Engineering Services (P)
Examination - 2025

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T.B.C. : ASNP–T–ELTE **Test Booklet Series**

A

Serial No. 10009813

TEST BOOKLET

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Time Allowed : Three Hours **Maximum Marks : 300**

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET *DOES NOT* HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series A, B, C or D carefully and without any omission or discrepancy at the appropriate places in the OMR Answer Sheet. Any omission/discrepancy will render the Answer Sheet liable for rejection.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. *DO NOT* write *anything else* on the Test Booklet.
4. This Test Booklet contains **150** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose *ONLY ONE* response for each item.
5. You have to mark all your responses *ONLY* on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. ***All*** items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**
    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.
    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
    (ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
    (iii) If a question is left blank, i.e., no answer is given by the candidate, there will be **no penalty** for that question.

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1. Which one of the following is the maximum reverse voltage that can be applied to the *P-N* junction?

(a) Maximum forward voltage

(b) Peak inverse voltage

(c) Maximum average voltage

(d) Respective peak forward voltage

2. The common-base DC current gain of a transistor is 0·967. If the emitter current is 10 mA, the base current will be

(a) 0·53 mA

(b) 0·44 mA

(c) 0·33 mA

(d) 0·24 mA

3. In actual MOSFET characteristic, a non-zero slope exists beyond the saturation point. For the saturation region, i.e., ($V_{DS} > V_{DS}$ (sat)), the effective channel length decreases and this phenomenon is called

(a) base width modulation

(b) channel width modulation

(c) channel length modulation

(d) base length modulation

4. MOSFETs have characteristics similar in form to those of JFETs. Hence MOSFETs are also known as

(a) Depletion MOSFETs (D-MOSFETs)

(b) Enhancement MOSFETs (E-MOSFETs)

(c) Insulated Gate Field Effect Transistors (IGFETs)

(d) *p*-channel MOSFETs

5. A transistor has $\alpha = 0 \cdot 995$ and if the base current is 200 μA, the value of the emitter current will be

(a) 30 mA

(b) 35 mA

(c) 40 mA

(d) 45 mA

6. A common-emitter transistor amplifier has an input impedance of 2 kΩ and a load resistance of 25 kΩ. If the β of the transistor is 100, the power gain will be

(a) 112500

(b) 125000

(c) 150000

(d) 175000

7. Which one of the following amplifiers is called an emitter follower?

(a) Common-emitter amplifier

(b) Common-collector amplifier

(c) Common-base amplifier

(d) Common-drain amplifier

8. Which one of the following is ***not*** the correct advantage of integrated circuits (ICs)?

(a) Low power consumption

(b) Very high reliability because failure rate becomes minimal as there is no exposed component

(c) There are no limitations of power and voltage rating

(d) Improved performance

9. MOSFET, used as a load device, is referred to as

(a) critical load

(b) dormant load

(c) active load

(d) passive load

10. ICs in which circuits are fabricated, i.e., all the transistors in such circuits operate in cut-off and saturation regions, the adders, multiplexers and comparators are

(a) digital ICs

(b) linear ICs

(c) analog ICs

(d) hybrid ICs

11. For a non-inverting amplifier, the input resistor $R_1 = 1\ k\Omega$ and feedback resistor $R_f = 10\ k\Omega$. The closed-loop voltage gain A_f and feedback factor β respectively are

(a) 11 and 0·07

(b) 11 and 0·09

(c) 13 and 0·07

(d) 13 and 0·09

12. Which one of the following is a three-region reverse-biased junction diode?

(a) *P-N* junction diode

(b) Light-emitting diode

(c) PIN photodiode

(d) Zener diode

13. Two resistances, one of 30 Ω and another of unknown value are connected in parallel; the total power dissipated in the circuit is 450 W, when the applied voltage is 90 volts. The value of the unknown resistance will be

(a) 35 Ω

(b) 40 Ω

(c) 45 Ω

(d) 50 Ω

14. A voltmeter has a resistance of 20000 Ω. When connected in series with an external resistance across a 230 V supply, the instrument reads 160 V. The value of the external resistance will be

(a) 8750 Ω

(b) 8560 Ω

(c) 8370 Ω

(d) 8180 Ω

15. Which one of the following is ***not*** the correct advantage of wound-rotor (or slip-ring) induction motor?

(a) It has high starting torque with low starting current

(b) It has adjustable speed

(c) It has high overload capacity

(d) It has high efficiency as compared to squirrel-cage motor

16. Which one of the following statements is correct regarding an ideal transformer?

(a) The leakage flux is large.

(b) The transformer core losses are large.

(c) The transformer core material has infinite permeability.

(d) The transformer windings are with large resistances.

17. A 3-phase, 4-pole, 50 Hz induction motor is running at 1455 r.p.m. The value of the slip will be

(a) 2%

(b) 3%

(c) 4%

(d) 5%

18. The e.m.f. per turn of a single-phase, 10 kVA, 2200/220 V, 50 Hz transformer is 10 V. If the maximum flux density is 1·5 T, the net cross-sectional area of the core will be

(a) 0·01 m^2

(b) 0·02 m^2

(c) 0·03 m^2

(d) 0·04 m^2

19. A transformer rated 200/50 V, 10 kVA has a core loss of 100 W. If the full-load copper loss is 200 W and lagging power factor is 0·8, the load at maximum efficiency will be nearly

(a) 9 kVA

(b) 7 kVA

(c) 5 kVA

(d) 3 kVA

20. The impedance which transforms from one side of the ideal transformer to the other is in the direct

(a) square ratio of turns

(b) square root of ratio of turns

(c) ratio of turns

(d) square root of square ratio of turns

21. In which one of the following machines, the field poles are on the stator (and are DC excited) and the rotor constitutes the armature?

