KENNEDY 4th EDITION
MULTIPLE CHOICES

INTRO TO COMMUNICATIONS SYSTEM

1. In a communications system, noise is most likely to affect the signal

   a. at the transmitter
   b. in the channel
   c. in the information source
   d. at the destination

2. Indicate the *false* statement. Fourier analysis shows that a sawtooth wave consist of

   a. fundamental and subharmonic sine waves
   b. a fundamental sine wave and an infinite number of harmonics
   c. fundamental and harmonic sine waves whose amplitude decreases with the harmonic number
   d. sinusoidal voltages, some of which are small enough to ignore in practice

3. Indicate the *false* statement. Modulation is used to

   a. reduce the bandwidth used
   b. separate differing transmissions
   c. ensure that intelligence may be transmitted over long distances
   d. allow the use of practicable antennas

4. Indicate the *false* statement. From the transmitter the signal deterioration because of noise is usually

   a. unwanted energy
   b. predictable in character
   c. present in the transmitter
   d. due to any cause

5. Indicate the *true* statement. Most receivers conforms to the

   a. amplitude-modulated group
   b. frequency-modulated group
   c. superheterodyne group
   d. tuned radio frequency receiver group

6. Indicate the *false* statement. The need for modulation can best be exemplified by the following.

   a. Antenna lengths will be approximately λ/4 long
   b. An antenna in the standard broadcast AM band is 16,000 ft
   c. All sound is concentrated from 20 Hz to 20 kHz
   d. A message is composed of unpredictable variations in both amplitude and frequency

7. Indicate the *true* statement. The process of sending and receiving started as early as

a. the middle 1930s
b. 1850
c. the beginning of the twentieth century
d. the 1840s

8. Which of the steps is not included in the process of reception?

a. decoding
b. encoding
c. storage
d. interpretation

9. The acoustic channel is used for which of the following?

a. UHF communications
b. single-sideband communication
c. television communications
d. person-to-person voice communications

10. Amplitude modulation is the process of

a. superimposing a low frequency on a high frequency
b. superimposing a high frequency on a low frequency
c. carrier interruption
d. frequency shift and phase shift

NOISE

1. One of the following types of noise becomes of great importance at high frequencies. It is the

   a. shot noise
   b. random noise
   c. impulse noise
   d. transit-time noise

2. 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.

3. The value of a resistor creating thermal noise is doubled. The noise power generator is therefore
   a. halved
   b. quadrupled
   c. doubled
   d. unchanged

4. One of the following is *not* a useful quantity for comparing the noise performance of receivers:

   a. Input noise voltage
   b. Equivalent noise resistance
   c. Noise temperature
   d. Noise figure

5. Indicate the noise whose source is in a category different from that of the other three.

   a. Solar noise
   b. Cosmic noise
   c. Atmospheric noise
   d. Galactic noise

6. Indicate the *false* statement. The square of the thermal noise voltage generated by a resistor is proportional to

   a. its resistance
   b. its temperature
   c. Boltzmann's constant
   d. the bandwidth over which it is measured

7. Which of broad classifications of noise are most difficult to treat?

a. noise generated in the receiver
b. noise generated in the transmitter
c. externally generated noise
d. internally generated noise

8. Space noise generally covers a wide frequency spectrum, but the strongest interference occurs

a. between 8 MHz and 1.43 GHz
b. below 20 Mhz
c. between 20 to 120 MHz
d. above 1.5 GHz

9. When dealing with random noise calculations it must be remembered that

a. all calculations are based on peak to peak values
b. calculations are based on peak values
c. calculations are based on average values
d. calculations are based on RMS values

10. Which of the following is the most reliable measurement for comparing amplifier noise characteristics?

a. signal-to-noise ratio
b. noise factor
c. shot noise
d. thermal noise agitation

11. Which of the following statements is *true*?

a. Random noise power is inversely proportional to bandwidth
b. Flicker is sometimes called *demodulation noise*
c. Noise is mixers is caused by inadequate image frequency rejection
d. A random voltage across a resistance cannot be calculated

AMPLITUDE MODULATION

1. If the plate supply voltage for a plate-modulated class C amplifier is V, the maximum plate-cathode voltage could be almost as high as

a. 4V
b. 3V
c. 2V
d. 1V

2. In a low-level AM system, amplifiers following the modulated stage must be

a. linear devices
b. harmonic devices
c. class C amplifiers
d. nonlinear devices

3. If the carrier of a 100 percent modulated AM wave is suppressed, the percentage power saving will be

a. 50
b. 150
c. 100
d. 66.66

4. Leak-type bias is used in a plate-modulated class C amplifier to

a. prevent tuned circuit damping
b. prevent excessive grid current
c. prevent overmodulation
d. increase the bandwidth

5. The output stage of a television transmitter is most likely to be a

a. plate-modulated class C amplifier
b. grid-modulated class C amplifier
c. screen-modulated class C amplifier
d. grid-modulated class A amplifier

6. The modulation index of an AM wave is changed from 0 to 1. The transmitted power is

a. unchanged
b. halved
c. doubled
d. increase by 50 percent

7. One of the advantages of the base modulation over collector modulation of a transistor class C amplifier is

a. the lower modulating power required
b. higher power output per transistor
c. better efficiency
d. better linearity

8. A carrier is simultaneously modulated by two sine waves with modulation indices of 0.3 and 0.4; the total modulation index

a. is 1
b. cannot be calculated unless the phase relations are known
c. is 0.5
d. is 0.7

9. Amplitude modulation is used for broadcasting because

a. it is more noise immune than other modulation systems.
b. Compared with other systems it requires less transmitting power
c. its use avoids receiver complexity.
d. no other modulation system can provide the necessary bandwidth for high fidelity

10. What is the ratio of modulating power to total power at 100 percent modulation?

a. 1:3
b. 1:2
c. 2:3
d. None of the above

SINGLE-SIDEBAND TECHNIQUES

1. Indicate the *false* statement regarding the advantages of SSB over double sideband, full-carrier AM

a. More channel space is available.
b. Transmitter circuits must be more stable, giving better reception.
c. The signal is more noise-resistant
d. Much less power is required for the same signal strength

2. When the modulation index of an AM wave is doubled, the antenna current is also doubled. The AM system being used is

a. Single-sideband, full carrier (H3E)
b. Vestigial sideband (C3F)
c. Single-sideband, suppressed carrier (J3E)
d. Double-sideband, full carrier (A3E)

3. Indicate which one of the following advantages of the phase cancellation method of obtaining SSB over the filter method is *false*:

a. Switching from one sideband to the other is simpler.
b. It is possible to generate SSB at any frequency.
c. SSB with lower audio frequencies present can be generated
d. There are more balanced modulators; therefore the carrier is suppressed better.

