GATE ELECTRONICS AND COMMUNICATION ENGINEERING

MULTUPLE SELECT QUESTIONS (MSQ's)

1. Which of the following are the active materials of a lead acid cell:
(a) Lead Peroxide (PbO_2) for positive plate
(b) Sponge Lead (Pb) for negative plate
(c) Concentrated Sulphuric acid (H_2SO_4) as electrolyte
(d) Dilute Sulphuric acid (H_2SO_4) as electrolyte

2. Which of the following methods are used for producing damping torque in analog instruments:
(a) Air friction damping
(b) Fluid friction damping
(c) Eddy current damping
(d) Electromagnetic damping

3. Which of the following methods are used for measurement of low resistance:
(a) Ammeter voltmeter method
(b) Kelvin's double bridge method
(c) Maxwell's bridge method
(d) Potentiometer method

4. Which of the following land line telemetry systems are available:
(a) Voltage telemetry systems
(b) Current telemetry systems
(c) Position telemetry systems
(d) Resistive telemetry systems

5. A core of processor chip consists of:
(a) ALU
(b) Instruction logic
(c) Load/store logic
(d) L1 data cache

6. Which of the following will cause internal interrupt to CPU:
(a) Stack overflow
(b) Attempt to divide by zero
(c) I/O device finished transfer of data
(d) Power failure

7. What are the components of a memory management unit:
(a) A facility for dynamic storage relocation
(b) Provision for preventing users for sharing programs stored in memory by different users
(c) Protection of information against unauthorized access
(d) Provision for users for changing operating system functions

8. Which of the following steps are followed by HIS during synthesis:
(a) Data model generation
(b) Data flow analysis
(c) Scheduling and allocation
(d) Data path optimization

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9. Which of the following are the advantages of digital filters over analog filters:
(a) Highly flexible
(b) Portable
(c) Negligible noise interference
(d) Lumped *RLC* components

10. For a lead compensator having transfer function

$$G_c(s) = \frac{(s+z_c)}{(s+p_c)} = \frac{\left(s+\frac{1}{\tau}\right)}{\left(s+\frac{1}{\alpha\tau}\right)}$$

Which of the following are correct:

(a) $\alpha = \frac{z_c}{p_c} < 1$
(b) $\alpha = \frac{z_c}{p_c} > 1$
(c) $\tau > 0$
(d) $\tau < 0$

11. Which of the following statements are correct:
(a) A pseudo instruction is a machine instruction.
(b) A pseudo instruction is an instruction to the assembler.
(c) The ORG (origin) is an example of pseudo instruction.
(d) It is not possible to use ORG more than once in a program.

12. Which of the following are the advantages of packet switching:
(a) Greater link efficiency than circuit switching
(b) Connections are not blocked when traffic congestion occurs
(c) Direct channel established between transmitter and receiver
(d) No time is taken to establish connection

13. Which of the following regarding cellular systems with small cells are correct:
(a) Higher capacity and robustness
(b) Needless transmission power and have to deal with local interference only
(c) Frequency planning and infrastructure needed
(d) These require both circuit switching and packet switching

14. Which of the following statements regarding the formation of *pn*-junctions are correct:
(a) Holes diffuse across the junction from *p*-side to *n*-side.
(b) The depletion layer is wiped out.
(c) There is continuous flow of current across the junction.
(d) A barrier potential is set up across the junction.

15. Silicon devices can be employed for a higher temperature limit $(190\,°\text{C to } 200\,°\text{C})$ as compared to germanium devices $(85\,°\text{C to } 100\,°\text{C})$. With respect to this, which of the following are incorrect:
(a) Higher resistivity of silicon
(b) Higher gap energy of silicon
(c) Lower intrinsic concentration of silicon
(d) Use of silicon devices in higher-power applications

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16. Which of the following are the properties of Polytetrafluoroethylene:
(a) Extreme heat resistant
(b) Low resistance to most chemical reagents
(c) Excellent insulating properties over a wide range of temperature
(d) Non-hygroscopicity

17. Which of the following represent the properties of carbon nanotubes:
(a) High electrical conductivity
(b) Very high tensile strength
(c) High thermal conductivity
(d) Low thermal expansion coefficient

18. A vector voltmeter can be used to measure:
(a) complex insertion loss
(b) two-port network parameters
(c) amplifier gain and phase shift
(d) harmonic distortion

19. Which of the following statements pertaining to FIR filters are correct:
(a) These are non-recursive and hence stable.
(b) These have high coefficient sensitivity.
(c) These have linear phase characteristics.
(d) These are realized using feedback structures.

20. Which of the following statements are correct:
(a) For an isotropic medium, ε is a scalar constant.
(b) For a homogeneous medium, ε, μ and σ are constant throughout the region.
(c) In an anisotropic medium, D and E have the same direction.
(d) For certain crystalline medium, ε varies with the direction of E.

21. Which of the following factors does inductance depend:
(a) Number of turns of the coil
(b) Length of the coil
(c) Area of cross-section of the coil
(d) Permeability of the core

22. Which of the following statements in connection with deflection-type and null-type instruments are correct:
(a) Null-type instruments are more accurate than the deflection-type ones.
(b) Null-type of instrument can be highly sensitive compared to a deflection-type instrument.
(c) Under dynamic conditions, null-type instruments are less preferred to deflection-type instruments.
(d) Response is faster in null-type instruments as compared to deflection-type instruments.

23. Which of the following statements regarding essential functional operations of a digital data acquisition system are correct:
(a) Handling of analog signals
(b) Converting the data to digital form and handling it
(c) Making the measurement
(d) Internal programming and telemetry

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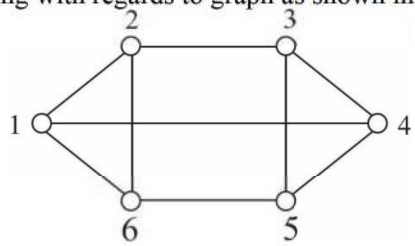
24. Which of the following with regards to graph as shown in the following figure are correct:



(a) Regular graph
(b) Connected graph
(c) Complete graph
(d) Non-regular graph

25. Which of the following statements with respect to a parallel *RLC* circuit are correct:
(a) The bandwidth of the circuit decreases if R is increased.
(b) The bandwidth of the circuit remains same if L is increased.
(c) At resonance, input impedance is a real quantity.
(d) At resonance, the magnitude of the input impedance attains its minimum value.

26. If primary and secondary windings of core-type single-phase transformer are wound on non-magnetic core, then which of the following possibilities are realized:
(a) efficiency of the transformer will decrease
(b) efficiency of the transformer will increase
(c) transformer regulation will increase
(d) transformer regulation will decrease

27. Which of the following statements regarding 'relative stability' are correct:
(a) It is defined in terms of gain margin
(b) It is defined in terms of phase margin
(c) It is defined in terms of location of poles in s-plane
(d) It is defined in relation to another identified system

28. Which of the following statements regarding the functions of an operating system in a computer are correct:
(a) It controls hardware access.
(b) It manages files and folders.
(c) It provides a user interface.
(d) It manages applications.

29. Which of the following statements regarding database normal forms are correct:
(a) Any relation with two attributes is BCNF.
(b) Lossless, dependency-preserving decomposition into BCNF is always possible.
(c) Lossless, dependency-preserving decomposition into 3NF is not possible.
(d) BCNF is stricter than 3NF.