(a) Induction machine

(b) Elementary synchronous machine

(c) DC machine

(d) AC machine

22. A 6-pole synchronous generator driven at 1000 r.p.m. feeds a 4-pole induction motor. If it is loaded to run at a slip of 4%, the motor speed will be

(a) 1360 r.p.m.

(b) 1440 r.p.m.

(c) 1560 r.p.m.

(d) 1640 r.p.m.

23. An 8-pole, lap-wound, DC generator has 1000 armature conductors, a flux of 20 mWb per pole and the e.m.f. generated is 200 V. What is the speed of the machine?

(a) 300 r.p.m.

(b) 600 r.p.m.

(c) 900 r.p.m.

(d) 1200 r.p.m.

24. Consider the following statements regarding transformer :

1. It is a device that transfers electric power from one circuit to another.
2. In transformer, the two electric circuits are linked by mutual induction.

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

25. Whenever a charged particle has an angular momentum, it will contribute to the permanent dipole moment. The following are the contributions to the angular momentum of an atom :

1. Orbital angular momentum of electron
2. Electron spin angular momentum
3. Nuclear spin angular momentum

Which of the above contributions to the angular momentum of an atom are correct?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

26. A substance of FCC lattice is having a molecular weight of 60·2 and density of 6250 kg/m^3. If the value of N is $6 \cdot 02 \times 10^{26}$/kg-mole, the lattice constant will be

(a) 2 Å

(b) 4 Å

(c) 6 Å

(d) 8 Å

27. Steatite is made from

(a) talc mixed with small quantity of clay and feldspar

(b) metal oxides and titanium dioxide

(c) aluminium dioxide

(d) barium titanate

28. Which of the following are the important varieties of electrical mica?

(a) Muscovite mica and phlogopite mica

(b) Muscovite mica and pyrex mica

(c) Phlogopite mica and quartz mica

(d) Phlogopite mica and pyrex mica

29. The dielectric strength of rubber is 40000 volts/mm at frequency 60 Hz. What is the thickness of insulation on a wire carrying 33 kV to sustain the breakdown?

(a) 0·64 mm

(b) 0·72 mm

(c) 0·82 mm

(d) 0·94 mm

30. STM stands for

(a) Scanning Tunneling Microscope

(b) Scientific Technical Microscope

(c) Scanning Technical Microscope

(d) Scientific Tunneling Microscope

31. An iron rod of 2 m length and 4 cm^2 cross-section is in the form of a closed ring. The permeability of the iron ring is 50×10^{-4} H-m^{-1}. To produce a magnetic flux of 4×10^{-4} Wb, the required ampere-turns will be

(a) 200 A/m

(b) 225 A/m

(c) 250 A/m

(d) 275 A/m

32. When transactions are executing concurrently in an interleaved fashion, then the order of execution of operations from the various transactions is known as

(a) schedule

(b) serializability

(c) concurrency

(d) controllable

33. Which one of the following is one of the most popular solutions processing for nanoparticles (mostly oxides) production?

(a) CVD technique

(b) Sol-gel technique

(c) Aerogel synthesis technique

(d) Co-precipitation technique

34. The transition temperature T_c of a superconductor varies with its isotopic mass M as

(a) $T_c \propto M^{-\frac{1}{2}}$

(b) $T_c \propto M^{\frac{1}{2}}$

(c) $T_c \propto M^{-2}$

(d) $T_c \propto M^2$

35. The 'Cooper pairing' is related to

(a) chemical vapour deposition

(b) thermal conductivity

(c) superconductivity

(d) flame pyrolysis

36. For mercury of mass number 202, the value of α is 0·5 and $T_c = 4 \cdot 153$ K. For the isotope of mercury of mass number 200, the transition temperature is nearly

(a) 3·4 K

(b) 4·2 K

(c) 5·4 K

(d) 6·2 K

37. Which one of the following is ***not*** a correct method of obtaining damping?

(a) Air friction

(b) Fluid friction

(c) Magnetic field

(d) Eddy current

38. A 0–25 A ammeter has a guaranteed accuracy of 1% of full-scale reading. If the current measured by this instrument is 10 A, the limiting error will be

(a) 2·5%

(b) 2·0%

(c) 1·5%

(d) 1·25%

39. The torque of an ammeter is directly proportional to the current flowing through it. A current of 10 A causes a deflection of 60°. When the instrument is spring-controlled, for a deflection of 40°, the value of the current will be nearly

(a) 6·7 A

(b) 5·7 A

(c) 4·9 A

(d) 3·9 A

40. The basic Permanent Magnet Moving Coil (PMMC) instrument mechanism is often called

(a) electrodynamic movement

(b) galvanometer movement

(c) iron vane movement

(d) d'Arsonval movement

41. Which one of the following types of instruments will be used for AC measurements (current, voltage, power and energy)?

