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T.B.C. : O-FTF-J-FUA

Test Booklet Series

Serial No 064949

## TEST BOOKLET



### ELECTRONICS AND 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. ENCODE CLEARLY THE TEST BOOKLET SERIES A, B, C, OR D AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
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 IN THE OBJECTIVE TYPE QUESTION PAPERS.
  - (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. Which of the following statements is/are true for the diamond structure?
1. Coordination number is four.
  2. Packing fraction is 0.34.
  3. Copper crystallizes into diamond structure.
  4. Lattice is FCC.
- (a) 1 only  
(b) 1, 2 and 4  
(c) 2 and 3 only  
(d) 2, 3 and 4
2. Which of the following statements is/are true for a good conductor of electricity?
1. Its conductivity decreases with increasing temperature.
  2. Number of free electrons is around  $10^{26} \text{ m}^{-3}$ .
  3. Its conductivity decreases with addition of impurities.
  4. It is a good conductor of heat also.
- (a) 1, 2, 3 and 4  
(b) 1 only  
(c) 2 and 3 only  
(d) 3 and 4 only
3. Which of the following materials is *not* an insulator?
- (a) Diamond  
(b) Graphite  
(c) Bakelite  
(d) Lucite
4. Consider the following statements :  
The conductivity of a metal has negative temperature coefficient since :
1. The electron concentration increases with temperature.
  2. The electron mobility decreases with temperature.
  3. The electron - lattice scattering rate increases with temperature.
- Which of the above statements is/are correct ?
- (a) 1 only  
(b) 1 and 2  
(c) 2 and 3  
(d) 3 only
5. Which of the following is *not* a conducting material?
- (a) Copper  
(b) Tungsten  
(c) Germanium  
(d) Platinum
6. What is the chemical bonding in silicon semiconductor ?
- (a) Metallic  
(b) Ionic  
(c) Covalent  
(d) Van der Waals
7. Which one of the following is a trivalent material ?
- (a) Antimony  
(b) Phosphorus  
(c) Arsenic  
(d) Boron

8. The fuse material used in electrical lines must have which one of the following properties ?
- High resistivity
  - Low conductivity
  - High melting point
  - Low melting point
9. Manganin, an alloy of copper and manganese, is used in
- Soldering material
  - Heating elements
  - Ballast resistors
  - Standard resistances
10. Which one of the following pairs is *not* correctly matched ?
- NaCl : Diamagnetic
  - Gd : Paramagnetic
  - Ferrite : Ferrimagnetic
  - Cr<sub>2</sub>O<sub>3</sub> : Ferromagnetic
11. Hysteresis loss in a transformer working at 220 V and at a frequency of 50 Hz is 100 W. When the transformer is operated at 220 V and at a frequency of 100 Hz, what is the hysteresis loss ?
- 50 W
  - 100 W
  - 200 W
  - 400 W
12. Which of the following is *not* an electromagnetic device ?
- Hall transducer
  - Transformer
  - Speedometer
  - Eddy current damping device
13. Which one of the following materials is used for making permanent magnets ?
- Steel
  - Carbon
  - Carbon-Steel
  - Graphite
14. What happens when a paramagnetic material is heated above Curie temperature ?
- It becomes diamagnetic
  - It becomes non-magnetic
  - It becomes ferromagnetic
  - It becomes anti-ferromagnetic
15. Ferromagnetic materials show hysteresis in B – H characteristic. As the magnetic field is increased slowly from zero value, what is the first process which sets in the material to give net magnetization ?
- Growth of favourably oriented domains at the cost of other domains by reversible boundary displacements
  - Growth of favourably oriented domains at the cost of other domains by irreversible boundary displacements
  - Domain wall orientation
  - A combination of processes (a) and (c) above
16. The following properties are associated with ferroelectric materials :
- Its susceptibility is negative.
  - The susceptibility is expressed as  $\chi = \frac{c}{T - T_c}$  where  $c$  is the Curie constant and  $T_c$  is the Curie temperature.
  - It has permanent dipoles oriented randomly.
- Which of the above statements is/are correct ?
- 1 only
  - 1 and 3
  - 2 only
  - 1, 2 and 3

17. Consider the following :

1. Si
2. Ge
3. GaAs
4. InP

Which of the above semiconductors should be used for making highly efficient photodiodes ?