30. Stokes' theorem is valid irrespective of:
(a) shape of closed curve C
(b) type of vector A
(c) type of coordinate system
(d) whether the surface is closed or open

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31. Which of the following are the properties of TEM mode in a lossless medium:
(a) Its cut-off frequency is zero.
(b) Its transmission line is not a hollow waveguide.
(c) Its wave impedance is the impedance in a unbounded dielectric.
(d) Its phase velocity is the velocity of light in an unbounded dielectric.

32. The 8259A Programmable Interrupt Controller can:
(a) manage eight interrupts
(b) vector an interrupt request anywhere in the memory map
(c) have 8-bit or 16-bit interval between interrupt vector locations
(d) be initialized with operational command words

33. If the maximum range of radar has to be doubled:
(a) the peak transmitted power may be increased 16 folds
(b) the antenna diameter may be doubled
(c) the sensitivity of receiver may be doubled
(d) the transmitted pulse width may be doubled

34. Which of the following statements are correct:
(a) Two identical 2nd order Butterworth LP fitters when connected in cascade will make a 4th order Butterworth LP filter.
(b) A high 2nd order filter will exhibit a peak if Q exceeds certain value,
(c) A band pass filter cannot be of order one.
(d) A network consists of an amplifier of real gain A and a β network in cascade with each other. The network will generate sinusoidal oscillations if the β network is a first order LP filter.

35. Which of the following statements are correct:
(a) The magnetic field at the centre of a circular coil of a wire carrying current is inversely proportional to the radius of the coil
(b) Lifting power of a magnet is proportional to square of magnetic flux density
(c) A static electric field is conservative (irrotational)
(d) If the divergence of a vector 'A' is zero, then vector 'A' can be expressed as curl of a vector F

36. Which of the following are examples of convection current:
(a) Electric current flowing in a conducting wire
(b) A moving charged belt
(c) An electron beam in a cathode ray tube
(d) Electron movement in a vacuum tube

37. Which of the following are the sources of steady magnetic field:
(a) A permanent magnet
(b) A charged disc rotating at uniform speed
(c) An accelerated charge
(d) An electric field which changes linearly with time

38. Which of the following regions of operation are mainly responsible for heating of the transistor under switching operation:
(a) Saturation region
(b) Cut-off region
(c) Transition from saturation to cut-off
(d) Transition from cut-off to saturation

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39. Which of the following statements regarding Wien Bridge oscillator are correct:
(a) It has a larger bandwidth than the phase shift oscillator.
(b) It has a smaller bandwidth than the phase shift oscillator.
(c) It has 2 capacitors while the phase shift oscillator has 3 capacitors.
(d) It has 3 capacitors while the phase shift oscillator has 2 capacitors.

40. Which of the following statements related to oscillator circuits are correct:
(a) The tank circuit of a Hartley oscillator is made up of a tapped capacitor and a common inductor.
(b) The tank circuit of a Colpitts oscillator is made up of a tapped capacitor and a common oscillator.
(c) The Wien Bridge oscillator is essentially a two-stage amplifier with an *RC* bridge in the first stage, and, the second stage serving as an inverter.
(d) Crystal oscillators are fixed frequency oscillators with a high *Q* factor.

41. Which of the following statements are correct regarding a multiplexer:
(a) selects one of the several inputs and transmits it to a single output.
(b) routes the data from a single input to one of many outputs.
(c) converts parallel data into serial data.
(d) is a combinational circuit.

42. Which of the following statements are correct:
(a) An 8-input MUX can be used to implement any 4 variable functions.
(b) A 3-line to 8-line DEMUX can be used to implement any 4 variable functions.
(c) A 64-input MUX can be built using nine 8-input MUXs.
(d) A 6-line to 64-line DEMUX can be built using nine 3-line to 8-line DEMUXs.

43. Which of the following are typical elements of machine instructions:
(a) Operation code
(b) Source operand reference
(c) Result operand reference
(d) Next instruction reference

44. By doping Germanium with Gallium, the types of semi-conductors formed are:
(a) *n*-type
(b) *p*-type
(c) Intrinsic
(d) Extrinsic

45. An *n*-type of silicon can be formed by adding impurity of:
(a) Phosphorous
(b) Arsenic
(c) Boron
(d) Aluminium

46. Which of the following statements regarding an *n-p-n* bipolar junction transistor are corrects:
(a) Emitter diode is forward biased and collector diode is reverse biased
(b) Emitter has many free electrons
(c) Free electrons are injected into base and pass through collector
(d) Depletion layers around junction *J*1 and *J*2 of BJT are widened.

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47. The solutions to many problems involving electric fields are simplified by making use of equipotential surfaces. An equipotential surface is a surface:
(a) On which the potential is same everywhere
(b) The movement of charge over such a surface would require no work
(c) The tangential electric field is zero
(d) The normal electric field is zero

48. Which of the following properties of electromagnetic waves are correct:
(a) These waves do not require any material medium to propagate
(b) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of waves
(c) The energy in electromagnetic wave is divided equally between electric and magnetic vectors
(d) Both electric and magnetic field vectors attain the maxima and minima at the same place and same time

49. Which of the following statements regarding error occurring in current transformer are correct:
(a) It is due to the magnetic leakage in secondary winding.
(b) It is due to power consumption in the metering circuit.
(c) It is due to the exciting MMF required by the primary winding to produce flux.
(d) It is due to the non-linear relation between flux density in the core and magnetizing force.

50. Which of these require a fixed reference voltage at the comparator stage of digital voltmeter:
(a) Ramp type
(b) Dual slope integrating type
(c) Integrating type using voltage to frequency conversion
(d) Successive approximation type

51. Which of the following types of transducers can be used for the measurement of the angular position of a shaft:
(a) Circular potentiometer
(b) LVDT
(c) e-pickup
(d) Synchro pair

52. Which of the following statements in the context of the conditions needed to operate a bipolar junction transistor (BJT) in active region in a linear circuit are correct:
(a) The emitter diode must be forward biased.
(b) The collector diode must be reverse biased.
(c) The voltage across the collector diode must be greater than the breakdown voltage.
(d) The voltage across the collector diode must be less than the breakdown voltage.

53. Which of the following statements in respect of an *RC* coupled transistor amplifier are correct:
(a) The low frequency response is determined by the transistor junction capacitors.
(b) The high frequency response is limited by coupling capacitors.
(c) The Miller capacitance reduces the gain at high frequencies.
(d) As the gain is increased the bandwidth gets reduced.

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54. Which of the following statements pertaining to frequency response of *RC* coupled amplifier are correct:
(a) Coupling capacitance affects high frequency response.
(b) Bypass capacitance affects high frequency response.
(c) Coupling capacitance affects low frequency response.
(d) Bypass capacitance affects low frequency response.

55. In a voltage regulator, zener diode is
(a) Connected in series with filter output.
(b) Forward biased.
(c) Connected in parallel with filter output.
(d) Reverse biased.

56. A Schottky diode is included when a transistor is fabricated so as to:
(a) Prevent the transistor from full saturation.
(b) Eliminate saturation delay time.
(c) Achieve better switching speed.
(d) Reduce thermal stability.

57. Which of the following statements are correct:
(a) A magnitude comparator is a combinational circuit that compares two numbers.
(b) A decoder with enable input can function as a demultiplexer.
(c) The number of AND gates in a 32-to-1 Line multiplexer is 32.
(d) The number of 3×8 decoders required to realize a 6×64 decoder is 8.