4. The most commonly used filters in SSB generation are

a. mechanical
b. RC
c. LC
d. low-pass

5. In an SSB transmitter, one is most likely to find a

a. class C audio amplifier
b. tuned modulator
c. class B RF amplifier
d. class A RF output amplifier

6. Indicate in which one of the following only one sideband is transmitted.

a. H3E
b. A3E
c. B8E
d. C3F

7. One of the following *cannot* be used to remove the unwanted sideband in SSB. This is the

a. filter system
b. phase-shift method
c. third method
d. balanced modulator

8. R3E modulation is sometimes used to

a. allow the receiver to have a frequency synthesizer
b. simplify the frequency stability problem in reception
c. reduce the power that must be transmitted
d. reduce the bandwidth required for transmission

9. To provide two or more voice circuits with the same carrier, it is necessary to use

a. ISB
b. carrier insertion
c. SSB with pilot carrier
d. Lincompex

10. Vestigal sideband modulation (C3F) is normally used for

a. HF point-to-point communications
b. monoaural broadcasting
c. TV broadcasting
d. stereo broadcasting

FREQUENCY MODULATION

1. In the stabilize reactance modulator AFC system,
   a. the discriminator must have a fast time constant to prevent demodulation
   b. the higher the discriminator frequency, the better the oscillator frequency stability
   c. the discriminator frequency must not be too low, or the system will fail
   d. phase modulation is converted into FM by the equalizer circuit

2. In the spectrum of a frequency-modulated wave
   a. the carrier frequency disappears when the modulation index is large
   b. the amplitude of any sideband depends on the modulation index
   c. the total number of sidebands depends on the modulation index
   d. the carrier frequency cannot disappear

3. The difference between phase and frequency modulation
   a. is purely theoretical because they are the same in practice
   b. is too great to make the two system compatible
   c. lies in the poorer audio response of phase modulation
   d. lies in the different definitions of the modulation index

4. Indicate the *false* statement regarding the Armstrong modulation system
   a. The system is basically phase, not frequency modulation,
   b. AFC is not needed, as crystal oscillator is used.
   c. Frequency multiplication must be used.
   d. Equalization is unnecessary

5. An FM signal with a modulation index m_f is passed through a frequency tripler. The wave in the output of the tripler will have a modulation index of
   a. $m_f/3$
   b. m_f
   c. **$3m_f$**
   d. $9m_f$

6. An FM signal with a deviation δ is passed through a mixer, and has its frequency reduced fivefold. The deviation in the output of the mixer is
   a. 5δ
   b. Indeterminate
   c. $\delta/5$
   d. δ

7. A pre-emphasis circuit provides extra noise immunity by
   a. boosting the bass frequencies
   b. amplifying the higher audio frequencies
   c. preamplifying the whole audio band
   d. converting the phase modulation to FM

8. Since noise phase-modulates the FM wave, as the noise sideband frequency approaches the carrier frequency, the noise amplitude
   a. remains constant
   b. is decreased
   c. is increased
   d. is equalized

9. When the modulating frequency is doubled, the modulation index is halved, and the modulating voltage remains constant. The modulation system is
   a. amplitude modulation
   b. phase modulation
   c. frequency modulation
   d. any of the three

10. Indicate which one of the following is *not* an advantage of FM over AM:
   a. Better noise immunity is provided
   b. Lower bandwidth is required
   c. The transmitted power is more useful
   d. Less modulating power is required

11. One of the following is an indirect way of generating FM. This is the
   a. reactance FET modulator
   b. varactor diode modulator
   c. Armstrong modulator
   d. reactance bipolar transistor modulator

12. In an FM stereo multiplex transmission, the
   a. sum signal modulates 19 kHz subcarrier
   b. difference signal modulates the 19 kHz subcarrier
   c. difference signal modulates the 38 kHz subcarrier
   d. difference signal modulates the 67 kHz subcarrier

RADIO RECEIVERS

1. Indicate which of the following statements about the advantages of the phase discriminator over the slope detector is *false*:

a. Much easier alignment
b. Better linearity
c. Greater limiting
d. Fewer tuned circuits

2. Show which of the following statements about the amplitude limiter is *untrue*:

a. The circuit is always biased in class C, by virtue of the leak-type bias.
b. When the input increases past the threshold of the limiting, the gain decreases to keep the output constant.
c. The output must be tuned
d. Leak-type bias must be used

3. In a radio receiver with simple AGC

a. an increase in signal strength produces more AGC
b. the audio stage gain is normally controlled by the AGC
c. the faster the AGC time constant the more accurate the output
d. the highest AGC voltage is produced

4. In a broadcast superheterodyne receiver, the

a. local oscillator operates below the signal frequency
b. mixer input must be tuned to the signal frequency
c. local oscillator frequency is normally double the IF
d. RF amplifier normally works at 455 kHz above the carrier frequency

5. To prevent overloading of the IF amplifier in a receiver, one should use

a. squelch
b. variable sensitivity
c. variable selectivity
d. double conversion

6. A superheterodyne receiver with an IF of 450 kHz is tuned to a signal at 1200 kHz. The image frequency is

a. 750 kHz
b. 900 kHz
c. 1650 kHz
d. 2100 kHz

7. In a ratio detector

a. the linearity is worse than in phase discriminator
b. stabilization against signal strength variations is provided
c. the output is twice that obtainable from a similar phase discriminator
d. the circuit is the same as in a discriminator, except that the diodes are reversed

8. The typical squelch circuit cuts off

a. an audio amplifier when the carrier is absent
b. RF interference when the signal is weak
c. An IF amplifier when the AGC is maximum
d. An IF amplifier when the AGC is minimum

9. Indicate the *false* statement in connection with communications receivers.

a. The noise limiter cuts off the receiver's output during a noise pulse.
b. A product demodulator could be used for the reception of Morse code.
c. Double conversion is used to improve image rejection
d. Variable sensitivity is used to eliminate selective fading

10. The controlled oscillator synthesizer is sometimes preferred over the direct one because

a. it is a simpler piece of equipment
b. its frequency stability is better
c. it does not require crystal oscillator
d. it is relatively free of spurious frequency

11. The frequency generated by each decade in a direct frequency synthesizer is much higher than the frequency shown; this is done to

a. reduce the spurious frequency problem
b. increase the frequency stability of the synthesizer
c. reduce the number of decades
d. reduce the number of crystals required

12. Indicate which of the following circuits could *not* demodulate SSB:

a. Balance modulator
b. Product modulator
c. BFO
d. Phase discriminator

13. If a FET is used as the first AF amplifier in a transistor receiver, this will have the effect of

a. improving the effectiveness of the AGC
b. reducing the effect of negative-peak clipping
c. reducing the effect of noise at low modulation depths
d. improving the selectivity of the receiver

14. Indicate the *false* statement. The superheterodyne receiver replaced the TRF receiver because the latter suffered from

a. gain variation over the frequency coverage range
b. insufficient gain and sensitivity
c. inadequate selectivity at high frequencies
d. instability

15. 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 be the IF tuned circuits
d. is independent of the frequency to which the receiver is tuned

16. One of the main functions of the RF amplifier in a superheterodyne receiver is to

a. provide improved tracking
b. permit better adjacent-channel rejection
c. increase the tuning range of the receiver
d. improve the rejection of the image frequency

17. A receiver has poor IF selectivity. It will therefore also have poor

a. blocking
b. double-spotting
c. diversion reception
d. sensitivity

18. Three-point tracking is achieved with

a. variable selectivity
b. the padder capacitor
c. double spotting
d. double conversion