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

18. The materials not having negative temperature coefficient of resistivity are

- (a) Metals
- (b) Semiconductors
- (c) Insulators
- (d) None of the above

19. Which one of the following compounds is widely used for making ferrites ?

- (a) FeO
- (b) CuO
- (c) MgO
- (d) Fe<sub>2</sub>O<sub>3</sub>

20. Effective Q of the equivalent electrical circuit of quartz crystal is of the order of

- (a) 200
- (b) 2000
- (c) 20,000
- (d) 2,00,000

21. In a material, the Fermi level is located between the centre of the forbidden band and the conduction band. Then what is that material ?

- (a) A p-type semiconductor
- (b) An n-type semiconductor
- (c) An intrinsic semiconductor
- (d) An insulator

22. Consider the following statements :

1. Acceptor level is formed very close to the conduction band.
2. The effective mass of the free electron is same as that of a hole.
3. The magnitude of the charge of a free electron is same as that of a hole.
4. Addition of donor impurities adds holes to the semiconductor.

Which of the above statements are correct ?

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

23. Diffusion current of holes in a semiconductor is proportional to (with  $p =$  concentration of holes / unit volume)

- (a)  $\frac{dp}{dx^2}$
- (b)  $\frac{dp}{dx}$
- (c)  $\frac{dp}{dt}$
- (d)  $\frac{d^2p}{dx^2}$

24. The junction capacitance of a linearly graded pn junction (with applied voltage =  $V_B$ ) is proportional to

- (a)  $V_B^2$
- (b)  $V_B^{-\frac{1}{2}}$
- (c)  $V_B^{\frac{1}{3}}$
- (d)  $V_B^{-\frac{1}{3}}$

25. As per Hall effect, if any specimen carrying a current  $I$  is placed in a transverse magnetic field  $B$ , then an electric field  $E$  is induced in the specimen in the direction

- (a) parallel to  $I$
- (b) perpendicular to  $B$  and parallel to  $I$
- (c) parallel to  $I$  and  $B$
- (d) perpendicular to both  $I$  and  $B$

26. What current does

$$I = Aq \left( \frac{D_p}{L_p N_D} + \frac{D_n}{L_n N_A} \right) n_i^2$$

represent in pn junction diode? (where the symbols have their usual meaning)

- (a) Forward current
- (b) Diffusion current
- (c) Drift current
- (d) Reverse saturation current

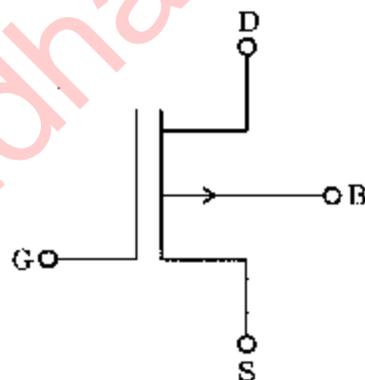
27. Which of the following quantities **cannot** be measured/determined using Hall effect?

- (a) Type of semiconductor (p or n)
- (b) Mobility of charge carriers
- (c) Diffusion constant
- (d) Carrier concentration

28. A junction FET, can be used as a voltage variable resistor

- (a) at pinch-off condition
- (b) beyond pinch-off voltage
- (c) well below pinch-off condition
- (d) for any value of  $V_{DS}$

29.



The above figure shows the symbol of

- (a) p channel depletion MOSFET
- (b) p channel enhancement MOSFET
- (c) complementary MOSFET
- (d) p channel JFET

30. The maximum power dissipation capacity of a transistor is 50 mW. If the collector emitter voltage is 10 V, what is the safe collector current that can be allowed through the transistor?

