**CHAPTER 1**

**1.** Every known element has
A. the same type of atoms
B. **a unique type of atom**
C. the same number of atoms
D. several different types of atom

**2.** An atom consist of
A. one nucleus and only one electron
B. one nucleus and one or more electrons
C. protons, electrons, and neutrons
D. **answer b or c**

**3.** The nucleus of an atom is made up to
A. **proton and neutrons**
B. electrons and protons
C. electrons
D. electrons and protons

**4.** The atomic number of silicon is
A. 8 B. **14**
C. 4 D. 2

**5.** The atomic number of germanium is
A. **32** B. 4
C. 2 D. 8

**6.** The valence shell in a silicon atom has the number designation of
A. 1 B. 0
C. **3** D. 2

**7.** Valence electrons are
A. in the closet orbit to the nucleus
B. in various orbits around the nucleus
C. **in the most distant orbit from the nucleus**
D. not associated with a particular atom

**8.** A positive ion is formed when
A. there are more holes than electrons in the outer orbit
B. two atoms bond together
C. **a valence electron breaks away from the atom**
D. an atom gains extra valence electron

**9.** The most widely used semiconductive material in electronic device is
A. **silicon** B. carbon
C. germanium D. copper

**10.** The energy band in which free electrons exist is the
A. first band B. **conduction band**
C. second band D. valence band

**11.** Electron-holes pairs are produced by
A. ionization B. **thermal energy**
C. recombination D. doping

**12.** Recombination is when
A. a crystal is formed
B. a positive and a negative ion bond together
C. **an electron falls into a hole**
D. a valence electron becomes a conduction electron

**13.** In a semiconductor crystal, the atoms are held together by
A. forces of attraction
B. the interaction of valence electrons
C. covalent bonds
D. **answer a, b, c**

**14. Each atom in a silicon crystal has**
A. no valence electrons because all are shared with others atoms
B. **eight valence electrons because all are with other atoms**
C. four valence electrons
D. four conduction electrons

**15.** The current in a semiconductor is produced by
A. holes only
B. electrons only
C. **both electrons and holes**
D. negative ions

**16.** In an intrinsic semiconductor
A. there are no free electrons
B. the free electrons are thermally produced
C. there are only holes
D. there are as many electrons as there are holes
E. **answer b and d**

**17.** The difference between an insulator and a semiconductor is
A. a wider energy gap between the valence band and the conduction band
B. the number of free electrons
C. the atomic structure
D. **answers a, b and c**

**18. The process of adding an impurity to an intrinsic semiconductor is called**
A. atomic modification B. **doping**
C. recombination D. ionization

**19.** A trivalent impurity is added to silicon to create
A. germanium
B. an n-type semiconductor
C. a depletion region
D. **a p-type semiconductor**

**20.** The purpose of a pentavalent impurity is to
A. **increase the number of free electrons**
B. create minority carriers
C. reduce the conductivity of silicon
D. increase the number of holes

**21.** The majority carriers in an n-type semiconductor are
A. holes
B. **conduction electrons**
C. valence electron
D. protons

**22.** Holes in an n-type semiconductor are
A. **minority carriers that are thermally produced**
B. majority carriers that are thermally produced
C. minority carriers that are produced by doping
D. majority carriers that are produced by doping

**23.** A pn junction is formed by
A. ionization
B. **the boundary of a p-type and an n-type material**
C. the recombination of electrons and holes
D. the collision of a proton and a neutron

**24.** The depletion region is created by
A. ionization B. diffusion
C. recombination D. **answer a, b and c**

**25.** The depletion region is consist of
A. nothing but minority carriers
B. positive and negative ions
C. no majority carriers
D. **answer b and c**

**26.** The term bias means
A. **a dc voltage is applied to control the operation of a device**
B. neither a, b nor c
C. the ratio of majority carriers to minority carriers
D. the amount of current across a diode

**27.** To forward-bias a diode
A. an external voltage is applied that is positive at the anode and negative at the cathode
B. an external voltage applied that is negative at the anode and positive at the cathode
C. an external voltage is applied that is positive at the p region and negative at the n region
D. **answer a and c**

**28.** When diode is forward-biased
A. the only current is hole current
B. the only current is produced by majority carriers
C. **the current is produced by both holes and electrons**
D. the only current is electron current

**29.** Although current is blocked in reverse bias
A. there is some current due to majority carriers
B. **there is very small current due to minority carriers**
C. there is an avalanche current

**30.** For a silicon diode, the value of the forward-bias voltage typically
A. must be greater than 0.3 V
B. depends on the width of the depletion region
C. depends on the concentration of majority carriers
D. **must be greater than 0.7 V**

**31.** When forward-biased, a diode
A. block current
B. has a high resistance
C. **conducts current**
D. drops a large voltage

**32.** When a voltmeter is placed across a forward-biased diode, it will read a voltage approximately equal to
A. **the diode barrier potential**
B. the bias battery voltage
C. the total circuit voltage
D. 0 V

**33.** A silicon diode is in series with 1.0 kΩ resistor and a 5 V battery. If the anode is connected to the positive battery terminal, the cathode voltage with respect to the negative battery terminal is
A. 0.7 V B. 5.7 V
C. 0.3 V D. **4.3 V**

**34.** The positive lead of an ohmmeter is connected to the anode of a diode and the negative lead is connected to the cathode. The diode is
A. reverse-biased B. forward-biased
C. open D. **faulty**
E. answers b and d

**CHAPTER 2**

**35.** The average value of a half-wave rectified voltage with a peak value of 200 V is
A. 127.3 V B. 141 V
C. 0 V D. **63.7 V**

**36.** When a 60 Hz sinusoidal voltage is applied to the input of a half-wave rectifier, the output frequency is
**A. 60 Hz** B. 120 Hz
C. 0 Hz D. 30 Hz

**37.** The peak value of the input to a half-wave rectifier is 10 V. The approximate peak value of the output is
A. 10.7 V B. **9.3 V**
C. 10 V D. 3.18 V

**38.** For the circuit in Question in Question 3, the diode must be able to withstand a reverse voltage of
A. 5 V B. **10 V**
C. 20 V D. 3.18 V

**39.** The average value of a full-wave rectified voltage with a peak value of 75 V is
A. 37.5 V B. 23.9 V
C. 53 V D. **47.8 V**

**40.** When a 60 Hz sinusoidal voltage is applied to the input of a full-wave rectifier, the output frequency is
A. 60 Hz B. **120 Hz**
C. 240 Hz D. 0 Hz

**41.** The total secondary voltage in a center-tapped full-wave rectifier is 125 rms. Neglecting the diode drop, the rms output voltage is
A. 117 V B. 100 V
C. **62.5 V** D. 125 V

**42.** When the peak output voltage is 100 V, the PIV for each diode in a center-tapped full-wave rectifier is (neglecting the diode drop)
A. 100 V B. 141 V
C. **200 V** D. 50 V

