. 600
c. 1900
d. 984

655. In the interlaced frame, alternate lines are skipped during vertical scanning because the
a. Trace is slower than retrace
b. **Vertical scanning frequency is doubled from the 30-Hz frame rate to the 60-Hz field rate**
c. Horizontal scanning is slower than vertical scanning
d. Frame has the aspect ratio of 4:3

656. With ten percent for horizontal flyback, this time equals
a. 10 us
b. 5 us
c. **6.4 us**
d. 83 us

657. Which of the following is not true?
a. Line pairing indicates poor interlacing
b. People will look tall and thin on square raster on the picture tube screen
c. A person can appear to have one shoulder wider than the other because of nonlinear horizontal scanning
658. The width of a vertical sync pulse with its serrations includes the time of
   a. 6 half lines or 3 lines
   b. Three half lines
   c. Five lines
   d. Five half lines

659. Sawtooth generator circuits produce scanning raster, but the sync pulse are needed for
   a. Linearity
   b. **Timing**
   c. Keystoneing
   d. Line pairing

660. Which of the following frequencies is wrong?
   a. 15, 750 90 Hz for horizontal sync and scanning
   b. 60 Hz for vertical sync and scanning
   c. 31, 500 Hz for equalizing pulses and serrations in the vertical sync pulse
   d. **31, 500 Hz for the vertical scanning frequency**

661. The modulated picture carrier wave includes the composite video signal as the
   a. Average carrier level
   b. **Symmetrical envelope of amplitude variations**
   c. Lower sideband without upper sideband
   d. Upper envelope without the lower envelope

662. Which of the following statements is true?
   a. Negative transmission means the carrier amplitude decrease for black
   b. **Negative transmission means the carrier amplitude decreases for white**
   c. Vestigial sideband transmission means both upper and lower sidebands are transmitted for all modulating frequencies
   d. Vestigial sideband transmission means the modulated picture carrier signal has only the upper envelope

663. With 2 MHz video signal modulating the picture carrier for channel $ (66$ to $72$ MHz), which of the following is transmitted?
   a. 66- MHz carrier and 68-MHz upper side frequency
   b. 71.75 MHz carrier, with 69- and 73- MHz carrier
   c. 67.25-MHz carrier, with 65.25- and 69.25- MHz side frequencies
   d. **67.25 MHz carrier and 69.25 MHz upper side frequency**

664. With 0.5 MHz video signal modulating the picture carrier,
   a. Both upper and lower side frequencies are transmitted
   b. Only the upper side frequency is transmitted
   c. Only the lower side frequency is transmitted
   d. No side frequency are transmitted

665. In all standard television broadcast channels he difference between picture and sound carrier frequencies is
   a. 0.25 MHz
   b. 1.25 MHz
c. 4.5 MHz
d. 6 MHz

666. The difference between sound carrier frequencies in two adjacent channels equals
a. 0.25 MHz
b. 1.25 MHz
c. 4.5 MHz
d. **6 MHz**

667. With 7% black setup, maximum black in picture corresponds to what percent amplitude in the modulated carrier signal?
- a. 5
- b. **68**
- c. 75
- d. 95

668. Line-of-sight transmission is a characteristic of propagation for the
- a. **VHF and UHF bands**
- b. VHF bands but not the UHF band
- c. Low radio frequencies below a MHz
- d. AM picture signal but not the FM sound signal

669. In channel 14, 3.58 MHz color signal is transmitted at the frequency of
- a. 471.25 MHz
- b. 473.25 MHz
- c. **474.83 MHz**
- d. 475.25 MHz

670. The difference between the sound carrier and color subcarrier frequencies is
- a. 4.5 MHz
- b. 1.25 MHz
- c. **0.92 MHz**
- d. 0.25 MHz