- (a) 5 mA
- (b) 2.5 mA
- (c) 10 mA
- (d) 25 mA

31. Which one of the following statements is correct for MOSFETS ?
- p channel MOS is easier to produce than n channel MOS
  - n channel MOS must have twice the area of p channel MOS for the same ON resistance
  - p channel MOS has faster switching action than n channel MOS
  - p channel MOS has higher packing density than n channel MOS
32. The process of extension of a single-crystal surface by growing a film in such a way that the added atoms form a continuation of the single-crystal structure is called
- Ion implantation
  - Chemical vapour deposition
  - Electroplating
  - Epitaxy
33. The maximum concentration of the element which can be dissolved in solid silicon at a given temperature is termed as
- Solid solubility
  - Dissolution coefficient
  - Solidification index
  - Concentration index
34. Which of the following devices is used in the microprocessors ?
- JFET
  - BJT
  - MOSFET
  - CMOS
35. In a CMOS CS amplifier, the active load is obtained by connecting a
- p channel current mirror circuit
  - n channel transistor
  - p channel transistor
  - BJT current mirror
36. Which one of the following is *not* LED material ?
- GaAs
  - GaP
  - SiC
  - SiO<sub>2</sub>
37. The minimum energy of a photon required for intrinsic excitation is equal to
- energy of bottom of conduction band
  - energy of top of valence band
  - forbidden gap energy
  - Fermi energy
38. A signal  $x_1(t)$  and  $x_2(t)$  constitute the real and imaginary parts respectively of a complex valued signal  $x(t)$ . What form of waveform does  $x(t)$  possess ?
- Real symmetric
  - Complex symmetric
  - Asymmetric
  - Conjugate symmetric

39. A function of one or more variables which conveys information on the nature of physical phenomenon is called

- (a) Noise
- (b) Interference
- (c) System
- (d) Signal

40. The output  $y(t)$  of a continuous-time system  $S$  for the input  $x(t)$  is given by:

$$y(t) = \int_{-\infty}^t x(\lambda) d\lambda$$

Which one of the following is correct ?

- (a)  $S$  is linear and time-invariant
- (b)  $S$  is linear and time-varying
- (c)  $S$  is non-linear and time-invariant
- (d)  $S$  is non-linear and time-varying

41. What is the period of the sinusoidal signal  $x(n) = 5 \cos [0.2 \pi n]$  ?

- (a) 10
- (b) 5
- (c) 1
- (d) 0

42. Transfer function of a certain system is

$$\frac{Y(s)}{U(s)} = \frac{1}{s^4 + 5s^3 + 8s^2 + 6s + 3}$$

Which one of the following will be the  $A, B$  matrix pair of state variable representation of this system ?

(a)  $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -3 & -6 & -8 & -5 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$

(b)  $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -5 & -8 & -6 & -3 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$

(c)  $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -3 & -6 & -8 & -5 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

(d)  $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -3 & -6 & -8 & -5 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$

43. Separation property of state-transition matrix is

- (a)  $\phi(t - t_0) = \phi(t) \phi(t_0)$
- (b)  $\phi(t - t_0) = \phi^{-1}(t) \phi^{-1}(t_0)$
- (c)  $\phi(t - t_0) = \phi(t) \phi^{-1}(t_0)$
- (d)  $\phi(t - t_0) = \phi^{-1}(t) \phi^{-1}(t_0)$

44. When  $y(t) \xrightarrow{FT} Y(j\omega)$ ;  $x(t) \xrightarrow{FT} X(j\omega)$ ;  $h(t) \xrightarrow{FT} H(j\omega)$ . What is  $Y(j\omega)$ ?
- (a)  $\frac{X(j\omega)}{H(j\omega)}$   
 (b)  $X(j\omega) H(j\omega)$   
 (c)  $X(j\omega) + H(j\omega)$   
 (d)  $X(j\omega) - H(j\omega)$