**43.** When the rms output voltage of a bridge full wave rectifier is 20 V, the peak inverse voltage across the diodes is (neglecting the diode drop)
A. **28.3 V** B. 20 V
C. 40 V D. 56.6 V

**44.** The ideal dc output voltage of a capacitor-input filter is equal to
A. the average value of the rectified voltage
B. the rms value of the rectified voltage
C. **the peak value of the rectified voltage**

**45.** A certain power supply filter produces an output with a ripple of 100 mV peak-to-peak and a dc value of 20 V. The ripple factor is
A. **0.005** B. 0.05
C. 0.02 D. 0.00005

**46.** A 60 V peak full-wave rectified voltage is applied to a capacitor-input filter. If f = 120 Hz. $R_L$ = 10 k Ω and C = 10 μF, the ripple voltage is
A. 0.6 V B. **5.0 V**
C. 6 mV D. 2.88 V

**47.** If the load resistance of a capacitor-filtered full-wave rectifier is reduced, the ripple voltage
A. is not affected B. **increases**
C. decreases D. has a different frequency

**48.** Line regulation is determined by
A. zener current and load current
B. changes in load resistance and output voltage
C. load current
D. **changes in output voltage and input voltage**

**49.** Load regulations is determined by
A. changes in zener current and load current
B. **changes in load current and output voltage**
C. changes in load current and input voltage
D. changes in load resistance and input voltage

**50.** A 10 V peak-to-peak sinusoidal voltage is applied across a silicon diode and series resistor. The maximum voltage across the diode is
A. 0.7 V B. **10 V**
C. 9.3 V D. 5 V
E. 4.3 V

**51.** If the input voltage to a voltage tripler has an rms value of 12 V, the dc output voltage is approximately
A. 36 V B. 33.9 V
C. 32.4 V D. **50.9 V**

**52.** If one of the diode in a bridge full-wave rectifier opens, the output is
A. one-fourth the amplitude of the input voltage
B. 0 V
C. 120 Hz voltage
D. **a half-wave rectified voltage**

**53.** If you are checking a 60 Hz full-wave bridge rectifier and observe that the output has a 60 Hz ripple
A. the filter capacitor is leaky
B. the transformer secondary is shorted
C. **there is an open diode**
D. the circuit is working properly

**CHAPTER 3**

**54.** The cathode of zener diode in a voltage regulator is normally
A. more negative than the anode
B. **more positive than the anode**
C. at + 0.7 V
D. grounded

**55.** If a certain zener diode has a zener voltage of 3.6 V, it operates in
A. avalanche breakdown
B. **zener breakdown**
C. regulated breakdown
D. forward conduction

**56.** For a certain 12 V zener diode, a 10 mA change in zener current produces a 0.1 V change in zener voltage. The zener impedance for this current ranges is
A. 0.1 Ω B. 100 Ω
C. **10 Ω** D. 1 Ω

**57.** The data sheet for a particular zener gives $V_Z$ = 10 V at $I_{ZT}$ = 500 mA. $Z_Z$ for these conditions is
A. **20 Ω** B. 50 Ω
C. 10 Ω D. unknown

**58.** A no-load condition means that
A. the load has infinite resistance
B. the load has zero resistance
C. **answer a and c**
D. the output terminal are open

**59.** A varactor diode exhibits
A. a variable capacitance that depends on forward current
B. **a variable capacitance that depends on reverse voltage**
C. a constant capacitance over a range of reverse voltages
D. a variable resistance that depends on reverse voltage

**60.** An LED
A. **emits light when forward-biased**
B. emits light when reverse-biased
C. acts as a variable resistance
D. senses light when reverse-biased

**61.** Compared to a visible red LED, an infrared LED
A. **produces light with longer wavelength**
B. produces light when reverse-biased
C. produces light with shorter wavelengths
D. produces only one color of light

**62.** The internal resistance of a photodiode
A. increase with light intensity when forward-biased
B. **decrease with light intensity when forward-biased**
C. increases with light intensity when reverse-biased
D. decrease with light intensity when forward-biased

**63.** A diode that has a negative resistance characteristics is the
A. **tunnel diode** B. laser diode
C. schottky diode D. hot-carrier diode

**64.** An infrared LED is optically coupled to a photodiode. When the LED is turned off, the reading on an ammeter is series with the reverse-biased photodiode will
A. increase B. not change
C. fluctuate D. **decrease**

**65.** In order for a system to function properly, the various types of circuits that make up the system must be
A. properly biased B. properly connected
C. properly interfaced D. **all of the above**
E. answer a and b

**CHAPTER 4**

**66.** The three terminals of a bipolar junction transistor are called
A. input, output, ground C. p,n,p
B. **base, emitter, collector** D. n,p,n

**67.** In a pnp transistor, the p-region are
A. base and emitter
B. base and collector
C. **emitter and collector**

**68.** For operation as an amplifier, the base of a npn transistor must be
A. 0 V
B. negative with respect to the emitter
C. positive with respect to the collector
D. **positive with respect to the emitter**

**69.** The emitter current is always
A. greater than the base current
B. less than the collector current
C. greater than the collector current
D. **answer a and c**

**70.** The $\beta_{DC}$ of a transistor is its
A. internal resistance B. power gain
C. voltage gain D. **current gain**

**71.** If $I_C$ is 50 times larger than $I_B$, then $\beta_{DC}$ is
A. 500 B. 0.02
C. 100 D. **50**

**72.** The approximate voltage across the forward-biased base emitter junction of a silicon BJT is
A. 0.3 V B. **0.7 V**
C. 0 V D. $V_{BB}$

**73.** The bias condition for a transistor to be used as linear amplifier is called
A. reverse-reverse B. **forward-reverse**
C. collector bias D. forward-forward

**74.** If the output of a transistor amplifier is 5 V rms and the input is 100 mV rms, the voltage gain is
A. **50** B. 500
C. 5 D. 100

**75.** When operated in cutoff and saturation, the transistor acts like
A. **a switch** B. a linear amplifier
C. a variable capacitor D. a variable resistor

**76.** In cutoff, $V_{CE}$ is
A. 0 V B. minimum
C. maximum D. equal to $V_{CC}$
E. answer a and b F. **answer c and d**

**77.** In saturation, $V_{CE}$ is
A. 0.7 V B. equal to $V_{CC}$
C. maximum D. **minimum**

**78.** To saturate a BJT,
A. **$I_B > I_{C(sat)}/\beta_{DC}$**
B. $I_B = I_{C(sat)}$
C. $V_{CC}$ must be at least 10 V
D. the emitter must be grounded

**79.** Once in saturation, a further increase in base current will
A. **not affected the collector current**
B. cause the collector current to decrease
C. cause the collector current to increase
D. turn the transistor off