671. Brightness variations of the picture information are in which signal?
- a. I
- b. Q
- c. **Y**
- d. R-Y

672. The hue 1800 out of phase with red is
- a. **Cyan**
- b. Yellow
- c. Green
- d. Blue

673. Greater peak-to-peak amplitude of the 3.58-MHz chrominance signal indicates more
- a. White
- b. Yellow
- c. Hue
d. Saturation
674. The interesting beat frequency of 920 kHz is between the 3.58-MHz color subcarrier and
   a. 4.5-MHz intercarrier sound
   b. Picture carrier
   c. Lower adjacent sound
   d. Upper adjacent picture
675. The hue of color sync phase is
   a. Red
   b. Cyan
   c. Blue
   d. Yellow-green
676. Which signal has color information for 1.5 MHz bandwidth?
   a. I
   b. Y
   c. R - Y
   d. B – Y
677. Which of the following is false?
   a. I video hues are orange or cyan
   b. The transmitter matrix output includes Y, I and Q video
   c. A three-gun picture tube can serve as a matrix
   d. A full saturated color is mostly white
678. The color with the most luminance is
   a. Red
   b. Yellow
   c. Green
   d. Blue
679. What is the hue of the color 90 degrees leading sync burst phase?
   a. Yellow
   b. Cyan
   c. Blue
   d. Orange
680. The average voltage value of the 3.58 MHZ modulated chrominance signal is
   a. Zero for most colors
   b. Close to black for yellow
   c. The brightness of the color
   d. The saturation of the color
681. The IF value for the color in receivers, for any station, is
   a. 0.5 MHz
   b. 1.5 MHz
   c. 3.58 MHz
   d. 4.5 MHz
682. If the 3.58 MHz C amplifier in the receiver does not operate, the result will be
   a. No color
b. No red  
c. Too much blue  
d. Too much yellow

683. Which of the following is not tuned to 3.58 MHz?  
a. Burst amplifier  
b. **Video preamplifier**  
c. Chroma amplifier  
d. Color demodulator input

684. When B – Y and Y signal are combined, the result is  
a. **Blue video**  
b. 3.58 MHz chroma  
c. Red video  
d. Green video

685. The phase angle between B – Y and R – Y is  
a. 180°  
b. 57°  
c. 0°  
d. 90°

686. Which of the following applies for a monochrome program?  
a. Chroma amplifier on  
b. Y video amplifier off  
c. **Color killer on**  
d. Picture tube off

687. The manual color control is generally in which circuit?  
a. Red video output  
b. Y video output  
c. **Chroma bandpass amplifier**  
d. R – Y demodulator

688. The contrast control is generally in which circuit  
a. Red video output  
b. **Y video output**  
c. Chroma bandpass amplifier  
d. R – Y demodulator

689. If the color oscillator does not operate, the result will be  
a. No picture  
b. **No color**  
c. Incorrect hues  
d. No color sync

690. The hue of the color sync burst phase is  
a. Red  
b. Blue  
c. Magenta  
d. **Yellow-green**
691. The balance for Y video signals to the three guns in the picture tube is set by the
   a. Drive controls
   b. Contrast control
   c. Screen control
   d. Color control

692. The voltage waveshape in the output of the vertical amplifier is a
   a. Trapezoid
   b. Sawtooth
   c. Rectangle
   d. Square

693. An auto transformer in the vertical output circuit
   a. Steps up voltage for the scanning coils
   b. Isolates the scanning coils for B+ voltage in the primary
   c. Isolates the oscillator and output stages
   d. Does not isolate the secondary from dc voltage in the primary

694. Vertical flyback pulses at the plate of the vertical output tube are for retrace blanking at the picture tube
   a. Cathode
   b. Control grid
   c. Screen grid
   d. Anode

695. The top of the picture is stretched with too much height. To correct this
   a. Vary the vertical hold control
   b. Reduce height with the vertical linearity control
   c. Increase height with the size control
   d. Replace the vertical oscillator tube

696. Peak-to-peak sawtooth scanning current in the vertical coils can be
   a. 0.7 mA
   b. 0.7 A
   c. 50 A
   d. 150 μA

697. A push-pull amplifier in the vertical output circuit
   a. Usually operates class C
   b. Can use PNP and NPN transistor
   c. Cannot be used
   d. Generally uses two beam-power pentodes

698. Which stage is not necessary for producing horizontal output?
   a. Horizontal oscillator
   b. Horizontal amplifier
   c. Damper
   d. Horizontal AFC

699. The frequency of the sawtooth current in the horizontal amplifier is
   a. 60 Hz
b. 10500 Hz
c. 15750 Hz
d. 70 kHz

700. When the horizontal amplifier is conducting peak plate current, the electron scanning beam is at the
   a. Left edge of the raster
   b. Right edge of the raster
   c. Center of trace
   d. Center of flyback

701. The minimum range of radar is primarily determined by
   a. The pulse width and the TR cell recovery time
   b. The ATR cell recovery time
   c. The overall height of the antenna
   d. The peak power output of the radar transmitter

