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T.B.C. : B–GTD–O–SAA **Test Booklet Series**

Serial No. 006628

TEST BOOKLET

A

ELECTRONICS & TELECOMMUNICATION ENGINEERING

Paper—I

Time Allowed : Two Hours ***Maximum Marks : 200***

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.
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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 **120** 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 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 (0.33)** 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 **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. The radius of the first Bohr orbit of electrons in hydrogen atom is 0.529 Å. What is the radius of the second Bohr orbit in singly ionized helium atom?

   (a) 1.058 Å
   (b) 0.264 Å
   (c) 10.58 Å
   (d) 0.0264 Å

2. For which one of the following materials, is the Hall coefficient closest to zero?

   (a) Metal
   (b) Insulator
   (c) Intrinsic semiconductor
   (d) Alloy

3. Copper has a resistivity of $17 \times 10^{-9}\ \Omega$ m. What is the end to end resistance of a copper strip, 2 cm long with cross sectional dimensions 5 mm × 1 mm?

   (a) 34 μΩ
   (b) 68 μΩ
   (c) 34 mΩ
   (d) 68 mΩ

4. At temperature of 298 Kelvin, Silicon is not suitable for most electronic applications, due to small amount of conductivity. This can be altered by

   (a) Gettering
   (b) Doping
   (c) Squeezing
   (d) Sintering

5. The energy gap in the energy band structure of a material is 9 eV at room temperature. The material is

   (a) Semiconductor
   (b) Conductor
   (c) Metal
   (d) Insulator

6. By doping Germanium with Gallium, the types of semi-conductors formed are:

   1. N type
   2. P type
   3. Intrinsic
   4. Extrinsic

   Which of the above are correct?

   (a) 1 and 4
   (b) 2 and 4
   (c) 1 and 3
   (d) 2 and 3

7. An n-type of silicon can be formed by adding impurity of:

   1. Phosphorous
   2. Arsenic
   3. Boron
   4. Aluminium

   Which of the above are correct?

   (a) 1 and 2
   (b) 2 and 3
   (c) 3 and 4
   (d) 1 and 4

(Contd.)

8. According to Einstein's relationship for a semiconductor, the ratio of diffusion constant to the mobility of the charge carriers is

(a) Variable and is twice the volt equivalent of the temperature

(b) Constant and is equal to the volt equivalent of the temperature

(c) Equal to two and is twice the volt equivalent of the temperature

(d) Equal to one and is equal to the volt equivalent of the temperature

9. Swept-out voltage in PIN diode happens when PIN diode is

(a) Forward biased and the thickness of the depletion layer decreases till I-region becomes free of mobile carriers

(b) Reverse biased and the thickness of the depletion layer increases till I-region becomes free of mobile carriers

(c) Forward biased and the thickness of the depletion layer increases till I-region becomes free of mobile carriers

(d) Reverse biased and the thickness of the depletion layer decreases till I-region becomes free of mobile carriers

10. Consider the following statements related to piezoelectric effect:

1. It gives electrical response in terms of voltage change when mechanical stress occurs in some materials

2. It gives mechanical response in terms of dimensional change due to electrical excitation of some materials

Which of the above statements is/are correct?

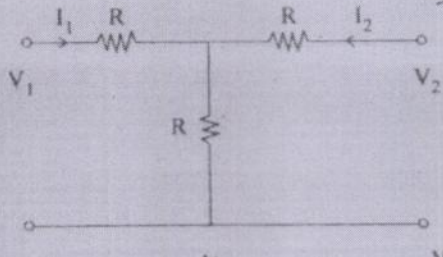
(a) 1 only

(b) 2 only

(c) Neither 1 nor 2

(d) Both 1 and 2

11. A 2-port Network is shown in figure. The parameter h_{21} for this network can be given by



(a) –1/2

(b) +1/2

(c) –3/2

(d) +3/2

(Contd.)

