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T.B.C. : B–HUF–P–VEA   **Test Booklet Series**

Serial No.   0065685

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.

2. **PLEASE NOTE THAT IT IS THE CANDIDATE'S RESPONSIBILITY TO ENCODE AND FILL IN THE ROLL NUMBER AND TEST BOOKLET SERIES CODE A, B, C OR D CAREFULLY AND WITHOUT ANY OMISSION OR DISCREPANCY AT THE APPROPRIATE PLACES IN THE <u>OMR</u> 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 **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** 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. Which one of the following helps experimental confirmation of the Crystalline state of matter ?

    (a) Shock compression

    (b) Photo emission

    (c) Conductivity measurements

    (d) X-ray diffraction

2. The electrical conductivity of pure semiconductor is :

    (a) Proportional to temperature

    (b) Increases exponentially with temperature

    (c) Decreases exponentially with temperature

    (d) Not altered with temperature

3. Consider the following statements pertaining to the resistance of a conductor :

    1. Resistance can be simply defined as the ratio of voltage across the conductor to the current through the conductor. This is, in fact, Georg Ohm's law

    2. Resistance is a function of voltage and current

    3. Resistance is a function of conductor geometry and its conductivity

    Which of the above statements are correct?

    (a) 1 and 2 only

    (b) 2 and 3 only

    (c) 1 and 3 only

    (d) 1, 2 and 3

4. The ratio of ionic radii of Cations i.e. r_C and that of Anions i.e. r_A for stable and unstable ceramic crystal structure, is :

    (a) Less than unity

    (b) Greater than unity

    (c) Unity

    (d) Either lesser or greater than unity

5. Which one of the following statements is correct?

    (a) For insulators the band-gap is narrow as compared to semiconductors

    (b) For insulators the band-gap is relatively wide whereas for semiconductors it is narrow

    (c) The band-gap is narrow in width for both the insulators and conductors

    (d) The band-gap is equally wide for both conductors and semiconductors

6. In an extrinsic semiconductor the conductivity significantly depends upon :

    (a) Majority charge carriers generated due to impurity doping

    (b) Minority charge carriers generated due to thermal agitation

    (c) Majority charge carriers generated due to thermal agitation

    (d) Minority charge carriers generated due to impurity doping

7. Necessary condition for photo-electric emission is :

    (a) $h\nu \geq e\phi$

    (b) $h\nu \geq mc$

    (c) $h\nu \geq e\phi^2$

   (d) $h\nu \geq \frac{1}{2} mc$

(Contd.)

8. In some substances when an electric field is applied the substance becomes polarized. The electrons and nucleii assume new geometrical positions and the mechanical dimensions are altered. This phenomenon is called :
   (a) Electrostriction
   (b) Hall-Effect
   (c) Polarization
   (d) Magnetization

9. In ferromagnetic materials, the net magnetic moment created due to magnetization by an applied field is :
   (a) Normal to the applied field
   (b) Adds to the applied field
   (c) In line with magneto motive force
   (d) Substracts from the applied field

10. At what temperatures domains lose their ferromagnetic properties ?
    (a) Above ferromagnetic Curie temperature
    (b) Below paramagnetic Curie temperature
    (c) Above 4° K
    (d) At room temperature

11. Which of the following materials does not have paramagnetic properties ?
    1. Rare earth elements (with incomplete shell)
    2. Transition elements
    3. Magnesium oxide
    Select the correct answer from the codes given below :
    (a) 1 only
    (b) 2 only
    (c) 3 only
    (d) 1 and 2

12. In a superconducting magnet, wires of superconducting material are embedded in the thick copper matrix, because while the material is in the superconducting state :
    (a) The leakage current passes through copper part
    (b) Copper part helps in conducting heat away from the superconductor
    (c) Copper part helps in overcoming the mechanical stress
    (d) Copper acts as an insulating cover for superconductor

13. The crystal structure of some Ceramic materials may be thought of being composed of electrically charged Cations and Anions, instead of Atoms, and as such :
    (a) The Cations are negatively charged, because they have given up their valence electrons to Anions which are positively charged.
    (b) The Cations are positively charged, because they have given up their valence electrons to Anions which are negatively charged.
    (c) The Cations are positively charged, because they have added one electron to their valence electrons borrowing from Anions which are negatively charged.
    (d) The Cations are negatively charged, as they are non-metallic whereas Anions are positively charged being metallic.

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(Contd.)

14. Manganin alloy used for making resistors for laboratory instruments contains :
    (a) Copper, Aluminium and Manganese
    (b) Copper, Nickel and Manganese
    (c) Aluminium, Nickel and Manganese
    (d) Chromium, Nickel and Manganese

15. A rolled-paper capacitor of value 0.02 μF is to be constructed using two strips of aluminium of width 6 cm, and, wax impregnated paper of thickness 0.06 mm whose relative permittivity is 3. The length of foil strips should be :
    (a) 0.3765 m
    (b) 0.4765 m
    (c) 0.5765 m
    (d) 0.7765 m

16. A Ge sample at room temperature has intrinsic carrier concentration, $n_i = 1.5 \times 10^{13}$ cm^{-3} and is uniformly doped with acceptor of 3×10^{16} cm^{-3} and donor of 2.5×10^{15} cm^{-3}. Then, the minority charge carrier concentration is :
    (a) 0.918×10^{10} cm^{-3}
    (b) 0.818×10^{10} cm^{-3}
    (c) 0.918×10^{12} cm^{-3}
    (d) 0.818×10^{12} cm^{-3}

17. Assume that the values of mobility of holes and that of electrons in an intrinsic semiconductor are equal and the values of conductivity and intrinsic electron density are 2.32/Ωm and 2.5×10^{19} / m^3 respectively. Then, the mobility of electron / hole is approximately :
    (a) 0.3 m^2/Vs
    (b) 0.5 m^2/Vs
    (c) 0.7 m^2/Vs
    (d) 0.9 m^2/Vs

18. A silicon sample A is doped with 10^{18} atom/cm^3 of Boron and another silicon sample B of identical dimensions is doped with 10^{18} atom/cm^3 of Phosphorous. If the ratio of electron to hole mobility is 3, then the ratio of conductivity of the sample A to that of B is :
    (a) $\dfrac{3}{2}$
    (b) $\dfrac{2}{3}$
    (c) $\dfrac{1}{3}$
    (d) $\dfrac{1}{2}$

19. The Hall-coefficient of a specimen of doped semiconductor is 3.06×10^{-4} m^{-3} C^{-1} and the resistivity of the specimen is 6.93×10^{-3} Ωm. The majority carrier mobility will be :
    (a) 0.014 m^{2}V^{-1}s^{-1}
    (b) 0.024 m^{2}V^{-1}s^{-1}
    (c) 0.034 m^{2}V^{-1}s^{-1}
    (d) 0.044 m^{2}V^{-1}s^{-1}

20. Doped silicon has Hall-coefficient of 3.68×10^{-4} m^{3}C^{-1} and then its carrier concentration value is :
    (a) 2.0×10^{22} m^{-3}
    (b) 2.0×10^{-22} m^{-3}
    (c) 0.2×10^{22} m^{-3}
    (d) 0.2×10^{-22} m^{-3}

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(Contd.)

21. What is the value of current I through the ideal diode in the circuit ?
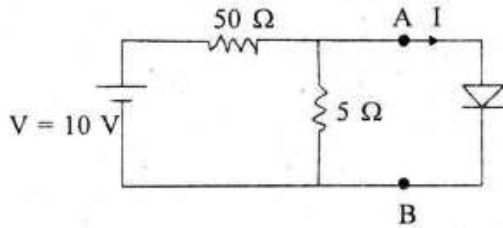

(a) 100 mA

(b) 150 mA

(c) 200 mA

(d) 250 mA

22. What is the output voltage V_0 for the circuit shown below assuming an ideal diode ?
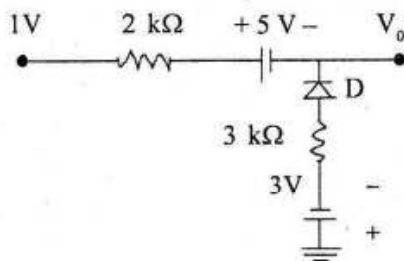
(a) $-\dfrac{18}{5}$ V

(b) $\dfrac{18}{5}$ V

(c) $-\dfrac{13}{5}$ V

(d) $\dfrac{13}{5}$ V

23. In a semiconductor diode, cut-in voltage is the voltage :
    (a) upto which the current is zero
    (b) upto which the current is very small
    (c) at which the current is 10% of the maximum rated current
    (d) at which depletion layer is formed

24. A transistor circuit is shown in the figure. Assume $\beta = 100$, $R_B = 200\ k\Omega$, $R_C = 1\ k\Omega$, $V_{CC} = 15$ V, $V_{BE_{act}} = 0.7$ V, $V_{BE_{sat}} = 0.8$ V and $V_{CE_{sat}} = 0.2$ V.
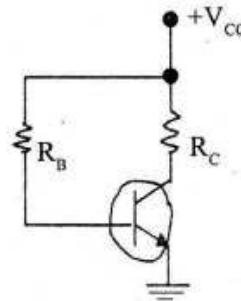
The transistor is operating in :

(a) Saturation

(b) Cut-off

(c) Normal active

(d) Reverse active

25. The position of the intrinsic Fermi level of an undoped semiconductor (E_{Fi}) is given by :

(a) $\dfrac{E_C - E_V}{2} + \dfrac{kT}{2} \ln \dfrac{N_V}{N_C}$

(b) $\dfrac{E_C + E_V}{2} - \dfrac{kT}{2} \ln \dfrac{N_V}{N_C}$

(c) $\dfrac{E_C + E_V}{2} + \dfrac{kT}{2} \ln \dfrac{N_V}{N_C}$

(d) $\dfrac{E_C - E_V}{2} - \dfrac{kT}{2} \ln \dfrac{N_V}{N_C}$

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□

(Contd.)