(a) Moving iron

(b) Moving coil permanent magnet

(c) Moving coil dynamometer

(d) Induction

42. In a measurement system, if the force (across) is a measured variable, then its associated variable (power-based) will be

(a) translational displacement

(b) translational acceleration

(c) translational velocity

(d) rotational acceleration

43. A coil with a resistance of 5 Ω is connected to the terminals of a Q-meter. Resonance occurs at an oscillator frequency of 8 MHz and resonating capacitance of 150 pF. What is the percentage error introduced by the insertion resistance of 0·1 Ω?

(a) 4%

(b) 3%

(c) 2%

(d) 1%

44. The speed of a 6-pole induction motor supplied at 50 Hz is measured by a stroboscopic method. The neon lamp is supplied from the same source to which the induction motor is connected. The stroboscopic disc has 6 black and 6 white sectors. When the sector appears to be moving at 50 r.p.m., the speed of the induction motor will be

(a) 990 r.p.m.

(b) 950 r.p.m.

(c) 890 r.p.m.

(d) 840 r.p.m.

45. An accelerometer has a seismic mass of 0·06 kg and a spring constant of 4500 N/m. If the maximum mass displacement is ± 0·025 m (before the mass hits the top), the maximum measurable acceleration will be

(a) 1675 m/s^2

(b) 1765 m/s^2

(c) 1875 m/s^2

(d) 1965 m/s^2

46. The deflection sensitivity of a CRT is 0·05 mm/V and an unknown voltage applied to the horizontal deflection plates shifts the spot by 5 mm towards the right in the horizontal direction. The unknown applied voltage will be

(a) 100 V

(b) 125 V

(c) 150 V

(d) 200 V

47. A capacitive transducer with its plate separation of 0·05 mm under static conditions has a capacitance of 5×10^{-12} F. For causing a change of capacitance of $0 \cdot 75 \times 10^{-12}$ F, the displacement will be nearly

(a) 0·22 mm

(b) 0·33 mm

(c) 0·42 mm

(d) 0·53 mm

48. The input for most of the instrumentation systems is non-electrical. This is converted into an electrical signal by a device called

(a) rectifier

(b) oscillator

(c) amplifier

(d) transducer

49. Which of the following statements are correct?

1. Cut-off matrix provides a compact and effective means of writing algebraic equations giving branch voltages in terms of tree branches.
2. In cut-set matrix, the number of independent node-pair terminals is equal to the number of tree branches.
3. Tie-set matrix is used to find the branch currents.

Select the correct answer.

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

50. Which of the following statements are correct?

1. The end points of a line segment on the junction between two or more branches or the end points of an isolated branch are called nodes.
2. If a sub-graph consists of an ordered sequence of branches, traversing from one node to another, this particular sub-graph is known as path.
3. The closed contour selected in a graph is known as loop.

Select the correct answer.

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

51. Which of the following statements are correct?

1. A connected sub-graph of a connected graph having all the nodes of a graph without any loop is known as a tree.
2. The branches of the tree are known as twigs.
3. The branches that are removed from the tree are termed links.

Select the correct answer.

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

52. Consider a reduced incidence matrix of a graph :

$$[A] = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 0 & -1 & 1 & -1 & 0 & 0 \\ -1 & 0 & -1 & 0 & -1 & 0 \end{bmatrix}$$

The number of possible trees will be

(a) 16

(b) 24

(c) 26

(d) 28

53. The Laplace transform of a function $f(t)$ is defined by

$$L\{f(t)\} = F(s) = \int_0^\infty f(t)\, e^{-st}\, dt$$

where s is a complex variable given by

(a) $\sigma - j\omega$

(b) $\sigma + j\omega$

(c) $\sigma / j\omega$

(d) $j\omega / \sigma$

54. In an induction type energy meter, normally the flux due to shunt magnet does not lag the supply voltage exactly by 90°. The reason being that the shunt coil has some resistance. Due to this, the angle of phase is less than 90°, as a result, the torque on the disc is not zero at zero power factor. This type of error is called

(a) speed error

(b) creeping

(c) phase error

(d) torque error

55. Which one of the following statements is ***not*** correct regarding moving iron instruments?

(a) These instruments possess high operating torque.

(b) In these instruments, power consumption is higher for low voltage ranges.

(c) These instruments are capable of giving accuracy within the limits of both precision and industrial grades.

(d) Scales of these instruments are uniform.