12. The four band colour code on a carbon composite resistor is as follows:

First band colour : Yellow

Second band colour : Violet

Third band colour : Red

Fourth band colour : Silver

The specification of the resistor is

(a) 35 kΩ ± 10%

(b) 4.7 kΩ ± 10%

(c) 6.8 kΩ ± 5%

(d) 46 kΩ ± 2%

13. Which one of the following materials has temperature coefficient of resistance very close to zero?

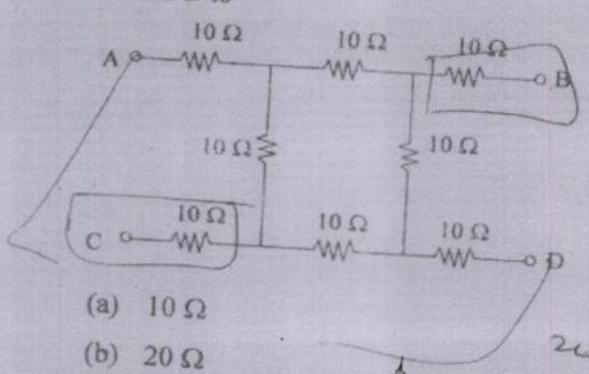
(a) Manganin

(b) Nichrome

(c) Carbon

(d) Aluminium

14. The equivalent resistance between the points A and D is



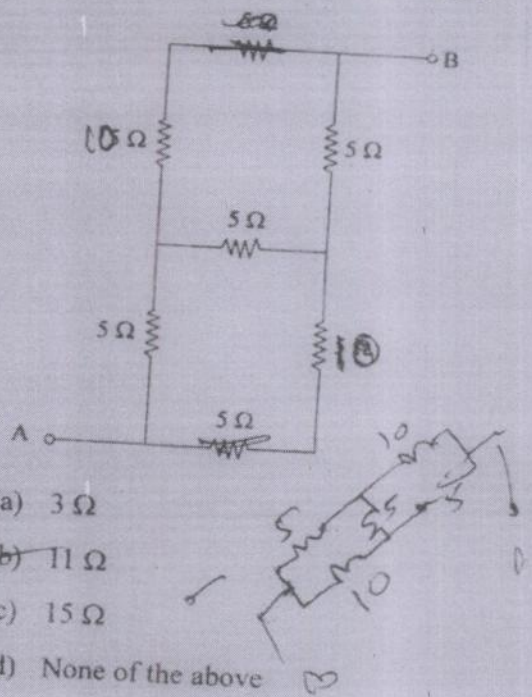
(a) 10 Ω

(b) 20 Ω

(c) 30 Ω

(d) 40 Ω

15. Seven resistances each of 5 Ω are connected as shown in the figure. The equivalent resistance between the points A and B is



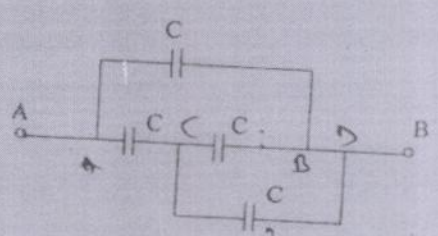
(a) 3 Ω

(b) 11 Ω

(c) 15 Ω

(d) None of the above

16. The capacitance of each capacitor is C = 3 μF in the figure shown. The effective capacitance between points A and B is



(a) 2 μF

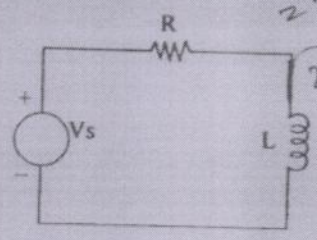
(b) 3 μF

(c) 4 μF

(d) 5 μF

(Contd.)

17. $V_s = 5\cos t$ and the complex power drawn is $P_{complex} = \frac{3}{2} + 2j$, the value of R and L respectively will be



(a) $\frac{3}{5}$ and $\frac{4}{5}$

(b) $\frac{16}{3}$ and $\frac{16}{5}$

(c) 4 and 3

(d) 3 and 4

18. The complex permeability of ferrite at radio frequency is given as $\mu = (\mu' - j\mu'')$. Here μ'' represents

(a) Relative permeability

(b) Relative permittivity

(c) Loss parameter

(d) Resistivity

9. The number of holes in an N-type silicon with intrinsic value $1.5 \times 10^{10}/cm^3$ and doping concentration of $10^{17}/cm^3$, by using mass-action law is

(a) $6.67 \times 10^6/cc$

(b) $4.44 \times 10^{-25}/cc$

(c) $1.5 \times 10^{-24}/cc$

(d) $2.25 \times 10^3/cc$

20. A tunnel-diode is best suited for

(a) Very low frequencies

(b) 50 Hz

(c) 100 kHz

(d) Microwave frequencies

21. Small recovery time of a diode is most significant for

(a) Line-frequency rectification

(b) Switching operations

(c) High-frequency rectification and switching operations

(d) Low-frequency rectification and switching operations

22. In JFET, when operated above the pinch-off voltage, the

(a) Depletion region becomes smaller

(b) Drain current starts decreasing

(c) Drain current remains practically constant

(d) Drain current increases steeply

23. Thermal runaway is not possible in FET because, as the temperature of FET increases

(a) The drain current increases

(b) The mobility of charge carriers decreases

(c) The mobility of charge carriers increases

(d) The transconductance increases

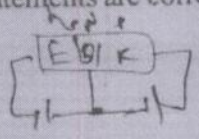
(Contd.)

24. Consider the following statements regarding an N-P-N Bipolar Junction Transistor:

1. Emitter diode is forward biased and collector diode is reverse biased
2. Emitter has many free electrons
3. Free electrons are injected into base and pass through collector
4. Depletion layers around junction J1 and J2 of BJT are widened.

Which of the above statements are correct?