26. The stability factor S in a bipolar junction transistor is :

(a) $\dfrac{1+\beta}{1-\beta\left(\dfrac{dI_B}{dI_C}\right)}$

(b) $\left(\dfrac{1+\beta}{1-\beta}\right)\left[1-\left(\dfrac{dI_B}{dI_C}\right)\right]$

(c) $(1+\beta)\left[1-\beta\left(\dfrac{dI_B}{dI_C}\right)\right]$

(d) $\dfrac{\beta-1}{\left[1-\beta\left(\dfrac{dI_B}{dI_C}\right)\right]}$

27. The leakage current in an NPN transistor is due to the flow of :
   (a) Holes from base to emitter
   (b) Electrons from collector to base
   (c) Holes from collector to base
   (d) Minority carriers from emitter to collector

28. In Early effect :
   (a) Increase in magnitude of Collector voltage increases space charge width at the input junction of a BJT
   (b) Increase in magnitude of Emitter-Base voltage increases space charge width of output junction of a BJT
   (c) Increase in magnitude of Collector voltage increases space charge width of output junction of a BJT
   (d) Decrease in magnitude of Emitter-Base voltage increases space charge width of output junction of a BJT

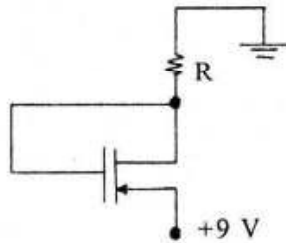29. The signal $x(t) = u(t + 2) - 2u(t) + u(t - 2)$ is represented by :

(a)

(b)

(c)

(d)
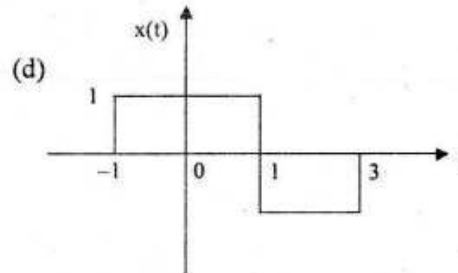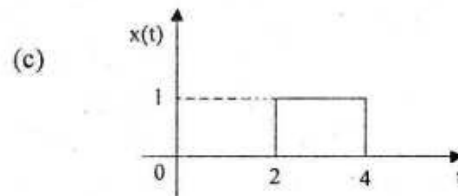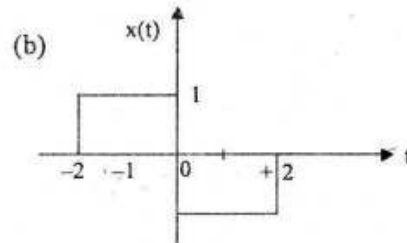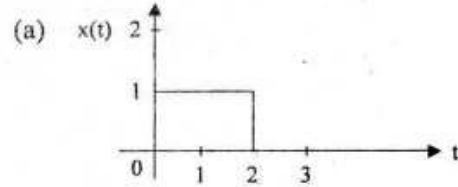
30. The figure shown represents :
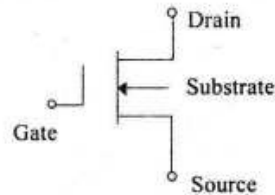
   (a) n-channel MOSFET
   (b) Enhanced-mode E-MOSFET
   (c) p-Channel MOSFET
   (d) J-FET

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(Contd.)

31. The PMOSFET circuit shown in the figure has $V_{TP} = -1.4$ V, $K'_p = 25$ $\mu A/V^2$, $L = 2$ μm, $\lambda = 0$. If $I_{DS} = -0.1$ mA and $V_{DS} = -2.4$ V then the width of channel W and R are respectively :

(a) 16 μm and 66 $k\Omega$

(b) 18 μm and 33 $k\Omega$

(c) 16 μm and 33 $k\Omega$

(d) 18 μm and 66 $k\Omega$

32. Maximum energy of electrons liberated photoelectrically is :

(a) Proportional to light intensity and independent of frequency of the light

(b) Independent of light intensity and varies linearly with frequency of the light

(c) Proportional to both, light intensity and frequency of the light

(d) Independent of light intensity and inversely proportional to frequency of the light

33. The response of a Gaussian random process applied to a stable linear system is :

1. A Gaussian random process

2. Not a Gaussian random process

3. Completely specified by its mean and auto-covariance functions

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 2 and 3

(d) 1 and 3

34. Consider a system, which computes the 'MEDIAN' of signal values in a window of size 'N'. Such a discrete time system is :

(a) Linear

(b) Non-linear

(c) Sometimes linear

(d) Sometimes non-linear

35. Consider a discrete time system which satisfies the additivity property, i.e., if the output for $u_1[n]$ is $y_1[n]$ and that for $u_2[n]$ is $y_2[n]$, then output for $u_1[n] + u_2[n]$ is $y_1[n] + y_2[n]$. Such a system is :

(a) Linear

(b) Sometimes linear

(c) Non-linear

(d) Sometimes non-linear

36. Consider an ideal low pass filter. Such a discrete-time system is :

(a) always realizable physically

(b) never realizable physically

(c) a non linear system

(d) a linear, causal system

(Contd.)

37. The result of $h(2t) * \delta(t - t_0)$ ("*" denotes convolution and "$\delta(\cdot)$" denotes the Dirac delta function) is :

(a) $h(2t - 2t_0)$

(b) $h(2t_0 - 2t)$

(c) $h(-2t - 2t_0)$

(d) $h(2t + 2t_0)$

38. A ray of light incident on a glass slab (of refractive index 1.5) with an angle $\frac{\pi}{4}$, then the value of sine of angle of refraction is :

(a) $\dfrac{1}{\sqrt{2}}$

(b) $\dfrac{3}{\sqrt{2}}$

(c) $\dfrac{\sqrt{2}}{3}$

(d) $\sqrt{2}$

39. The complex exponential power form of Fourier series of x(t) is :

$$x(t) = \sum_{k=-\infty}^{\infty} a_k \cdot e^{j\frac{2\pi}{T_0} \cdot kt},$$

If $x(t) = \sum_{b=-\infty}^{\infty} \delta(t - b)$, then the value of a_k is :

(a) $1 - (-1)^k$

(b) $1 + (-1)^k$

(c) 1

(d) -1

40. Laplace transform of the function v(t) shown in the figure is :
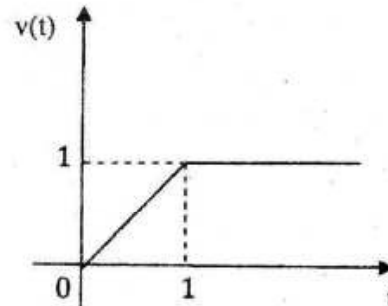
(a) $s^2[1 - e^s]$

(b) $s^2[1 - e^{-s}]$

(c) $\dfrac{1}{s^2}[1 - e^s]$

(d) $\dfrac{1}{s^2}[1 - e^{-s}]$

41. In a discrete-time complex exponential sequence of frequency $\omega_0 = 1$, the sequence is :

1. Periodic with period $\dfrac{2\pi}{\omega_0}$

2. Non periodic

3. Periodic for some value of period N

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1 and 3

(Contd.)

42. Consider the following transforms :

1. Fourier transform
2. Laplace transform

Which of the above transforms is/are used in signal processing ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

43. The varactor diode has a voltage-dependent :

1. Resistance
2. Capacitance
3. Inductance

Which of the above is/are correct ?

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

44. The impulse response for the discrete-time system :

$y [n] = 0.24 \ (x [n] + x [n - 1] + x [n - 2] + x [n - 3])$ is given by

(a) 0 for $0 \le n \le 3$ and 0.24 otherwise
(b) 0.24 for $0 \le n \le 3$ and 0 otherwise
(c) 0.24 for $n = 0$ to $n = \infty$
(d) 0 for $n = 0$ to $n = \infty$

45. The product of emitter efficiency (γ) and transport factor (β^*) for a BJT is equal to :

(a) Small signal current gain
(b) High frequency current gain
(c) Power loss in the BJT
(d) Large-signal current gain

46. Consider a two-sided discrete-time signal (neither left sided, nor right sided). The region of convergence (ROC) of the Z-transform of the sequence is:

1. All region of z-plane outside a unit circle (in z-plane)
2. All region of z-plane inside a unit circle (in z-plane)
3. Ring in z-plane

Which of the above is/are correct ?

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

47. When is a function f(n) said to be left-sided ?

(a) $f(n) = 0$ for $n < 0$
(b) $f(n) < 0$ for $n > 0$
(c) $f(n) = 0$ for $n > n_0$
(d) $f(n) = \infty$ for $n < n_0$

($n_0 \rightarrow$ Positive or negative integer)

48. Z-transform deals with discrete time systems for their :

1. Transient behaviour
2. Steady-state behavior

Which of the above behaviours is/are correct ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

(Contd.)