19. The local oscillator of a broadcast receiver is tuned to a frequency higher than the incoming frequency

a. to help the image frequency rejection
b. to permit easier tracking
c. because otherwise an intermediate frequency could not be produced
d. to allow adequate frequency coverage without switching

20. If the intermediate frequency is very high (indicate *false* statement)

a. image frequency rejection is very good
b. the local oscillator need not be extremely stable
c. the selectivity will be poor
d. tracking will be improved

21. A low ratio of the ac to the dc load impedance of a diode detector results in

a. diagonal clipping
b. poor AGC operation
c. negative-peak clipping
d. poor AF response

22. One of the following *cannot* be used to demodulate SSB:

a. Product detector
b. Diode Balance modulator
c. Bipolar transistor balanced modulator
d. Complete phase-shift generator

23. Indicate the *false* statement. Noting that no carrier is transmitter with J3E, we see that

a. the receiver cannot use a phase comparator for AFC
b. adjacent-channel rejection is more difficult
c. production of AGC is a rather complicated process
d. the transmission is not compatible with A3E

24. When a receiver has good blocking performance, this means that

a. it does not suffer from double-spotting
b. its image frequency rejection is poor
c. it is unaffected by AGC derived from nearby transmissions
d. its detector suffers from burnout

25. An AM receiver uses a diode detector for demodulation. This enables it satisfactorily to receive

a. single-sideband, suppressed-carrier
b. single-sideband, reduced-carrier
c. ISB
d. Single-sideband, full-carrier

TRANSMISSION LINES

1. Indicate the *false* statement. The SWR on a transmission line is infinity; the line is terminated in

a. a short circuit
b. a complex impedance
c. an open circuit
d. a pure reactance

2. A (75-*j*50)-Ω is connected to a coaxial transmission line of Z_O = 75 Ω, 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
d. a short-circuited stub at some specific distance from the load

3. The velocity factor of a transmission line

a. depends on the dielectric constant of the material used
b. increases the velocity along the transmission line
c. is govern by the skin effect
d. is higher for a solid dielectric than for air

4. Impedance inversion may be obtained with

a. a short-circuited stub
b. an open-circuited stub
c. a quarter-wave line
d. a half-wave line

5. Short-circuited stubs are preferred to open-circuited stubs because the latter are

a. more difficult to make an connect
b. made of a transmission line with a different characteristic impedance
c. liable to radiate
d. incapable of giving a full range of reactances

6. For transmission-line load matching over a range of frequencies, it is best to use a

a. balun
b. broadband directional coupler
c. double stub
d. single stub of adjustable position

7. The main disadvantage of the two-hole directional coupler is

a. low directional coupling
b. poor directivity
c. high SWR
d. narrow bandwidth

8. To couple a coaxial line to a parallel-wire line, it is best to use a

a. slotted line
b. balun
c. directional coupler
d. quarter-wave transformer

9. Indicate the three types of transmission line energy losses.

a. I^2R, R_L, and temperature
b. Radiation, I^2R, and dielectric heating
c. Dielectric separation, insulation breakdown, and radiation
d. Conductor heating, dielectric heating, and radiation resistance.

10. Indicate the *true* statement below. The directional coupler is

a. a device used to connect a transmitter to a directional antenna
b. **a coupling device for matching impedance**
c. a device used to measure transmission line power
d. an SWR measuring instrument

RADIATION AND PROPAGATION OF WAVES

1. Indicate which one of the following terms applies to troposcatter propagation:

a. SIDs
b. Fading
c. Atmospheric storms
d. Faraday rotation

2. VLF waves are used for some type of services because

a. of the low powers required
b. the transmitting antennas are of convenient size
c. they are very reliable
d. the penetrate the ionosphere easily

3. Indicate which of the following frequencies *cannot* be used for reliable beyond-the-horizon terrestrial communications without repeaters:

a. 20 kHz
b. 15 MHz
c. 900 MHz
d. 12 GHz

4. High-frequency waves are

a. absorbed by the F_2 layer
b. reflected by the *D* layer
c. capable of use for long-distance communications on the moon
d. affected by the solar cycle

5. Distances near the skip distance should be used for the sky-wave propagation

a. to avoid tilting
b. to prevent sky-wave and upper ray interference
c. to avoid the Faraday effect
d. so as nor to exceed the critical frequency

6. A ship-to-ship communications system is plagued by fading. The best solution seems to be use of

a. a more directional antenna
b. a broadband antenna
c. frequency diversity
d. space diversity

7. A range of microwave frequencies more easily passed by the atmosphere than are the others is called a

a. window
b. critical frequency
c. gyro frequency range
d. resonance in the atmosphere

8. Frequencies in the UHF range normally propagate by means of

a. ground waves
b. sky waves
c. surface waves
d. space waves

9. Tropospheric scatter is used with frequencies in the following range:

a. HF
b. VHF
c. UHF
d. VLF

10. The ground wave eventually disappears, as one moves away from the transmitter, because of

a. interference from the sky wave
b. loss of line-of-sight conditions
c. maximum single-hop distance limitation
d. tilting

11. In electromagnetic waves, polarization

a. is caused by reflection
b. is due to the transverse nature of the waves
c. results from the longitudinal nature of the waves
d. is always vertical in an isotropic medium

12. As electromagnetic waves travel in free space, only one of the following can happen to them:

a. absorption
b. attenuation
c. refraction
d. reflection

13. The absorption of radio waves by the atmosphere depends on

a. their frequency
b. their distance from the transmitter
c. the polarization of the waves
d. the polarization of the atmosphere

14. Electromagnetic waves are refracted when they

a. pass into a medium of different dielectric constant
b. are polarized at right angles to the direction of propagation
c. encounter a perfectly conducting plane
d. pass through a small slot in a conducting plane

15. Diffraction of electromagnetic waves

a. is caused by reflections from the ground
b. arises only with spherical wavefronts
c. will occur when the waves pass through a large slot
d. may occur around the edge of a sharp obstacle

16. When microwave signals follow the curvature of the earth, this is known as

a. the Faraday effect
b. ducting
c. tropospheric scatter
d. ionospheric reflection

17. Helical antennas are often used for satellite tracking at VHF because of

a. troposcatter
b. superrefraction
c. ionospheric refraction
d. the Faraday effect

ANTENNAS

1. An ungrounded antenna near the ground

   a. acts as a single antenna of twice the height
   b. is unlikely to need a ground screen
   c. acts as an antenna array
   d. must be horizontally polarized

2. One of the following consists of nonresonant antennas:

   a. The rhombic antenna
   b. The folded dipole
   c. The end-fire array
   d. The broadside array

3. 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

4. Which of the following antennas is best excited from a waveguide?

   a. Biconical
   b. Horn
   c. Helical
   d. Discone

5. Indicate which of the following reasons for using a counterpoise with antenna is *false*:

   a. Impossibility of a good ground connection
   b. Protection of personnel working underground
   c. Provision of an earth for the antenna
   d. Rockiness of the ground

6. 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

7. Indicate the antenna that is *not* widebandL:

   a. Discone
   b. Folded Dipole
   c. Helical
   d. Marconi

8. Indicate which one of the following reasons for the use of a ground screen 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