(a) 1, 2 and 4
(b) 1, 3 and 4
(c) 2, 3 and 4
(d) 1, 2 and 3



25. A freewheeling diode in a phase controlled rectifier

(a) improves the line power factor
(b) enables inverse operation
(c) is responsible for additional reactive power
(d) is responsible for additional harmonics

26. In a thyristor, the minimum current required to maintain the device in the 'ON' state is called

(a) Latching current
(b) Ignition current
(c) Holding current
(d) Avalanche current

27. The zeners incorporated within the encapsulations of some MOSFETs are meant for

(a) Reducing the cost
(b) Biasing the gate circuit
(c) Self-protecting the device against transients
(d) None of the above

28. Which of the following magnetic materials has the highest reluctance?

(a) Ferromagnetic
(b) Paramagnetic
(c) Diamagnetic
(d) None of the above

29. When UJT is used for triggering an SCR, the wave-shape of the signal obtained from UJT circuit is

(a) Sine wave
(b) Saw tooth wave
(c) Trapezoidal wave
(d) Square wave

30. Darlington pairs are frequently used in linear ICs because, they

(a) Do not require any capacitors o inductors
(b) Have enormous impedance transfor mation capability
(c) Can be readily formed/hooked fror two adjacent transistors
(d) Resemble emitter follower

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31. In a MOS capacitance fabricated on a P-type semiconductor, strong inversion occurs, when potential is

(a) Equal to Fermi level

(b) Zero

(c) Negative and equal to Fermi potential in magnitude

(d) Positive and equal to Fermi potential in magnitude

32. A CMOS amplifier when compared to an N channel MOSFET has the advantage of

(a) Higher cutoff frequency

(b) Higher voltage gain

(c) Higher current gain

(d) Lower power dissipation

33. Consider the following statements regarding optocouplers:

1. Optocouplers are LEDs driving photodiodes in a single package to provide electrical isolation between input and output
2. Optocoupler is LED driving a phototransistor in a single package that replaces pulse transformers working at input zero crossing
3. Optocouplers are used as temporary non fixed joints between optical fibre terminations

Which of the above statements are correct?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

34. Which of the following does not cause permanent damage to an SCR?

(a) High current

(b) High rate of rise of current

(c) High temperature rise

(d) High rate of rise of voltage

35. The discrete LTI system is represented by impulse response

$$h(n)=\left(\frac{1}{2}\right)^{n} u(n)$$, then the system is

(a) Causal and stable

(b) Causal and unstable

(c) Non causal and stable

(d) Non causal and unstable

36. In the first Cauer LC network, the first element is a series inductor when the driving point function consists of a

(a) Pole at $\omega = \infty$

(b) Zero at $\omega = \infty$

(c) Pole at $\omega = 0$

(d) Zero at $\omega = 0$

37. Consider a complex exponential sequence $e^{j\omega_0 n}$ with frequency ω_0. Suppose $\omega_0 = 1$, then

(a) Such a sequence is periodic

(b) Such a sequence is not periodic at all

(c) Periodic for some value of period 'N'

(d) Some definite range $N_0 < n < N_1$ exists for a periodic sequence

(Contd.)

38. Ideal low pass filter as a discrete time system is

(a) Causal, realizable

(b) Non causal, physically/computationally unrealizable

(c) Non causal, physically realizable

(d) None of the above

39. Consider a continuous time system A, modelled by the equation $y(t) = t\,x(t) + 4$ and a discrete time system B modelled by the equation $y[n] = x^2[n]$. These systems are

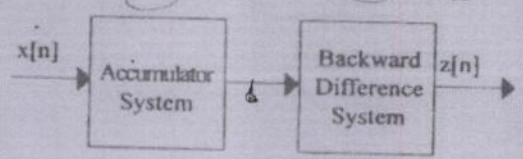
(a) A-time invariant and B-time invariant

(b) A-time varying and B-time invariant

(c) A-time invariant and B-time varying

(d) A-time varying and B-time varying

40. Consider a discrete time accumulator system $y[n] = \sum_{k=-\infty}^{n} x[k]$ and the backward difference system $y[n] = x[n] - x[n-1]$ where $x[\cdot]$ represents the input and $y[\cdot]$ represents the output of the individual systems.



When these two systems are cascaded as in figure, the impulse response of combined system with output z[n] is

(a) Unit impulse sequence

(b) Unit step sequence

(c) Unit ramp sequence

(d) None of the above

41. Measurement of pressure can be done by using wire, foil or semiconductor type Strain Gauges. The disadvantage of the semiconductor type of Strain Gauge compared to the other two is in terms of

(a) Gauge factor

(b) Hysteresis characteristics

(c) Temperature sensitivity

(d) Frequency response

42. The Fourier series of a periodic function $x_T(t)$ with a period T is given by

$$\sum_{k=-\infty}^{\infty} X_s(k)\, e^{jk\omega_o t}, \text{ where } \omega_o = 2\pi/T$$

and the Fourier coefficient $X_s(k)$ is defined as,

$$X_s(k) = \frac{1}{T}\int x_T(t)\, e^{-jk\omega_o t}\, dt$$

If $x_T(t)$ is real and odd, the Fourier coefficients $X_s(k)$ are

(a) Real and odd

(b) Complex

(c) Real

(d) Imaginary

43. Consider a continuous time periodic signal x(t) with fundamental period T and Fourier series coefficient X[K]. What is the Fourier series coefficient of the signal

$y(t) = x(t - t_o) + x(t + t_o)$?