49. The response of a linear, time-invariant, discrete-time system to a unit step input $u[n]$ is $\delta[n]$. The system response to a ramp input $n\ u[n]$ would be :

(a) $\delta[n - 1]$

(b) $u[n - 1]$

(c) $n\ \delta[n - 1]$

(d) $n\ u[n - 1]$

50. Consider a discrete-random variable z assuming finitely many values. The cumulative distribution function, $F_z(z)$ has the following properties :

1. $\int_{-\infty}^{+\infty} F_z(z)\,dz = 1$

2. $F_z(z)$ is non-decreasing with finitely many jump-discontinuities

3. $F_z(z)$ is negative and non-decreasing

Which of the above properties is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 2 and 3

51. Consider a random process given by :
$x(t) = A \cos (2\pi\ f_c t + \theta)$, where A is a Rayleigh distributed random variable and θ is uniformly distributed in $[0, 2\pi]$. A and θ are independent. For any time t, the probability density function (PDF) of $x(t)$ is :

(a) Gaussian

(b) Rayleigh

(c) Rician

(d) Uniform in $[-A, A]$

52. Poisson's equation is derived with the following assumption about the medium. The medium is :

(a) Non-homogeneous and isotropic

(b) Non-homogeneous and non-isotropic

(c) Homogeneous and non-isotropic

(d) Homogeneous and isotropic

53. The state space representation of a linear time invariant system is :
$$X(t) = A\ X(t) + Bu(t)$$
$$Y(t) = C\ X(t)$$
What is the transfer function $H(s)$ of the system ?

(a) $C\ (sI - A)^{-1}\ B$

(b) $B\ (sI - A)^{-1}\ C$

(c) $C\ (sI - A)\ B$

(d) $B\ (sI - A)\ C$

54. $x(t) = \dfrac{1}{T_o} + \Sigma_{k=1}^{N} \dfrac{2}{T_o} \cos k\ \omega_0 t$, is the combined trigonometric form of Fourier series for :

(a) Half rectified wave

(b) Saw-tooth wave

(c) Rectangular wave

(d) Impulse train

55. A signal x_n is given by $x_0 = 3$, $x_1 = 2$, $x_2 = 5$, $x_3 = 1$, $x_4 = 0$, $x_5 = 1$, $x_6 = 2$, $x_7 = 2$, $x_8 = 4$, where the subscript 'n' denotes time. The peak value of the auto correlation of x_{2n-11} is :

(a) 0

(b) 10

(c) 54

(d) 64

56. A system has impulse response $h[n] = \cos(n)u[n]$. The system is :
    (a) Causal and stable
    (b) Non causal and stable
    (c) Non causal and not stable
    (d) Causal and not stable

57. If the three resistors in a delta network are all equal in values i.e. R_{DELTA}, then the value of the resultant resistors in each branch of the equivalent star network i.e. R_{STAR} will be equal to :

    (a) $\dfrac{R_{DELTA}}{3}$

    (b) $\dfrac{R_{DELTA}}{2}$

    (c) $2\, R_{DELTA}$

    (d) R_{DELTA}

58. Loop-voltage equations of a passive circuit are given by :

$$\begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}$$

    1. $Z_{ij} = Z_{ji}$, $i, j = 1, 2, 3$
    2. $Z_{ii} > 0$, $i = 1, 2, 3$
    3. $\Delta Z \leq 0$

    Which of the above relations are correct ?
    (a) 1 and 2 only
    (b) 1 and 3 only
    (c) 2 and 3 only
    (d) 1, 2 and 3

59. A function $c(t)$ satisfies the differential equation $\dot{c}(t) + c(t) = \delta(t)$. For zero initial condition $c(t)$ can be represented by :
    (a) ϵ^{-t}
    (b) ϵ^{t}
    (c) $\epsilon^{t}\, u(t)$
    (d) $\epsilon^{-t}\, u(t)$

    where $u(t)$ is a unit step function.

60. For the network shown, Thevenin's equivalent voltage source and resistance are, respectively :
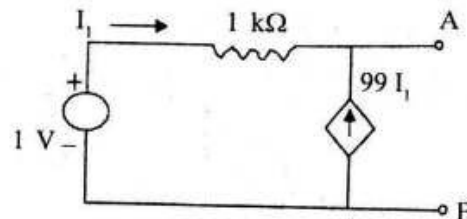
    (a) 1 mV and 10 Ω
    (b) 1 V and 1 kΩ
    (c) 1 mV and 1 kΩ
    (d) 1 V and 10 Ω

61. In the circuit shown, if the power consumed by the 5 Ω resistor is 10 W, then the power factor of the circuit is :

    (a) 0.8
    (b) 0.6
    (c) 0.4
    (d) 0.2

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(Contd.)

62. For the circuit shown, if the power consumed by 5 Ω resistor is 10 W, then :

1. $|I| = \sqrt{2}$ A

2. Total impedance = 5 Ω

3. Power factor = 0.866

Which of the above are correct ?

(a) 1 and 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

63. For a given fixed tree of a network, the following form an independent set :
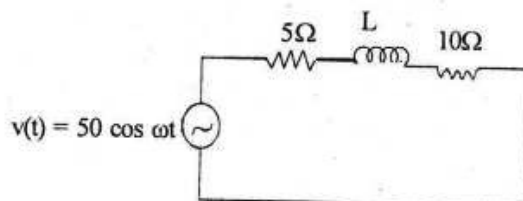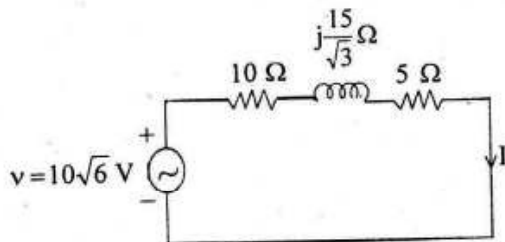
1. Branch currents

2. Link voltages

Which of the above is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

64. For the network graph, the number of trees (P) and the number of cut-sets (Q) are respectively :
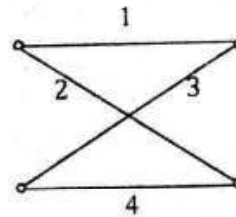
(a) 4 and 2

(b) 6 and 2

(c) 4 and 6

(d) 2 and 6

65. For which one of the following measurements a thermistor can be used ?

(a) Velocity

(b) Humidity

(c) Displacement

(d) Percent of CO_2 in air

66. According to network graphs, the network with :

1. Only two odd vertices is traversable

2. No odd vertices is traversable

3. Two or more than two odd vertices are traversable

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1 and 2

(Contd.)

67. For any lumped network, for any cut sets and at any instant of time the algebraic sum of all branch currents traversing the cut-set branches is always :

(a) One

(b) Zero

(c) Infinity

(d) Greater than zero, but less than one

68. Which one of the following statements concerning Tellegen's theorem is correct ?

(a) It is useful in determining the effects in all parts of a linear four-terminal network

(b) It is applicable for any lumped network having elements which are linear or nonlinear, active or passive, time varying or time-invariant, and may contain independent or dependent sources

(c) It can be applied to a branch, which is not coupled to other branches in a network

(d) It states that the sum of powers taken by all elements of a circuit within constraints imposed by KCL and KVL is non-zero

69. The open circuit input impedance of a 2-port network is :
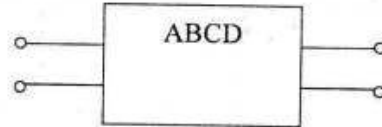
(a) $\dfrac{A}{C} \Omega$

(b) $\dfrac{B}{D} \Omega$

(c) $\dfrac{D}{C} \Omega$

(d) $\dfrac{A}{B} \Omega$

70. Consider the following statements :

1. Two identical 2nd order Butterworth LP filters when connected in cascade will make a 4th order Butterworth LP filter.

2. A high 2nd order filter will exhibit a peak if Q exceeds certain value.

3. A band pass filter cannot be of order one.

4. 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.

Which of the above statements are correct ?

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

(Contd.)

71. The lowest and the highest critical frequencies of RC driving point admittance are, respectively :

    (a) a zero and a pole

    (b) a pole and a zero

    (c) a zero and a zero

    (d) a pole and a pole

72. The poles and zeros of a voltage function v(t) are : zero at the origin and simple poles at −1, −3 and the scale factor is 5. The contribution of the pole at −3 to v(t) is :

    (a) $2.5 \, \epsilon^{-3t}$

    (b) $7.5 \, \epsilon^{-3t}$

    (c) $2.5 \, \epsilon^{+3t}$

    (d) $7.5 \, \epsilon^{+3t}$

73. The driving point impedance of the circuit shown is given by $Z(s) = \dfrac{0.2s}{s^2 + 0.1s + 2}$:
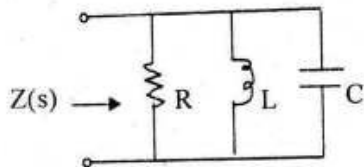
The component values R, L and C are respectively :

    (a) 0.5 Ω, 1 H and 0.1 F

    (b) 2 Ω, 5 H and 5 F

    (c) 0.5 Ω, 0.1 H and 0.1 F

    (d) 2 Ω, 0.1 H and 5 F

74. Consider the following driving point impedances which are to be realized using passive elements :

    1. $\dfrac{s+3}{s^2(s+5)}$

    2. $\dfrac{s^2+3}{s^2(s^2+5)}$

    Which of the above is/are realizable ?