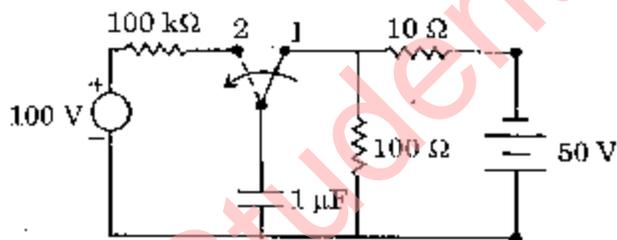
45. For a series R-L-C circuit, the characteristic equation is given as

$$s^2 + \frac{R}{L}s + \frac{1}{LC} = 0$$

If  $\frac{R}{2L}$  is denoted by  $\alpha$  and  $\frac{1}{\sqrt{LC}}$  by  $\beta$ , then under the condition of  $\beta^2 > \alpha^2$ , the system will be

- (a) critically damped  
 (b) under damped  
 (c) undamped  
 (d) over damped

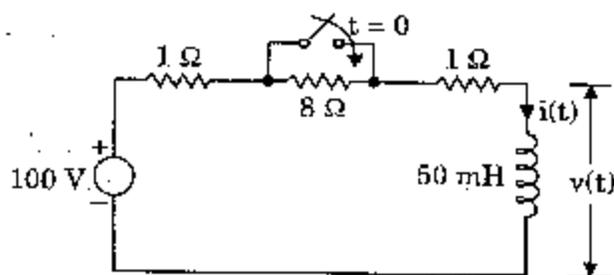
46.



In the above circuit, the switch has been in position 1 for quite a long time. At  $t = 0$  the switch is moved to position 2. At this position what is the time constant?

- (a) 0.1 s  
 (b) 1 s  
 (c) 0.11 s  
 (d) 1.11 s

47.



In the above circuit, the switch is open for a long time. At time  $t = 0$ , the switch is closed. What are the initial and final values of voltages across the inductor?

- (a) 0 V and 0 V  
 (b) 0 V and 80 V  
 (c) 80 V and 0 V  
 (d) 80 V and 80 V

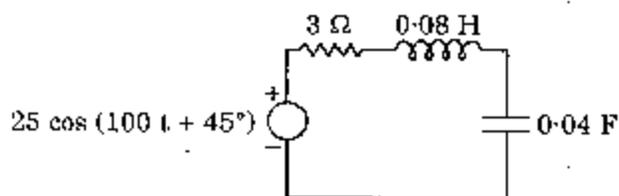
48. The voltage applied to an R-L circuit at  $t = 0$  when switch is closed is  $100 \cos(100t + 30^\circ)$ . The circuit resistance is  $80 \Omega$  and inductance is  $0.6 \text{ H}$  (in which initial current is zero). What is the maximum amplitude of current flowing through the circuit?

- (a) 1 A  
 (b) 2 A  
 (c) 5 A  
 (d) 10 A

49. A series R-C circuit with  $R = 3 \Omega$  and  $X_C = 4 \Omega$  at  $50 \text{ Hz}$  is supplied with a voltage  $V = 50 + 141.4 \sin 314t$ . What is the RMS value of the current flowing through the circuit?

- (a) 5 A  
 (b) 10 A  
 (c) 20 A  
 (d) 22.36 A

50.



What is the approximate steady state current in the above circuit ?

- (a) 50 A
- (b) 25 A
- (c) 5 A
- (d) 1 A

51. Consider the following statements regarding the properties of an R-L-C series circuit under resonance :

1. Current in the circuit is in phase with applied voltage.
2. Voltage drop across capacitor C and inductance L are equal in magnitude.
3. Voltage across the capacitor is equal in magnitude to the applied voltage.
4. Current in the circuit is maximum.

Which of the above statements is/are correct ?

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

52.

Which one of the following is applicable to any network — linear or non-linear, active or passive, time-varying or invariant — as long as Kirchoff's laws are *not* violated ?