702. Bearing resolution is
   a. The ability to distinguish two target of different distances
   b. The ability to distinguish two target of different elevations
   c. The ability to distinguish two adjacent targets of equal distances
   d. The ability to distinguish two targets of different sizes

703. Find the distance in yards to an object if the display of a radar signal measures 4.4 microseconds.
   a. 380
   b. 328
   c. 722
   d. 656

704. What device is located between the magnetron and the mixer and prevents received signals from entering the magnetron?
   a. TR box
   b. ATR box
   c. RF attenuator
   d. Resonant cavity

705. Where is RF attenuator used in a radar unit?
   a. Between the antenna and the receiver
   b. Between the magnetron and the antenna
   c. Between the magnetron and the AFC section of the receiver
   d. Between the AFC section and klystron

706. What radar circuit determines the pulse repetition rate?
   a. Discriminator
   b. Timer/ synchronizer circuit
   c. Artificial transmission line
   d. Pulse-rate indicator circuit

707. Given the pulse width of 8 microseconds and a duty cycle of 8%, determine the pulse repetition time of a radar system.
   a. 100 us
708. On runway, an ILS localizer shows
   a. Deviation left or right of runway center line
   b. Deviation up or down from ground speed
   c. Deviation percentage from authorized ground speed
   d. Wind speed along runway

709. Range markers are determined by
   a. CRT
   b. Magnetron
   c. **Timer**
   d. Video amplifier

710. The characteristic of the magnetron output pulse that relates to accurate range measurement is its
   a. Amplitude
   b. Decay time
   c. **Rise time**
   d. Duration

711. The minimum range of a radar is determined by
   a. The frequency of the radar transmitter
   b. The pulse repetition rate
   c. **The transmitted pulse width**
   d. The pulse repetition frequency

712. A circuit to develop AFC voltage in a radar receiver is called the
   a. Peak detector
   b. Crystal mixer
   c. Second detector
   d. **Discriminator**

713. The echo box is used for
   a. **Testing and tuning of the radar unit by providing artificial targets**
   b. Testing the wavelength of the incoming echo signal
   c. Amplification of the echo signal
   d. Detection of the echo pulses

714. In a radar unit, the local oscillator is
   a. A hydrogen thyratron
   b. **A klystron**
   c. A pentagrid converter tube
   d. A reactance tube modulator

715. What is the peak power of a radar pulse if the pulse width is 1.0 microsecond, PRR is 900 and the average plate power input is 45 watts?
   a. **50 kW**
   b. 45 kW
   c. 60 kW
d. 62.5 kW

716. Radar uses what form of energy to detect planes, ships and land masses
   a. Sound energy
   b. Visible light
   c. Infrared radiation
   d. **Electromagnetic energy**

717. In a pulse radar system, what component controls the timing throughout the system?
   a. Power supply
   b. **Synchronizer**
   c. Indicator
   d. Receiver

718. What radar measurement of an object is referenced to true north?
   a. Height
   b. **Surface angle**
   c. Vertical angle
   d. One-way distance

719. Surface search radar normally scans how many degrees of azimuth?
   a. 30 degrees
   b. 90 degrees
   c. **360 degrees**
   d. 180 degrees

720. What limits the maximum range of a surface search radar?
   a. Pulse width
   b. Transmitter power
   c. Frequency
   d. **Radar horizon**

721. What IF frequency (ies) is (are) normally used in radar receivers?
   a. **30 or 60 MHz**
   b. 455 kHz
   c. 70 MHz
   d. 10.7 MHz

722. What is the typical frequency range about the center frequency of a tunable magnetron?
   a. **Plus or minus 5 percent**
   b. Plus or minus 10 percent
   c. Plus or minus 15 percent
   d. Plus or minus 8 percent

723. What type of radar provides continuous range, bearing and elevation data on an object?
   a. **Track radar**
   b. Search radar
   c. Pulsed radar
   d. Doppler shift
724. What radio navigation and determines the distance from a transponder beacon by measuring the length of time the radio signal took to travel to the receiver?
   a. Radar
   b. Loran C
   c. Distance marking
   d. **Distance measuring equipment**

725. Which of the following is a feature of an instrument landing system?
   a. The localizer which shows aircraft deviation horizontally from center of runway
   b. The glideslope or glide path which shows vertical altitude of an aircraft during landing
   c. Provides communications to aircraft
   d. **Both a and b**