58. Which of the following techniques are used to determine relative stability of a closed loop linear system:
(a) Bode plot
(b) Nyquist plot
(c) Nichol's chart
(d) Routh-Hurwitz criterion

59. The Bode plot of the transfer function $G(s) = s$ is:
(a) Constant magnitude
(b) slope of 20 dB/decade
(c) Constant phase shift of $\pi/3$
(d) Constant phase shift of $\pi/2$

60. The effect of phase lead network is given as
(a) Increased velocity constant.
(b) Increase phase margin.
(c) Increased bandwidth.
(d) Slower response.

61. It can be converted into an oscillator by:
(a) Providing adequate positive feedback.
(b) Phase shifting the output by 180° and feeding this phase-shifted output to the input.
(c) Using only a series turned circuit as a load on the amplifier.
(d) Using the negative resistance device as a load on the amplifier.

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62. The built-in potential (diffusion potential) in a *p-n* junction:
(a) is equal to the difference in the Fermi-level of the two sides, expressed in volts.
(b) increases with the increase in the doping levels of the two sides.
(c) increases with the increase in temperature.
(d) is equal to the average of the Fermi-levels of the two sides.

63. Which of the following statements for TEM (Transverse Electro Magnetic) waves are correct:
(a) Only for TEM wave, could the conductor separation be small compared with a wavelength.
(b) TEM mode needs to be considered at low frequencies.
(c) TEM waves are usually not obeying Maxwell's equations.
(d) TEM waves are usually treated like 'ordinary transmission line signals'.

64. The ratio $\frac{\sigma}{\omega\varepsilon}$ is:
(a) Intrinsic ratio
(b) Loss tangent
(c) Conduction ratio
(d) Dissipation factor

65. Which of the following statements are correct:
(a) DRAM offers reduced power consumption.
(b) An associative memory is cheaper than RAM.
(c) The fastest and most flexible cache organization uses content addressable memory.
(d) The address generated by a segmented program is called a physical address.

66. Which of the following statements are correct in association with the superposition theorem:
(a) It is applicable to networks having more than one source.
(b) It is used to determine the current in a branch or voltage across branch.
(c) It is applicable to direct current circuits only.
(d) It is applicable to networks having linear and bilateral elements.

67. Any element is redundant if connected in:
(a) series with an ideal current source
(b) parallel with an ideal current source
(c) series with an ideal voltage source
(d) parallel with an ideal voltage source

68. Which of the following statements regarding Maxwell's equation in differential form are correct:
(a) For free space, $\nabla \times H = (\sigma + j\omega\varepsilon)E$
(b) For free space, $\nabla \cdot D = \rho$
(c) For steady current, $\nabla \times H = J$
(d) For static electric field, $\nabla \cdot D = \rho$

69. Piezoelectric transducer has:
(a) a very good HF response
(b) typical output voltage of the order of 1 mV to 30 mV per unit of acceleration
(c) no requirement of external power and is self-generating
(d) no response for static conditions

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70. Which of the following statements are correct:
(a) A flip-flop is used to store 1 bit of information.
(b) Race around condition occurs in a *JK* flip-flop when both of its inputs are 1.
(c) Master slave configuration is used in flip-flops to store 2 bits of information.
(d) A transparent latch consists of *D* type flip-flops.

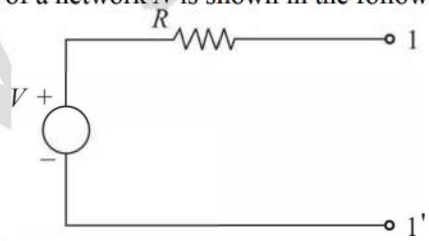
71. Thermal runaway in a transistor biased in the active region is due to:
(a) heating of the transistor.
(b) change in β due to increase in temperature.
(c) change in reverse collector saturation current due to rise in temperature.
(d) base emitter voltage V_{BE} which decreases with rise in temperature.

72. A Zener diode has the following properties:
(a) It is properly doped crystal diode with sharp breakdown
(b) It is reverse biased
(c) Its forward characteristics are just that of ordinary diode
(d) Its reverse characteristics are like ordinary diode

73. Which of the following are essentials of a transistor biasing circuit:
(a) Proper zero signal collector current flow
(b) V_{CE} should not fall below 0.5 V for germanium and 0.7 V for silicon
(c) Ensure stabilization of operating point
(d) Loading to the source

74. Which of the following Dirichlet's conditions are correct for convergence of Fourier transform of the function $x(t)$:
(a) $x(t)$ is square integrable
(b) $x(t)$ must be periodic
(c) $x(t)$ should have finite number of maxima and minima within any finite interval
(d) $x(t)$ should have finite number of discontinuities within any finite interval

75. Thevenin equivalent circuit of a network N is shown in the following figure (at terminals $1-1'$).



To determine the value of R
(a) all initial conditions are set to zero
(b) all independent sources are turned off
(c) all controlled sources are turned off
(d) small load connected to terminals $1-1^1$ (outside network N) is removed

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76. Which of these are needed for determining the response of a linear network for $t < t_0$:

(a) Input applied for $t < t_0$

(b) Input applied for $t \geq t_0$

(c) Stale of the network at $t = t_0$

(d) State of the network at $t < t_0$

77. In the following statements, choose the correct combinations:

(a) if $z_{11} = z_{22}$ and $|h| = 1$ the network is symmetric

(b) If $y_{11} = y_{22}$ the network is symmetric

(c) If $h_{12} = -h_{21}$ the network is reciprocal

(d) If $AD - BC = 1$ the network is reciprocal

78. Which of the following statements are not true for the driving point functions of a lossless network:

(a) They are the ratio of odd to even or even to odd polynomials.

(b) They do not satisfy the separation property.

(c) They have either a pole or a zero at the origin and infinity.

(d) Their degrees of the numerator and denominator polynomials differ by 2 and only 2.

79. Which of the following are electromagnetic in nature:

(a) Alpha rays

(b) X-rays

(c) Gamma rays

(d) Cathode rays

80. Which of the following regions of operation are mainly responsible for heating of the transistor under switching operation:

(a) Saturation operation

(b) Cut-off region

(c) Transition from saturation to cut-off

(d) Transition from cut-off to saturation

81. Which of the following are the characteristics of a Junction Field Effect Transistor:

(a) High input resistance

(b) Good thermal stability

(c) High current gain

(d) More noisy than bipolar junction transistor

82. A digital multiplexer can be used for:

(a) Parallel to serial conversion

(b) Many-to-one switch

(c) Generating memory chip select

(d) Code conversion

83. In a feedback control system, phase margin (PM) is:

(a) Directly proportional to small value of ξ

(b) Inversely proportional to large value of ξ

(c) Independent of ξ

(d) Zero when $\xi = 0$

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84. With reference to 8085 microprocessor, which of the following statements are correct:
(a) The DAD instruction adds the contents of the specified register pair to the contents of the DL register pair.
(b) The program counter is an instruction pointer.
(c) Whenever an instruction uses the HL pointer, the addressing is called indirect addressing.
(d) HL register pair is also called memory pointer.