**80.** If the base-emitter junction is open, the collector voltage is
A. floating B. **$V_{CC}$**
C. 0 V D. 0.2 V

**CHAPTER 5**

**81.** The maximum value of collector current in a biased transistor is
A. $\beta_{DC}I_B$ B. **$I_{C(sat)}$**
C. greater than $I_E$ D. $I_E - I_B$

**82.** Ideally, a dc load line is s straight line drawn on the collector characteristics curves between
A. the Q-point and saturation
B. **$V_{CE(cut\ off)}$ and $I_{C(sat)}$**
C. the Q-point and cut-off
D. $I_B = 0$ and $I_B = I_C / \beta_{DC}$

**83.** If a sinusoidal voltage is applied to the base of a biased npn transistor and the resulting sinusoidal collector voltage is clipped near zero volts, the transistor is
A. being driven into saturation
B. being driven into cut off
C. operating nonlinearly
D. answer a and c
E. **answer b and c**

**84.** The input resistance at the base of a biased transistor depends mainly on
A. $\beta_{DC}$ B. **$\beta_{DC}$ and $R_E$**
C. $R_B$ D. $R_E$

**85.** In a voltage-divider biased transistor circuit such as Figure 5 –13, $R_{IN(base)}$ can generally be neglected in calculation when
A. **$R_{IN(base)} > 10 R_2$** B. $R_1 << R_2$
C. $R_{IN(base)} > R_2$ D. $R_2 > 10 R_{IN(base)}$

**86.** In a certain voltage-divider biased npn transistor, $V_B$ is 2.95 V. The dc emitter voltage is approximately
A. 2.95 V B. **2.25 V**
C. 0.7 V D. 3.65 V

**87.** Voltage-divider bias
A. **can be essentially independent of $\beta_{DC}$**
B. is not widely used
C. cannot be independent of $\beta_{DC}$
D. requires fewer components than all the other methods

**88.** The disadvantage of base bias is that
A. it produces low gain
B. it is very complex
C. **it produces high leakage current**
D. it is too beta dependent

**89.** Emitter bias is
A. essentially independent of $\beta_{DC}$
B. very dependent of $\beta_{DC}$
C. provides a stable bias point
D. **answer a and c**

**90.** In an emitter bias circuit, $R_E = 2.7\ k\ \Omega$ and $V_{EE} = 15$ V. The emitter current
A. is 180 mA B. is 2.7 mA
C. **is 5.3 mA** D. cannot be determined

**91.** Collector-feedback bias is
A. **based on the principle of negative feedback**
B. based on beta multiplication
C. based on the principle of positive feedback
D. not very stable

**92.** In a voltage-divider biased npn transistor, if the upper voltage-divider resistor (the one connected to $V_{CC}$ opens,
A. the transistor burns out
B. the transistor goes into saturation
C. **the transistor goes into cutoff**
D. the supply voltage is too high

**93.** In a voltage-divider biased npn transistor, if the lower voltage-divider resistor (the one connected to $V_{CC}$) opens.
A. the collector current will decrease
B. **the transistor may be driven into saturation**
C. the transistor is not affected
D. the transistor may be driven into cutoff

**94.** In a voltage-divider biased pnp transistor, there is no base current, but the base voltage is approximately correct. The most likely problem(s) is
A. a bias resistor is open
B. the collector resistor is open
C. the base-emitter junction is open
D. the emitter resistor is open
E. answer a and c
F. **answer c and d**

**CHAPTER 6**

**95.** A small-signal amplifier
A. is always a common-emitter amplifier
B. always has an output signal in the mV range
C. **uses only a small portion of its load line**
D. goes into saturation once on each input cycle

**96.** The parameter $h_{fe}$ corresponds to
A. **$\beta_{AC}$** B. $\beta_{DC}$
C. $r'_c$ D. $r'_e$

**97.** If the dc emitter current in a certain transistor amplifier is 3 mA, the approximate value of $r'_e$ is
A. 3 Ω B. 3 kΩ
C. 0.33 kΩ D. **8.33 Ω**

**98.** A certain common-emitter amplifier has a voltage gain of 100. If the emitter bypass capacitor is removed,
A. **the voltage gain will decrease**
B. the voltage gain will increase
C. the circuit will become unstable
D. the Q-point will shift

**99.** For a common-collector amplifier, $R_E$ = 100 Ω, $r'_e$ = 10 Ω, and $\beta_{AC}$ = 150. The ac input resistance at the base is
A. **16.5 Ω** B. 15 kΩ
C. 110 Ω D. 1500 Ω

**100.** If a 10 mV signal is applied to the base of the emitter-follower circuit in Question 5, the output signal is approximately
A. 1.5 mV B. **10 mV**
C. 100 mV D. 150 mV

**101.** For a common-emitter amplifier, $R_C$ = 1.0 kΩ, $R_E$ = 390 Ω, and $\beta_{ac}$ = 75. Assuming the $R_E$ is completely bypassed at the operating frequency, the voltage gain is
A. 2.56 B. **66.7**
C. 2.47 D. 75

**102.** In the circuit of Question 7, if the frequency is reduced to the point where $X_{C(bypass)} = R_E$, the voltage gain
A. remains the same B. **is less**
C. is greater D.

**103.** In a certain emitter-follower circuit, the current gain is 50. The power gain is approximately
A. 50 $A_V$ B. 50
C. 1 D.**answer a and b**

**104.** In a darlington pair configuration, each transistor has an ac beta of 125. If $R_E$ is 560 Ω, the input resistance is
A. 560 Ω B. 70 Ω
C. 140 kΩ D. **8.75 MΩ**

**105.** The input resistance of a common-base amplifier is
A. the same as a CC
B. the same as a CE
C. **very low**
D. very high

**106.** In a common-emitter amplifier with voltage-divider bias, $R_{in(base)}$ = 68 kΩ, $R_1$ = 33 kΩ, and $R_2$ = 15 kΩ. The total input resistance is
A. 22.2 kΩ B. 68 kΩ
C. **8.95 kΩ** D. 12.3 kΩ

**107.** A CE amplifier is driving a 10 kΩ load. If $R_C$ = 2.2 kΩ and $r'_e$ = 10 Ω, the voltage gain is approximately
A. **180** B. 220
C. 10 D. 1000

**108.** The overall gain found in Question 14 can be expressed in decibels as
A. 47.0 dB B. 35.6 dB
C. **94.1 dB** D. 69.8 dB

**CHAPTER 7**

**109.** The JFET is
A. a unipolar device
B. a voltage-controlled device
C. a current-controlled device
D. answer a and c
E. **answer a and b**

**110.** The channel of a JFET is between the
A. **drain and source** B. gate and drain
C. input and output D. gate and source

**111.** A JFET always operates with
A. the gate connected to the source
B. the gate-to-source pn junction forward-biased
C. **the gate-to-source pn junction reverse-biased**
D. the drain connected to ground