726. What transmission method does not depend on relative frequency or target motion?
   a. Digital transmission
   b. Frequency modulation
   c. **Pulse modulation**
   d. CW modulation

727. The beat frequency in a swept-frequency transmitter provides what contact information?
   a. Frequency
   b. Travel time
   c. **Range**
   d. Velocity

728. A self-synchronization radar system obtains timing trigger pulses from what source?
   a. **Transmitter**
   b. Echo box
   c. Anti-transmit and receive box
   d. Transmit and receive box

729. In externally-synchronized radar, what determines the PRR of the transmitter?
   a. Synchronizer
   b. **Master oscillator**
   c. Blocking oscillator
   d. Free-running multivibrator

730. Transmitter power readings are most often referenced to what power level?
   a. 1 watt
   b. **1 milliwatt**
   c. 1 microwatt
   d. 1 picowatt

731. What type of radiator normally drives a corner reflector?
   a. **Half-wave**
   b. Despun
c. Isotropic
d. Marconi

732. A monopulse receiver has how many separate channels?
   a. One
   b. Two
   c. Three
   d. Four

733. How many major lobes are produced by a paraboloid reflector?
   a. One
   b. Two
   c. Three
   d. Four

734. The Doppler variation is directly proportional to what radar contact characteristics?
   a. Frequency
   b. Velocity
   c. Range
   d. Travel time

735. What is the simplest type of scanning?
   a. Single lobe scanning
   b. Mechanical scanning
   c. Electronic scanning
   d. Electromechanical scanning

736. What term is used to describe the ability of a radar system to distinguish between targets that are close together?
   a. Target resolution
   b. Bearing resolution
   c. Range resolution
   d. Angular resolution

737. Radar altimeters use what type of transmission signal?
   a. Amplitude modulated
   b. Frequency modulated
   c. Phase modulated
   d. Pulsed modulated

738. Tracking radar searches a small volume of space during which phase of operation?
   a. Scanning
   b. Tracking
   c. Searching
   d. Acquisition

739. How many active elements are contained in a magnetron?
   a. Two
   b. Three
   c. Four
d. Five

740. Transit time might be defined as the time required for
   a. RF energy to travel through the waveguide
   b. A pulse to travel a wavelength inside a waveguide
   c. One cycle of operation to be completed
   d. **Electrons to travel from cathode to anode**

741. On a basic synchro system, the angular information is carried on
   a. Dc feedback signal
   b. **Stator lines**
   c. Deflection coils
   d. Rotor lines

742. What circuit element receives the drive voltage in a radar system’s fiber optic signal transmitter?
   a. Filter capacitor
   b. Load-limiting capacitor
   c. Temperature sensor
   d. **Transistor**

743. For a range of 10 nautical miles, the radar pulse repetition frequency (PRF) should be
   a. **Approximately 8.1 kHz or less**
   b. 900 Hz
   c. 18.1 kHz or more
   d. 120.3 microseconds

744. If the operating radar frequency is 3000 MHz, what is the distance between the waveguide and the spark gaps in older radar units?
   a. 10 cm
   b. 5 cm
   c. **2.5 cm**
   d. 20 cm

745. Ship raster scan radar has a CRT with the following characteristics: 70 pixels per character, 80 character per line, 25 lines per screen and it scans 100 screen per second. What is the minimum required bandwidth for the electron beam control signal?
   a. 210 MHz
   b. 0.21 MHz
   c. 2.1 MHz
   d. **21 MHz**

746. Continuous wave radar is frequency modulated with a 50-Hz sine wave. At the output of the receiver phase detector, a phase delay of 36 degrees is measured. This indicates a target range of
   a. 15 km
   b. 75 km
   c. 150 km
   d. **300 km**
747. A target pulse appears on the CRT 100 microseconds after the transmitted pulse. The target slant range is
   a. 30 km
   b. 93 miles
   c. **15 km**
   d. 15,000 yards

748. A gated LC oscillator operating at 12.5 kHz is being used to develop range markers. If each is converted to a range, the range between markers will be
   a. 120 km
   b. **12 km**
   c. 1.2 km
   d. 210 km

749. What type of tube best meets the requirements of a modulator switching element?
   a. **Thyratron**
   b. Magnetron
   c. Klystron
   d. Phanotron

750. What type of transmitter power is measured over a period of time?
   a. Peak
   b. Return
   c. **Average**
   d. Reciprocal