(a) $2\cos\left(\frac{2\pi}{T} K t_o\right) X[K]$

(b) $2\sin\left(\frac{2\pi}{T} K t_o\right) X[K]$

(c) $e^{-t_o} X[K] + e^{t_o} X[-K]$

(d) $e^{-t_o} X[-K] + e^{t_o} X[K]$

(Contd

44. Consider the following transfer functions:

1. $\frac{1}{j\omega+1}$
2. $\frac{1}{(j\omega+1)^2}$
3. $\frac{1}{(j\omega+1)(j\omega+2)}$

The transfer functions which have a non linear phase are:

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

45. A continuity equation is also called as the law of conservation of

(a) Mass

(b) Energy

(c) Charge

(d) Power

46. The basic structure of an avalanche photodiode is

(a) $p^+ - i - p - n^+$

(b) $p^+ - i - n^+$

(c) $p^+ - p^- - n^+$

(d) $i - p^+ - n^+$

47. Consider two infinite duration input sequences $\{x_1[n], x_2[n]\}$. When will the Region of Convergence [ROC] of Z-transform of their superposition i.e. $\{x_1[n] + x_2[n]\}$ be entire Z plane except possibly at $Z = 0$ or $Z = \infty$?

(a) When their linear combination is of finite duration

(b) When they are left sided sequences

(c) When they are right sided sequences

(d) When their linear combination is causal

48. If the lower limit of Region of Convergence (ROC) is greater than the upper limit of ROC, the series $X(Z) = \sum_{n=-\infty}^{\infty} x(n) Z^{-n}$

(a) Converges

(b) Zero

(c) Does not converge

(d) None of the above

49. For a random signal (continuous time) x(t) defined for $t \geq 0$, its probability density function (pdf) at $t = t_0$ is such that

(a) It is non-negative and its integral equals 1

(b) Need not be non-negative, but integral equals 1

(c) It is non-negative, but integral is not 1

(d) None of the above

(Contd.)

50. The response of a system to a complex input $x(t) = e^{j2t}$ is specified as $y(t) = t \cdot e^{j2t} + e^{-j2t}$. The system

(a) is definitely LTI

(b) is definitely not-LTI

(c) may be LTI

(d) information is insufficient

51. The rise time of the output response of a low pass filter circuit when a step input is applied will be

(a) Proportional to the band width

(b) Inversely proportional to the band width

(c) Half the value of the band width

(d) $\frac{1}{\sqrt{2}}$ of the band width

52. Consider an LTI system subjected to a wide-sense stationary input $\{x(n)\}$, which is a white noise sequence. The cross correlation $\Phi_{xy}[m]$ between input x(n) and output y(n) is