**112.** For $V_{GS}$ = 0 V, the drain current becomes constant when $V_{DS}$ exceeds
A. 0 V B. **$V_p$**
C. $V_{DD}$ D. cutoff

**113.** The constant-current area of a FET lies between
A. **pinch-off and breakdown** B. 0 and $I_{DSS}$
C. cutoff and saturation D. cutoff and pinch-off

**114.** $I_{DSS}$ is
A. the drain current at cutoff
B. **the maximum possible drain current**
C. the drain current with the source shorted
D. the midpoint drain current

**115.** Drain current in the constant-current area increases when
A. the drain-to-source voltage decreases
B. the gate-to-source bias voltage increases
C. **the gate-to-source bias voltage decreases**
D. the drain-to-source voltage increases

**116.** In a certain FET circuit, $V_{GS}$ = 0 V, $V_{DD}$ = 15 V, $I_{DSS}$ = 15 mA, and $R_D$ = 470 Ω. If $R_D$ is decreased to 330 Ω, $I_{DSS}$ is
A. 1 mA
B. 10.5 mA
C. 19.5 mA
D. **15 mA**

**117.** At cutoff, the JFET channel is
A. **completely closed by the depletion region**
B. at its wide points
C. extremely narrow
D. reverse-biased

**118.** A certain JFET data sheet gives $V_{GS(off)}$ = - 4 V. The pinch-off voltage, $V_p$,
A. cannot be determined
B. is –4 V
C. depends on $V_{GS}$
D. **is + 4 V**

**119.** The JFET in Question 10
A. **is an n channel**
B. is a p channel
C. can be either
D.

**120.** For a certain JFET, $I_{GSS}$ = 10 nA at $V_{GS}$ = 10 V. The input resistance is
A. 1 MΩ
B. **1000 MΩ**
C. 100 MΩ
D. 1000 mΩ

**121.** For a certain p-channel JFET, $V_{GS(off)}$ = 8 V. The value of $V_{GS}$ for an approximately midpoint bias is
A. **2.34 V**
B. 0 V
C. 4 V
D. 1.25 V

**122.** A MOSFET differs from a JFET mainly because
A. of the power rating
B. **the JFET has a pn junction**
C. MOSFETs do not have a physical channel
D. the MOSFET has two gates

**123.** A certain D-MOSFET is biased at $V_{GS}$ = 0 V. Its data sheet specifies $I_{DSS}$ = 20 mA and $V_{GS(off)}$ = - 5 V. The value of the drain current
A. **is 0 A**
B. cannot be determined
C. is 20 mA
D.

**124.** An n-channel D-MOSFET with positive $V_{GS}$ is operating in
A. the depletion mode
B. cutoff
C. **the enhancement mode**
D. saturation

**125.** A certain p-channel E-MOSFET has a $V_{GS(th)}$ = - 2 V. If $V_{GS}$ = 0 V, the drain current is
A. 0 A
B. maximum
C. $I_{DSS}$
D. $I_{D(on)}$

**126.** A TMOSFET is a special type of
A. JFET
B. D-MOSFET
C. answer a and c
D. **E-MOSFET**

**CHAPTER 8**

**127.** In a common-source amplifier, the output voltage is 180° out of phase with the input
A. in phase with the input
B. taken at the source
C. taken at the drain
D. answer a and c
E. **answer a and d**

**128.** In a certain common-source (CS) amplifier, $V_{DS}$ = 3.2 V rms and $V_{GS}$ = 280 mV rms. The voltage gain is
A. 1
B. **11.4**
C. 8.75
D. 3.2

**129.** In a certain CS amplifier, $R_D$ = 1.0 kΩ, $R_S$ = 560 Ω, $V_{DD}$ = 10 V, and $g_m$ = 4500 µS. If the source resistor is completely bypassed, the voltage gain is
A. 450
B. 45
C. **4.5**
D. 2.52

**130.** Ideally, the equivalent circuit of a FET contains
A. a current source in series with a resistance
B. a resistance between drain and source terminals
C. a current source between gate and source terminals
D. **a current source between drain and source terminals**

**131.** The value of the current source in Question 4 is dependent on the
A. **transconductance and gate-to-source voltage**
B. dc supply voltage
C. external drain resistance
D. answer b and c

**132.** A certain common-source amplifier has a voltage gain of 10. If the source bypass capacitor is removed,
A. the voltage gain will increase
B. the transconductance will increases
C. **the voltage gain will decreases**
D. the Q-point will shift

**133.** A CS amplifier has a load resistance of 10 kΩ and $R_D$ = 820 Ω, If $g_m$ = 5 mS and $V_{in}$ = 500 mV, the output signal voltage is
A. **1.89 V**
B. 2.05 V
C. 25 V
D. 0.5 V

**134.** If the load resistance in Question 7 is removed, the output voltage will
A. stay the same
B. decrease
C. **increase**
D. be zero

**135.** A certain common-drain (CD) amplifier with $R_S$ = 1.0 kΩ has a transconductance of 6000 µS. The voltage gain is
A. 1
B. **0.86**
C. 0.98
D. 6

**136.** The data sheet for the transistor used in a CD amplifier specifies $I_{GSS}$ = 5 nA at $V_{GS}$ = 10 V. If the resistor from ate to ground, $R_G$, is 50 MΩ, the total input resistance is approximately.
A. 50 MΩ
B. 200 MΩ
C. 40 MΩ
D. 20.5 MΩ

**137.** The common-gate (CG) amplifier differs from both the CS and CD configuration in that it has a
A. much higher voltage gain
B. much lower voltage gain
C. much higher input resistance
D. **much lower input resistance**

**138.** If you are looking for both good voltage gain and high input resistance, you must use a
A. **CS amplifier**
B. CD amplifier
C. CG amplifier
D.

**139.** For small-signal operation, an n-channel JFET must be biased at
A. $V_{GS}$ = 0 V
B. $V_{GS} = V_{GS(off)}$
C. **$-V_{GS(off)} < V_{GS} < 0V$**
D. $V_{GS} = V_{GS(off)}$
E. $0V < V_{GS} < +V_{GS(off)}$

**140.** Two FET amplifier are cascaded. The first stage has a voltage gain of 5 and the second stage has a voltage gain of 7. The overall voltage gain is
A. **35**
B. 12
C. dependent on the second stage loading

**141.** If there is an internal open between the drain and source in a CS amplifier, the drain voltage is equal to
A. 0 V B. **$V_{DD}$**
C. a value less than normal D. $V_{GS}$

**CHAPTER 9**

**142.** An amplifier that operates in the linear region at all times is
A. Class A B. Class AB
C. Class B D. Class C

**143.** A certain class A power amplifier delivers 5 W to a load with an input signal power of 100 mW. The power gain is
A. 100 B. **50**
C. 250 D. 5