56. If the z-parameters for a network are $z_{11} = 42\ \Omega$, $z_{22} = 35\ \Omega$, $z_{12} = 25\ \Omega$ and $z_{21} = 25\ \Omega$, then the parameters A, B, C and D are respectively

(a) 1·68, 33·8 Ω, 0·04 mho, 1·4

(b) 2·68, 33·8 Ω, 0·04 mho, 0·4

(c) 1·68, 13·8 Ω, 0·14 mho, 1·4

(d) 2·68, 13·8 Ω, 0·14 mho, 0·4

57. Which one of the following features is ***not*** correct for Electronic Voltmeter (EVM)?

(a) Sensitivity is of the order of 10 μV (full-scale)

(b) In EVM, we also put some impedance matching stages

(c) Has very small frequency operating range

(d) Has internal protection against overloading

58. In a series *R-C* circuit, the value of R is $10\ \Omega$ and $C = 25$ nF. A sinusoidal voltage of 50 MHz is applied and the maximum voltage across the capacitance is 2·5 V. The maximum voltage across the series combination will be nearly

(a) 233 V

(b) 196 V

(c) 163 V

(d) 136 V

59. An impedance $Z_1(2 - j5)\ \Omega$ is connected in parallel with another impedance of $Z_2(1 + j1)\ \Omega$. If the applied voltage is $17\angle 0°$ V, then the currents through Z_1 and Z_2 are respectively

(a) $3{\cdot}16\angle 68{\cdot}2°$ A and $10{\cdot}02\angle -35°$ A

(b) $2{\cdot}16\angle 48{\cdot}2°$ A and $10{\cdot}02\angle -35°$ A

(c) $3{\cdot}16\angle 68{\cdot}2°$ A and $12{\cdot}02\angle -45°$ A

(d) $2{\cdot}16\angle 48{\cdot}2°$ A and $12{\cdot}02\angle -45°$ A

60. The *P-N* junction diodes and thermistors can be used to compensate for variations in current, thus stabilizing the operating point. Such methods are known as

(a) thermal runaway

(b) thermal stabilization

(c) bias compensation

(d) fixed bias

61. The turns ratio of a transformer used in a half-wave rectifier is $n_1 : n_2 = 12 : 1$. The primary is connected to the power mains 220 V, 50 Hz. If the diode resistance in forward bias is zero, the PIV of the diode will be nearly

(a) 16 V

(b) 19 V

(c) 22 V

(d) 26 V

62. FET amplifiers are introduced at the initial stages of receivers to make

(a) the final output less noisy

(b) the bandwidth very large

(c) the gain very large

(d) the output impedance very low

63. A JFET has $V_P = -4{\cdot}5$ V, $I_{DSS} = 10$ mA and $I_{DS} = 2{\cdot}5$ mA. The transconductance will be nearly

(a) 3·2 mA/V

(b) 2·8 mA/V

(c) 2·2 mA/V

(d) 1·8 mA/V

64. Which one of the following is ***not*** the correct advantage of negative feedback in amplifiers?

(a) Less harmonic distortion

(b) Reduced noise

(c) Highly stabilized gain

(d) Decreased bandwidth

65. The advantage of the dual-slope ADC is its

(a) high sensitivity to noise and to variations in its component values caused by pressure changes

(b) low sensitivity to noise and to variations in its component values caused by pressure changes

(c) high sensitivity to noise and to variations in its component values caused by temperature changes

(d) low sensitivity to noise and to variations in its component values caused by temperature changes

66. Consider the following Boolean expression :

$$f = A\overline{B}C + B + B\overline{D} + AB\overline{D} + \overline{A}C$$

The simplified expression will be

(a) $A + B$

(b) $B + C$

(c) $C + D$

(d) $A + D$

67. What is the result of Excess-3 (XS-3) addition of numbers 9 and 5?

(a) 11

(b) 12

(c) 13

(d) 14

68. The network that couples the output signal voltage of a stage to the input of the next stage of a multi-stage amplifier is called

(a) biasing network

(b) resistive network

(c) feedback network

(d) coupling network

69. The expression

$$f = (B + BC)(B + \overline{B}C)(B + D)$$

after reduction is equivalent to

(a) $\overline{B}$

(b) B

(c) C

(d) D

70. PAL is the programmable logic device with a fixed OR array and a programmable AND array. Because only the AND gates are

(a) non-programmable, the PAL is easier to program than, but it is not as flexible as the PLA

(b) programmable, the PAL is not easier to program than, but it is flexible as the PLA

(c) non-programmable, the PAL is not easier to program than, but it is flexible as the PLA

(d) programmable, the PAL is easier to program than, but it is not as flexible as the PLA

71. ROM is a

(a) non-volatile memory

(b) volatile memory

(c) read/write memory

(d) byte-organized memory

72. The characteristic equation of *J-K* flip-flop is

(a) $Q_{n+1} = \overline{Q}_n J + Q_n \overline{K}$

(b) $Q_{n+1} = \overline{Q}_n J - Q_n \overline{K}$

(c) $Q_{n+1} = \overline{Q}_n K + Q_n J$

(d) $Q_{n+1} = \overline{Q}_n K - Q_n J$

73. Which one of the following noise bandwidths is the bandwidth of that ideal bandpass system which produces the same noise power as the actual system?