751. One of the following processes or system best describe an example of a pilot tone system normally use in commercial broadcast FM stations.
   a. Time division
   b. Frequency division
   c. **Stereo multiplex**
   d. QSK

752. What is the maximum transmitting power permitted an amateur station in beacon operation?
   a. 10 W PEP output
   b. **100 W PEP output**
   c. 500 W PEP output
   d. 1500 W PEP output

753. What kind of emission would your FM transmitter produce if its microphone failed to work?
   a. **An unmodulated carrier**
   b. A phase modulated carrier
   c. An amplitude-modulated carrier
   d. A frequency modulated carrier

754. The main function of the RF amplifier in superheterodyne receiver is to
   a. Provide improved tracking
   b. Permits better adjacent channel rejection
c. **Improve the rejection of the image frequency**
d. All of these

755. Local oscillator of a broadcast receiver always tunes to a frequency higher than the incoming frequency in order
a. To help the image frequency rejection
b. To allow easy tracking
c. **To allow adequate frequency coverage without switching**
d. All of these

756. What is the first letter symbol for emission of unmodulated carrier?
   a. A
   b. N
   c. H
   d. F

757. International broadcasting (short wave) uses frequency between _____ in accordance with international agreements.
   a. 7012 and 26100 kHz
   b. 6409 and 26100 kHz
   c. **5950 and 26100 kHz**
   d. 10950 and 26100 kHz

758. Which of the class station below is a regional channel?
   a. Class I-A
   b. Class II-D
   c. **Class III-B**
   d. Class IV

759. The permissible power in kW of stations II-A during nighttime is
   a. **0.25-50**
   b. 10-50
   c. 1-5
   d. None of these

760. A term applied to third and higher order products, which can greatly degrade the performance of a system
   a. **Composite triple beat**
   b. Single dual mode
   c. Field strength
   d. Noise

761. A station similar to a translator station in terms of equipment and service area, but is permitted to originate programming from virtually any source
   a. DME
   b. **LPTV**
   c. HDTV
   d. ITFS

762. MDS means
   a. **Multipoint Distribution Service**
   b. Multipoint Digital Service
c. Multipoint Data Standard  
d. Multipoint Drop Standards

763. What is the channel number of an FM station with 88.1 MHz carrier?  
a. 201  
b. 202  
c. 203  
d. 204

764. If an FM station has an effective radiated power of 100 kW then it is under what class?  
a. Class A  
b. Class B  
c. Class C  
d. Class D

765. What is the range of an AM broadcast frequency tolerance above or below its assigned frequency?  
a. 25 kHz  
b. 20 Hz  
c. 60 kHz  
d. 120 kHz

766. What type of emission is produced when amplitude modulated transmitter is modulated by a television signal?  
a. A3F  
b. F3C  
c. F3F  
d. A3C

767. How would you best describe an example of a pilot tone system used in commercial frequency modulation broadcast radio stations?  
a. Frequency simplex  
b. Time division  
c. Stereo multiplex  
d. QSK

768. What type of emission is produced when a frequency modulated transmitter is modulated by a facsimile signal?  
a. A3F  
b. F3F  
c. A3C  
d. F3C

769. What is the highest assigned carrier frequency for standard AM broadcast?  
a. 107 kHz  
b. 535 kHz  
c. 540 kHz  
d. 1600 kHz

770. One of the following refers to the standard frequency band limits of AM broadcast band.
a. 30-300 MHz  
b. 88-108 MHz  
c. 3-30 MHz  
d. **535-1605 kHz**

771. What do you call the service area of a standard AM broadcast where fading is not allowed?
   a. Secondary
   b. Tertiary
   c. **Primary**
   d. Experimental

772. In basic transmitter, ____ is a kind of transmitter that develops type B emission.
   a. Arc
   b. **Spark**
   c. Alexanderson
   d. High end

773. High speed network as defined by the NTC memorandum circular are network in ICT that have a capacity of at least _______.
   a. **2.048 Mbps**
   b. 3.048 Mbps
   c. 20.48 Mbps
   d. 5.05 Mbps

774. Type of radio communication transmission utilizing frequency modulation technique
   a. Television
   b. Broadcasting in 535-1606 kHz
   c. Single side band HF transmission
   d. **Television Audio**

775. What frequency standard can be used to calibrate the tuning dial of the receiver?
   a. A sweep generator
   b. A deviation meter
   c. A calibrated voltmeter
   d. **Signals from WWV and WWVH**