    (a) 1 only

    (b) 2 only

    (c) Both 1 and 2

    (d) Neither 1 nor 2

75. A reactance function in the first Foster form has poles at $\omega = 0$ and $\omega = \infty$. The black-box (B.B.) in the network contains :
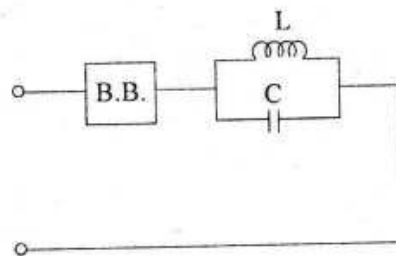
    (a) An inductor

    (b) A capacitor

    (c) A parallel L-C circuit

    (d) A series L-C circuit

14

(Contd.)

76. Consider the following statements :

1. The magnetic field at the centre of a circular coil of a wire carrying current is inversely proportional to the radius of the coil

2. Lifting power of a magnet is proportional to square of magnetic flux density

3. A static electric field is conservative (irrotational)

4. If the divergence of a vector 'A' is zero, then vector 'A' can be expressed as Curl of a vector F

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

77. Consider the following :

1. Electric current flowing in a conducting wire

2. A moving charged belt

3. An electron beam in a cathode ray tube

4. Electron movement in a vacuum tube

Which of the above are examples of convection current ?

(a) 2, 3 and 4 only

(b) 1, 2 and 4 only

(c) 1 and 3 only

(d) 1, 2, 3 and 4

78. Consider the following sources :

1. A permanent magnet

2. A charged disc rotating at uniform speed

3. An accelerated charge

4. An electric field which changes linearly with time

Which of the above are the sources of steady magnetic field ?

(a) 1, 2 and 3 only

(b) 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

79. A charge Q is enclosed by a Gaussian spherical surface of radius R. If R is doubled then the outward flux is :

(a) Doubled

(b) Increased four times

(c) Reduced to a quarter

(d) Remains unaltered

80. Divergence of a vector div D in the cylindrical coordinate system is :

(a) $\dfrac{1}{\rho}\dfrac{\partial}{\partial\rho}(D_\rho)+\dfrac{1}{\rho}\dfrac{\partial D_\phi}{\partial\phi}+\dfrac{\partial D_z}{\partial z}$

(b) $\dfrac{1}{\rho}\dfrac{\partial}{\partial\rho}(\rho D_\rho)+\dfrac{1}{\rho}\dfrac{\partial(\phi D_\phi)}{\partial\phi}+\dfrac{1}{z}\dfrac{\partial(Z D_z)}{\partial z}$

(c) $\dfrac{1}{\rho}\dfrac{\partial}{\partial\rho}(\rho D_\rho)+\dfrac{1}{\rho}\dfrac{\partial D_\phi}{\partial\phi}+\dfrac{\partial D_z}{\partial z}$

(d) $\dfrac{\partial D_\rho}{\partial\rho}+\dfrac{\partial D_\phi}{\partial\phi}+\dfrac{\partial D_z}{\partial z}$

15

(Contd.)

15

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81. What is the value of work required to move a + 8 nC charge from infinity to a point P which is at 2 m distance from a point charge Q = + 5 μC ?

(a) 180 μJ

(b) 180 nJ

(c) 18 μJ

(d) 18 nJ

82. An electrostatic force between two point charges increases when they are :

(a) More apart and dielectric constant of the medium between them decreases

(b) Less apart and dielectric constant of the medium between them decreases

(c) More apart and dielectric constant of the medium between them increases

(d) Less apart and dielectric constant of the medium between them increases

83. A plane Y = 2 carries infinite sheet of charge 6 nC/m². If medium is free space then force on a point charge of 10 mC located at the origin is :

(a) $-1080\ \pi\bar{a}_y$ N

(b) $-108\ \pi\bar{a}_y$ N

(c) $-10.8\ \pi\bar{a}_y$ N

(d) $-1.08\ \pi\bar{a}_y$ N

84. The potential at the centroid of an equilateral triangle of side $r\sqrt{3}$ due to three equal positive point charges each of value q and placed at the vertices of the triangle would be :

(a) $\dfrac{q}{2\pi\epsilon_0\ r}$

(b) $\dfrac{\sqrt{3}\ q}{8\pi\epsilon_0\ r}$

(c) $\dfrac{3\ q}{4\pi\epsilon_0\ r}$

(d) Zero

85. The point form of the relation connecting vector magnetic potential A and current density J is :

(a) $\nabla\times A = J + \dfrac{\partial D}{\partial t}$

(b) $A = \int \dfrac{\mu_o J}{4\pi\epsilon R}\ dv$

(c) $\nabla^2 A = -\mu_o J$

(d) $\dfrac{\partial A}{\partial t} = -\dfrac{J}{\sigma}$

86. In the region $Z < 0$, $\varepsilon_{r1} = 2$, $\bar{E}_1 = -3\bar{a}_x + 4\bar{a}_y - 2\bar{a}_z$ V/m. For region $Z > 0$, where $\varepsilon_{r2} = 6.5$, $\bar{E}_2$ is :

(a) $-3\bar{a}_x + 4\bar{a}_y + \dfrac{6.5}{4}\bar{a}_z$ V/m

(b) $-3\bar{a}_x + 4\bar{a}_y + \dfrac{4}{6.5}\bar{a}_z$ V/m

(c) $-3\bar{a}_x + 4\bar{a}_y - \dfrac{6.5}{4}\bar{a}_z$ V/m

(d) $-3\bar{a}_x + 4\bar{a}_y - \dfrac{4}{6.5}\bar{a}_z$ V/m

(Contd.)

87. Consider the following statements regarding a conductor and free space boundary :

1. No charge and no electric field can exist at any point within the interior of a conductor

2. Charge may appear on the surface of a conductor

Which of the above statements are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

88. A sphere of homogeneous linear dielectric material of dielectric constant ≥ 1 is placed in a uniform electric field E_0, then the electric field E that exists inside the sphere is :

(a) Uniform and $E \leq E_0$

(b) Uniform and $E \geq E_0$

(c) Varies but $E < E_0$ always

(d) Varies but $E > E_0$ always

89. Which of the following Maxwell's equations represents Ampere's law with correction made by Maxwell ?

(a) $\nabla \cdot E = \dfrac{\rho}{\varepsilon_0}$

(b) $\nabla \cdot B = 0$

(c) $\nabla \times E = -\dfrac{\partial B}{\partial t}$

(d) $\nabla \times B = \mu_0 J + \mu_0 \varepsilon_0 \dfrac{\partial E}{\partial t}$

90. Precision is composed of two characteristics, one is the number of significant figures to which a measurement may be made, the other is :

(a) Conformity

(b) Meter error

(c) Inertia effects

(d) Noise

91. If phasors $P_1 = 3 + j4$ and $P_2 = 6 - j8$, then $| P_1 - P_2 |$ is :

(a) 5

(b) $\sqrt{53}$

(c) $\sqrt{73}$

(d) $\sqrt{153}$

92. A plane wave in free space has a magnetic field intensity of 0.2 A/m in the Y-direction. The wave is propagating in the Z-direction with a frequency of 3 GHz. The wavelength and amplitude of the electric field intensity are, respectively :

(a) 0.05 m and 75 V/m

(b) 0.10 m and 75 V/m

(c) 0.05 m and 150 V/m

(d) 0.10 m and 150 V/m

17

(Contd.)

93. For energy propagation in a lossless transmission line, the characteristic impedance of the line is expressed in ohm as below (where notations have usual meanings).

   (a) $\sqrt{LC}\ \Omega$

   (b) $\sqrt{\dfrac{L}{C}}\ \Omega$

   (c) $\sqrt{\dfrac{C}{L}}\ \Omega$

   (d) $\sqrt{\dfrac{R + j\omega L}{G - j\omega L}}\ \Omega$

94. A quarter wave-length transformer is used to match a load of 200 Ω to a line with input impedance of 50 Ω. The characteristic impedance of the transformer would be :

   (a) 40 Ω

   (b) 100 Ω

   (c) 400 Ω

   (d) 1000 Ω

95. For a lossless transmission line L = 0.35 µH/m, C = 90 pF/m and frequency = 500 MHz. Then the magnitude of propagation constant is :

   (a) 14.48

   (b) 17.63

   (c) 19.59

   (d) 21.20

96. If an antenna has a main beam with both half-power beam widths equal to 20°, its directivity (D) is nearly :

   (a) 90.6

   (b) 102.5

   (c) 205

   (d) 226

97. An instrument always extracts some energy from the measured medium. Thus the measured quantity is always disturbed by the act of measurement, which makes a perfect measurement theoretically impossible and it is due to :

   (a) Skin-effect

   (b) Inductive effect

   (c) Loading effect

   (d) Lorenz effect

98. The characteristic impedance η_0 of a free space is :

   (a) $\dfrac{\mu_o}{\varepsilon_o}$

   (b) $\sqrt{\dfrac{\mu_o}{\varepsilon_o}}$

   (c) $\sqrt{\mu_o\,\varepsilon_o}$

   (d) $\mu_o\,\varepsilon_o$

99. A 3½ digit voltmeter has an accuracy specification of ± 0.5% of reading ± one digit. What is the possible error in volts when the instrument displays 2.00 V on the 10 V scale ?

   (a) 0.03 V

   (b) 0.02 V

   (c) 0.01 V

   (d) 0.005 V

(Contd.)