9. Which one of the following terms does *not* apply to the Yagi-Uda array?

a. Good bandwidth
b. Parasitic elements
c. Folded dipole
d. High gain

10. An antenna that is currently polarized us the

a. helical
b. small circular loop
c. parabolic reflector
d. Yagi-Uda

11. The standard reference antenna for the directive gain is the

a. infinitesimal dipole
b. isotropic antenna
c. elementary doublet
d. half-wave dipole

12. Top loading is sometimes used with an antenna in order to increase its

a. effective height
b. bandwidth
c. beamwidth
d. input capacitance

13. 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

14. Zoning is used with a dielectric antenna in order to

a. reduce the bulk of the lense
b. increase the bandwidth of the lens
c. increase pin-point focusing
d. correct the curvature of the wavefront from a horn that is too short

15. A helical antenna is used for satellite tracking because of its

a. circular polarization
b. maneuverability
c. broad bandwidth
d. good front-to-back ratio

16. The discone antenna is

a. useful direction-finding antenna
b. used as a radar receiving antenna
c. circularly polarized like other circular antennas
d. useful as UHF receiving antennas

17. One of the following is *not* an omnidirectional antenna:

a. Half-wave dipole
b. Log-periodic
c. Discone
d. Marconi

WAVEGUIDES, RESONATORS AND COMPONENTS

1. When an electromagnetic waves are propagated in a waveguide

   a. they travel along a broader walls of the guide
   b. they are reflected from the walls but do not travel along them
   c. they travel through the dielectric without touching the walls
   d. they travel along all four walls of the waveguide

2. Waveguides are used mainly for microwave signals because

   a. they depend on straight-line propagation which applies to microwaves only
   b. losses would be too heavy at lower frequencies
   c. there are no generators powerful enough to excite them at lower frequencies
   d. they would be too bulky at lower frequencies

3. The wavelength of a wave in a waveguide

   a. is greater than of free space
   b. depends only on the waveguide dimensions and the free-space wavelength
   c. is inversely proportional to the phase velocity
   d. is directly propotional to the group velocity

4. The main difference between the operation of transmission lines and waveguides is that

   a. the latter are not distributed, like transmission lines
   b. the former can use stubs and quarter-wave transformers, unlike the latter
   c. transmission lines use the principal mode of propagation, and therefore do not suffer from low-frequency cut-off
   d. terms such as *impedance matching* and *standing-wave ratio* cannot be applied to waveguides

5. Compared with equivalent transmission lines, 3-GHz waveguides (indicate *false* statement)

   a. are less lossy
   b. can carry higher powers
   c. are less bulky
   d. have lower attenuation

6. When a particular mode is excited in a waveguide, three 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

7. When electromagnetic waves are reflected at an angle from a wall, their wavelength along the wall is

a. the same as in free space
b. the same as the wavelength perpendicular to the wall
c. shortened because of Doppler effect
d. greater than in the actual direction of propagation

8. 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

9. Indicate the *false* statement. When the free space wavelength of a signal equals the cut-off wavelength of the guide

a. the group velocity of the signal becomes zero
b. the phase velocity of the signal becomes infinite
c. the characteristic impedance of the guide becomes infinite
d. the wavelength within the waveguide becomes infinite

10. A signal propagation in a waveguide has a full wave of electric intensity change between the two further walls, and no component of the electric field in the direction of propagation. The mode is

a. $TE_{1,1}$
b. $TE_{1,0}$
c. $TM_{2,2}$
d. $TE_{2,0}$

11. The dominant mode of propagation is preferred with rectangular waveguides because (indicate *false* statement)

a. it leads to the smallest waveguide dimensions
b. the resulting impedance can be matched directly to coaxial lines
c. it is easier than the other modes
d. propagation of it without any spurious generation can be ensured

12. 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

13. In order to couple two generators to a waveguide system without coupling them to each other, on could *not* use a

a. rat-race
b. *E*-plane T
c. hybrid ring
d. magic T

14. Which of the following waveguides tuning components is *not* easily adjustable?

a. Screw
b. Stub
c. Iris
d. Plunger

15. A piston attenuator is a

a. vane attenuator
b. waveguide below cutoff
c. mode filter
d. flap attenuator

16. Cylindrical cavity resonators are not used with klystrons because they have

a. a *Q* that is too low
b. a shape whose resonant frequency is too difficult to calculate
c. harmonically related resonant frequencies
d. too heavy losses

17. A directional coupler with three or more holes is sometimes used in preference to the two-hole coupler

a. because it is more efficient
b. to increase coupling of the signal
c. to reduce spurious mode generation
d. to increase the bandwidth of the system

18. A ferrite is

a. a nonconductive with magnetic properties
b. an intemetallic compound with particularly good conductivity
c. an insulator which heavily attenuates magnetic fields
d. a microwave semiconductor invented by Faraday

19. Manganese ferrite may be used as a (indicate *false* answer)

a. circulator
b. isolator
c. garnet
d. phase shifter

20. The maximum power that may be handled by a ferrite component is limited by the

a. Curie temperature
b. Saturation magnetization
c. line width
d. gyromagnetic resonance

21. A PIN diode is

a. a metal semiconductor point-contact diode
b. a microwave mixer diode
c. often used as a microwave detector
d. suitable for use as a microwave switch

22. A duplexer is used

a. to couple two different antennas to a transmitter without mutual interference
b. to allow the one antenna to be used for reception or retransmission without mutual interference
c. to prevent interference between two antennas when they are connected to a receiver
d. to increase the speed of the pulses in pulses in pulsed radar

23. For some applications, circular waveguides may be preferred to rectangular ones because of

a. the smaller cross section needed at any frequency
b. lower attenuation
c. freedom from spurious modes
d. rotation of polarization

24. Indicate which of the following cannot be followed by the word "waveguide":

a. Elliptical
b. Flexible
c. Coaxial
d. Ridged

25. In order to reduce cross-sectional dimensions, the waveguide to use is

a. circular
b. ridged
c. rectangular
d. flexible

26. For low attenuation, the best transmission medium is

a. flexible waveguide
b. ridged waveguide
c. rectangular waveguide
d. coaxial line

MICROWAVE TUBES AND CIRCUITS

1. A microwave tube amplifier uses an axial magnetic field and a radial electric field. This is the

   a. reflex klystron
   b. coaxial magnetron
   c. traveling-wave magnetron
   d. CFA

2. One of the following is unlikely to be used as a pulsed device. It is the

   a. multicavity klystron
   b. BWO
   c. CFA
   d. TWT

3. One of the reasons why vacuum tubes eventually fail at microwave frequencies is that their

   a. noise figure increases
   b. transit time becomes too short
   c. shunt capactitive reactances become too large
   d. series inductive reactances become too small

4. Indicate the *false* statement. Transit time in microwave tubes will be reduced if

   a. the electrodes are brought closer together
   b. a higher anode current is used
   c. multiple or coaxial leads are used
   d. the anode voltage is made larger

5. The multicavity klystron

   a. is not a good low-level amplifier because of noise
   b. has a higher repeller voltage to ensure a rapid transit time
   c. is not suitable for pulsed operation
   d. needs a long transit time through the buncher cavity to ensure current modulation

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

   a. prevent the oscillations that occur in two-cavity klystrons
   b. increase the bandwidth of the device
   c. improve the power gain
   d. increase the efficiency of the klystron