85. On the 8085, which of the following machine cycles are not used in the CALL instruction:
(a) Instruction fetch
(b) I/O
(c) Memory Read
(d) Memory Write

86. The stack pointer will be affected by instructions
(a) PUSH PSW
(b) CALL ADDR
(c) XTHL
(d) RST n

87. Which of the following statements related to JFET are correct:
(a) Its operation depends on the flow of minority carriers only.
(b) It is less noisy than BJT
(c) It has poor thermal stability
(d) It is relatively immune to radiation

88. Which of the following statements are correct:
(a) Speed of operation of MOSFET is more than the speed of operation of SCR
(b) SCRs have lower power loss than MOSFETs.
(c) The current in conducting state can easily be controlled through the gate in SCR.
(d) MOSFET is not a current triggered device.

89. Which of the following statements for a DRAM are correct:
(a) Bit is stored as a charge.
(b) It is made of MOS transistors.
(c) Speed of DRAM is faster than processors.
(d) Each memory cell requires six transistors.

90. Which of the following quantities give a measure of the transient characteristics of a control system, when subjected to unit step excitation:
(a) Maximum overshoot, Peak time
(b) Maximum undershoot, Overall gain
(c) Delay time, Rise time
(d) Fall time, marginal gain

91. Which of the following are 8085 software interrupts:
(a) INTR
(b) RST 6
(c) RST 7.5
(d) RST0

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92. For smooth and reliable operation of an amplifier using BJT, it is necessary that the circuit must be properly designed from the point of view of bias stabilization, because:
(a) Reverse saturation current I_{CO} increases with rise in temperature.
(b) V_{BE} decreases with rise in temperature.
(c) h_{FE} or β changes with change of temperature and replacement of the transistor.
(d) h_{FE} or β changes with change in collector supply voltage.

93. Biasing is used in transition amplifiers to:
(a) Stabilize the operating point against temperature variations.
(b) Place the operating point in the linear region of the characteristics.
(c) Make α, β and I_{CO} of the transistor independent of temperature variations.
(d) Reduce distortion and increase dynamic range.

94. A 'hole' in a semiconductor has:
(a) Positive charge equal to the electron charge.
(b) Positive mass equal to the mass of the electron.
(c) An 'effective mass' greater than the effective mass of electron.
(d) Negative mass and positive charge equal to the charge in nucleus.

95. The free electrons in a metal follow the kinetic theory of gases Then which of the following statements are correct about their properties:
(a) The velocity of all the electrons is equal.
(b) The electrons have a velocity distribution ranging from zero to infinity.
(c) The average velocity of electron gas is proportional to T.
(d) The maximum velocity of electrons is proportional to T.

96. Using transistors,
(a) Class-A power amplifier has a efficiency of 50%.
(b) Class-B push-pull power amplifier gives rise to crossover distortion.
(c) Class-AB push-pull power amplifier has higher efficiency than Class-B push-pull amplifier.
(d) Class-C power amplifier is generally used with tuned load for RF amplification.

97. A material shows spontaneous magnetization. This is due to
(a) Weiss molecular field.
(b) Cooperative effect among dipoles.
(c) Cooperative effect among domains.
(d) Absence of applied magnetic field.

98. A type-I superconductor is
(a) A conductor of infinite conductivity at all temperatures.
(b) A conductor with very large conductivity below a critical temperature.
(c) A material showing susceptibility of -1 below critical temperature.
(d) A perfect conductor having conductivity drastically reduced by a critical current.

99. Which of the following statements with regard to semiconductors are correct:
(a) In n type material free electron concentration is nearly equal to density of donor atoms.
(b) 1 part in 10^8 donor type impurity added to Ge improves its conductivity at 30°C by a factor 12.
(c) Phosphorus is an example of n type impurity.
(d) Conductivity of Si is more sensitive to temperature than Ge.

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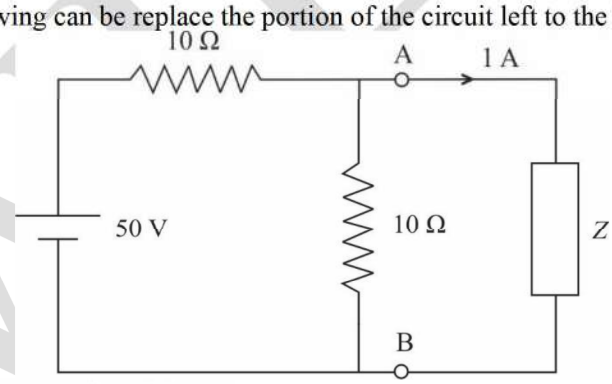
100. Which of the following statements are correct:
(a) The radiation falling on a photodiode is primarily a minority carrier injector.
(b) The short-circuit current of a reverse biased photodiode under illumination varies exponentially with light intensity.
(c) The photovoltaic emf of an open-circuited photodiode varies logarithmically with the light-generated short-circuit current.
(d) The spectral response of a photodiode does not depend upon the frequency of the incident light.

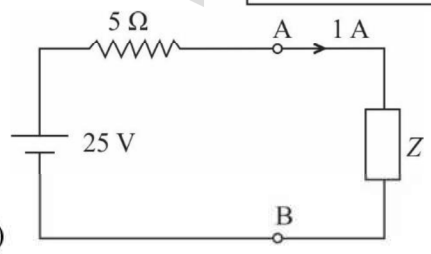
101. Which of the following statements are correct:
(a) The efficiency of a light emitting diode (LED) decreases with the injected current.
(b) The efficiency of a LED increases with a decrease in temperature.
(c) The light emitted is concentrated near the junction because most of the carriers are within a diffusion length of the junction.
(d) Light is emitted in a LED when electrons move from the valence band to the conduction band.

102. Which of the following statements are correct:
(a) In a Silicon Controlled Rectifier (SCR), if the cathode gate is reverse-biased, then the SCR cannot fire at all.
(b) The turn-on time of an SCR increases with temperature.
(c) After an SCR is turned on, it can be made to turn off again by reverse biasing the gate.
(d) Gate recovery time is the minimum time that the anode voltage must be maintained below holding voltage V_H to turn off the SCR.

103. Which of the following statements about CMOS are correct:
(a) CMOS logic inverter has maximum signal swing of 0 V to V_{DD}.
(b) The output signal swing is independent of exact value of aspect ratio and other device parameters.
(c) It is a fast switching device with wide noise margins.
(d) It has zero input resistance and infinite output resistance.

104. Which of the following can be replace the portion of the circuit left to the terminals *AB*:





(a)

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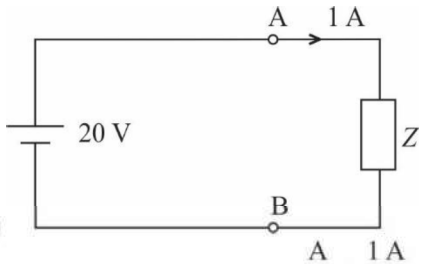
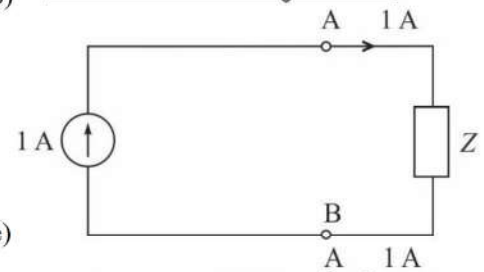
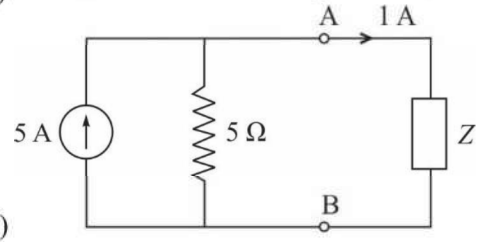


(b)



(c)

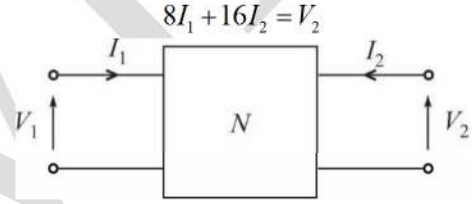


(d)

105. Which of the following statements are correct:
(a) Voltage across a capacitor cannot change abruptly.
(b) Voltage across an inductor cannot change abruptly.
(c) Current through a capacitor cannot change abruptly.
(d) Current through an inductor cannot change abruptly.