100. A megger is an instrument used for measuring :
  (a) Very high voltages
  (b) Very low voltages
  (c) Very high resistances
  (d) Very low resistances

101. The values of capacitance and inductance used in the series LCR circuit are 160 pF and 160 µH with the inherent tolerance −10% in each. Then, the resonance frequency of the circuit is in the range of :
  (a) 0.8 MHz to 1.2 MHz
  (b) 0.9 MHz to 1.0 MHz
  (c) 0.8 MHz to 1.0 MHz
  (d) 0.9 MHz to 1.2 MHz

102. Dynamic characteristics of instruments leading to variations during measurement are :
  1. Speed of response
  2. Fidelity
  3. Dynamic error
  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

103. The reliability of an instrument refers to :
  (a) Degree to which repeatability continues to remain within specified limits
  (b) The extent to which the characteristics remain linear
  (c) Accuracy of the instrument
  (d) Sensitivity of the instrument

104. AC Voltmeters use diodes with :
  (a) High forward current and low reverse current ratings
  (b) Low forward current and low reverse current ratings
  (c) Low forward current and high reverse current ratings
  (d) High forward current and high reverse current ratings

105. The bridge circuit shown can be used to measure unknown lossy capacitor C_X with resistance R_X. At balance :
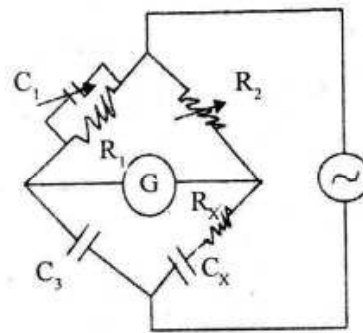
  (a) $R_X = \dfrac{C_1}{C_3} R_2$ and $C_X = \dfrac{R_1}{R_2} C_3$

  (b) $R_X = \dfrac{C_3}{C_1} R_1$ and $C_X = \dfrac{R_2}{R_1} C_3$

  (c) $R_X = \dfrac{R_1}{C_2} R_2$ and $C_X = \dfrac{C_1}{R_1} R_2$

  (d) $R_X = R_2$ and $C_X = C_3$

  where R_1, R_2, C_1 and C_3 can be assumed ideal components

19

(Contd.)

106. Inductance of a coil having Q value in the range of $(1 < Q < 10)$, can be measured by using :
   (a) Hay's bridge
   (b) De Sauty's bridge
   (c) Maxwell's bridge
   (d) Carry Foster's bridge

107. The instrument servomechanism is actually an instrument system made of components, which are :
   (a) Exclusively passive transducers
   (b) Exclusively active transducers
   (c) Combination of passive transducers and active transducers
   (d) Exclusively primary sensing elements

108. The scale of an electrodynamometer usually reads the :
   (a) Average value of the ac
   (b) Mean value of the ac
   (c) Effective value of the ac
   (d) Squared value of the ac

109. The resolution of an indicating instrument can be defined as :
   1. Variation in the meter reading for the same applied input
   2. Detectable change in the deflection due to smallest change in the applied input
   3. Detectable change in the output due to drifting of pointer

   Which of the above statements are correct ?
   (a) 1 only
   (b) 2 only
   (c) 3 only
   (d) 1 and 3

110. While measuring the phase difference between the signals $v_1(t) = 10 \sin \omega t$ and $v_2(t) = 10 \sin(\omega t + \phi)$, the Lissajous pattern observed on CRO is a circle. The value of ϕ is :
   (a) 2π
   (b) π
   (c) $\dfrac{\pi}{2}$
   (d) $\dfrac{\pi}{4}$

111. The expected voltage across a resistor is 100 V. However, the voltmeter reads a value of 97 V. The relative error is :
   (a) 0.97
   (b) 0.03
   (c) 0.07
   (d) 3.00

112. A sinusoidal voltage of amplitude 150 V has been applied to a circuit having a rectifying device that prevents flow of current in one direction and offers a resistance of 15 Ω for the flow of current in the other direction. If hot wire type and PMMC type instruments are connected in this circuit to measure the electric current, their readings would respectively be :
   (a) 3.18 A and 5 A
   (b) 5 A and 3.18 A
   (c) 3.18 A and 5 mA
   (d) 5 A and 3.18 mA

113. A tachometer encoder can be used for measurement of speed :
   (a) of false pulses because of electrical noise
   (b) in forward and reverse directions
   (c) in one direction only
   (d) for single revolution in a multiple track

114. A rotameter works on the principle of variable :
   (a) Pressure
   (b) Length
   (c) Area
   (d) Resistance

115. An input voltage required to deflect a beam through 3 cm in a Cathode Ray Tube having an anode voltage of 1000 V and parallel deflecting plates 1 cm long and 0.5 cm apart, when screen is 30 cm from the centre of the plates is :
   (a) 300 V
   (b) 200 V
   (c) 100 V
   (d) 75 V

116. A 6-bit ADC has a maximum precision supply voltage of 20 V. What are the voltage changes for each LSB present and voltage to be presented by (100110), respectively ?
   (a) 0.317 V and 12.06 V
   (b) 3.17 V and 12.06 V
   (c) 0.317 V and 1.206 V
   (d) 3.17 V and 1.206 V

117. Which of the following transducers measures the pressure by producing emf as a function of its deformation ?
   (a) Photoelectric transducer
   (b) Capacitive transducer
   (c) Inductive transducer
   (d) Piezoelectric transducer

118. Maxwell's bridge measures an unknown inductance in terms of :
   (a) Known inductance
   (b) Known capacitance
   (c) Known resistance
   (d) Q of the coil

119. Strain gauges are constructed with Germanium chips because Germanium :
   (a) has a strong Hall Effect
   (b) is crystalline in nature
   (c) can be doped
   (d) has piezo-electric property

120. The advantages of an LVDT is/are :
   1. Linearity
   2. Infinite resolution
   3. Low Hysteresis
   Which of the above advantages is/are correct ?
   (a) 1 only
   (b) 2 only
   (c) 3 only
   (d) 1, 2 and 3

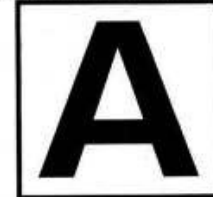SPACE FOR ROUGH WORK

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Test Booklet Series

Serial 1071017

TEST BOOKLET

A

ELECTRONICS & TELECOMMUNICATION ENGINEERING
Paper II

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.

2. **Please note that it is the candidate's responsibility to encode and fill in the Roll Number and Test Booklet Series Code 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 **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 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 (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 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. A single-stage amplifier has a voltage gain of 100. The load connected to the collector is 500 Ω and its input impedance is 1 kΩ. Two such stages are connected in cascade through an R-C coupling. The overall gain is
   (a) 10000
   (b) 6666·66
   (c) 5000
   (d) 1666·66

2. Assuming $V_{CE\,(Sat)} = 0.3\,V$ for a Silicon transistor at ambient temperature of 25°C and $h_{FE} = 50$, the minimum base current I_B required to drive the transistor into saturation for the circuit shown is

   o +5 V
   ⎧ 1 kΩ
   I_B → Q
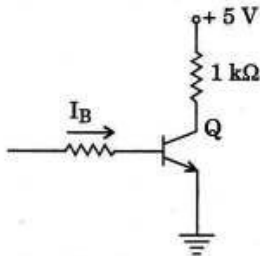
   (a) 64 μA
   (b) 78 μA
   (c) 94 μA
   (d) 140 μA

3. Which of the following regions of operation are mainly responsible for heating of the transistor under switching operation ?
   1. Saturation region
   2. Cut-off region
   3. Transition from saturation to cut-off
   4. Transition from cut-off to saturation
   Select the correct answer using the codes given below :
   (a) 1, 2, and 4 only
   (b) 1, 3, and 4 only
   (c) 2 and 3 only
   (d) 1 and 3 only

4. In a sinusoidal oscillator, sustained oscillations will be produced only if the loop gain (at the oscillation frequency) is
   (a) Less than unity but not zero
   (b) Zero
   (c) Unity
   (d) Greater than unity

5. The Class-B push-pull amplifier is an efficient two-transistor circuit, in which the two transistors operate in the following way :
   (a) Both transistors operate in the active region throughout the negative ac cycle
   (b) Both transistors operate in the active region for more than half-cycle but less than a whole cycle
   (c) One transistor conducts during the positive half-cycle and the other during the negative half-cycle
   (d) Full supply voltage appears across each of the transistors

6. Consider the following statements regarding Wien Bridge oscillator :
   1. It has a larger bandwidth than the phase shift oscillator.
   2. It has a smaller bandwidth than the phase shift oscillator.
   3. It has 2 capacitors while the phase shift oscillator has 3 capacitors.
   4. It has 3 capacitors while the phase shift oscillator has 2 capacitors.
   Which of the above statements are correct ?
   (a) 1 and 3 only
   (b) 2 and 4 only
   (c) 1 and 4 only
   (d) 2 and 3 only

7. For normal operation of a transistor
   (a) Forward bias the emitter diode and reverse bias the collector diode
   (b) Forward bias the emitter diode as well as the collector diode
   (c) Reverse bias the emitter diode as well as the collector diode
   (d) Reverse bias the emitter diode and forward bias the collector diode

8. Consider the following statements regarding linear power supply :
   1. It requires low frequency transformer.
   2. It requires high frequency transformer.
   3. The transistor works in active region.
   Which of the above statements is/are correct ?
   (a) 1 only
   (b) 2 and 3 only
   (c) 1 and 3 only
   (d) 3 only

B-HUF-P-VEB   (2 – A)

9. The capacitance of a full wave rectifier, with 60 Hz input signal, peak output voltage $V_p = 10$ V, load resistance R = 10 kΩ and input ripple voltage $V_r = 0.2$ V, is

(a) 22·7 µF

(b) 33·3 µF

(c) 41·7 µF

(d) 83·4 µF

10. A full wave rectifier connected to the output terminals of the mains transformer produces an RMS voltage of 18 V across the secondary. The no-load voltage across the secondary of the transformer is

(a) 1·62 V

(b) 16·2 V

(c) 61·2 V

(d) 6·12 V

11. An Op-Amp can be connected to provide

1. Voltage controlled current source

2. Current controlled voltage source

3. Current controlled current source

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

12. In an Op-Amp, if the feedback voltage is reduced by connecting a voltage divider at the output, which of the following will happen ?