(a) $\sigma_x^2\, h[m]$

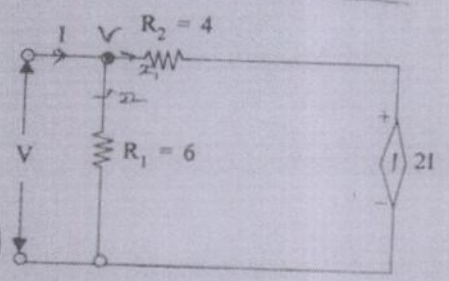
(b) $\sigma_x\, h[m]$

(c) $\frac{\sigma_x^2}{2} h[m]$

(d) $\frac{\sigma_x}{2} h[m]$

where $\Phi_{xx}[m] = \sigma_x^2\, \delta[m]$ and $h[\cdot]$ is impulse response

53. For the active network shown in figure, the value of V/I is



(a) 2 Ω

(b) 2.4 Ω

(c) 3.6 Ω

(d) 10 Ω

54. In a discrete-time Low Pass Filter, the frequency response is

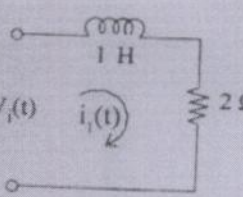
(a) Aperiodic

(b) Aperiodic with response restricted to $(-\omega_c, +\omega_c)$

(c) Periodic with period 2π

(d) Quasi periodic with response extending to infinity

55. For the R-L circuit shown, the current i(t) for unit step input voltage will rise to 0.63 in



(a) 1 s

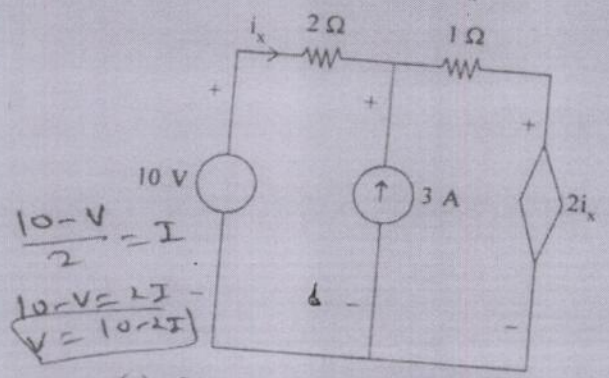
(b) 2 s

(c) 0.5 s

(d) 1.5 s

(Contd

56. In the circuit the value of i_x is



(a) 2 A

(b) −0.6 A

(c) 2.6 A

(d) 1.4 A

57. When the frequency of the applied voltage (sine wave) across an inductor is increased then the current will

(a) Decrease

(b) Increase

(c) Remain same

(d) Be zero

58. A series resonant circuit is tuned to 10 MHz and provides 3-dB bandwidth of 100 kHz. The quality factor Q of the circuit is

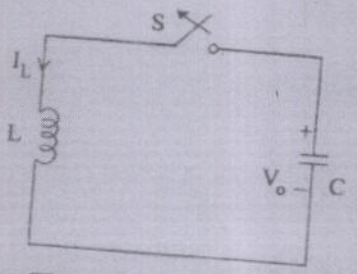
(a) 30

(b) 1

(c) 100

(d) 10

59. In the figure, initial voltage on C is V_o. S is closed at $t = 0$. The I_L for $t > 0$ is



(a) $-\omega_o C V_o \sin \omega_o t$

(b) $\omega_o V_o \sin \omega_o t$

(c) $-\omega_o V_o \sin \omega_o t$

(d) $\omega_o C V_o \sin \omega_o t$

where $\omega_o^2 = 1/LC$

60. A reduced incidence matrix of a graph is given by

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

The number of possible trees is

(a) 14

(b) 15

(c) 16

(d) 17

61. In a singly connected network if there are b number of branches and n number of nodes, then the number of independent meshes M and independent nodes N are respectively

(a) n and b

(b) b − n + 1 and n − 1

(c) b − n and b

(d) b + n − 1 and n + 1

(Contd.)

62. For a symmetric lattice network the value of the series impedance is 3 Ω and that of the diagonal impedance is 5 Ω, then the Z-parameters of the network are

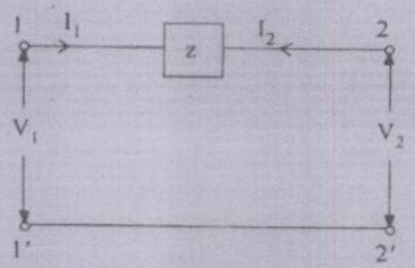
(a) $Z_{11} = Z_{22} = 2\ \Omega$ and $Z_{12} = Z_{21} = \frac{1}{2}\ \Omega$

(b) $Z_{11} = Z_{22} = 4\ \Omega$ and $Z_{12} = Z_{21} = 1\ \Omega$

(c) $Z_{11} = Z_{22} = 8\ \Omega$ and $Z_{12} = Z_{21} = 2\ \Omega$

(d) $Z_{11} = Z_{22} = 16\ \Omega$ and $Z_{12} = Z_{21} = 4\ \Omega$

63. Z-Parameters for the network shown in the figure are



(a) $Z_{11} = Z, Z_{22} = Z, Z_{12} = Z_{21} = Z$

(b) $Z_{11} = 1/Z, Z_{22} = 1/Z, Z_{12} = Z_{21} = 1/Z$

(c) Cannot be determined

(d) $Z_{11} = Z, Z_{22} = Z, Z_{12} = Z_{21} = 1/Z$

64. If y(s) = 1 + s, the network has 1 Ω resistor and

(a) 1F capacitor in series

(b) 1F capacitor in parallel

(c) 1H inductor in series

(d) 1H inductor in parallel

65. The solutions to many problems involving electric fields are simplified by making use of equipotential surfaces. An equipotential surface is a surface:

1. On which the potential is same everywhere
2. The movement of charge over such a surface would require no work
3. The tangential electric field is zero
4. The normal electric field is zero

Which of the above statements are correct?

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 2, 3 and 4 only

(d) 1, 2, 3 and 4

66. A charge 'Q' is divided between two point charges. What should be the values of this charge on the objects so that the force between them is maximum?

(a) $\frac{Q}{3}$

(b) $\frac{Q}{2}$

(c) (Q – 2)

(d) 2Q

67. What is the force developed per meter length between two current-carrying conductors 10 cm apart and carrying 1000 A and 1500 A currents, respectively?