106. A two-port network satisfies the following relations:

$$4I_1 + 8I_2 = 2V_1$$
$$8I_1 + 16I_2 = V_2$$



Which of these relations are correct ?
(a) The network is not a reciprocal network
(b) $Z_{11} = 4$ and $Z_{12} = 8$
(c) $Z_{21} = 8$ and $Z_{22} = 16$
(d) $Z_{11} = 2$ and $Z_{12} = 4$

107. For a network transfer function $H(s) = \dfrac{P(s)}{Q(s)}$, where $P(s)$ and $Q(s)$ are polynomials in s. Which of following statements are correct:
(a) The degree of $P(s)$ and $Q(s)$ are same.
(b) The degree of $P(s)$ is always greater than the degree of $Q(s)$.
(c) The degree of $P(s)$ is independent of the degree of $Q(s)$.
(d) The maximum degree of $P(s)$ and $Q(s)$ differ at most by one.

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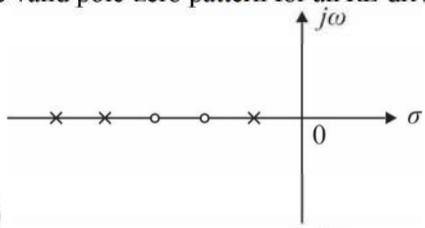
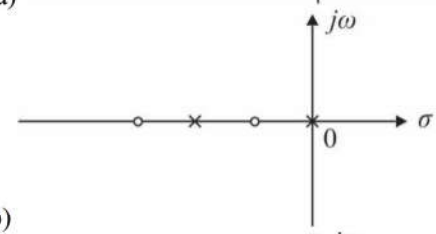
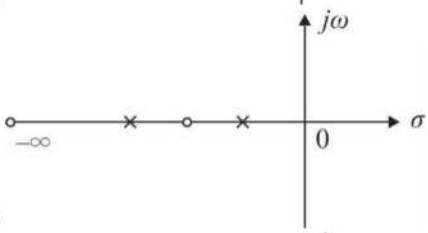
108. The valid pole-zero pattern for an RL driving point impedance function, are:



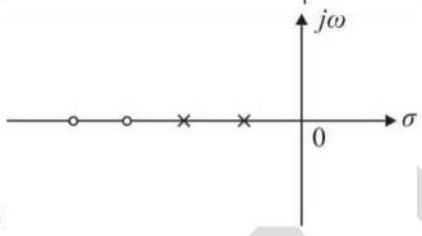
(a)



(b)



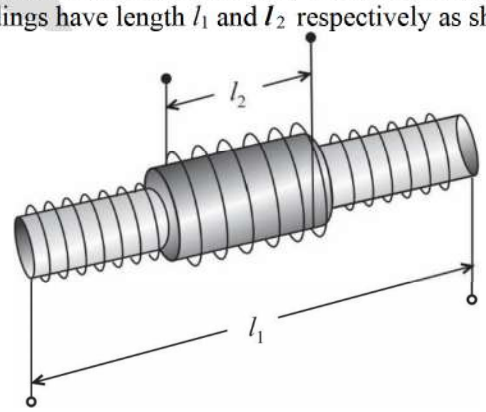
(c)



(d)

109. Which of the following properties are correct for an RC driving point impedance $Z_{RC}(s)$:
(a) Poles and zeros are simple and interlace.
(b) Residues at the poles on the imaginary axis are real.
(c) $Z_{RC}(0) > Z_{RC}(\infty)$.
(d) The slopes of the reactance curves are positive.

110. Two coils N_1 and N_2 turns are wound concentrically on a straight cylindrical core of radius r and permeability μ. The windings have length l_1 and l_2 respectively as shown in figure.



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Which of the following are statements are correct regarding mutual inductance:
(a) Proportional to N_1N_2.
(b) Proportional to μ.
(c) Inversely proportional to I_1.
(d) Inversely proportional to r^2.

111. The electric field component of a wave in free space is given by $\vec{E} = 10\cos(10^7 t + kz)\hat{a}_y$ V/m.

Which of the following are correct regarding inferences can be drawn from $\vec{E}$:
(a) Wave propagates along $\hat{a}_y$
(b) Wavelength $\lambda = 188.5$ m
(c) Wave amplitude is 10 V/m
(d) Wave number = 0.033 rad/m

112. Loading of a cable is done to
(a) Increase its inductance
(b) Increase its leakage resistance
(c) Decrease its capacitance
(d) Achieve distortionless condition

113. Which of the following statements about the Smith chart are correct:
(a) A complete revolution (360°) around the Smith chart represents a distance of half wavelength on the line.
(b) Clockwise movement on the chart is regarded as moving toward the generator.
(c) Although three scales around the periphery of Smith chart are used, but only one scale can be sufficient.
(d) Smith chart cannot be used as admittance chart.

114. Which of the following statements are correct:
(a) The antennas radiate energy.
(b) An antenna is a transition device, or transducer between a guided wave and a free space wave or vice versa.
(c) The resonators and transmission lines store energy.
(d) An antenna converts electromagnetic signal to currents or vice versa.

115. A good S/H circuit should have:
(a) High input impedance
(b) High output impedance
(c) Low input impedance
(d) Low output impedance

116. A dual slope Analog to Digital converter:
(a) Responds very fast.
(b) Has better accuracy.
(c) Requires an accurate and stable DC source.
(d) Requires a buffer at the input side.

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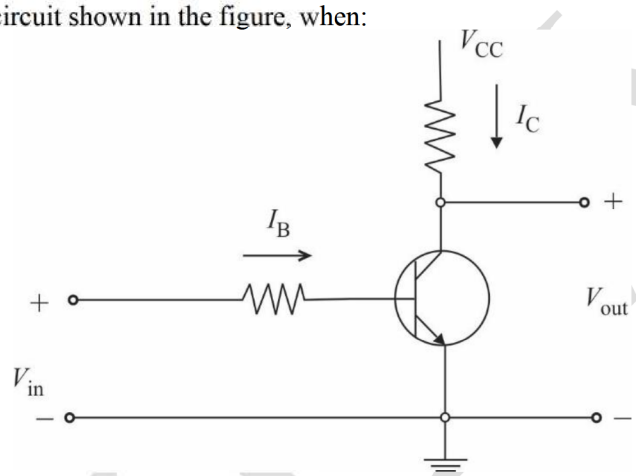
117. Which of the following statements for an N-bit DACs are correct:
(a) R-$2R$ ladder type is based on dual slope integration.
(b) R-$2R$ requires resistors of large spread in values.
(c) R-$2R$ requires roughly $2N$ resistors.
(d) R-$2R$ requires roughly N number of resistors.