1. Input impedance increases

2. Output impedance reduces

3. Overall gain increases

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

13. The transient response rise time (unity gain) of an Op-Amp is 0·05 µs. The small signal bandwidth is

(a) 7 kHz

(b) 20 kHz

(c) 7 MHz

(d) 20 MHz

14. A negative feedback of $\beta = 2.5 \times 10^{-3}$ is applied to an amplifier of open-loop gain 1000. What is the change in overall gain of the feedback amplifier, if the gain of the internal amplifier is reduced by 20% ?

(a) 295·7

(b) 286·7

(c) 275·7

(d) 266·7

15. If the quality factor of a single-stage single-tuned amplifier is doubled, the bandwidth will

(a) Remain the same

(b) Become half

(c) Become double

(d) Become four times

16. Consider the following statements related to oscillator circuits :

1. The tank circuit of a Hartley oscillator is made up of a tapped capacitor and a common inductor.

2. The tank circuit of a Colpitts oscillator is made up of a tapped capacitor and a common oscillator.

3. 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.

4. Crystal oscillators are fixed frequency oscillators with a high 2-factor.

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 2, 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 3 and 4 only

17. The most commonly used transistor configuration for use as a switching device is

    (a) Common-base configuration

    (b) Common-collector configuration

    (c) Collector-emitter shorted configuration

    (d) Common-emitter configuration

18. The value of h_{FE} (the hybrid parameters) of a Common-Emitter (CE) connection of a Bipolar Junction Transistor (BJT) is given as 250. What is the value of α_{dc} (ratio of collector current to emitter current), for this BJT ?

    (a) 0·436

    (b) 0·656

    (c) 0·874

    (d) 0·996

19. For realizing a binary half-subtractor having two inputs A and B, the correct set of logical expressions for the outputs D (A minus B) and X (borrow) are

    1. The difference output $D = \bar{A}B + A\bar{B}$

    2. The borrow output $B = A\bar{B}$

    Which of the above statements is/are correct ?

    (a) 1 only

    (b) 2 only

    (c) Both 1 and 2

    (d) Neither 1 nor 2

20. The simplified form of the Boolean expression $AB + A(B + C) + B(B + C)$ is given by

    (a) $AB + AC$

    (b) $B + AC$

    (c) $BC + AC$

    (d) $AB + C$

21. Product of Maxterms representation for the Boolean function $F = \bar{B}D + \bar{A}D + BD$ is

    (a) $\prod M\,(1, 3, 5, 7)$

    (b) $\prod M\,(0, 2, 4, 6)$

    (c) $\prod M\,(0, 1, 2, 3)$

    (d) $\prod M\,(4, 5, 6, 7)$

22. Simplified form of the Boolean expression

    $Y = \overline{(A.B + \bar{C})(\bar{A} + B + C)}$ is

    (a) $\bar{A}\bar{C} + A\bar{C} + \bar{B}\bar{C} + BC$

    (b) $(\bar{A} + \bar{B} + \bar{C})(A + B + C)$

    (c) $(\bar{A} + \bar{B})(A + \bar{C})$

    (d) $A(B + C)$

23. What is the maximum frequency for a sine wave output voltage of 10 V peak with an Op-Amp whose slew rate is 1 V/µs ?

    (a) 15·92 kHz

    (b) 19·73 kHz

    (c) 23·54 kHz

    (d) 27·36 kHz

24. Which one of the following statements is correct ?

    (a) TTL logic cannot be used in digital circuits.

    (b) Digital circuits are linear circuits.

    (c) AND gate is a logic circuit whose output is equal to its highest input.

    (d) In a four-input AND circuit, all inputs must be high for the output to be high.

25. The slew rate is the rate of change of output voltage of an operational amplifier when a particular input is applied. What is that input ?

    (a) Sine wave input

    (b) Ramp input

    (c) Pulse input

    (d) Step input

26. Except at high frequencies of switching, nearly all the power dissipated in the switch mode operation of a BJT occurs, when the transistor is in the

(a) Active region
(b) Blocking state
(c) Hard saturation region
(d) Soft saturation region

27. Consider the following statements with respect to combinational circuit :

1. The output at any time depends only on the present combination of inputs.
2. It does not employ storage elements.
3. It performs an operation that can be specified logically by a set of Boolean functions.

Which of the above statements are correct ?

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

28. Consider the following statements :

A multiplexer

1. selects one of the several inputs and transmits it to a single output.
2. routes the data from a single input to one of many outputs.
3. converts parallel data into serial data.
4. is a combinational circuit.

Which of the above statements are correct ?

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

29. What are the two types of basic adder circuits ?

(a) Half adder and full adder
(b) Half adder and parallel adder
(c) Asynchronous adder and synchronous adder
(d) One's complement adder and two's complement adder

30. Consider the following statements :

1. An 8-input MUX can be used to implement any 4 variable functions.
2. A 3-line to 8-line DEMUX can be used to implement any 4 variable functions.
3. A 64-input MUX can be built using nine 8-input MUXs.
4. A 6-line to 64-line DEMUX can be built using nine 3-line to 8-line DEMUXs.

Which of the above statements are correct ?

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

31. For an n-bit binary adder, what is the number of gates through which a carry has to propagate from input to output ?

(a) n
(b) 2n
(c) n^2
(d) n + 1

32. The main disadvantage of DTL logic circuits is

(a) Medium speed
(b) Very large power supply voltage
(c) High cost
(d) Very large gate propagation delay

33. Which one of the following statements best describes the operation of a negative-edge-triggered D flip-flop ?

(a) The logic level at the D input is transferred to Q on NGT of CLK.
(b) The Q output is always identical to the CLK input if the D input is high.
(c) The Q output is always identical to the D input when CLK = PGT.
(d) The Q output is always identical to the D input.

34. A 3-bit ripple counter is constructed using three T flip-flops to do the binary counting. The three flip-flops have T-inputs fixed at

(a) 0, 0 and 1
(b) 1, 0 and 1
(c) 0, 1 and 1
(d) 1, 1 and 1

35. What is the function $Y = A + \bar{B}C$ in Product-of-Sums (POS) form ?
   (a) $M_6 M_5 M_4 M_3$
   (b) $M_3 M_2 M_1 M_0$
   (c) $M_0 M_2 M_3$
   (d) $M_4 M_3 M_2 M_1$

36. The initial content of a four-bit shift register is 1000. What is the register content after it is shifted four times to the right, with the serial input being 111100 ?
   (a) 1111
   (b) 1100
   (c) 1000
   (d) 0011

37. When a large number of analog signals is to be converted to digital form, an analog multiplexer is used. The A-to-D converter most suitable in this case will be
   (a) Forward counter type
   (b) Up-down counter type
   (c) Successive approximation type
   (d) Dual slope type

38. For Emitter-Coupled Logic (ECL), the switching speed is very high because
   (a) Negative logic is used
   (b) The transistors are not saturated when they are conducting
   (c) Multi-emitter transistors are used
   (d) Of low fan-out

39. A flip-flop is a
   (a) Combinational logic circuit and edge sensitive
   (b) Sequential logic circuit and edge sensitive
   (c) Combinational logic circuit and level sensitive
   (d) Sequential logic circuit and level sensitive

40. The transfer function $\dfrac{1}{2s+1}$ will have
   (a) dc gain 1 and high frequency gain 1
   (b) dc gain 0 and high frequency gain ∞
   (c) dc gain 1 and high frequency gain 0
   (d) dc gain 0 and high frequency gain 1

41. The closed-loop transfer function of a certain control system is given by $\dfrac{C}{R}(s) = \dfrac{100}{s^2 + 10s + 100}$. Then the settling time for a 2% tolerance band is given by
   (a) 0·8 s
   (b) 1·2 s
   (c) 1·5 s
   (d) 2·1 s

42. The unit step input response of a certain control system is given by $c(t) = 1 + 0 \cdot 2\, e^{-60t} - 1 \cdot 2\, e^{-10t}$. The undamped natural frequency ω_n and damping ratio δ are, respectively
   (a) 24·5 and 1·27
   (b) 33·5 and 1·27
   (c) 24·5 and 1·43
   (d) 33·5 and 1·43

43. In Force-Voltage Analogy
   (a) Force is analogous to current
   (b) Mass is analogous to capacitance
   (c) Velocity is analogous to current
   (d) Displacement is analogous to magnetic flux linkage

44. For a unity feedback control system having an open-loop transfer function $G(s) = \dfrac{25}{s(s+6)}$, what is the time t_p at which the peak of the step input response occurs ?
   (a) 0·52 s
   (b) 2·75 s
   (c) 0·79 s
   (d) 1·57 s

45. The transfer function $G(s) = \dfrac{10(s-1)}{(s+10)}$

represents

(a) Unstable system

(b) Minimum phase system

(c) Non-minimum phase system

(d) PID controller system

46. What is the maximum input frequency limit of a 3-bit Ripple counter configured around flip-flops, with inherent propagation delay time $t_{pd} = 50$ ns ?