(a) 3 N

(b) $\frac{N}{3}$

(c) 2 N

(d) $\frac{N}{2}$

(Contd.)

68. A practical dc current source provides 20 kW to a 50 Ω load and 20 kW to a 200 Ω load. The maximum power that can drawn from it, is

(a) 22.5 kW

(b) 30.3 kW

(c) 40.5 kW

(d) 45.0 kW

69. If an ammeter is to be used in place of a voltmeter, we must connect with the ammeter a

(a) High resistance in parallel

(b) High resistance in series

(c) Low resistance in parallel

(d) Low resistance in series

70. A point charge is located at origin. At point (a, a), electric field is E_1. At point (–a, a) the electric field is E_2 and at a point (–a, –a) the electric field is E_3.

Which one of the following is correct?

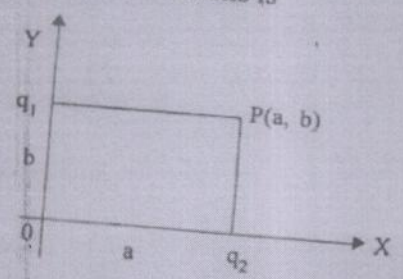
(a) $E_1 \cdot E_2 = 0$

(b) $|E_1 \times E_3| = 0$

(c) Both $E_1 \cdot E_2 = 0$ and $|E_1 \times E_3| = 0$

(d) Neither $E_1 \cdot E_2 = 0$ nor $|E_1 \times E_3| = 0$

71. Two point charges $q_1 = 2\ \mu C$ and $q_2 = 1\ \mu C$ are placed at distances b = 1 cm and a = 2 cm from the origin on the Y and X axes as shown in figure. The electric field vector at point P(a, b) that will subtend at angle θ with the X-axis is



(a) $\tan\theta = 1$

(b) $\tan\theta = 2$

(c) $\tan\theta = 3$

(d) $\tan\theta = 4$

72. In a coaxial transmission line ($\varepsilon_r = 1$), the electric field intensity is given by:

$$E = \frac{100}{\rho}\cos(10^9 t - 6z)\,u_\rho \text{ V/m}$$

The displacement current density is

(a) $-\frac{100}{\rho}\sin(10^9 t - 6z)\,u_\rho$ A/m²

(b) $\frac{116}{\rho}\sin(10^9 t - 6z)\,u_\rho$ A/m²

(c) $-\frac{0.9}{\rho}\sin(10^9 t - 6z)\,u_\rho$ A/m²

(d) $-\frac{216}{\rho}\cos(10^9 t - 6z)\,u_\rho$ A/m²

(Contd.)

73. Consider the following properties of electromagnetic waves:

1. These waves do not require any material medium to propagate
2. Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of waves
3. The energy in electromagnetic wave is divided equally between electric and magnetic vectors
4. Both electric and magnetic field vectors attain the maxima and minima at the same place and same time

Which of the above properties of electromagnetic waves are correct?

(a) 1, 2 and 3 only
(b) 1, 3 and 4 only
(c) 2, 3 and 4 only
(d) 1, 2, 3 and 4

74. Electromagnetic waves are transverse in nature due to

(a) Reflection
(b) Diffraction
(c) Interference
(d) Polarization

75. In a pn junction diode, $\frac{dV}{dT}$ is equal to

(a) 2.3 mV/°C
(b) 3.5 mV/°C
(c) 10.0 mV/°C
(d) 12.5 mV/°C

76. A transmission line having a characteristic impedance of 50 Ω is terminated at one end by j 50 Ω. The voltage standing wave ratio produced will be

(a) ∞
(b) +j
(c) 1
(d) 0

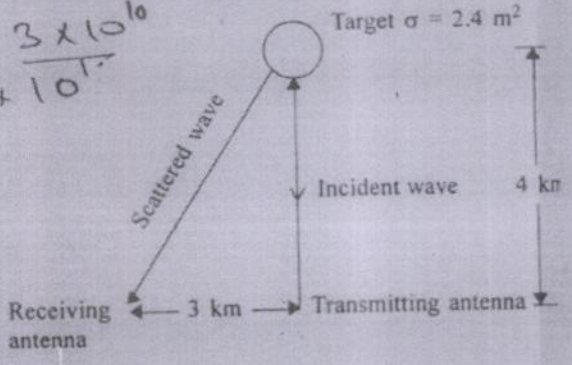
77. In viscosity meters the quantity measured is

(a) Buoyant force
(b) Frictional force
(c) Coriolis force
(d) Centrifugal force

78. The cut-off frequency of a rectangular waveguide in dominant mode is 10 GHz. The width of the wave guide is

(a) 2 cm
(b) 1.5 cm
(c) 1 cm
(d) 2.5 cm

79. A bistatic radar system shown in figure has following parameters: f = 5 GHz, G_{dt} = 34 dB, G_{dr} = 22 dB. To obtain a return power of 8p W the minimum necessary radiated power should be



(a) 1.394 kW
(b) 2.046 kW
(c) 1.038 kW
(d) 3.46 kW

(Contd.