118. A small signal voltage amplifier in common emitter configuration was working satisfactorily. Suddenly its emitter-bypass capacitor (C_E) got disconnected. Its:
(a) Voltage gain will decrease
(b) Voltage gain will increase
(c) Bandwidth will decrease
(d) Bandwidth will increase

119. For the transistor circuit shown in the figure, when:



(a) $V_{in} > 0$, transistor is OFF
(b) $V_{in} \leq 0$ transistor is OFF
(c) $I_B > I_C / h_{FE}$ transistor is ON
(d) $I_B \leq I_C / h_{FE}$ transistor is ON

120. Which of the following are universal gates:
(a) AND
(b) NAND
(c) NOR
(d) NOT

121. CMOS logic families are associated with:
(a) Low power dissipation
(b) High noise immunity
(c) Low Fan-out
(d) Comparatively high logic voltage swing

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122. The logic function:

$$\text{Out} = ab + bc + ca$$

Defines:
(a) The output of a 3-inputs XOR gate
(b) The output of a 3-inputs majority gate
(c) The sum output of a full adder
(d) The carry output of a full adder

123. Dual-slope integration type Analog-to-Digital converters provide:
(a) Higher speeds compared to all other types of A/D converters.
(b) Very good accuracy without putting extreme requirements on component stability.
(c) Good rejection of power supply hum.
(d) Better resolution compared to all other types of A/D converters for the same number of bits.

124. Which of the following are source codes:
(a) Hamming code
(b) Huffman code
(c) Shannon-Fano code
(d) Convolutional code

125. Which of the following statements about the maximum usable frequency (MUF) for radio communication between two specified points using an ionospheric layer are correct:
(a) MUF is equal to critical frequency
(b) MUF is more than the critical frequency
(c) MUF depends upon the height of the ionospheric layer
(d) MUF depends upon the distance between the two points

126. Which of the following diodes are used as detector diodes:
(a) Gunn diode
(b) Schottky diode
(c) Crystal diode
(d) Tunnel diode

127. Which of the following statements in case of a magic Tee are correct:
(a) The collinear arms are isolated from each other
(b) One of the collinear arms is isolated from E-arm
(c) One of the collinear arms is isolated from H-arm
(d) E and H arms are isolated from each other

128. Sorting is useful for:
(a) Report generation
(b) Making searching easier and efficient
(c) Responding to queries easily
(d) Minimizing the storage needed

129. Which of the following statements correct regarding the inter element spacing of:
(a) More than λ in array antenna will produce grating lobes in unscanned condition.
(b) More than $\lambda/2$ but less than λ in array antenna will produce grating lobes under scanned condition.
(c) Less than $\lambda/2$ in array antenna will not produce any grating lobe.
(d) More than 1.5λ in array antenna will not produce any grating lobe.

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130. Which of the following statements for a symmetrical T section are correct:
(a) Z_{11} and Z_{22} are equal.
(b) Z_{12} and Z_{21} are equal.
(c) Z_{11} and Z_{12} are equal.
(d) Z_{21} and Z_{22} are equal.

131. Which of the following statements regarding an FET are correct:
(a) Its operation depends upon the flow of majority carriers only
(b) It has a high input resistance.
(c) It is suitable for high frequency.
(d) Its operation depends upon the flow of both majority and minority carriers.

132. Which of the following statements are correct:
(a) The Laplace transform of the unit impulse function is six Laplace transform of the unit ramp function.
(b) The impulse function is a time derivative of the ramp function.
(c) The Laplace transform of the unit impulse function is s times of Laplace transform of the unit step function.
(d) The impulse function is a time derivative of the unit step function.

133. Which of the following statements regarding depth of penetration or skin depth in a conductor are correct:
(a) It increases as frequency increases.
(b) It is inversely proportional to square root of μ and σ.
(c) It is inversely proportional to square root of f.
(d) It is directly proportional to square root of μ and σ.

134. Which of the following statements regarding the use of Laplace transforms and Fourier transforms in circuit analysis are correct:
(a) Both make the solution of circuit problems simple and easy.
(b) Both are applicable for the study of circuit behaviour for $t \to -\infty$ to ∞.
(c) Both convert differential equations to algebraic equations.
(d) Both can be used for transient and steady state analysis.

135. Which of the following statements regarding Thermistor are correct:
(a) It has a high sensitivity.
(b) It has a linear relationship with temperature.
(c) It is a resistive device.
(d) It can be used as a time-delay device.

136. Which of the following statements regarding a transmission line are correct:
(a) Its attenuation is constant and is independent of frequency.
(b) Its attenuation varies linearly with frequency
(c) Its phase shift varies linearly with frequency.
(d) Its phase shift is constant and is independent of frequency.

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137. Which of these are included in the present definition of computer architecture to design a full computer system:
(a) Compilers
(b) Design
(c) Evaluation
(d) Instruction set architecture

138. The impulse response $h[n]$ of an LTI system is $h[n] = u[n+3] + u[n-2] - 2u[n-7]$. Then the system is:
(a) Stable
(b) Causal
(c) Unstable
(d) Not causal

139. A compensated probe of a CRO contains which of the following:
(a) An amplifier
(b) *RC* network
(c) Only resistive network
(d) Only capacitive network

140. While of the following capacitors are made use for a capacitance application in monolithic ICs:
(a) MOS capacitor
(b) Collector-Substrate capacitor
(c) Collector-Base capacitor
(d) Base-Emitter capacitor

141. Which of the following statements are correct regarding *n*-type of silicon can be:
(a) formed by adding impurity of phosphorus
(b) formed a adding impurity of arsenic
(c) formed by adding impurity of boron
(d) formed by adding impurity of aluminum

142. The interfacing of assembly language routines with some high level language, one must address which of the following are correct:
(a) How is the subroutine invoked?
(b) How are parameters passed?
(c) How are values returned?
(d) How many parameters are passed?

143. The parallel computers are divided into which of the following architectural configuration:
(a)Array processors
(b) Data processors
(c) Multi processor systems
(d) Pipeline computers

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144. A good line code should have which of the following are correct:
(a) Favorable pad
(b) Low inter symbol interference
(c) Adequate timing content
(d) Transparency

145. Dominant-pole frequency compensation in an OP-AMP:
(a) increases the slew-rate of the OP-AMP.
(b) increase the stability of the OP-AMP.
(c) reduces the bandwidth of the OP-AMP.
(d) reduces the CMRR of the OP-AMP.

146. Which of the following components are chosen to construct a DC power supply. A supply to supply 6 V DC voltage force 230 V AC to operate a tape recorder:
(a) Step down transformer
(b) Diodes
(c) Resistors and capacitors
(d) Three-pin voltage stabilizer

147. Which of the following components control the high frequency response of the *RC* coupled amplifier:
(a) Parasitic capacitances of the transistor
(b) Coupling capacitance
(c) Stray capacitances
(d) Wiring capacitance

148. On the 8085, which of the following machine cycles are used in the CALL instruction:
(a) Instruction Fetch
(b) I/O
(c) Memory Read
(d) Memory Write

149. Why are semiconductor lasers important for communication engineering:
(a) They possess large bandwidth
(b) They operate at low voltage
(c) They are suitable for coupling to fibers at wavelengths, where the attenuation is very small
(d) Their integration with other components is easy

150. A digital multiplexer can be used for which of the following are correct:
(a) Parallel to serial conversion
(b) Many-to-one switch
(c) To generate memory chip select
(d) For code conversion

151. Which of the following statements is/are true for the diamond structure:
(a) Coordination number is four.
(b) Packing fraction is 0.34.
(c) Copper crystallizes into diamond structure.
(d) Lattice is FCC.