(a) 6670 MHz

(b) 667 MHz

(c) 66·7 MHz

(d) 6·67 MHz

47. The characteristic equation of a certain feedback control system is given by

$s^4 + 4s^3 + 13s^2 + 36s + k = 0$. The range of values of k for which the feedback system is stable, is given by

(a) $0 < k < 4$

(b) $4 < k < 36$

(c) $0 < k < 36$

(d) $13 < k < 36$

48. The closed-loop transfer function of a unity feedback control system is,

$\dfrac{C(s)}{R(s)} = \dfrac{\omega_n^2}{s^2 + 2\zeta\omega_n s + \omega_n^2}$.

The velocity error constant of the system is

(a) $\dfrac{\omega_n}{2\zeta}$

(b) $\dfrac{\omega_n}{\zeta}$

(c) $\dfrac{2\omega_n}{\zeta}$

(d) $\dfrac{3\omega_n}{2\zeta}$

49. The system described by the following state equations

$\dot{X} = \begin{bmatrix} 0 & 1 \\ 2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u, \quad Y = [1, 1]X$ is

1. Completely controllable

2. Completely observable

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

50. Consider the system with $G(s) = \dfrac{K(s+2)}{s^2 + 2s + 3}$

and $H(s) = 1$. The breakaway point(s) of the root loci is/are at

(a) $-0·265$ only

(b) $-3·735$ only

(c) $-3·735$ and $-0·265$

(d) There is no breakaway point

51. How would a binary number 0010 be represented by a 4-bit binary word, if the range of voltage is 0 to 10 V ?

(a) 0·666 V

(b) 1·333 V

(c) 0·333 V

(d) 2·000 V

52. For a unity feedback system with open-loop transfer function $\dfrac{25}{s(s+6)}$, the resonant peak output M_m and the corresponding resonant frequency ω_m are, respectively

(a) 2·6 and 2·67 r/s

(b) 1·04 and 2·67 r/s

(c) 2·6 and 4·8 r/s

(d) 1·04 and 4·8 r/s

53. The transfer function of a control system is said to be 'All Pass System', if it has

(a) Unit magnitude at all frequencies with anti-symmetric pole-zero pattern

(b) Unit magnitude at all frequencies with symmetric pole-zero pattern

(c) Magnitude varying with frequency and with anti-symmetric pole-zero pattern

(d) Unit magnitude at some frequencies with symmetric pole-zero pattern

54. Consider the following :

1. Bode plot
2. Nyquist plot
3. Nichols chart

Which of the above frequency response plots are commonly employed in the analysis of control systems ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

55. An A-to-D converter in which one sub-circuit is a D-to-A converter is

(a) Parallel A/D converter

(b) Dual slope A/D converter

(c) Successive approximation A/D converter

(d) Extended parallel type A/D converter

56. Consider the transfer function :

$$G(s) = \frac{5(s^2 + 10s + 100)}{s^2(s^2 + 15s + 1)}$$

The corner frequencies in Bode's plot for this transfer function are as

(a) 10 r/s and 10 r/s

(b) 100 r/s and 10 r/s

(c) 10 r/s and 1 r/s

(d) 100 r/s and 1 r/s

57. Consider the transfer function $(0\cdot1 + 0\cdot01s)$ for a PD controller. What is the frequency at which the magnitude is 20 dB (by using asymptotic Bode's plot) ?

(a) 2000 r/s

(b) 1000 r/s

(c) 200 r/s

(d) 100 r/s

58. The main objectives of drawing the root-locus plot are

1. To obtain a clear picture of the open-loop poles and zeros of the system

2. To obtain a clear picture of the transient response of the system for varying gain, K

3. To find the range of K to make the system stable

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

59. A unity feedback system has open-loop poles at $s = -2 \pm j\,2$, $s = -1$ and $s = 0$ and a zero at $s = -3$.

What are the angles made by the root-loci asymptotes with the real axis ?

(a) 60°, 180° and – 60°

(b) 30°, 90° and 60°

(c) 60°, 120° and – 30°

(d) 30°, 60° and 180°

60. The open-loop transfer function of a unity feedback system is $G(s) = \dfrac{K}{s(s + 5)}$. The gain K that results in a phase margin of 45° is

(a) 35

(b) 30

(c) 25

(d) 20

61. Consider the following statements :

The Gain margin and Phase margin of an unstable system may respectively be

1. Positive, negative
2. Negative, positive
3. Negative, negative

Which of the above statements is/are correct ?

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

62. A phase lead compensator has its transfer function, $G_c(s) = \dfrac{1 + 0.5s}{1 + 0.05s}$. The maximum phase lead and the corresponding frequency, respectively are nearly

(a) $\sin^{-1}(0.9)$ and 6 r/s
(b) $\sin^{-1}(0.82)$ and 4 r/s
(c) $\sin^{-1}(0.9)$ and 4 r/s
(d) $\sin^{-1}(0.82)$ and 6 r/s

63. Consider the following statements :

1. Lead compensation decreases the bandwidth of the system.
2. Lag compensation increases the bandwidth of 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

64. A proportional controller with transfer function, K_p is used with a first-order system having its transfer function as $G(s) = \dfrac{K}{(1 + s\tau)}$, in unity feedback structure. For step inputs, an increase in K_p will

(a) Increase the time constant and decrease the steady state error
(b) Decrease the time constant and decrease the steady state error
(c) Decrease the time constant and increase the steady state error
(d) Increase the time constant and increase the steady state error

65. For a second-order differential equation, if the damping ratio ζ is unity, then

(a) The poles are imaginary and complex conjugate
(b) The poles are in the right half of s-plane
(c) The poles are equal, negative and real
(d) Both the poles are unequal, negative and real

66. Consider the following statements associated with microstrip patch antenna :

1. The microstrip patch behaves more like a leaky cavity rather than like a radiator and this is not a highly efficient antenna.
2. They can be adapted for radiation of circularly polarized waves.

Which of the above statements is/are correct ?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

67. A carrier waveform $10 \cos \omega_c t$ and modulating signal $3 \cos \omega_m t$ have f_c = 100 kHz and f_m = 4 kHz. Given that sensitivity of FM is 4 kHz/V and FM spectra beyond J_6 is negligible, what are the channel bandwidth requirements for AM and FM, respectively ?

(a) 12 kHz and 48 kHz

(b) 8 kHz and 48 kHz

(c) 12 kHz and 24 kHz

(d) 8 kHz and 24 kHz

68. When the modulating frequency is doubled, the modulation index is halved, and the modulating voltage remains constant. The modulation system is

1. Amplitude modulation

2. Phase modulation

3. Frequency modulation

Select the correct answer from the codes given below :

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

69. What is the modulation index of an FM signal having a carrier swing of 100 kHz and modulating frequency of 8 kHz ?

(a) 4·75

(b) 5·50

(c) 6·25

(d) 7·50

70. In a Pulse Code Modulated system, the number of bits is increased from 7 to 8 bits. The improvement in signal to quantization noise ratio will be

(a) 2 dB

(b) 4 dB

(c) 6 dB

(d) 8 dB

71. In the process of modulation

(a) Some characteristics of a high frequency sine wave are varied in accordance with the instantaneous value of a low frequency signal

(b) Parameters of carrier wave are held constant

(c) For proper and efficient radiation, the receiving antennas should have heights comparable to half-wavelength of the signal received

(d) The signal is converted first within the range of 10 Hz to 20 Hz

72. If the sampling is carried out at a rate higher than twice the highest frequency of the original signal (f_{max}), then it is possible to receive the original signal from the sampled signal by passing it through

(a) A high-pass filter with the cut-off frequency equal to f_{max}

(b) A low-pass filter with the cut-off frequency equal to f_{max}

(c) A high-pass filter with the cut-off frequency greater than f_{max}

(d) A low-pass filter with the cut-off frequency greater than f_{max}

73. The open-loop transfer function of a unity feedback system is $G(s) = \dfrac{10\,(1+0\cdot2s)}{(1+0\cdot5s)}$. The phase shift at $\omega = 0$ and $\omega = \infty$, will be, respectively

(a) – 90° and 180°

(b) 0° and 180°

(c) – 90° and 90°

(d) 0° and 0°

74. The conversion time for a 10-bit successive approximation A/D converter, for a clock frequency of 1 MHz is

(a) 1 μs

(b) 5 μs

(c) 10 μs

(d) 15 μs

75. The minimum bandwidth of the link needed for a guard band of 10 kHz frequency to prevent interference between six channels, each with 100 kHz frequency, is

(a) 425 kHz

(b) 575 kHz

(c) 650 kHz

(d) 725 kHz

76. The different access methods which permit many satellite users to operate in parallel through a single transponder without interfering with each other are

1. Frequency Division Multiple Access (FDMA)

2. Time Division Multiple Access (TDMA)

3. Code Division Multiple Access (CDMA)

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

77. In an optical fibre, the pulse dispersion effect is minimized by

1. Using a high frequency light source

2. Using plastic cladding

3. Minimizing the core diameter

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

78. Consider the following statements :

As compared to short-circuited stubs, open-circuited stubs are not preferred because the latter

1. Are of different characteristic impedance

2. Have a tendency to radiate

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

79. Consider the following statements for multiple access system in a satellite earth station :

1. Access to same repeater sub-systems and same RF channel is possible.

2. Frequency division multiple access is used.

3. Several carriers are not amplified by same TWT.

Which of the above statements are correct ?