(a) Equivalent noise bandwidth

(b) Linear noise bandwidth

(c) Actual noise bandwidth

(d) Generalized noise bandwidth

74. If an audio signal $s(t) = 3\cos(2\pi 500t)$ is quantized using 10-bit PCM, the signal-to-quantization noise ratio will be nearly

(a) $0 \cdot 6 \times 10^6$

(b) $1 \cdot 2 \times 10^6$

(c) $1 \cdot 6 \times 10^6$

(d) $2 \cdot 2 \times 10^6$

75. In information probability, when the base is '2', the unit is a 'bit' and when the base is '*e*', the unit is a

(a) 'bit'

(b) 'decit'

(c) 'hartley'

(d) 'nat'

76. An AM broadcast transmitter has a carrier power output of 50 kW. With 80% of modulation, the total power produced will be

(a) 66 kW

(b) 58 kW

(c) 50 kW

(d) 42 kW

77. A transmitter operates from a 12 V supply with a collector current of 2 A. If the modulation transformer has a turns ratio of 4 : 1, the load impedance seen by the audio amplifier will be

(a) 78 Ω

(b) 82 Ω

(c) 88 Ω

(d) 96 Ω

78. The fall of $|A_v|$ and the increase of θ over 180° with decreasing frequency in the low frequency range are accounted by the

(a) coupling capacitors

(b) inter-electrode capacitors

(c) current gain of BJT (β)

(d) wiring capacitors

79. Which one of the following is particularly useful when large amounts of code are needed to handle infrequently occurring cases?

(a) Dynamic loading

(b) Static loading

(c) Dynamic binding

(d) Static binding

80. For a Pulse Amplitude Modulated (PAM) transmission of voice signal having maximum frequency equal to 2·5 kHz, if the sampling frequency is 10 kHz and the pulse duration is one-tenth of the sampling period, the transmission bandwidth will be

(a) 60 kHz

(b) 50 kHz

(c) 40 kHz

(d) 30 kHz

81. $S(t)$, the output ASK signal for $kT < t \leq (k+1)T$, is

(a) $Am(t)\omega_c(t+kT)$

(b) $Am(t)\omega_c(t-kT)$

(c) $Am(t)\cos\omega_c(t+kT)$

(d) $Am(t)\cos\omega_c(t-kT)$

where

T is the time width

k is an integer constant

t is the continuous time variable

ω_c is the carrier frequency

$m(t)$ is the modulating signal

A is the amplitude of the output signal

82. Which of the following statements are correct?

1. A system is said to be linear if it obeys the principle of superposition.
2. A system is said to be linear if it satisfies the homogeneity property.
3. A system is said to be non-linear if it obeys the principle of superposition.

Select the correct answer.

(a) 1 and 3 only

(b) 2 and 3 only

(c) 1 and 2 only

(d) 1, 2 and 3

83. An optical fiber has a bandwidth-distance product of 500 MHz-km. If a bandwidth of 85 MHz is required for a particular mode of transmission, the maximum distance that can be used between repeaters will be nearly

(a) 5·9 km

(b) 9·7 km

(c) 13·5 km

(d) 18·3 km

84. A single-mode fiber has a numerical aperture of 0·15. What is the maximum core diameter it could have for use with infrared light with a wavelength of 820 nm?

(a) 8·4 μm

(b) 6·3 μm

(c) 4·2 μm

(d) 2·1 μm

85. Consider the following statements :

A time-invariant system is

1. also referred to equivalently as a shift-invariant system
2. a system for which a time shift or delay of the input sequence causes a corresponding shift in the output sequence

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

86. Consider the following statements :

The Nyquist criteria

1. provide the theoretical basis for using the loop frequency response to determine the stability of a closed-loop system
2. may be used to assess stability from experimental data describing the system

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

87. Consider the following statements :

Bode diagram is

1. a method for studying the stability of a linear feedback system
2. useful in developing engineering intuition regarding the effect of pole-zero placement on the frequency response $L(j\omega)$

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

88. A unit impulse function is defined as

1. $\delta(t) = \begin{cases} 0 & \text{for } t \neq 0 \\ \infty & \text{for } t = 0 \end{cases}$
2. $\int_{-\infty}^{\infty} \delta(t)\, dt = 1$
3. $\int_{-\infty}^{\infty} \delta(t)\, f(t)\, dt = f(0)$

Which of the above are correct?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

89. Consider the characteristic equation

$$s^2 + s(2+K) + 4K = 0$$

The open-loop transfer function of the system $G(s)H(s)$ is

(a) $\dfrac{K(s+2)}{s(s+4)}$

(b) $\dfrac{K(s+4)}{s(s+2)}$

(c) $\dfrac{K(s+4)}{(s+2)}$

(d) $\dfrac{K(s+2)}{(s+4)}$

90. Which one of the following is ***not*** the correct property of signal flow graph?

(a) The signal flow graph is applicable to non-linear time-invariant systems

(b) The value of the variable at each node is equal to the algebraic sum of all signals entering at that node

(c) The signal gets multiplied by the branch gain when it travels along it

(d) The signal flow graph is not the unique property of the system

91. A closed-loop control system has the characteristic equation

$$s^3 + 4 \cdot 5s^2 + 3 \cdot 5s + 1 \cdot 5 = 0$$

As per Routh-Hurwitz criterion, the system will be

(a) stable

(b) unstable

(c) absolutely unstable

(d) semi-stable

92. In paging, the percentage of times that a page number is found in the associative registers is called

(a) effective memory access time

(b) effective access time

(c) hit ratio

(d) register ratio

93. Which one of the following is an effect of phase lead network?

(a) Phase margin is decreased

(b) Bandwidth is decreased

(c) The velocity constant is usually decreased

(d) The slope of the magnitude curve is reduced at the gain crossover frequency, with the result relative stability improves