7. The TWT is sometimes preferred to the multicavity klystron amplifier, because it

a. is more efficient
b. has a greater bandwidth
c. has a higher number of modes
d. produces a higher output power

8. The transit time in the repeller space of a reflex klystron must be *n* + ¾ cycles to ensure that

a. electrons are accelerated by the gap voltage on their return
b. returning electrons give energy to the gap oscillations
c. it is equal to the period of the cavity oscillations
d. the repeller is not damaged by striking electrons

9. The cavity magnetron uses strapping to

a. prevent mode jumping
b. prevent cathode back-heating
c. ensure bunching
d. improve the phase-focusing effect

10. A magnetic field is used in the cavity magnetron to

a. prevent anode current in the absence of oscillation
b. ensure that the oscillations are pulsed
c. help in focusing the electron beam, thus preventing spreading
d. ensure that the electrons will orbit around the cathode

11. To avoid difficulties with strapping at high frequencies, the type of cavity structure used in the magnetron is th

a. hole-and-slot
b. slot
c. vane
d. rising sun

12. 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

13. The attenuator is used in the traveling-wave tube to

a. help bunching
b. prevent oscillations
c. prevent saturation
d. increase gain

14. Periodic permanent-magnet focusing is used with TWTs to

a. allow pulsed operation
b. improve electron bunching
c. avoid the bulk of an electromagnet
d. allow coupled-cavity operation at the highest frequencies

15. The TWT is sometimes preferred to the magnetron as a radar transmitter output tube because it is

a. capable of a longer duty cycle
b. a more efficient bandwidth
c. more broadband
d. less noisy

16. 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

17. Indicate which of the following is *not* a TWT slow-wave structure:

a. Periodic-permanent magnet
b. Coupled cavity
c. Helix
d. Ring-bar

18. The glass tube of a TWT may be coated with aquadag to

a. help focusing
b. provide attenuation
c. improve bunching
d. increase gain

19. A backward-wave oscillator is based on the

a. rising-sun magnetron
b. crossed-field amplifier
c. coaxial magnetron
d. traveling-wave tube

SEMICONDUCTOR MICROWAVE DEVICES AND CIRCUITS

1. 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

2. A ruby maser amplifier must be cooled

   a. because 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

3. A disadvantage of microstrip compared with stripline is that microstrip

   a. does not readily lend itself to printed circuit techniques
   b. is more likely to radiate
   c. is bulkier
   d. is more expensive and complex to manufacture

4. The transmission system using two ground plane is

   a. microstrip
   b. elliptical waveguide
   c. parallel-wire line
   d. stripline

5. Indicate the *false* statement. An advantage of stripline over wveguide is its

   a. smaller bulk
   b. greater bandwidth
   c. higher power-handling capability
   d. greater compatibility with solid-state devices

6. Indicate the *false* statement. An advantage of stripline over microstrip is its

   a. easier integration with semiconductor devices
   b. lower tendency to radiate
   c. higher isolation between adjacent circuits
   d. higher Q

7. Surface acoustics waves propagate in

   a. gallium arsenide
   b. indium phosphide
   c. stripline
   d. quartz crystal

8. SAW devices may be used as

a. transmission media like stripline
b. filters
c. UHF amplifiers
d. Oscillators at millimeter frequencies

9. Indicate the *false* statement. FETs are preferred to bipolar transistors at the highest frequencies because they

a. are less noisy
b. lend themselves more easily to integration
c. are capable of higher effeciencies
d. can provide higher gains

10. For best low-level noise performance in the X-band, an amplifier should use

a. a bipolar transistor
b. a Gunn diode
c. a step-recovery diode
d. an IMPATT diode

11. The biggest advantage of the TRAPATT diode over the IMPATT diode is its

a. lower noise
b. higher efficiency
c. ability to operator at higher frequencies
d. lesser sensitivity to harmonics

12. Indicate which of the following diodes will produce the highest pulsed power output:

a. Varator
b. Gunn
c. Schottky barrier
d. RIMPATT

13. Indicate which of the following diodes does not use negative resistnace in its operation:

a. Backward
b. Gunn
c. IMPATT
d. Tunnel

14. One of the following is *not* used as a microwave mixer or detector:

a. Crystal diode
b. Schottky-barrier diode
c. Backward diode
d. PIN diode

15. One of the following microwave diodes is suitable for very low-power oscillators only:

a. Tunnel
b. avalanche
c. Gunn
d. IMPATT

16. The transferred-electron bulk effect occurs in

a. germanium
b. gallium arsenide
c. silicon
d. metal semiconductor junctions

17. The gain-bandwidth frequency of a microwave transistor, f_T, is the frequency at which the

a. alpha of the transistor falls by 3 dB
b. beta of the transistor falls by 3 dB
c. power gain of the transistor falls to unity
d. beta of the transistor falls to unity

18. For a microwave transistor to operate at the highest frequencies, the (indicate the *false* answer)

a. collector voltage must be large
b. collector current must be high
c. base should be thin
d. emitter area must be large

19. A varactor diode may be useful at microwave frequencies (indicate the *false* answer)

a. for electronic tuning
b. for frequency multiplication
c. as an oscillator
d. as a parametric amplifier

20. If high-order frequency multiplication is required from a diode multiplier,

a. the resistive cutoff frequency must be high
b. a small value of the base resistance is required
c. a step-recovery diode must be used
d. a large range of capacitance variation is needed

21. A parametric amplifier has an input and output frequency of 2.25 GHz, and is pumped at 4.5 GHz. It is

a. traveling-wave amplifier
b. degenerative amplifier
c. lower-sideband up-converter
d. upper-sideband up-converter

22. A nondegenerate parametric amplifier has an input frequency f_i and a pump frequency f_p. Then idler frequency is

a. f_i
b. $2f_i$
c. $f_i - f_p$
d. $f_p - f_i$

23. Traveling-wave parametric amplifiers are used to

a. provide a greater gain
b. reduce the number of varactor diodes required
c. avoid the need for cooling
d. provide greater bandwidth

24. A parametric amplifier sometimes uses a circulator to

a. prevent noise feedback
b. allow the antenna to be used simultaneously for transmission and reception
c. separate the signal and idler frequencies
d. permit more efficient pumping

25. The nondegenerate one-port parametric amplifier should have a high ratio of pump to signal frequency because this

a. permits satisfactory high-frequency operation
b. yields a low noise figure
c. reduce the pump power required
d. permits satisfactory

26. The tunnel diode

a. has a tiny hole through its center to facilitate tunneling
b. is a point-contact diode with a very high reverse resistance
c. uses a high doping level to provide a narrow junction
d. works by quantum tunneling exhibited by gallium arsenide only

27. A tunnel diode is loosely coupled to its cavity in order to

a. increase the frequency stability
b. increase the available negative resistance
c. facilitate tuning
d. allow operation at the highest frequencies

28. The negative resistance in a tunnel diode

a. is maximum at the peak point of the characteristic
b. is available between the peak and valley points
c. is maximum at the valley point
d. may be improved by the use of reverse bias