**144.** The peak current a class A power amplifier can deliver to a load depends on the
A. maximum rating of the power supply
B. **quiescent current**
C. current in the bias resistor
D. size of the heat sink

**145.** For maximum output, a class A power amplifier must be maintain a value of quiescent current that is
A. **one-half the peak load current**
B. twice the peak load current
C. at least as large as the peak load current
D. just above the cutoff value

**146.** A certain class A power amplifier has $V_{CEQ}$ = 12 V and $I_{CQ}$ = 1 A. The maximum signal power output is
A. 6 W B. 12 W
C. 1 W D. 0.707 W

**147.** The efficiency of a power amplifier is the ratio of the power delivered to the load to the
A. input signal power
B. power dissipated in the last stage
C. **power from the dc power supply**
D. none of these answer

**148.** The maximum efficiency of a class A power amplifier is
A. **25%** B. 50%
C. 79% D. 98%

**149.** The transistor is a class B amplifier are biased
A. into cutoff B. in saturation
C. at midpoint of the load line D. **right at cutoff**

**150.** Crossover distortion is a problem for
A. class A amplifiers B. class AB amplifiers
C. **class B amplifiers** D. all of these amplifiers

**151.** A BJT class B push-pull amplifier with no transformer coupling uses
A. two npn transistors B. two pnp transistors
C. **complementary symmetry transistors**
D. none of these

**152.** A current mirror in a push-pull amplifier should give an $I_{CQ}$ that is
A. **equal to the current in the bias resistors and diodes**
B. twice the current in the bias resistors and diodes
C. half the current in the bias resistors and diodes
D. zero

**153.** The maximum efficiency of a class B push-pull amplifier is
A. 25% B. 50%
C. **79%** D. 98%

**154.** The output of a certain two-supply class B push pull amplifier has a $V_{CC}$ of 20 V. If the load resistance is 50 Ω, the value of $I_{C(sat)}$ is
A. 5 mA B. **0.4 A**
C. 4 mA D. 40 mA

**155.** The maximum efficiency of a class AB amplifier is
A. higher than a class B
B. the same as class B
C. about the same as a class A
D. **slightly less than a class B**

**156.** The power dissipation of a class C amplifier is normally
A. **very low** B. very high
C. the same as a class B D. the same as a class A

**157.** The efficiency of a class C amplifier is
A. less than class A
B. less than class B
C. less than class AB
D. **greater than classes A, B, or AB**

**158.** The transistor in a class C amplifier conducts for
A. more than 180˚ of the input cycle
B. one-half of the input cycle
C. **a very small percentage of the input cycle**
D. all of the input cycle

**CHAPTER 10**

**159.** The low-frequency response of an amplifier is determined in part by
A. the voltage gain
B. the type of transistor
C. the supply voltage
D. **the coupling capacitors**

**160.** The high-frequency response of an amplifier is determined in part by
A. the gain-bandwidth product
B. the bypass capacitor
C. **the internal transistor capacitances**
D. the roll-off

**161.** The bandwidth of an amplifier is determined by
A. **the midrange gain**
B. the critical frequencies
C. the roll-off rate
D. the input capacitance

**162.** The gain of a certain amplifier decrease by 6 dB when the frequency is reduced from 1 kHz to 10 Hz. The roll-off is
A. - 3 dB/decade
B. - 6 dB/decade
C. - 3 dB/octave
D. **- 6 dB/octave**

**163.** The gain of a particular amplifier at a given frequency decreases by 6 dB when the frequency is doubled. The roll-off is
A. - 12 dB/decade
B. - 20 dB/decade
C. - 6 dB/octave
D. **answer b and c**

**164.** The miller input capacitance of an amplifier is dependent, in part, on
A. the input coupling capacitor
B. **the voltage gain**
C. the bypass capacitor
D. none of these

**165.** An amplifier has the following critical frequencies: 1.2 kHz, 950 Hz, 8 kHz, and 8.5 kHz. The bandwidth is
A. 7550 Hz
B. 7300 Hz
C. **6800 Hz**
D. 7050 Hz

**166.** Ideally, the midrange gain of an amplifier
A. increase with frequency
B. decrease with frequency
C. **remains constant with frequency**
D. depends on the coupling capacitors

**167.** The frequency at which an amplifier's gain is 1 is called the
A. **unity-gain frequency**
B. midrange frequency
C. corner frequency
D. break frequency

**168.** When the voltage gain of an amplifier is increased, the bandwidth
A. is not affected
B. increases
C. **decreases**
D. becomes distorted

**169.** If the $f_r$ of the transistor used in a certain amplifier is 75 MHz and the bandwidth is 10 MHz, the voltage gain must be
A. 750
B. **7.5**
C. 10
D. 1

**170.** In the midrange of an amplifier's bandwidth, the peak output voltage is 6 V. At the lower critical frequency, the peak output voltage is
A. 3 V
B. 3.82 V
C. 8.48 V
D. **4.24 V**

**171.** At the upper critical frequency, the peak output voltage of a certain amplifier is 10 V. The peak voltage in the midrange of the amplifier is
A. 7.07 V
B. 6.37 V
C. **14.14 V**
D. 10 V

**172.** In the step response of a noninverting amplifier, a longer rise time means
A. **a narrower bandwidth**
B. a lower $f_{cl}$
C. a higher $f_{cu}$
D. answer a and b

**173.** The lower critical frequency of a direct-coupled amplifier with no bypass capacitor is
A. variable
B. 0 Hz
C. dependent on the bias
D. none of these

**CHAPTER 11**

**174.** a thyristor has
A. two pn junctions
B. **three pn junctions**
C. four pn junctions
D. only two terminals

**175.** Common types of thyristors includes
A. BJTs and SCRs
B. UJTs and PUTs
C. FETs and triacs
D. **diacs and triacs**

**176.** A 4-layer didoe turns on when the anode to cathode voltage exceeds
A. 0.7 V
B. the gate voltage
C. **the forward-breakover voltage**
D. the forward-blocking voltage

**177.** Once it conducting, a 4-layer diode can be turned off by
A. reducing the current below a certain value
B. disconnecting the anode voltage
C. **answer a and b**
D. neither answer a nor b

**178.** An SCR differs from 4-layer diode because
A. **it has a gate terminal**
B. it is not thyristor
C. it does not have four layers
D. it cannot be turned on and off

**179.** An SCR can be turned off by
A. forced commutation
B. a negative pulse on the gate
C. anode current interruption
D. answer a, b and c
D. **answer a and c**

**180.** In the forward-blocking region, the SCR is
A. reverse-biases
B. **in the off state**
C. in the on state
D. at the point of breakdown

**181.** The specified value of holding current for an SCR means that
A. the device will turn on when the anode current exceeds this value
B. **the device will turn off when the anode current falls below this value**
C. the device may be damaged if the anode current exceeds this value
D. the gate current must be equal or exceeds this value to turn the device on