94. For the first-order system with unit ramp function, the steady-state error is

(a) $\frac{1}{T}$

(b) 0

(c) T

(d) 1

95. A second-order system has a transfer function given by

$$G(s) = \frac{25}{s^2 + 8s + 25}$$

If the system initially at rest is subjected to a unit step input at $t = 0$, the second peak in the response will occur at

(a) π s

(b) $\frac{\pi}{3}$ s

(c) $\frac{2\pi}{3}$ s

(d) $\frac{\pi}{2}$ s

96. Which one of the following is ***not*** the correct advantage of frequency domain analysis?

(a) Frequency response tests are simple to perform

(b) Those systems which do not have rational transfer function, frequency response can be precisely applied to them also

(c) Transfer function can be obtained from frequency response of the system

(d) Frequency response methods can be applied for non-linear systems

97. In computer memory, for the non-random access memory, an average time T_N to read or write N bits is

(a) $T_A + \frac{n}{R}$

(b) $R + \frac{n}{T_A}$

(c) $n + R + \frac{1}{T_A}$

(d) $\frac{R}{T_A} + n$

where

R is rate of transfer

n is number of bits

T_A is average access time

98. A fundamental characteristic of a memory is the order or sequence in which information can be accessed. If storage locations can be accessed in any order and access time is independent of the location being accessed, the memory is termed as

(a) sequential access memory

(b) random access memory

(c) serial access memory

(d) optical memory

99. Which one of the following is a small, fast memory that acts as a buffer for a slower, larger memory?

(a) SRAM

(b) DRAM

(c) Cache memory

(d) Flash memory

100. Which of the following applications are characterized by the presence of many single-threaded processes?

(a) Java applications

(b) Multi-threaded native applications

(c) Multi-instance applications

(d) Multi-process applications

101. If c is the number of check bits required to achieve single-error correction with n-bit data words, clearly the check bits have 2^c patterns that must distinguish between $n+c$ possible error locations and the single error-free case, then c must satisfy the inequality of

(a) $2^c \geq n+c+1$

(b) $2^c \leq n+c+1$

(c) $2^{c-1} \geq n+c+1$

(d) $2^{c-1} \leq n+c+1$

102. Which one of the following protocols allows the transaction of serial bit stream of any length without the implication of character boundaries?

(a) Bit-oriented protocol

(b) Check redundancy protocol

(c) Parity bit protocol

(d) Byte-oriented protocol

103. In which one of the following data transfer modes, the CPU momentarily stops the task for processing, branches to a service program to process the I/O transfer, and then returns to the task it was originally performing?

(a) Programmed I/O

(b) Interrupt-initiated I/O

(c) Direct memory access

(d) Hybrid memory transfer

104. A collection of blocks that logically belong on the disk but are being kept in memory for performance reason is known as

(a) block cache

(b) stream cache

(c) segment

(d) page

105. A virus that could overwrite the master boot record or boot sector with devastating results is known as

(a) boot sector virus

(b) bootstrap virus

(c) memory-resident virus

(d) cavity virus

106. An employee might learn many job skills, and each job skill might be learned by many employees. Database designers label the relationship 'EMPLOYEE learns SKILL' as

(a) one-to-one relationship

(b) many-to-many relationship

(c) one-to-many relationship

(d) many-to-one relationship

107. In the 680X0 family, simple instructions are assigned short formats as follows :

ADD.L D1, D2

This instruction denotes

(a) register to register addition

(b) register to memory addition

(c) register to memory and register addition

(d) memory to memory addition

108. Which one of the following is true for atomicity with respect to transaction properties?

(a) Requires that all operations of transactions be completed; if not transaction is aborted

(b) Indicates the permanency of the database's consistent state

(c) The results of the concurrent execution of several transactions

(d) The data used during the execution of a transaction cannot be used by a second transaction until the first one is completed

109. A pulse of a given frequency transmitted upward is received back after a period of 5 millisecond. If the value of c is 3×10^8 m/s, the virtual height of the reflecting layer will be

(a) 650 km

(b) 700 km

(c) 750 km

(d) 800 km

110. The velocity factor V_f with respect to transmission line wave propagation is

(a) $\frac{V_p}{c}$

(b) $\frac{2V_p}{c}$

(c) $\frac{V_p}{3c}$

(d) $\frac{2V_p}{3c}$

where

V_p is actual velocity of propagation

c is velocity of propagation through free space

111. A dielectric medium, in which the conduction current is almost non-existent in comparison with the displacement current, may be treated as

(a) homogeneous dielectric medium

(b) imperfect dielectric medium

(c) perfect dielectric medium

(d) isotropic dielectric medium

112. A load of pure resistance of 60 Ω is to be connected through a quarter-wave line to a transmission line of characteristic impedance 100 Ω. If VSWR = 1, the characteristic impedance of the quarter-wave line will be

(a) 82·5 Ω

(b) 77·5 Ω

(c) 72·5 Ω

(d) 67·5 Ω

113. A lossless transmission line having characteristic impedance of 600 Ω is terminated by a resistance of 300 Ω. The voltage standing wave ratio in the line will be