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152. Which of the following statements is/are true for a good conductor of electricity:
(a) Its conductivity decreases with increasing temperature.
(b) Number of free electrons is around 10^{28} /m^3.
(c) Its conductivity decreases with addition of impurities.
(d) It is a good conductor of heat also.

153. Which of the following semiconductors should be used for making highly efficient photodiodes:
(a) Si
(b) Ge
(c) GaAs
(d) InP

154. Which of the following statements are correct:
(a) Acceptor level is formed very close to the conduction band.
(b) The effective mass of the free electron is same as that of a hole.
(c) The magnitude of the charge of a free electron is same as that of a hole.
(d) Addition of donor impurities adds holes to the semiconductor.

155. Which of the following statements regarding the properties of an *RLC* series circuit under resonance are correct:
(a) Current in the circuit is in phase with applied voltage.
(b) Voltage drop across capacitor *C* and inductance *L* are equal in magnitude.
(c) Voltage across the capacitor is equal in magnitude to the applied voltage.
(d) Current in the circuit is maximum.

156. Which of the following statements regarding a 10 m long common power line connecting a switch to a light bulb are correct:
(a) It is a distributed circuit.
(b) Time delay for propagation through it is negligible.
(c) It is in the form of a shielded coaxial cable of circular cross-section.
(d) As the intensity of the lamp varies, input impedance of this line also changes.

157. Which of the following statements regarding a microstrip line are correct:
(a) Wavelength $\Delta = \lambda / \varepsilon_\pi$, where ε_π is the effective dielectric constant and λ is the free space wavelength.
(b) Electromagnetic fields exist partly in the air above the dielectric substrate and partly within the substrate itself.
(c) The effective dielectric constant is greater than the dielectric constant of the air.
(d) Conductor losses increase with decreasing characteristic impedance.

158. For a square waveguide of cross-section 3 m × 3 m it has been found:
(a) At 6 GHz dominant mode will propagate.
(b) At 4 GHz all the modes are evanescent.
(c) At 11 GHz only dominant modes and no higher order mode will propagate.
(d) At 7 GHz degenerate modes will propagate.

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159. Which of the following statements regarding an antenna are correct:
(a) It is a transducer.
(b) Its performance is essentially frequency sensitive.
(c) It is a reciprocal device.
(d) With increase in its effective aperture area, width of the radiated beam increases.

160. Which of the following statements about ultrasonic flowmeters are correct:
(a) The measurement is insensitive to viscosity, pressure and temperature variations.
(b) It has bidirectional measuring capability and can be used for any pipe size.
(c) It has a relatively lower cost.
(d) It has good accuracy, fast response and wide frequency range.

161. Which of the following are used as a feedback amplifiers:
(a) Oscillator
(b) Emitter follower
(c) Cascaded amplifier
(d) Power amplifier

162. To draw AC equivalent circuit of a transistor, all:
(a) DC sources are shorted
(b) AC sources are kept as it is
(c) DC sources are opened
(d) AC sources are connected to DC sources

163. Which of the following statements regarding the class-B power amplifiers (Complementary symmetry type) are correct:
(a) The efficiency of the amplifier is higher than that of class-A amplifier.
(b) The power output is low.
(c) Cross over distortion is present.
(d) The standby power dissipation is absent.

164. Which of the following properties of the power amplifier one should concentrate upon while designing a good power amplifier circuit:
(a) Distortion
(b) Gain
(c) Bias stabilization
(d) Sensitivity

165. Which of the following components in a *RC* coupled amplifier control the lower cut-off frequency of the amplifier:
(a) Coupling capacitor
(b) Emitter by-pass capacitor
(c) Emitter to base diffusion capacitance of the BJT.
(d) Stray capacitance of the circuit.

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166. Which of the following statements are correct, regarding an Op-amp:
(a) All types of negative feedback reduce non-linear distortion.
(b) All types of negative feedback reduce the output offset voltage.
(c) Non-inverting (current and voltage) feedback increases the input impedance.
(d) Inverting (current and voltage) feedback decreases input impedance.

167. The bias stability of an emitter-bias amplifier circuit improves by:
(a) decreasing the value of R_B.
(b) increasing the value of R_E .
(c) decreasing the value of R_E .
(d) increasing the value of R_B.

168. Which of the following will be true for a CE transistor amplifier if the emitter resistor value is made equal to zero:
(a) Its gain will increase.
(b) Its stability will increase.
(c) Its gain will decrease.
(d) Its stability will decrease.

169. Which of the following describe the correct properties of an emitter follower circuit:
(a) It is a voltage series feedback circuit.
(b) It is a current series feedback circuit.
(c) Its voltage gain is less than unity.
(d) Its output impedance is very low.

170. Which of the following are the non-linear applications of Op-amp:
(a) Current-to-voltage converter
(b) Comparator
(c) Peak detector
(d) Limiter

171. Which of the following conditions must be satisfied for a transistor to remain under saturation:
(a) Its collector to base junction should be under forward bias.
(b) Its collector to base junction should be under reverse bias.
(c) Its emitter to base junction should be under reverse bias.
(d) Its emitter to base junction should be under forward bias.

172. What are the ultimate purposes of minimising logic expressions:
(a) To get a small size expression.
(b) To reduce the number of variables in the given expression.
(c) To implement the function of the logic expression with least hardware.
(d) To reduce the expression for making it feasible for hardware implementation.

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173. Which of the following factors are responsible to design IC logic gates to operate at a fixed supply voltage of 5 V:
(a) Low heating of IC logic gates.
(b) Compatibility with other logic gates.
(c) Satisfactory and safe operation.
(d) Standardization from IC manufacturing point of view.

174. Which of the following circuits come under the class of combinational logic circuits:
(a) Full adder
(b) Full subtractor
(c) Half adder
(d) *JK* flip-flop

175. For a master-slave *JK* flip-flop:
(a) the toggle frequency is the maximum clock frequency at which the flip-flop will toggle reliably.
(b) the data input must precede the clock triggering edge transition time by some minimum time.
(c) the data input must remain fixed for a given time after, the clock triggering edge transition time for reliable operation.
(d) propagation delay time is equal to the rise time and fall time of the data.

176. Which of the following statements are correct:
(a) A flip-flop is used to store 1-bit of information.
(b) Race-around condition occurs in a *J K* flip-flop when both the inputs are 1.
(c) Master-slave configuration is used in flip-flops to store 2-bits of information.
(d) A transparent latch consists of a *D* type flip-flop.

177. Which of the following conditions should be not satisfied to call an astable multivibrator circuit using discrete components as a digital circuit:
(a) A flip-flop is always a digital circuit.
(b) Only when we assign 1 and 0 to the high and low levels of the output, a flip-flop is called a digital circuit.
(c) Only if the power supply voltage is maintained at +5 V or −5 V, it is called a digital circuit.
(d) Only if it is in IC form, following the technology of IC manufacture, it is called a digital circuit.

178. Which of the following circuits come under the class of sequential logic circuits:
(a) Full adder
(b) Full subtractor
(c) *JK* flip-flop
(d) Counter

179. Which of the following statements regarding registers and latches are correct:
(a) Registers are made of edge-triggered FFs, whereas latches are made from level-triggered FFs.
(b) Registers are temporary storage devices whereas latches are not.
(c) A latch employs cross-coupled feedback connections.
(d) A register stores a binary word whereas a latch does not.