- (a) Tellegen's theorem
- (b) Reciprocity theorem
- (c) Maximum power transfer theorem
- (d) Superposition theorem

53. Number of fundamental cut-sets of any graph will be

- (a) same as the number of twigs
- (b) same as the number of tree branches
- (c) same as the number of nodes
- (d) equal to one

54. If in an electric network R, L and C are connected in series and supplied by a voltage source then its dual network will be described by the differential equation :

- (a)  $v(t) = Ri(t) + L \frac{di(t)}{dt} + \frac{1}{C} \int i(t) dt$
- (b)  $v(t) = \frac{1}{G} i(t) + C \frac{di(t)}{dt} + \frac{1}{L} \int i(t) dt$
- (c)  $i(t) = Gv(t) + C \frac{dv(t)}{dt} + \frac{1}{L} \int v(t) dt$
- (d)  $v(t) = Ri(t) + L \frac{di(t)}{dt} + C \int i(t) dt$

55. In a network with twelve circuit elements and five nodes, what is the minimum number of mesh equations ?

- (a) 24
- (b) 12
- (c) 10
- (d) 8

56. With respect to transmission parameters, which one of the following is correct ?

- (a) A and B are dimensionless
- (b) B and C are dimensionless
- (c) A and D are dimensionless
- (d) B and D are dimensionless

57. Match List I with List II and select the correct answer using the code given below the lists :

*List I*  
(Network parameter)

*List II*  
(Measured under open-circuit conditions)

- |             |   |
|-------------|---|
| A. $Z_{11}$ | 1. $\left. \frac{V_2}{I_2} \right _{I_1=0}$ |
| B. A        | 2. $\left. \frac{V_1}{V_2} \right _{I_2=0}$ |
| C. C        | 3. $\left. \frac{V_1}{I_1} \right _{I_2=0}$ |
| D. $Z_{22}$ | 4. $\left. \frac{I_1}{V_2} \right _{I_2=0}$ |

Code :

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 4 | 2 | 3 |
| (b) | 3 | 4 | 2 | 1 |
| (c) | 1 | 2 | 4 | 3 |
| (d) | 3 | 2 | 4 | 1 |

58. Which one of the following driving point functions does *not* represent an LC network ?

(a)  $Z(s) = \frac{s(s+3)}{(s^2+1)(s^2+9)}$

(b)  $Z(s) = \frac{(s^2+25)}{s(s^2+36)}$

(c)  $Z(s) = \frac{(s^2+1)(s^2+36)}{s(s^2+4)(s^2+25)}$

(d)  $Z(s) = \frac{s(s^2+16)}{(s^2+25)}$

59. If a two-port network is reciprocal as well as symmetrical, which one of the following relationships is correct ?

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

(b)  $Y_{12} = Y_{21}$  and  $Y_{11} = Y_{22}$

(c)  $AD - BC = 1$  and  $A = D$

(d) All of the above

60. If the connection of two two-ports is such that the transmission matrix of the overall network is the product of the transmission matrices of the individual networks, what type of connection is it ?

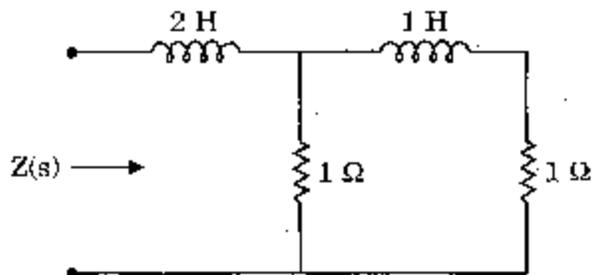
(a) Series connection

(b) Cascade connection

(c) Parallel connection

(d) None of the above

61.



Consider the above network. Impedance of this network as a function of the complex frequency  $s$  consists of a certain number of zeros and poles. What is the location of poles ?

- (a)  $-2$
- (b)  $-2, \infty$
- (c)  $2$
- (d)  $2, \infty$

62. Consider the following network function

$$N(s) = \frac{s(s+2)}{(s+4)(s+1+j1)(s+1-j1)}$$

In order to make  $N(s)$  as rational network function, it is essential to include

- (a) Zero at origin
- (b) Zero at infinity
- (c) Pole at origin
- (d) Pole at infinity

63. For determining the network functions of a two-part network, it is required to consider that

- (a) all initial conditions remain same
- (b) all initial conditions are zero
- (c) part of initial conditions are equal to zero
- (d) initial conditions vary depending on nature of network

64. All poles and zeros of a driving point immittance function of an L-C network

- (a) should lie on the  $j\omega$  axis
- (b) should lie on the +ve real axis
- (c) should lie on the -ve real axis
- (d) can lie anywhere in s-plane

65. In the field of a charge  $Q$  at the origin, the potentials at  $A(2, 0, 0)$  and  $B(1/2, 0, 0)$  are  $V_A = 15$  volt and  $V_B = 30$  volt respectively. What will be the potential at  $C(1, 0, 0)$  ?