**182.** The diac is
A. a thyristor
B. a bilateral, two terminal device
C. like two parallel 4-layer diode in reverse directions
D. **answer a, b and c**

**183.** The triac is
A. **like a bi-directional SCR**
B. a four-terminal device
C. not a thyristor
D. answer a and b

**184.** The SCS differs from the SCR because
A. it does not have a gate terminal
B. its holding current is less
C. it can handle much higher currents
D. **it has two gate terminals**

**185.** The SCS can be turned on by
A. an anode voltage that exceeds forward-breakover voltage
B. a positive pulse on the anode gate
C. a negative pulse on the anode gate
D. **either b or c**

**186.** The SCS can be turned off by
A. a negative pulse on the cathode gate and a positive pulse on the anode gate
B. reducing the anode current to below the holding value
C. **answer a and b**
D. a positive pulse on the cathode gate and a negative pulse on the anode gate

**187.** Which of the following is not a characteristic of the UJT?
A. intrinsic standoff ratio
B. negative resistance
C. peak-point voltage
D. **bilateral conduction**

**188.** The PUT is
A. much like the UJT
B. not a thyristor
C. **triggered on and off by the gate-to-anode voltage**
D. not a four-layer device

**189.** In a phototransistor, base current is
A. set by bias voltage
B. **directly proportional to light**
C. inversely proportional to light
D. not a factor

**CHAPTER 12**

**190.** An integrated circuit (IC) op-amp has
A. two inputs and two outputs
B. one input and one-output
C. **two inputs and one output**

**191.** Which of the following characteristics does not necessarily apply to an op-amp?
A. high gain B. **low power**
C. high input impedance D. low output impedance

**192.** A differential amplifier
A. is part of an op-amp
B. has one input and one output
C. has two outputs
D. **answer a and c**

**193.** When an op-amp is operated in the single-ended mode, the output is grounded
A. **one input is grounded and a signal is applied to the other**
B. both inputs are connected together
C. the output is not inverted

**194.** In the differential mode,
A. **opposite polarity signals are applied to the inputs**
B. the gain is 1
C. the output are different amplitudes
D. only one supply voltage us used

**195.** In the common mode,
A. both inputs are grounded
B. the output are connected together
C. **an identical signal appears on both inputs**
D. the output signals are in-phase

**196.** Common-mode gain is
A. very high B. **very low**
C. always unity D. unpredictable

**197.** If $A_{v(d)}$ = 3500 and $A_{cm}$ = 0.35, the CMRR is
A. 1225 B. 10,000
C. 80 dB D. **answers b and c**

**198.** With zero volts on both inputs, an op-amp ideally should have an output equal to
A. the positive supply voltage
B. the negative supply voltage
C. **zero**
D. the CMRR

**199.** Of the valued listed, the most realistic value for open-loop gain of an op-amp is
A. **1** B. 2000
C. 80 db D. 100,000

**200.** A certain op-amp has a bias current of 50µA and 49.3µA. The input offset current is
A. 700 nA B. **99.3µA**
C. 49.7µA D. none of these

**201.** The output of a particular op-amp increases 8 V in 12 µs. The slew rate is
A. 96 V/µs B. 0.67 V/ µs
C. **1.5 V/µs** D. none of the above

**202.** The purpose of offset nulling is to
A. reduce gain
B. equalize the input signals
C. **zero the output error voltage**

**203.** For an op-amp with negative feedback, the output is
A. equal to the input
B. increased
C. **fed back to the inverting input**
D. fed back to the noninverting input

**204.** The use of negative feedback
A. reduces the voltage gain of an op-amp
B. makes the op-amp oscillate
C. makes linear operation possible
D. **answer a and c**

**205.** Negative feedback
A. increases the input and output impedances
B. **increases the input impedance and the bandwidth**
C. decreases the output impedance and the bandwidth
D. does not affect impedances of bandwidth

**206.** A certain inverting amplifier has an $R_i$ of 0.1 kΩ and an $R_f$ of 100 kΩ. The closed loop gain is
A. 100,000 B. 1000
C. **101** D. 100

**207.** If the feedback resistor in Question 17 is open, the voltage gain is
A. **increases** B. decreases
C. is not affected D. depends on $R_i$

**208.**A certain inverting amplifier has a closed-loop gain of 25. The op-amp has an open-loop gain of 100,000. if another op-amp with an open loop gain of 200,000 is substituted in the configuration, the closed-loop gain
A. doubles B. drops to 12.5
C. **remains at 25** D. increases slightly

**209.**A voltage follower
A. has a gain of 1 B. is noninverting
C. has no feedback resistor D. **has all of these**

**210.**The bandwidth of an ac amplifier having a lower critical frequency of 1 kHz and an upper critical frequency of 10 kHz is
A. 1 kHz B. **9 kHz**
C. 10 kHz D. 11 kHz

**211.**The bandwidth of a dc amplifier having an upper critical frequency of 100 kHz is
A. **100 kHz** B. unknown
C. infinity D. 0 kHz

**212.**The midrange open-loop of an op amp
A. extends from lower critical frequency to the upper critical frequency
B. **extends from 0 Hz to the upper critical frequency**
C. rolls off at 20 db/decade beginning at 0 Hz
D. answers a and c

**213.**The frequency at which the open-loop gain is equal to 1 is called
A. the upper critical frequency
B. the cutoff frequency
C. the notch frequency
D. **the unity-gain frequency**

**214.**Phase shift through an op-amp is caused by
A. **the internal RC circuits**
B. the external RC circuits
C. the gain roll-off
D. negative feedback

**215.**Each RC circuit in an op-amp
A. causes the gain to roll off at – 6 dB/octave
B. causes the gain to roll off at – 20 db/octave
C. reduces the midrange gain by 3 dB
D. **answer a and b**

**216.**When negative feedback is used, the gain-bandwidth product of an op-amp
A. increases B. decreases
C. **stays the same** D. fluctuates

**217.**If a certain op-amp has a midrange open-loop gain of 200,000 and a unity gain frequency of 5 MHz, the gain-bandwidth product is
A. 200,000 Hz
B. $1 \times 10^{12}$ Hz
C. **5,000,000 Hz**
D. not determinable from the information

**218.**If a certain op-amp has a closed-loop gain of 20 and an upper critical frequency of 10 MHz, the gain-bandwidth product is
A. 200 MHz B. 10 MHz
C. the unity-gain frequency D. **answer a and c**

**CHAPTER 13**

**219.**In a zero-level detector, the output changes state when the input
A. is positive B. is negative
C. **crosses zero** D. has a zero rate of change

**220.**The zero-level detector is one application of a
A. **comparator** B. differentiator
C. summing amplifier D. diode

**221.**Noise on the input of a comparator can cause the output to
A. hang up in one state
B. go to zero
C. **change back and forth erratically between two states**
D. produce the amplified noise signal