(a) 2 and 3 only

(b) 1 and 3 only

(c) 1 and 2 only

(d) 1, 2 and 3

80. The Bode plot of the open-loop transfer function of a system is described as follows :

- Slope − 40 dB/decade $\omega < 0\cdot1$ rad/s

- Slope − 20 dB/decade $0\cdot1 < \omega < 10$ rad/s

- Slope   0 $\omega > 10$ rad/s

The system described will have

(a) 1 pole and 2 zeros

(b) 2 poles and 2 zeros

(c) 2 poles and 1 zero

(d) 1 pole and 1 zero

81. From the Nichols chart, one can determine the following quantities pertaining to a closed-loop system :

(a) Magnitude, bandwidth and phase

(b) Bandwidth and phase only

(c) Magnitude and phase only

(d) Bandwidth only

82. In position control systems, the Tacho-generator feedback is used to

(a) Increase the effective damping in the system

(b) Decrease the effective damping in the system

(c) Decrease the steady state error

(d) Increase the steady state error

83. Consider the following statements :

1. The pin diode consists of two narrow, but highly doped, semiconductor regions separated by a thicker, lightly doped material called the intrinsic region.

2. Silicon is used most often for its power-handling capability and because it provides a highly resistive intrinsic region.

3. The pin diode acts as an ordinary diode at frequencies above 100 MHz.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

84. Consider the following statements :

1. Additional cavities serve to velocity-modulate the electron beam and produce an increase in the energy available at the output.

2. The addition of intermediate cavities between the input and output cavities of the basic klystron greatly improves the amplification, power output, and efficiency of the klystron.

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

85. In a waveguide with perfectly conducting flat wall, the angle of reflection is equal to the angle of

(a) Diffraction

(b) Incidence

(c) Refraction

(d) Penetration

86. In microwave system, waveguides have the advantages of

(a) High power-handling capability and low loss

(b) Thin dielectric substrate

(c) Low power-handling and adequate stability

(d) Positive phase shift

87. A straight dipole radiator fed in the centre will produce maximum radiation at

1. The plane parallel to its axis

2. The plane normal to its axis

3. Extreme ends

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) 1 and 3 only

(d) 2 and 3 only

88. In communication systems, modulation is the process of
  (a) Improving frequency stability of transmitter
  (b) Combining signal and radio frequency waves
  (c) Generating constant frequency radio waves
  (d) Reducing distortion in RF waves

89. Which one of the following statements is correct ?
  (a) Sampling and quantization operate in amplitude domain.
  (b) Sampling and quantization operate in time domain.
  (c) Sampling operates in time domain and quantization operates in amplitude domain.
  (d) Sampling operates in amplitude domain and quantization operates in time domain.

90. What is the voltage attenuation provided by a 25 cm length of waveguide having $a = 1$ cm and $b = 0.5$ cm in which a 1 GHz signal is propagated in the dominant mode ?
  (a) 721 dB
  (b) 681 dB
  (c) 521 dB
  (d) 481 dB

91. When a plane wave travelling in free-space is incident normally on a medium having $\varepsilon_r = 9.0$ and $\mu_r = 1.0$, the fraction of power transmitted into the medium is
  (a) $\frac{4}{3}$
  (b) $\frac{3}{4}$
  (c) $\frac{1}{2}$
  (d) $\frac{1}{3}$

92. A microwave antenna with the absorbing cross-section area (A) and the power flux density (S) in the incident wave is employed as an absorber. The absorbed power (P) of the antenna is
  (a) $\frac{A}{S}$
  (b) $\frac{S}{A}$
  (c) SA
  (d) $\frac{S+1}{A-1}$

93. LASER beam of light essentially finds its application in transmission of a signal in the optical fibre communication systems due to
  (a) Incredible speed of signal communication
  (b) Low loss transmission of the signal
  (c) Inexpensive installation cost
  (d) Bulk availability of LASER sources

94. The controller which is highly sensitive to noise is
  (a) PI
  (b) PD
  (c) Both PI and PD
  (d) Neither PI nor PD

95. The 2's complement representation of -17 is
  (a) 100001
  (b) 101111
  (c) 110011
  (d) 101110

96. The subtraction of two hexadecimal numbers $84_{16} - 2A_{16}$ results in
  (a) $2B_{16}$
  (b) $3A_{16}$
  (c) $4B_{16}$
  (d) $5A_{16}$

97. The Vestigial Side Band (VSB) modulation is preferred in TV systems because

1. It reduces the bandwidth requirement to half

2. It avoids phase distortion at low frequencies

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

98. If, A = 60 and B = 3, then using C-programming A >> B results in

(a) 11100000

(b) 00000111

(c) 00111111

(d) 01111000

99. What is the base of the numbers for the following operation to be correct ?

$$\frac{(54)_b}{(4)_b} = (13)_b$$

(a) 2

(b) 4

(c) 8

(d) 16

100. It is awkward to employ signed-magnitude system in computer arithmetic, because

1. Sign and magnitude have to be handled separately

2. It has two representations for '0'

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

101. Consider the following statements :

Pointers in C-programming are useful to

1. Handle the data tables efficiently

2. Reduce the length of a program

3. Reduce the complexity of a program

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 2 and 3 only

(d) 1 and 3 only

102. Data transfer between the main memory and the CPU register takes place through two registers, namely,

(a) General purpose register and MDR

(b) Accumulator and Program counter

(c) MAR and MDR

(d) MAR and Accumulator

103. In a binary tree, the number of internal nodes of degree 1 is 3, and the number of internal nodes of degree 2 is 6. The number of leaf nodes in the binary tree is

(a) 7

(b) 8

(c) 9

(d) 10

104. Consider the following :

1. Operation code

2. Source operand reference

3. Result operand reference

4. Next instruction reference

Which of the above are typical elements of machine instructions ?

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 3 and 4 only

(d) 1, 2, 3 and 4

105. Which addressing mode helps to access table data in memory efficiently ?

   (a) Indirect mode

   (b) Immediate mode

   (c) Auto-increment or Auto-decrement mode

   (d) Index mode

106. Converting an analog signal to a digital signal is done by Sampling and

   (a) Companding

   (b) Mixing

   (c) Quantizing

   (d) Pre-emphasis

107. A computer employs RAM chips of 256 bytes and ROM chips of 1024 bytes. If the computer system needs 1 kB of RAM and 1 kB of ROM, then how many address lines are required to access the memory ?

   (a) 10

   (b) 11

   (c) 12

   (d) 13

108. A computer system has a cache with access time 10 ns, a hit ratio of 80% and average memory access time is 20 ns. Then what is the access time for physical memory ?

   (a) 50 ns

   (b) 40 ns

   (c) 30 ns

   (d) 20 ns

109. In a synchronous TDM, there are four inputs and data rate of each input connection is 3 kbps. If 1 bit at a time is multiplexed, what is the duration of each frame ?

   (a) 0·02 ms

   (b) 0·03 ms

   (c) 0·33 ms

   (d) 0·22 ms

110. Consider the following statements comparing static RAM with dynamic RAM :

   1. In static RAM typical cell requires more number of transistors than the dynamic RAM.

   2. Power consumption per bit of static RAM is less than that of dynamic RAM.

   3. Dynamic RAM is less expensive than the static RAM.

Which of the above statements are correct ?

   (a) 1, 2 and 3

   (b) 1 and 2 only

   (c) 2 and 3 only

   (d) 1 and 3 only

111. An addressing mode in which the location of the data is contained within the mnemonic, is known as

   (a) Immediate addressing mode

   (b) Implied addressing mode

   (c) Register addressing mode

   (d) Direct addressing mode

112. A processor has 32-bit architecture. Each instruction is 1 word long (32 bits). It has 64 registers. It supports 50 instructions, which have 2 register operands + 1 immediate operand. Assuming that the immediate operand is an unsigned integer, what is its maximum value ?

   (a) 16383

   (b) 32767

   (c) 65536

   (d) 1024

113. Microwave resonators are used in

   1. Microwave oscillators

   2. Microwave narrow band amplifiers

   3. Microwave frequency meters

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

114. The serial connection of interrupt lines for establishing hardware priority is known as

(a) Daisy Chaining Priority

(b) Parallel Priority

(c) Polling

(d) Serial-line Priority

*Directions : Each of the next **six** (6) 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.

115. *Statement (I) :*

PAM can be demodulated using a suitable integrator.

Statement (II) :

A suitable integrator practically acts as an envelope detector.

116. *Statement (I) :*

The direction flag D in 8086 selects increment or decrement mode for DI and/or SI registers.

Statement (II) :

If D = 0, the registers are automatically decremented.

117. *Statement (I) :*

An antenna of length $\frac{\lambda}{2}$ will have radiation pattern of two lobes.

Statement (II) :

An antenna of length $\frac{3\lambda}{2}$ will have radiation pattern of two lobes and two minor lobes.

118. *Statement (I) :*

The complex conjugate poles and zeros of the open-loop transfer function have no effect on the root-loci on the real axis.

Statement (II) :

Angle contribution of such a pair of conjugate poles or zeros is 2π radians on the real axis.

119. *Statement (I) :*

A basic memory unit of a flip-flop is a bistable multivibrator.

Statement (II) :

A flip-flop has two stable states. It remains in one state until it is directed by an input signal to switch over.

120. *Statement (I) :*

Multimode fibres are now used for long distance communication.

Statement (II) :

Multimode fibres have larger core-radius than single-mode fibres.

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