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180. Which of the following capabilities are available in a Universal Shift Register:
(a) Shift left
(b) Shift right
(c) Parallel load
(d) Serial add

181. Which of the following measurements can be done using a counter are correct:
(a) Pulse duration
(b) Interval between two pulses
(c) Amplitude of the pulse
(d) Rise time of a pulse

182. Which of the following statements about the matched filter in a communication receiver are correct:
(a) Its impulse response depends on the signed shape.
(b) It maximizes the SNR at the detection instant.
(c) It produces ISI.
(d) It may produce phase error if synchronization is improper.

183. On which bands, do the optical fibres operate:
(a) Ultraviolet band
(b) Ultra-high frequency band
(c) Visible light band
(d) Infra-red band

184. The Klystron and travelling wave tube differ from each other:
(a) In TWT the microwave circuit is non-resonant.
(b) In Klystron the microwave circuit is resonant.
(c) TWT uses attenuator.
(d) The wave in TWT is a non-propagating wave.

185. With reference to C programming language, which of the following statements are correct:
(a) An identifier may start with an underscore.
(b) An identifier may end with an underscore.
(c) IF is a valid identifier.
(d) The number of significant characters in an identifier is implementation dependent.

186. Which of the following statements are correct:
(a) Internal sorting is used if the number of items to be sorted is very large.
(b) External sorting is used if the number of items to be sorted is very large.
(c) External sorting needs auxiliary storage.
(d) Internal sorting needs auxiliary storage.

187. Which of the following statements are correct:
(a) Bus is a group of wires carrying information.
(b) Bus is needed to achieve reasonable speed of operation.
(c) Bus can carry data or address.
(d) A bus can be shared by more than one device.

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ANSWER KEY

1.	(a, b, d)	**2.**	(a, b, c, d)	**3.**	(a, b, d)	**4.**	(a, b, c)	**5.**	(a, b, c, d)
6.	(a, b)	**7.**	(a, c)	**8.**	(a, b, c, d)	**9.**	(a, b, c)	**10.**	(a, c)
11.	(b, c)	**12.**	(a, b)	**13.**	(a, c, d)	**14.**	(a, d)	**15.**	(a, b)
16.	(a, c, d)	**17.**	(a, b, c, d)	**18.**	(a, b, c)	**19.**	(a, c)	**20.**	(a, b, d)
21.	(a, b, c, d)	**22.**	(a, c)	**23.**	(a, b, c, d)	**24.**	(a, b)	**25.**	(a, b, c)
26.	(b, c)	**27.**	(a, b, c, d)	**28.**	(a, b, c, d)	**29.**	(a, c, d)	**30.**	(a, b, c)
31.	(a, b, c, d)	**32.**	(a, b, d)	**33.**	(a, b)	**34.**	(b, c)	**35.**	(a, b, c, d)
36.	(b, c, d)	**37.**	(a, b, d)	**38.**	(a, c, d)	**39.**	(a, c)	**40.**	(b, c, d)
41.	(a, c, d)	**42.**	(a, c, d)	**43.**	(a, b, c)	**44.**	(b, d)	**45.**	(a, b)
46.	(a, b, c)	**47.**	(a, b, c)	**48.**	(a, c, d)	**49.**	(a, b, c, d)	**50.**	(b, c)
51.	(c, d)	**52.**	(a, b, d)	**53.**	(c, d)	**54.**	(c, d)	**55.**	(c, d)
56.	(a, b, c)	**57.**	(a, b, c)	**58.**	(a, b, c)	**59.**	(b, d)	**60.**	(a, b, c)
61.	(a, b)	**62.**	(a, b)	**63.**	(a, b)	**64.**	(a, d)	**65.**	(a, c)
66.	(a, b, c, d)	**67.**	(a, d)	**68.**	(c, d)	**69.**	(a, b, c, d)	**70.**	(a, b, d)
71.	(a, c)	**72.**	(a, b, c)	**73.**	(a, b, c, d)	**74.**	(a, b, c, d)	**75.**	(a, d)
76.	(a, c, d)	**77.**	(a, b, c, d)	**78.**	(b, c)	**79.**	(b, c)	**80.**	(a, c, d)
81.	(a, b, c)	**82.**	(a, b)	**83.**	(a, b, d)	**84.**	(b, c, d)	**85.**	(a, c, d)
86.	(a, b, d)	**87.**	(b, d)	**88.**	(a, d)	**89.**	(a, b)	**90.**	(a, c)
91.	(b, d)	**92.**	(a, b, c)	**93.**	(a, b, c, d)	**94.**	(a, c)	**95.**	(b, c)
96.	(a, b, c, d)	**97.**	(a, b, d)	**98.**	(b, c)	**99.**	(a, b, c, d)	**100.**	(a, c, d)
101.	(b, d)	**102.**	(a, b, c)	**103.**	(a, b, c)	**104.**	(a, b, c, d)	**105.**	(a, d)
106.	(a, c, d)	**107.**	(a, c)	**108.**	(b, c)	**109.**	(a, c)	**110.**	(a, b)
111.	(b, c, d)	**112.**	(a, c, d)	**113.**	(a, b)	**114.**	(a, b, d)	**115.**	(a, d)
116.	(b, c)	**117.**	(a, b, c)	**118.**	(a, d)	**119.**	(b, c)	**120.**	(b, c)
121.	(a, b, c)	**122.**	(b, d)	**123.**	(b, c)	**124.**	(b, c)	**125.**	(b, d)
126.	(b, c)	**127.**	(a, d)	**128.**	(a, b, c, d)	**129.**	(b, c)	**130.**	(a, b)
131.	(a, b)	**132.**	(c, d)	**133.**	(b, c)	**134.**	(a, b, c, d)	**135.**	(a, c, d)
136.	(a, c)	**137.**	(b, c, d)	**138.**	(a, d)	**139.**	(b, d)	**140.**	(a, b)
141.	(a, b)	**142.**	(a, b, c)	**143.**	(a, c, d)	**144.**	(a, b, c, d)	**145.**	(a, b)
146.	(a, b, c, d)	**147.**	(a, b, c, d)	**148.**	(a, c, d)	**149.**	(a, b, c, d)	**150.**	(a, b, c)
151.	(a, b, d)	**152.**	(a, b, c, d)	**153.**	(c, d)	**154.**	(a, c)	**155.**	(a, b, d)
156.	(b, c)	**157.**	(a, b, c)	**158.**	(a, b, c)	**159.**	(a, b, c)	**160.**	(a, b, d)
161.	(a, b)	**162.**	(a, b)	**163.**	(a, c, d)	**164.**	(a, b, c)	**165.**	(a, b)
166.	(a, b, c, d)	**167.**	(a, b)	**168.**	(a, d)	**169.**	(a, c, d)	**170.**	(b, c, d)
171.	(a, d)	**172.**	(c, d)	**173.**	(b, c)	**174.**	(a, b, c)	**175.**	(a, b, c)
176.	(a, b, d)	**177.**	(b, c, d)	**178.**	(c, d)	**179.**	(a, c)	**180.**	(a, b, c)
181.	(a, b)	**182.**	(a, b)	**183.**	(a, b, c)	**184.**	(a, b, c)	**185.**	(a, b, c, d)
186.	(b, c)	**187.**	(a, b, c, d)						

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