(a) 4

(b) 3

(c) 2

(d) 1

114. The antenna efficiency η (with regards to a radiation resistance) is

(a) $\frac{P_{rad}}{2P_{in}} \times 100$

(b) $\frac{P_{rad}}{P_{in}} \times 100$

(c) $\frac{2P_{rad}}{P_{in}} \times 100$

(d) $\frac{3P_{rad}}{P_{in}} \times 100$

where

P_{rad} is radiated power

P_{in} is input power

115. Which one of the following relations is true for an angle of entrance θ_e on the axis of core?

(a) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 + \eta_2^2}}{\eta_0}$

(b) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 - \eta_2^2}}{\eta_0^2}$

(c) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 - \eta_2^2}}{\eta_0}$

(d) $\sin\theta_e = \dfrac{\sqrt{\eta_1^2 + \eta_2^2}}{\eta_0^2}$

where

η_1 is index of refraction of core

η_2 is index of refraction of cladding

η_0 is index of refraction of external medium

116. When the cut-off frequency for TE_{10} mode is 3 GHz, and the value of v_0 is 3×10^{10} cm/s, the broad wall dimension of a rectangular waveguide will be

(a) 2 cm

(b) 3 cm

(c) 4 cm

(d) 5 cm

117. The EM wave of 1 GHz is radiated by an antenna to cover a distance of 100 km. If the velocity of propagation is 3×10^8 m/s, the time taken by the wave to travel the above distance will be

(a) 369 μs

(b) 351 μs

(c) 333 μs

(d) 315 μs

118. The approximate –3 dB beam width for a parabolic antenna in degrees is

(a) $\theta = \dfrac{80\lambda}{D}$

(b) $\theta = \dfrac{70\lambda}{D}$

(c) $\theta = \dfrac{60\lambda}{D}$

(d) $\theta = \dfrac{50\lambda}{D}$

where

λ is wavelength

D is antenna mouth diameter

θ is beam width between half-power points (degrees)

119. The guide wavelength λ_g for a cut-off frequency and frequency of operation is

(a) $\lambda_g = \dfrac{c}{\sqrt{f^2 - f_c^2}}$

(b) $\lambda_g = \dfrac{c}{\sqrt{f_c^2 - f^2}}$

(c) $\lambda_g = \dfrac{c}{\sqrt{f^2 + f_c^2}}$

(d) $\lambda_g = \dfrac{c}{\sqrt{f_c + f}}$

where

c is free space propagation velocity

f is frequency of operation

f_c is cut-off frequency

120. A broadside array operating at 100 cm wavelength consists of four half-wave dipoles spaced 50 cm. If each element carries radio frequency current in the same phase and of magnitude 0·5 A, and radiation resistance is 73 Ω, the radiated power will be

(a) 68 W

(b) 73 W

(c) 78 W

(d) 83 W

121. Which one of the following, a polycrystalline material of high purity, is the raw material for the preparation of single-crystal silicon?

(a) Electronic Grade Silicon (EGS)

(b) Metallurgical Grade Silicon (MGS)

(c) Float Zone Silicon (FZS)

(d) Raw Silicon (RS)

122. For a 1000 μm long bond pad locus, the number of bond pads placed on a 100 μm pitch along a bond pad will be

(a) 10

(b) 11

(c) 12

(d) 13

123. Which one of the following incorporates both the level sensitivity and the scan path approach using shift registers?

(a) Built-in logic block observer

(b) Built-in test

(c) Level-sensitive scan design

(d) I_{DQ} test

124. In a reconstruction filter, if the output is $x(t)$ in time domain and $C_o X(f)$ in frequency domain with no frequency components above f_h and $X(f)$ is zero for $|f| \geq f_h$, then such signal is called

(a) reconstructed

(b) bandlimited

(c) constructed

(d) delimited

125. Fourier series exists only when the function $f(t)$ is well-defined and single-valued, possesses finite number of discontinuities, and finite number of positive and negative maxima in the period T. These conditions are called

(a) Parseval's conditions

(b) Blackman conditions

(c) Chebyshev conditions

(d) Dirichlet's conditions

126. If

$$X(z) = \frac{1+\frac{1}{2}z^{-1}}{1-\frac{1}{2}z^{-1}}$$

what is $x(n)$?

(a) $\frac{1}{2}[\delta(n) + 2u(n-1)]$

(b) $\left(\frac{1}{2}\right)^n [\delta(n) + 2u(n-1)]$

(c) $\left(\frac{1}{2}\right)^n [\delta(n) - 2u(n-1)]$

(d) $\frac{1}{2}[\delta(n) - 2u(n-1)]$

127. A first-order low-pass Butterworth active filter has a cut-off frequency of 10 kHz and unity gain at low frequency. The voltage transfer function magnitude at 12 kHz for the filter will be

(a) 0·32

(b) 0·64

(c) 0·96

(d) 1·28

128. The filters that exhibit symmetry, have an odd-numbered filter length and are used in applications like decimation and interpolation are known as

(a) half-band filters

(b) full-band filters

(c) bridge-band filters

(d) multi-band filters

129. The IIR filters involve designing of

(a) analog filter in analog domain and transforming into digital domain

(b) digital filter in analog domain and transforming into digital domain

(c) analog filter in digital domain and transforming into analog domain

(d) digital filter in digital domain and transforming into analog domain

130. If a pulse sent to the target returns after 15 μs, when the velocity of light is 300×10^6 m/s, the distance of the target will be

(a) 4·25 km

(b) 3·50 km

(c) 2·25 km

(d) 1·50 km

131. Pulse Width Modulation (PWM) mode is commonly used in embedded system application for

(a) controlling the speed of DC motors

(b) serial communication

(c) counting the electrical pulses

(d) recording the arrival time of either a rising or falling pulse

132. A chip with fewer transistors results into lower cost, less heat and less power requirements. These features are very desirable in small battery-powered embedded systems such as mobile phones. Which one of the following architectures is used?