29. The biggest advantage of gallium antimonide over germanium for tunnel-diode use it that former has a

a. lower noise
b. higher ion mobility
c. larger voltage swing
d. simpler fabrication process

30. Negative resistance is obtained with a Gunn diode because of

a. electron transfer to a less mobile energy level
b. avalanche breakdown with the high voltage gradient
c. tunneling across the junction
d. electron domains forming at the junction

31. For Gunn diodes, gallium arsenide is preferred to silicon because the former

a. has a suitable empty energy band, which silicon does not have
b. has a higher ion mobility
c. has a lower noise at the highest frequencies
d. is capable of handling higher power densities

32. The biggest disadvantage of the IMPATT diode is its

a. lower efficiency than that of the other microwave diodes
b. high noise
c. inability to provide pulsed operation
d. low power-handling ability

33. The magnetic field is used with a ruby maser to

a. provide sharp focusing for the electron beam
b. increase the population inversion
c. allow room-temperature operation
d. provide frequency adjustments

34. The ruby maser has been preferred to the ammonia maser for microwave amplification, because the former has

a. a much greater bandwidth
b. a better frequency stability
c. a lower noise figure
d. no need for a circulator

35. Parametric amplifiers and masers are similar to each other in that both (indicate *false* statement)

a. must have pumping
b. are extremely low-noise amplifiers
c. must be cooled down to a few kelvins
d. generally required cicultators, since they are one-port devices

36. A maser RF amplifier is not really suitable for

a. radioastronomy
b. satellite communications
c. radar
d. troposcatter receiver

37. The ruby laser differs from the ruby maser in that the former

a. does not require pumping
b. needs no resonator
c. is an oscillator
d. produces much lower powers

38. The output from a laser is monochromatic; this means that it is

a. infrared
b. polarized
c. narrow-beam
d. single-frequency

39. For a given average power, the *peak* output power of a ruby laser may be increased by

a. using cooling
b. using *Q* spoiling
c. increasing the magnetic field
d. dispensing with the Fabry-Perot resonator

40. Communications lasers are used with optical fiber, rather than in open links, to

a. ensure that the beam does not spread
b. prevent atmospheric interference
c. prevent interference by other laser
d. ensure that people are not blinded by them

41. Indicate the *false* statement. The advantages of semiconductor lasers over LEDs include

a. monochromatic output
b. higher power output
c. lower cost
d. ability to be pulsed at higher rates

DIGITAL COMMUNICATIONS

1. Digital signals

   a. do not provide a continuous set of values
   b. represent values as discrete steps
   c. can utilize decimal or binary systems
   d. all of the above

2. The event which marked the start of the modern computer age was

   a. design of the ENIAC computer
   b. development of the Hollerith code
   c. development of the transistor
   d. development of disk drives for data storage

3. The baud rate

   a. is always equal to the bit transfer rate
   b. is equal to twice the bandwidth of an ideal channel
   c. is not equal to the signaling rate
   d. is equal to one-half the bandwidth of an ideal channel

4. The Shannon-Hartley law

   a. refers to distortion
   b. defines bandwidth
   c. describes signaling rates
   d. refers to noise

5. The code which provides for parity checks is

   a. Baudot
   b. ASCII
   c. EBCDIC
   d. CCITT-2

6. A forward error-correcting code corrects errors by

   a. requiring partial retransmission of the signal
   b. requiring retransmission of the entire signal
   c. requiring no part of the signal to be retransmitted
   d. using parity to correct the errors in all cases

7. Full duplex operation

   a. requires two pairs of cables
   b. can transfer data in both directions at once
   c. requires modems at both ends of the circuit
   d. all of the above

8. The RS-232 interface

   a. interconnects data sets and transmission circuit
   b. uses several different connectors
   c. permits custom wiring of signal lines to the connector pins as desired
   d. all of the above

9. Switching systems

   a. improve the efficiency of data transfer
   b. are not used in data systems
   c. require additional lines
   d. are limited to small data networks

10. The data transmission rate of a modem is measured in

   a. bytes per second
   b. baud rate
   c. bits per second
   d. megahertz

BROADBAND CUMMUNICATIONS SYSTEMS

1. Broadband long-distance communications were made possible by the advent of

   a. telegraph cables
   b. repeater amplifiers
   c. HF radi
   d. Geostationary satellites

2. A scheme in which several channels are interleaved and then transmitted together is known as

   a. frequency-division multiplex
   b. time-division multiplex
   c. a group
   d. a supergroup

3. A basic group *B*

   a. occupies the frequency range from 60 to 108 kHz
   b. consists of erect channels only
   c. is formed at the group translating equipment
   d. consists of five supergroups

4. Time-division multiplex

   a. can be used with PCM only
   b. combines five groups into a supergroup
   c. stacks 24 channels in adjacent frequency slots
   d. interleaves pulses belonging to different transmissions

5. The number of repeaters along a coaxial cable link depends on

   a. whether separate tubes are used for the two directions of transmission
   b. the bandwidth of the system
   c. the number of coaxial cables in the tube
   d. the separation of the equalizers

6. A supergroup pilot is

   a. applied at each multiplexing bay
   b. used to regulate the gain of individual repeaters
   c. applied at each adjustable equalizer
   d. fed in at a GTE

7. Microwave link repeaters are typically 50 km apart

a. because of atmospheric attenuation
b. because of output tube power limitations
c. because of the Earth's curvature
d. to ensure that the applied dc voltage is not excessive

8. Microwave links are generally preferred to coaxial cable for television transmission because

a. they have less overall phase distortion
b. they are cheaper
c. of their greater bandwidths
d. of their relative immunity to impulse noise

9. Armored submarine cable is used

a. to protect the cable at great depths
b. to prevent inadvertent ploughing-in of the cable
c. for the shallow shore ends of the cable
d. to prevent insulation breakdown from the high feed voltages

10. A submarine cable repeater contains, among other equipment,

a. a dc power supply and regulator
b. filters for the two directions of transmission
c. multiplexing and demultiplexing equipment
d. pilot injected pilot extract equipment

11. A geostationary satellite

a. is motionless in space (except for its spin)
b. is not really stationary at all, but orbits the Earth within a 24-hr period
c. appears stationary over the Earth's magnetic pole
d. is located at a height of 35,800 km to ensure global coverage

12. Indicate the correct statement regarding satellite communications.

a. If two earth stations do not face a common satellite, they should communicate via a double-satellite hop.
b. Satellites are allocated so that it is impossible for two earth stations not to face the same satellite
c. Collocated earth stations are used for frequency diversity
d. A satellite earth station must have as many receive chains as there are carriers transmitted to it

13. Satellite used for intercontinental communications are known as

a. Comsat
b. Domsat
c. Marisat
d. Intelsat

14. Identical telephone numbers in different parts of a country are distinguished by their

a. language digits
b. access digits
c. area codes
d. central office codes

15. Telephone traffic is measured

a. with echo cancellers
b. by the relative congestion
c. in terms of the grade of service
d. in erlangs

16. In order to separate channels in a *TDM* receiver, it is necessary to use

a. AND gates
b. bandpass filters
c. differentiation
d. integration

17. To separate channels in an FDM receiver, it is necessary to use

a. AND gates
b. bandpass filters
c. differentiation
d. integration

18. Higher order TDM levels are obtained by

a. dividing pulse widths
b. using the a-law
c. using the μ-law
d. forming supermastergroups