**222.**The effect the noise can be reduced by
A. lowering the supply voltage
B. using positive feedback
C. using negative feedback
D. using hysteresis
E. **answer b and d**

**223.**A comparator with hysteresis
A. has one trigger point
B. **has two trigger points**
C. has a variable trigger point
D. is like a magnetic circuit

**224.**In a comparator with hysteresis
A. a bias voltage is applied between the two inputs
B. only one supply voltage is used
C. a portion of the output is feedback to the inverting input
D. **a portion of the output is feedback to the noninverting input**

**225.**Using the output bounding in a comparator
A. makes faster
B. keeps the output positive
C. **limits the output levels**
D. stabilizes the output

**226.**A summing amplifier can have
A. only one input
B. only two inputs
C. **any number of inputs**

**227.**If the voltage gain for each input of a summing amplifier with a 4.7 kΩ feedback resistor is unity, the input resistor must have a value of
A. **4.7 kΩ**
B. 4.7 kΩ divided by number of inputs
C. 4.7 kΩ times the number of inputs

**228.**An average amplifier has five inputs. The ratio $R_f/R_i$ must be
A. 5 B. **0.2**
C. 1

**229.**In a scaling adder, the input resistors are
A. all the same value
B. all of different values
C. **each proportional to the weight of its input**
D. related by a factor of two

**230.** In an integrator, the feedback element is a
A. resistor B. **capacitor**
C. zener diode D. voltage divider

**231.** For a step input, the output of an integrator is
A. a pulse B. a triangular waveform
C. a spike D. **a ramp**

**232.** The rate of change of an integrator's output voltage in response to a step input is set by
A. the RC time constant
B. the amplitude of the step input
C. the current through the capacitor
D. **all of these**

**233.** In a differentiator, the feedback element is
A. **resistor** B. capacitor
C. zener diode D. voltage divider

**234.** The output of a differentiator is proportional to
A. the RC time constant
B. the rate at which the input is changing
C. the amplitude of the input
D. **answer a and b**

**235.** When you apply a triangular waveform to the input of a differentiator, the output is
A. a dc level
B. an inverted triangular waveform
C. **a square waveform**
D. the first harmonic of the triangular waveform

**CHAPTER 14**

**236.** To make a basic instrumentation amplifier, it takes
A. one op-amp with a certain feedback arrangement
B. two op-amps and seven resistors
C. three op-amps and seven capacitors
D. **three op-amps and seven resistors**

**237.** Typically, an instrumentation amplifier has an external resistor used for
A. establishing the input impedance
B. **setting the voltage gain**
C. setting the current gain
D. interfacing with an instrument

**238.** Instrumentation amplifiers are used primarily in
A. **high-noise environments**
B. medical equipment
C. test instruments
D. filter circuits

**239.** Isolation amplifiers are used primarily in remote, isolated locations systems that isolate a single signal from many different signals
A. applications where there are high voltages and sensitive
B. equipment
C. applications where human safety is a concern
D. **answer c and d**

**240.** The three parts of a basic isolation amplifier are
A. amplifier, filter, and power
B. input, output, and coupling
C. **input, output, and power**
D. gain, attenuation, and offset

**241.** The stage of most isolation amplifiers are connected by
A. copper strips B. **transformers**
C. microwave links D. current loops

**242.** The characteristics that allows an isolation amplifier to amplify small signal voltages in the presence of much greater noise voltages is its
A. CMRR
B. high gain
C. high input impedance
D. magnetic coupling between input and output

**243.** The term OTA means
A. operational transistor amplifier
B. operational transformer amplifier
C. **operational transconductance amplifier**
D. output transducer amplifier

**244.** In an OTA, the transconductance is controlled by
A. the dc supply voltage
B. the input signal voltage
C. the manufacturing process
D. **a bias current**

**245.** The voltage gain of an OTA circuit is set by
A. a feedback resistor
B. the transconductance only
C. **the transconductance and the load resistor**
D. the bias current and supply voltage

**246.** An OTA is basically a
A. **voltage-to-current amplifier**
B. current-to-voltage amplifier
C. current-to-current amplifier
D. voltage-to-voltage amplifier

**247.** The operation of a logarithmic amplifier is based on
A. the nonlinear operation of an op-amp
B. **the logarithmic characteristics of a pn junction**
C. the reverse breakdown characteristics of a pn junction
D. the logarithmic charge and discharge of an RC circuit

**248.** If the input to a log amplifier is x, the output is proportional to
A. $\mathbf{e^x}$ B. ln x
C. $\log_{10}{}^{x}$ D. $2.3 \log_{10}{}^{x}$
E. answer a and c F. answer b and d

**249.** If the input to an antilog amplifier is x, the output is proportional to
A. $e^{\ln x}$ B. $\mathbf{e^x}$
C. ln x D. $e^{-x}$

**250.** The logarithm of the product of two numbers is equal to the
A. sum of the two numbers
B. **sum of the logarithms of each of the numbers**
C. ratio of the logarithm of the numbers

**251.** If you subtract ln y from ln x, you get
A. ln x/ln y B. (ln x)(ln y)
C. **ln(x/y)** D. ln(y/x)

**CHAPTER 15**

**252.** The term pole in filter terminology refers to
A. a high-gain op-amp B. one complete active filter
C. **a single RC circuit** D. the feedback circuit

**253.** A single resistor and a single capacitor can be connected to form a filter with a roll-off rate of
A. - 20 dB/decade
B. - 40 dB/decade
C. - 6 dB/octave
D. **answer a and c**

**254.** A band-pass response has
A. **two critical frequencies**
B. one critical frequency
C. a flat curve in the passband
D. a wide bandwidth

**255.** The lower frequency passed by a low-pass filter is
A. 1 Hz B. 0 Hz
C. 10 Hz D. dependent on the critical frequency

**256.** The quality factor (Q) of a band-pass filter depends on
A. the critical frequencies
B. only the bandwidth
C. **the center frequency and the bandwidth**
D. only the center frequency

**257.** The damping factor of an active filter determines
A. the voltage gain
B. the critical frequency
C. **the response characteristics**
D. the roll-off rate

**258.** A maximally flat frequency response is known as
A. chebyshev B. **butterworth**
C. Bessel D. colpitts

**259.** The damping factor of a filter is set by
A. **the negative feedback circuit**
B. the positive feedback circuit
C. the frequency-selective circuit
D. the gain of the op-amp

**260.** The number of poles in a filter affect the
A. voltage gain B. bandwidth
C. center frequency D. **roll-off rate**

**261.** Sallen-Key filters are
A. single-pole circuit
B. **second-order filters**
C. butterworth filters
D. band-pass filters

**262.** When filters are cascaded, the roll-off rate
A. **increases** B. decreases
C. does not change

**263.** When the low-pass and a high-pass filter are cascaded to get a band-pass filter, the critical frequency of the low-pass filter must be
A. equal to the critical frequency of the high-pass filter
B. less than the critical frequency of the high-pass filter
C. **greater than critical frequency of the high-pass filter**