- (a) 25 volt
- (b) 22.5 volt
- (c) 20 volt
- (d) 17.5 volt

66. What will be the equipotential surfaces for a pair of equal and opposite line charges ?

- (a) Spheres
- (b) Concentric cylinders
- (c) Non-concentric cylinders
- (d) None of the above

67. If the potential functions  $V_1$  and  $V_2$  satisfy Laplace's equation within a closed region and assume the same values on its surface, then which of the following is correct ?

- (a)  $V_1$  and  $V_2$  are identical
- (b)  $V_1$  is inversely proportional to  $V_2$
- (c)  $V_1$  has the same direction as  $V_2$
- (d)  $V_1$  has the same magnitude as  $V_2$  but has different direction

68. If  $V = \sinh x \cdot \cos ky \cdot e^{pz}$  is a solution of Laplace's equation, what will be the value of  $k$  ?
- (a)  $\frac{1}{\sqrt{1+p^2}}$
- (b)  $\sqrt{1+p^2}$
- (c)  $\frac{1}{\sqrt{1-p^2}}$
- (d)  $\sqrt{1-p^2}$
69. By what name is the equation  $\nabla \cdot \bar{J} = 0$  frequently known ?
- (a) Poisson's equation
- (b) Laplace's equation
- (c) Continuity equation for steady currents
- (d) Displacement equation
70. Method of images is applicable to which fields ?
- (a) Electrostatic fields only
- (b) Electrodynanic fields only
- (c) Neither electrostatic fields nor electrodynamic fields
- (d) Both electrostatic fields and electrodynamic fields
71. Who developed the concept of time varying electric field producing a magnetic field ?
- (a) Gauss
- (b) Faraday
- (c) Hertz
- (d) Maxwell
72. A single turn loop is situated in air, with a uniform magnetic field normal to its plane. The area of the loop is  $5 \text{ m}^2$  and the rate of change of flux density is  $2 \text{ Wb/m}^2/\text{s}$ . What is the emf appearing at the terminals of the loop ?
- (a)  $-5 \text{ V}$
- (b)  $-2 \text{ V}$
- (c)  $-0.4 \text{ V}$
- (d)  $0 \text{ V}$
73. Which of the following equations results from the circuital form of Ampere's law ?
- (a)  $\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$
- (b)  $\nabla \cdot \mathbf{B} = 0$
- (c)  $\nabla \cdot \mathbf{D} = \rho$
- (d)  $\nabla \times \mathbf{H} = \mathbf{J} + \frac{\partial \mathbf{D}}{\partial t}$
74. In which direction is the plane wave  $\bar{E} = 50 \sin(10^8 t + 2z) \hat{a}_y \text{ V/m}$ , (where  $\hat{a}_y$  is the unit vector in  $y$ -direction), travelling ?
- (a) along  $y$  direction
- (b) along  $-y$  direction
- (c) along  $z$  direction
- (d) along  $-z$  direction

75. For parallel plane waveguides, which is the mode with lowest cut-off frequency ?

- (a)  $TE_{10}$
- (b)  $TM_{10}$
- (c) TEM
- (d)  $TE_{11}$

76. For plane wave propagating in free space or two conductor transmission line, what must be the relationship between the phase velocity  $v_p$ , the group velocity  $v_g$  and speed of light  $c$  ?

- (a)  $v_p > c > v_g$
- (b)  $v_p < c < v_g$
- (c)  $v_p = c = v_g$
- (d)  $v_p < v_g < c$

77. The reflection coefficient on a 500 m long transmission line has a phase angle of  $-150^\circ$ . If the operating wavelength is 150 m, what will be the number of voltage maxima on the line ?