80. For the microwave antenna

(a) Shape only depends on the frequency range used

(b) Size only depends on the frequency range used

(c) Neither shape nor size depend on the frequency range used

(d) Both shape and size depend on the frequency range used

81. The antenna efficiency of a $\lambda/8$ long dipole antenna is 89.159%. The equivalent loss resistance of the antenna is

(a) 1.5 Ω

(b) 15 Ω

(c) 12.33 Ω

(d) 125 Ω

82. A small elemental wire antenna is excited with a sinusoidal current of frequency 1 MHz. The induction field and radiation field are at equal distance d from the antenna. The value of d will be nearly

(a) 300 m

(b) 50 m

(c) 150 m

(d) 20 m

83. Error caused by the act of measurement on the physical system being tested is

(a) Hysteresis error

(b) Random error

(c) Systematic error

(d) Loading error

84. Four independent observations recorded voltage measurement of 110.02 V, 110.11 V, 110.08 V and 110.03 V. The average range of error will be

(a) 110.06 V

(b) 0.05 V

(c) ± 0.045 V

(d) ± 0.9 V

85. A 1 kΩ resistor with an accuracy of ± 10% carries a current of 10 mA. The current was measured by an analog ammeter on a 25 mA range with an accuracy of ± 2%. The accuracy in calculating the power dissipated in the resistor would be

(a) ± 4 %

(b) ± 12 %

(c) ± 15 %

(d) ± 20 %

86. Consider the following statements regarding error occurring in current transformer:

1. It is due to the magnetic leakage in secondary winding.
2. It is due to power consumption in the metering circuit
3. It is due to the exciting mmf required by the primary winding to produce flux
4. It is due to the non-linear relation between flux density in the core and magnetizing force

Which of the above statements are correct?

(a) 1, 2, 3 and 4

(b) 1, 2 and 4 only

(c) 2, 3 and 4 only

(d) 1, 2 and 3 only

87. The different torques acting on the coil of a moving coil instrument are

(a) Deflecting torque and control torque

(b) Deflecting torque and damping torque

(c) Control torque and damping torque

(d) Deflecting torque, control torque and damping torque

88. A resistance strain gauge is cemented to a steel member, which is subjected to a strain of 2×10^{-6}. If the original resistance is 100 Ω and change in resistance is 600 μΩ, the gauge factor will be

(a) 3

(b) 0.33

(c) 300

(d) 0.03

89. An ac source is delivering power to a complex load $Z_L = 4 + j3$. The maximum power is transferred if the source impedance is

(a) 4 Ω

(b) j3 Ω

(c) (4 − j3) Ω

(d) (4 + j3) Ω

90. A ± 1 count error occurs in digital frequency meter due to

(a) Trigger level uncertainty

(b) Spurious interference

(c) Clock uncertainty

(d) Gate time uncertainty

91. True RMS voltmeter is ideal for the measurement of RMS value, because it employs

(a) Feedback

(b) High gain amplifier

(c) Two thermocouples

(d) Two heaters, heated by ac and dc

92. The principle of working of a D'Arsonva Galvanometer is based upon

(a) Heating effect of current

(b) Induction effect of current

(c) Magnetic effect of current

(d) Electrostatic effect of current

93. Examples of an active display and a passiv display respectively are

(a) LCD and Gas discharge plasma

(b) LED and LCD

(c) Gas discharge plasma and LED

(d) Electrophoretic Image display an LED

94. For displaying high frequency signal cathode ray tube should have

(a) High persistence

(b) Focusing system

(c) Very high input impedance

(d) Provision for post deflectic acceleration

95. A sinusoidal waveform has peak-peak amplitude of 6 cm viewed on a CRO screen. The vertical sensitivity is set to 5V/cm. The RMS value of the signal is

(a) 15 V

(b) 12.6 V

(c) 21.2 V

(d) 10.6 V

96. Consider the following types of digital voltmeters:

1. Ramp type
2. Dual slope integrating type
3. Integrating type using voltage to frequency conversion
4. Successive approximation type
5. Servo balanced potentiometer type

Which of these require a fixed reference voltage at the comparator stage?

(a) 1 and 2 only

(b) 3, 4 and 5 only

(c) 2 and 3 only

(d) 1, 4 and 5 only

97. Which of the following flow meters is capable of giving the rate of flow as well as the total flow?

(a) Nutating disc flow meter

(b) Electromagnetic flow meter

(c) Orifice meter

(d) Lobed impeller flow meter

98. Which of the following types of transducers can be used for the measurement of the angular position of a shaft?

1. Circular potentiometer
2. LVDT
3. e-pickup
4. Synchro pair

(a) 1 and 2

(b) 2 and 3

(c) 1 and 4

(d) 3 and 4

99. Which one of the following plays an important role in the fine recording of audio signals on magnetic tape recorder?

(a) Width of the air gap of the recording head

(b) Thickness of the tape used for recording

(c) Material of the recording head

(d) Speed of the motor

(Contd.)