**264.** A state-variable filter consist of
A. one op-amp with multiple-feedback paths
B. **a summing amplifier and two integrators**
C. a summing amplifier and two differentiators
D. three butterworth stages

**265.** When the gain of a filter is minimum at its center frequency, it is
A. a band-pass filter
B. a band-stop filter
C. a notch filter
D. **answer b and c**

**CHAPTER 16**

**266.** An oscillator differs from an amplifier because
A. it has more gain
B. **it requires no input signal**
C. it requires no dc supply
D. it always has the same output

**267.** Wien-bridge oscillators are based on
A. **positive feedback**
B. negative feedback
C. the piezoelectric effect
D. high gain

**268.** One condition for oscillation is
A. a phase shift around the feedback loop of 180˚
B. a gain around the feedback loop of one-third
C. **a phase shift around the feedback loop of 0˚**
D. a gain around the feedback loop of less than 1

**269.** A second condition for oscillation is
A. no gain around the feedback loop
B. **a gain of 1 around the feedback loop**
C. the attenuation of the feedback circuit must be one-third
D. the feedback circuit must be capacitive

**270.** In a certain oscillator, $A_V$ = 50. The attenuation of the feedback circuit must be
A. 1 B. 0.01
C. 10 D. **0.02**

**271.** For an oscillator to properly start, the gain around the feedback loop must initially be
A. 1 B. less than 1
C. **greater than 1** D. equal to B

**272.** In a Wien-bridge oscillator, if the resistance in the positive
A. feedback circuit are decreased, the frequency
B. decreases
C. **increases**
D. remains the same

**273.** The Wien-bridge oscillator's positive feedback circuit is
A. an RL circuit B. an LC circuit
C. a voltage divider D. **a lead-lag circuit**

**274.** A phase-shift oscillator has
A. **three RC circuits** B. three LC circuits
C. a T-type circuit D. a π-type circuits

**275.** Colpitts, Clapp, and Hartley are names refer to
A. types of RC oscillation
B. inventors of the transistor
C. **types of LC oscillators**
D. types of filters

**276.** An oscillator whose frequency is charged by a variable dc voltage is known as
A. a crystal oscillator B. **a VCO**
C. an Armstrong oscillator D. a piezoelectric device

**277.** The main feature of a crystal oscillator is
A. economy B. reliability
C. **stability** D. high frequency

**278.** The operation of a relaxation oscillator is based on
A. **the charging and discharging of a capacitor**
B. a highly selective resonant circuit
C. a very stable supply voltage
D. low power consumption

**279.** Which of the following is not an input or output of the 555 timer?
A. threshold B. control voltage
C. **clock** D. trigger
E. discharged F. reset

**CHAPTER 17**

**280.** In amplitude modulation, the pattern produced by the peaks of the carrier signal is called the
A. index B. **envelope**
C. audio signal D. upper-side frequency

**281.** Which of the following is not a part of an AM superheterodyne receiver?
A. mixer B. IF amplifier
C. DC restorer D. detector
E. audio amplifier F. local oscillator

**282.** In an AM receiver, the local oscillator always produces a frequency that is above the incoming RF by
A. 10.7 kHz B. 455 MHz
C. 10.7 MHz D. **455 kHz**

**283.** An FM receiver has an IF frequency that is
A. in the 88 MHz to 108 MHz range
B. in the 540 kHz to 1640 kHz range
C. 455 kHz
D. **greater than the IF in an AM receiver**

**284.** The detector or discriminator in an AM or an FM receiver
A. detects the difference frequency from mixer
B. changes the RF to IF
C. **recovers the audio signal**
D. maintains a constant IF amplitude

**285.** In order to handle all combinations of input voltage polarities, a multiplier must have
A. **four-quadrant capability**
B. three-quadrant capability
C. four inputs
D. dual-supply voltages

**286.** The internal attenuation of a multiplier is called the
A. transconductance B. **scalefactor**
C. reduction factor D.

**287.** When the two inputs of a multiplier are connected together, the device operates as a
A. voltage doubler
B. square root circuit
C. **squaring circuit**
D. averaging circuit

**288.** Amplitude modulation is basically a
A. summing of two signals
B. **multiplication of two signals**
C. subtraction of two signals
D. nonlinear process

**289.** The frequency spectrum of a balanced modulator contains
A. a sum frequency
B. a difference frequency
C. a carrier frequency
D. answer a, b, and c
E. **answers a and b**
F. answers b and c

**290.** The IF in a receiver is the
A. sum of the local oscillator frequency and the RF carrier frequency
local oscillator frequency
B. **difference of the local oscillator frequency and the carrier RF frequency**
C. difference of the carrier frequency and the audio frequency

**291.** When a receiver is tuned from one RF frequency to another, the IF changes by an amount equal to the LO (local oscillator) frequency
A. **the IF stays the same**
B. the LO frequency changes by an amount equal to the audio frequency
C. both LO and the IF frequencies change

**292.** The output of the AM detector goes directly to the
A. IF amplifier B. mixer
C. **audio amplifier** D. speaker

**293.** If the control voltage to a VCO increases, the output frequency
A. decreases
B. does not change
C. **increases**

**294.** A PLL maintains lock by comparing
A. **the phase of two signals**
B. the frequency of two signals
C. the amplitude of two signals

**Chapter 18**

**295.** In the case of line regulation,
A. when the temperature varies, the output voltage stays constant
B. when the output voltage changes, the load current stays constant
C. **when the input voltage changes, the output voltage stays constant**
D. when the load changes, the output voltage stays constant

**296.** All of the following are parts of a basic voltage regulator except
A. control element B. sampling circuit
C. **voltage-follower** D. error detector
E. reference voltage

**297.** The basic series regulator, $V_{out}$ is determined by
A. the control element B. the sample circuit
C. the reference voltage D. **answers b and c**

**298.** The main purpose of current limiting in a regulator is
A. **protection of the regulator from excessive current**
B. protection of the load from excessive current
C. to keep the power supply transformer from burning up
D. to maintain a constant output voltage

**299.** In a linear regulator, the control transistor is conducting

A. a small part of the time
B. half the time
C. **all of the time**
D. only when the load current is excessive

**300.** In a switching regulator, the control transistor is conducting

A. **part of the time**
B. all of the time
C. only when the input voltage exceeds a set limit
D. only when there is an overload

**301.** The LM317 is an example of an IC

A. three-terminal negative voltage regulator
B. fixed positive voltage regulator
C. switching regulator
D. linear regulator
E. variable positive voltage regulator
F. answers b and d only
G. **answers d and e only**

**302.** An external pass transistor is used for

A. increasing the output voltage
B. improving the regulation
C. **increasing the current that the regulator can handle**
D. short circuit protection