19. Losses in optical fibers can be caused by (indicate the *false* statement)

a. impurities
b. microbending
c. attenuation in the glass
d. stepped index operation

20. The 1.55 µm "window" is not yet in use with fiber optic systems because

a. the attenuation is higher than at 0.85 µm
b. the attenuation is higher that at 1.3 µm
c. suitable laser devices have not yet been developed
d. it does not lend itself to wave

21. Indicate which of the following is *not* a submarine cable

a. TAT-7
b. INTELSAT V
c. ATLANTIS
d. CANTAT 2

22. Indicate which of the following is an American domsat system

a. INTELSAT
b. COMSAT
c. TELSTAR
d. INMARSAT

RADAR SYSTEMS

1. If the peak transmitted power in a radar system is increased by a factor of 16, the maximum range will be increased by a factor

a. 2
b. 4
c. 8
d. 16

2. If the antenna diameter in a radar system is increased by a factor of 4, the maximum range will be increased by a factor of

a. √2
b. 2
c. 4
d. 8

3. If the ratio of the antenna diameter to the wavelength in a radar system is high this will result in (indicate the *false* statement)

a. large maximum range
b. good target discrimination
c. difficult target acquisition
d. increased capture area

4. The radar cross section of a target (indicate the *false* statement)

a. depends on the frequency used
b. may be reduced by special coating of the target
c. depends on the aspect of a target, if this nonspherical
d. is equal to the actual cross-sectional area for small targets

5. Flat-topped rectangular pulses must be transmitted in radar to (indicate the *false* statement)

a. allow a good minimum range
b. make the returned echoes easier to distinguish from noise
c. prevent frequency changes in the magnetron
d. allow accurate range measurements

6. A high PRF will (indicate the *false* statement)

a. make the returned echoes easier to distinguish from noise
b. make target tracking easier with conical scanning
c. increase the maximum range
d. have no effect on the range resolution

7. The IF bandwidth of a radar receiver is inversely proportional to the

a. pulse width
b. pulse repetition frequency
c. pulse interval
d. square root of the peak transmitted power

8. If a return echo arrives after the allocated pulse interval,

a. it will interfere with the operation of the transmitter
b. the receiver might be overloaded
c. it will not be received
d. the target will appear closer than it really is

9. After a target has been acquired, the best scanning system for tracking is

a. nodding
b. spiral
c. conical
d. helical

10. If the target cross section is changing, the best system for accurate tracking is

a. lobe switching
b. sequential lobing
c. conical scanning
d. monopulse

11. The biggest disadvantage of CW Doppler radar is that

a. it does not give the target velocity
b. it does not give the target range
c. a transponder is required at the target
d. it does not give the target position

12. The A scope displays

a. the target position and range
b. the target range, but not position
c. the target position, but not range
d. neither range nor position, but not only velocity

13. The Doppler effect is used in (indicate the *false* statement)

a. moving-target plotting on the PPI
b. the MTI system
c. FM radar
d. CW radar

14. The *coho* in MTI radar operates at the

a. intermediate frequency
b. transmitted frequency
c. received frequency
d. pulse repetition frequency

15. The function of the quartz delay line in an MTI radar is to

a. help in subtracting a complete scan from the previous scan
b. match the phase of the coho and the stalo
c. match the phase of the coho and the output oscillator
d. delay a sweep so that the next sweep can be subtracted from it

16. A solution to the "blind speed" problem is

a. to change the Doppler frequency
b. to vary the PRF
c. to use monopulse
d. to use MTI

17. Indicate which one of the following applications or advantages of radar beacons is *false:*

a. Target identification
b. Navigation
c. Very significant extension of the maximum range
d. More accurate tracking of enemy targets

18. Compared with other types of radar, phased array radar has the following advantages (indicate the *false* statement)

a. very fast scanning
b. ability to track and scan simultaneously
c. circuit simplicity
d. ability to track many targets simultaneously

PULSE COMMUNICATIONS

1. Indicate which of the following is *not* a binary code

   a. Morse
   b. Baudot
   c. CCITT-2
   d. ARQ

2. To permit the selection of 1 out of 16 equi-probable events, the number of bits required is

   a. 2
   b. $\log_{10}$ 16
   c. 8
   d. 4

3. A signaling system in which each letter of the alphabet is represented by a different symbol is not used because

   a. it would be too difficult for an operator to memorize
   b. it is redundant
   c. noise would introduce too many errors
   d. too many pulses per letter are required

4. The Hartley states that

   a. the maximum rate of information transmission depends on the channel bandwidth
   b. the maximum rate of information transmission depends on the depth of modulation
   c. redundancy is essential
   d. only binary codes may be used

5. Indicate the *false* statement. In order to combat noise,

   a. the channel bandwidth may be increased
   b. redundancy may be used
   c. the transmitted power may be increased
   d. the signaling rate may be reduced

6. The most common modulation system used for telegraphy is

   a. frequency-shift keying
   b. two-tone modulation
   c. pulse-code modulation
   d. single-tone modulation

7. Pulse-width modulation system used for telegraphy is

a. by differentiating pulse-position modulation
b. with a monostable
c. by integrating the signal
d. with a free-running multivibrator

8. Indicate which of the following system is digital.

a. Pulse-position modulation
b. Pulse-code modulation
c. Pulse-width modulation
d. Pulse-frequency modulation

9. Quantizing noise occurs in

a. time-division multiplex
b. frequency division multiplex
c. pulse-code modulation
d. pulse-width modulation

10. The modulation system inherently most noise-resistant is

a. SSB, suppressed-carrier
b. Frequency modulation
c. pulse-position modulation
d. pulse-code modulation

11. In order to reduce quantizing noise, one must

a. increase the number of standard amplitudes
b. send pulses whose sides are more nearly vertical
c. use an RF amplifier in the receiver
d. increase the number of samples per second

12. The Hartley-Shannon theorem sets a limit on the

a. highest frequency that may be sent over a given channel
b. maximum capacity of a channel with a given noise level
c. maximum number of coding levels in a channel with a given noise level
d. maximum number of quantizing levels in a channel of a given bandwidth

13. Indicate which of the following pulse modulation systems is analog

a. PCM
b. Differential PCM
c. PWM
d. Delta

14. Companding is used

a. to overcome quantizing noise in PCM
b. in PCM transmitters, to allow amplitude limited in the receivers
c. to protect small signals in PCM from quantizing distortion
d. in PCM receivers, to overcome impulse noise

15. The biggest disadvantage of PCM is

a. its inability to handle analog signals
b. the high error rate which its quantizing noise introduces
c. its incompatibility with TDM
d. the large bandwidths that are required for it

TELEVISION FUNDAMENTALS

1. The number of lines per field in the United States TV system is

   a. 262½
   b. 525
   c. 30
   d. 60

2. The number of frames per second in the United States TV system is

   a. 60
   b. 262½
   c. 4.5
   d. **30**

3. The number of lines per second in the United States TV system is

   a. 31,500
   b. 15,750
   c. 262½
   d. 525

4. The channel width in the United States TV system, in MHz, is

   a. 41.25
   b. 6
   c. 4.5
   d. 3.58

5. Interlacing is used in television to

   a. produce the illusion of motion
   b. ensure that all the lines on the screen are scanned, not merely the alternate ones
   c. simplify the vertical sync pulse train
   d. avoid flicker