100. A resistance strain gauge with a gauge factor of 3 is fixed to a steel member subjected to a stress of 100 N/mm. The Young's modulus of steel is 2×10^5 N/mm^2. The percentage change in resistance is

(a) 0.1 %

(b) 0.15 %

(c) 1.0 %

(d) 1.5 %

101. If a system produces frequencies in the output that are not present in the input, then the system cannot be

(a) Minimum phase system

(b) Linear shift invariant

(c) Stable and causal

(d) Stable and linear

102. In eddy current damping system, the disc employed should be of

(a) Conducting and magnetic material

(b) Conducting but non-magnetic material

(c) Magnetic but non-conducting material

(d) Non-conducting and non-magnetic material

103. Which of the following can act as an inverse transducer?

(a) LVDT

(b) Strain Gauge

(c) Piezo electric crystal

(d) Bimetal strip

104. Which one of the following thermocouple pairs has maximum sensitivity around 273 K?

(a) Nichrome-constantan

(b) Copper-Nickel

(c) Platinum-constantan

(d) Nickel-constantan

105. Maximum power will be delivered from an ac source to a resistive load in a network when the magnitude of the source impedance is equal to

(a) Half the load resistance

(b) Double the load resistance

(c) The load resistance

(d) Zero

106. The dc resistivity and permeability exhibite by a type 1 superconductor are respectivel

(a) Zero and zero

(b) Zero and unity

(c) Unity and zero

(d) Unity and Unity

Directions: —

Each of the next **Fourteen (14)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. 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

107. Statement (I) : One of the mechanisms by which a transistor's usefulness may be terminated, as the collector voltage is increased, is called punch through.

Statement (II) : Punch through results from the increased width of the collector-junction transition region with increased collector-junction voltage.

108. Statement (I) : In ferroelectric materials, domains with permanent electric dipoles may be created that would align along external electric field.

Statement (II) : Ferroelectric materials undergo phase transformation of symmetric to asymmetric structure below a critical temperature.

109. Statement (I) : Conduction takes place in an enhancement MOSFET only for gate voltages below the threshold level.

Statement (II) : In an enhancement MOSFET, a channel of semiconductor of the same type as the source and drain is induced in the substrate by a positive voltage applied to the gate.

110. Statement (I) : MOSFET is a field effect transistor whose drain current is controlled by the voltage applied at the gate.

Statement (II) : MOSFET is an insulated gate FET.

111. Statement (I) : All passive components can be fabricated in a single chip.

Statement (II) : As opposed to discrete circuits where all components are separately inserted and connected, in an integrated circuit, they are simultaneously created on a chip of semiconductor material during manufacturing.

(Contd.)

112. Statement (I) : The total energy of an energy signal falls between the limits 0 and ∞.

Statement (II) : The average power of an energy signal is zero.

113. Statement (I) : Sinusoidal signals are used as basic function in electrical systems.

Statement (II) : The response of a linear system to a sinusoidal input function remains sinusoidal.

114. Statement (I) : Dirichlet's conditions restrict the periodic signal x(t), to be represented by Fourier series, to have only finite number of maxima and minima.

Statement (II) : x(t) should possess only a finite number of discontinuities.

115. Statement (I) : Ferrite cored coils are used in high frequency tuned circuits.

Statement (II) : Ferrite cored coils have high Q as compared to iron-cored coils.

116. Statement (I) : A cylindrical conductor of radius R carries a current I. The magnetic field intensity within the conductor increases linearly with the radial distance $r < R$.

Statement (II) : The current enclosed increases as the square of the radial distance while the circumference increases linearly with the radial distance.

117. Statement (I) : Hall voltage is given by $V_H = R_H \frac{I.H}{t}$ where I is the current, H is the magnetic field strength, t is the thickness of probe and R_H is the Hall constant.

Statement (II) : Hall effect does not sense the carrier concentration.

118. Statement (I) : For an energy meter careful design and treatment of breaking magnet during its manufacture are essential in order to ensure consistency of break magnet during the use of meter.

Statement (II) : Steady rotational speed of energy meter disc is directly proportional to flux of the break magnet.

(Co

119. Statement (I) : If the limiting errors of measurement of power consumed by and the current passing through a resistance are ±1.5 % and ±1.0 % respectively, then the limiting error of resistance measurement will be ± 2.5 %.

Statement (II) : Mathematically if $f = xyz$ Then $\Delta f = (\Delta x)yz + x(\Delta y)z + xy(\Delta z)$

120. Statement (I) : Integrating DVM measures the true average value of the input voltage over a fixed measuring period.

Statement (II) : Since the display of measured signal is a decimal number, the errors due to parallax and observation error are eliminated.