776. In stereo FM, a 38 kHz subcarrier is used for the L-R signal. It is derive from a pilot subcarrier of
   a. 9.5 kHz
   b. 38 kHz
   c. **19 kHz**
   d. 76 kHz

777. An area characterized to have no interference but with fading or intermittent variations in intensity is ____.
   a. Primary service area
   b. Intermediate service area
778. Where does the FM broadcast band located in the spectrum band?
   a. ELF band
   b. UHF band
   c. HF band
   d. WHF band

779. What is the reason why Frequency modulation is used in the broadcast video recording on tape?
   a. High capacity
   b. Low noise
   c. Compressed bandwidth
   d. Faster recording

780. As part of the KBP Technical Requirement for FM which polarization was not recommended for use?
   a. Horizontal
   b. Vertical
   c. Circular
   d. Elliptical

781. Antenna current, as specified in KBP definitions, is defined as a condition of
   a. No modulation
   b. 80% modulation
   c. 85% modulation
   d. 100% modulation

782. ABS-CBN’s DXAB medium frequency broadcast station operates in …
   a. Luzon
   b. Visaya
   c. Mindanao
   d. Manila

783. International broadcast stations…
   a. Broadcast on shortwave frequencies between 5.95 MHz and 26.1 MHz
   b. Can be operated by both government and private entities
   c. Has transmissions which are intended to be received directly by the general public in foreign countries
   d. Is licensed by the NTC only when operated by private entities

784. Two FM broadcast stations are in Quezon City and another in Manila proper may be authorized to operate with a frequency separation less than 800 kHz.
   a. True
   b. False
   c. Cannot tell
   d. Sometimes

785. For Philippines AM broadcasting, according to standards, the maximum allowed modulation for satisfactory operation
   a. 75%
b. 85%
c. 90%
d. 100%

786. A third symbol radio emission represents telephone transmission including sound broadcasting.
   a. W
   b. F
   c. C
   d. E

787. Which broadcast parameter of the primary FM station is allowed to be changed in the operation of FM broadcast translator?
   a. Frequency
   b. Power
   c. Information content
   d. A and b

788. Input power, as defined by KBP, in the product of the voltage and current at the output of the last radio stage, measured…
   a. At 85% modulation
   b. Without modulation
   c. At 90% modulation
   d. At 100% modulation

789. In determining an antenna’s height above average terrain (HAAT), how many radial directions from the site are involved in the computation?
   a. 4
   b. 8
   c. 12
   d. 16

790. If DZFE 89.7’s antenna height above average terrain (HAAT) is 190 feet, what is the depression angle of the radio horizon?
   a. 0.17°
   b. 0.21°
   c. 0.27°
   d. 0.31°

791. The method of generating FM used by broadcasting station is
   a. Direct
   b. All of these
   c. Indirect
   d. Insertion

792. The maximum power suggested by KBP on 919-1312 AM broadcast station in Metro Manila
   a. 10 kW
   b. 20 kW
   c. 15 kW
   d. 5 kW
793. Production of radiation by transmitting station
   a. Monitoring
   b. Emission
   c. Radiation
   d. Transmission

794. A form of single emission where the degree of carrier suppression enables the carrier to be reconstituted and be used for demodulation.
   a. Half carrier single sideband emission
   b. Full carrier single sideband emission
   c. Reduced carrier single sideband emission
   d. Double sideband emission

795. When does a broadcast station conduct an equipment test?
   a. During day time
   b. At any time
   c. During night time
   d. During experimental period

796. The lowest resistance grounding on earth.
   a. Sand
   b. Limestone
   c. Surface loam soil
   d. Clay

797. The frequency spectrum of the stereophonic FM signal.
   a. 67 kHz
   b. 59.5 kHz – 74.5 kHz
   c. 19 kHz – 38 kHz
   d. 30 kHz -53 kHz

798. What is the maximum color TV bandwidth?
   a. 1.6 MHz
   b. 0.5 MHz
   c. 1.5 MHz
   d. 1.3 MHz

799. A beam antenna has a height of 10 meters over a service area. Determine the beam tilt angle.
   a. 0.088°
   b. 8.8°
   c. 9.2°
   d. 0.9°

800. Listing of the date and time of events, programs, equipment, test, malfunctions, and corrections in communication system.
   a. File
   b. Documentation
   c. Reporting
   d. Log