(a) AMD

(b) MIPS

(c) ARM

(d) TDP

133. Which kind of deposition has traditionally been done at higher temperatures to ensure that all the Si atoms being deposited are incorporated into lattice sites in order to obtain a single-crystal thin film?

(a) Epitaxial Si deposition

(b) Polysilicon deposition

(c) Silicon nitride deposition

(d) Silicon dioxide deposition

134. Which one of the following layers defines the procedure and functions that physical devices and interfaces have to perform for transmission to occur?

(a) Data link layer

(b) Network layer

(c) Physical layer

(d) Application layer

135. Which one of the following carries multiple voice frequency circuits using either frequency division multiplexed or synchronous time division multiplexed?

(a) Subscriber

(b) Local loop

(c) Exchange

(d) Trunk

136. Five channels, each with a 100 kHz bandwidth, are to be multiplexed together. If there is a need for a guard band of 10 kHz between the channels to prevent interference, the minimum bandwidth of the link will be

(a) 540 kHz

(b) 510 kHz

(c) 470 kHz

(d) 440 kHz

137. The entries in a CIDR routing table contain 32-bit IP address and a 32-bit mask. The CIDR enables a technique called

(a) supernetting

(b) routing tables

(c) deployment of CIDR

(d) logical packet flows

138. The free space path loss L_p incurred by an electromagnetic wave is

(a) $\left(\frac{4\pi fD}{c}\right)^2$

(b) $\left(\frac{2\pi fD}{c}\right)^2$

(c) $4\pi\left(\frac{fD}{c}\right)^2$

(d) $2\pi\left(\frac{fD}{c}\right)^2$

where

c is velocity of light in free space

f is frequency

D is distance

139. Which one of the following amplifiers is widely used in transponders to provide the final output power required to the transmit antenna?

(a) Travelling-wave tube amplifier

(b) Power amplifier

(c) Two-stage wave tube amplifier

(d) Three-stage wave tube amplifier

140. Which one of the following systems of satellites is sometimes called 'Internet in the Sky'?

(a) Globalstar

(b) Teledesic

(c) Iridium

(d) Medium Earth Orbit (MEO)

141. A directional antenna with 10 dB gain radiates 500 watts. The receiving antenna at 15 km distance receives 2 microwatt. If there is a negligible ground and ionospheric reflection, the effective area of the receiving antenna will be nearly

(a) $3{\cdot}1\ m^2$

(b) $2{\cdot}3\ m^2$

(c) $1{\cdot}1\ m^2$

(d) $0{\cdot}3\ m^2$

142. The time used for all civil timekeeping purposes, and is the time reference which is broadcast by the National Bureau of Standards as a standard for setting clocks, is

(a) Mean Time Coordinated

(b) Universal Time Coordinated

(c) Epoch Time Coordinated

(d) Real Time Coordinated

143. The point on the earth vertically under the satellite is referred to as the

(a) reference point

(b) meridian point

(c) apparent point

(d) sub-satellite point

144. The total reduction of power level in optical fiber cable, A(dB) is

(a) $25\log\frac{P_{out}}{P_{in}}$

(b) $20\log\frac{P_{out}}{P_{in}}$

(c) $15\log\frac{P_{out}}{P_{in}}$

(d) $10\log\frac{P_{out}}{P_{in}}$

where

P_{in} is cable input power

P_{out} is cable output power

Directions :

Each of the following **six (06)** items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is ***not*** the correct explanation of Statement (I)

(c) Statement (I) is true but Statement (II) is false

(d) Statement (I) is false but Statement (II) is true

145. Statement (I) :

Stokes' theorem gives relation between a double integral and a single integral, and is applied only to an open surface.

Statement (II) :

Gauss' divergence theorem gives relation between a triple integral and a double integral, and is applied only to a closed surface.

146. Statement (I) :

The microwave junction can be defined as S-parameters or scattering parameters.

Statement (II) :

A scattering matrix is a square matrix which gives all the combinations of power relationships between the various input and output ports of a microwave junction.

147. Statement (I) :

Electron lithography offers higher resolution than optical lithography.

Statement (II) :

Electron lithography has small wavelength of the 10–50 keV electrons.

148. Statement (I) :

In communication network, the element of the network should be designed such that maximum power transfer takes place between the source to the load.

Statement (II) :

The maximum power is absorbed by one network from another network, when the impedance of one is the complex conjugate of the other.

149. Statement (I) :

A network is two or more devices connected together through links.

Statement (II) :

A link is a communication pathway that transfers data from one device to another.

150. Statement (I) :

Mode partition noise is a multiplicative noise in an optical fiber link.

Statement (II) :

Mode partition noise arises when the optical source emits several frequencies in a rapid succession.

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