6. The signals sent by the TV transmitter to ensure correct scanning in the receiver are called

   a. sync
   b. chroma
   c. luminance
   d. video

7. In the United States color television system, the *intercarrier* frequency, in MHz, is

a. 3.58
b. 3.57945
c. 4.5
d. 45.75

8. Indicate which voltages are *not* found in the output of a normal monochrome receiver video detector.

a. Sync
b. Video
c. Sweep
d. Sound

9. The carrier transmitted 1.25 MHz above the bottom frequency in the United States TV channel is the

a. sound carrier
b. chroma carrier
c. intercarrier
d. picture carrier

10. In television, 4:3 represents the

a. interlace ratio
b. maximum horizontal deflection
c. aspect ratio
d. ratio of the two diagonals

11. Equalizing pulses in TV are sent during

a. horizontal blanking
b. vertical blanking
c. the serrations
d. the horizontal retrace

12. An odd number of lines per frame forms part of every one of the world's TV systems. This is

a. done to assist interlace
b. purely an accident
c. to ensure that line and frame frequencies can be obtained from the same original source
d. done to minimize interference with the chroma subcarrier

13. The function of the ***serrations*** in the composite video waveform is to

a. equalize the charge in the integrator before the start of vertical retrace
b. help vertical synchronization
c. help horizontal synchronization
d. simplify the generation of the vertical sync pulse

14. The width of the vertical sync pulse in the United States TV system is

a. 21***H***
b. 3*H*
c. ***H***
d. 0.5***H***

15. Indicate which of the following frequencies will ***not*** be found in the output of a normal TV receiver tuner:

a. 4.5 MHz
b. 41.25 MHz
c. 45.75 MHz
d. 42.17 MHz

16. The video voltage applied to the picture tube of a television receiver is fed in

a. between grid and ground
b. to the yoke
c. to the anode
d. between grid and cathode

17. The circuit that separates sync pulses from the composite video waveform is

a. the keyed AGC amplifier
b. a clipper
c. an integrator
d. a differentiator

18. The output of the vertical amplifier, applied to the yoke in a TV receiver, consists of

a. direct current
b. amplified vertical sync
c. a sawtooth voltage
d. a sawtooth current

19. The HV anode supply for the picture tube of a TV receiver is generated in the

a. mains transformer
b. vertical output stage
c. horizontal output stage
d. horizontal deflection oscillator

20. Another name for the horizontal retrace in a TV receiver is the

a. ringing
b. burst
c. damper
d. flyback

21. Indicate which of the following signals is *not* transmitted in color TV:

a. Y
b. Q
c. R
d. I

22. The *shadow mask* in a color picture tube is used to

a. reduce x-ray emission
b. ensure that each beam hits only its own dots
c. increase screen brightness
d. provide degaussing for the screen

23. In a TV receiver, the *color killer*

a. cuts off the chroma stages during monochrome reception
b. ensures that no color is transmitted to monochrome receivers
c. prevents color overloading
d. makes sure that the color burst is not mistaken for sync pulses, by cutting off reception during the back porch

INTRODUCTION TO FIBER OPTIC TECHNOLOGY

1. What is the frequency limit of copper wire?

   a. approximately 0.5 MHz
   b. approximately 1.0 MHz
   c. approximately 40 GHz
   d. None of the above

2. Approximately what is the frequency limit of the optical fiber?

   a. 20 GHz
   b. 1 MHz
   c. 100 MHz
   d. 40 MHz

3. A single fiber can handle as many voice channel as

   a. a pair of copper conductors
   b. a 1500-pair cable
   c. a 500-pair cable
   d. a 1000-pair cable

4. An incident ray can be defined as

   a. a light ray reflected from a flat surface
   b. a light ray directed toward a surface
   c. a diffused light ray
   d. a light ray that happens periodically

5. The term *dispersion* describes the process of

   a. separating light into its component frequencies
   b. reflecting light from a smooth surface
   c. the process by which light is absorbed by an uneven rough surface
   d. light scattering

6. Which of the following terms describes the reason that light is refracted at different angles?

   a. Photon energy changes with wavelength
   b. Light is refracted as a function of surface smoothness
   c. The angle is determined partly by *a* and *b*
   d. The angle is determined by the index of the materials

7. The term critical angle describes

a. the point at which light is refracted
b. the point at which light becomes invisible
c. the point at which light has gone from the refractive mode to the reflective mode
d. the point at which light has crossed the boundary layers from one index to another

8. The cladding which surrounds the fiber core

a. is used to reduce optical interference
b. is used to protect the fiber
c. acts to help guide the light in the core
d. ensures that the refractive index remains constant

9. The reflective index number is

a. a number which compares the transparency of a material with that of air
b. a number assigned by the manufacturer to the fiber in question
c. a number which determines the core diameter
d. a term for describing core elasticity

10. The terms ***single mode*** and ***multimode*** are best describes as

a. the number of fibers placed into a fiber-optic cable
b. the number of voice channels each fiber can support
c. the number of wavelengths each fiber can support
d. the index number

11. The higher the index number

a. the higher the speed of light
b. the lower the speed of light
c. has no effect on the speed of light
d. the shorter the wavelength propagation

12. The three major groups in the optical system are

a. the components, the data rate and response time
b. the source, the link, and the receiver
c. the transmitter, the cable, and the receiver
d. the source, the link, and the detector

13. As light is coupled in a multipoint reflective device, the power is reduced by

a. 1.5 dB
b. 0.1 dB
c. 0.5 dB
d. 0.001 dB

14. When connector losses, splice losses, and coupler losses are added, what is the final limiting factor?

a. Source power
b. Fiber attenuation
c. Connector and splice losses
d. Detector sensitivity

15. The term *responsivity* as it applies to a light detector is best described as

a. the time required for the signal to go from 10 to 90 percent of maximum amplitude
b. the ratio of the diode output current to optical input power
c. the ratio of output current to output power
d. the ratio of output current to input current

16. Loss comparisons between fusion splices and mechanical splices are

a. 1:10
b. 10:1
c. 20:1
d. 1:20

17. The mechanical splice is best suited for

a. quicker installation under ideal conditions
b. minimum attenuation losses
c. field service conditions
d. situations in which cost of equipment is not a factor

18. EMD is best describe by which statement?

a. 70 percent of the core diameter and 70% of the fiber NA should be filled with light
b. 70 percent of the fiber diameter and 70% of the cone of acceptance should be filled with light
c. 70 percent of input light should be measured at the output
d. 70 percent of the unwanted wavelengths should be attenuated by the fiber

19. Which of the following cables will have the highest launch power capability?

a. 50/125/0.2
b. 85/125/0.275
c. 62.5/125/0.275
d. 100/140/0.3

20. The term *power budgeting* refers to

a. the cost of cables, connectors, equipment, and installation
b. the loss of power due to defective components
c. the total power available minus the attenuation losses
d. the comparative costs of fiber and copper installations