- (a) 0
- (b) 3
- (c) 6
- (d) 7

78. Consider the following statements :

For a 10 m long common power line connecting a switch to a light bulb

1. It is a distributed circuit.
2. Time delay for propagation through it is negligible.
3. It is in the form of a shielded coaxial cable of circular cross-section.
4. As the intensity of the lamp varies, input impedance of this line also changes.

Which of the above statements is/are correct ?

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

79. With regard to a transmission line, which of the following statements is correct ?

- (a) Any impedance repeats itself every  $\lambda/4$  on the Smith chart.
- (b) The S.W.R. = 2 circle and the magnitude of reflection coefficient = 0.5 circle coincide on the Smith chart.
- (c) At any point on a transmission line, the current reflection coefficient is the reciprocal of the voltage reflection coefficient.
- (d) Matching eliminates the reflected wave between the source and the matching device location.

80. Consider the following statements :

In a microstrip line

1. Wavelength  $\Lambda = \frac{\lambda}{\epsilon_{eff}}$ , where  $\epsilon_{eff}$  is the effective dielectric constant and  $\lambda$  is the free space wavelength.
2. Electromagnetic fields exist partly in the air above the dielectric substrate and partly within the substrate itself.
3. The effective dielectric constant is greater than the dielectric constant of the air.
4. Conductor losses increase with decreasing characteristic impedance.

Which of the above statements is/are correct ?

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

81. It is required to match a  $200 \Omega$  load to a  $450 \Omega$  transmission line. To reduce the SWR along the line to 1, what must be the characteristic impedance of the quarter-wave transformer used for this purpose, if it is connected directly to the load ?

- (a)  $90 \text{ k}\Omega$
- (b)  $300 \Omega$
- (c)  $\frac{9}{4} \Omega$
- (d)  $\frac{3}{2} \Omega$

82. The load end of a quarter wave transformer gets disconnected thereby causing an open-circuited load. What will be the input impedance of the transformer ?

- (a) Zero
- (b) Infinite
- (c) Finite and Positive
- (d) Finite and Negative

83. Match List I with List II and select the correct answer using the code given below the lists :

*List I*  
(Types of transmission structure)

*List II*  
(Modes of propagation)

- |                                 |              |
|---------------------------------|--------------|
| A. Strip line                   | 1. Quasi TEM |
| B. Hollow rectangular waveguide | 2. Pure TEM  |
| C. Microstrip                   | 3. TE / TM   |
| D. Corrugated waveguide         | 4. Hybrid    |

Code :

	A	B	C	D
(a)	2	1	3	4
(b)	4	1	3	2
(c)	2	3	1	4
(d)	4	3	1	2

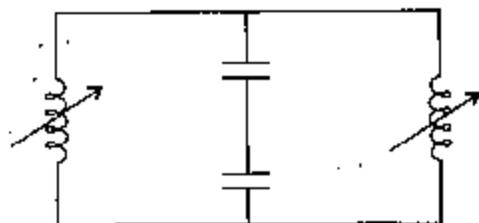
84. A standard waveguide WR90 has inside wall dimensions of  $a = 2.286 \text{ cm}$  and  $b = 1.016 \text{ cm}$ . What is the cut-off wavelength for  $TE_{01}$  mode ?

- (a)  $4.572 \text{ cm}$
- (b)  $2.286 \text{ cm}$
- (c)  $2.032 \text{ cm}$
- (d)  $1.857 \text{ cm}$

85. When a particular mode is excited in a waveguide, there appears an extra electric component, in the direction of propagation. In what mode is the wave propagating ?

- (a) Transverse electric
- (b) Transverse magnetic
- (c) Transverse electromagnetic
- (d) Longitudinal

86.



The above shown circuit is the equivalent circuit of which one of the following microwave resonator types ?

- (a) Butterfly resonator
- (b) Parallel-wire resonator
- (c) Cavity resonator
- (d) Coaxial line resonator

87. Which is the dominant mode in rectangular waveguides ?

- (a)  $TE_{10}$
- (b)  $TE_{11}$
- (c)  $TM_{01}$
- (d)  $TM_{11}$

88. Consider the following statements :

For a square waveguide of cross-section  $3\text{ m} \times 3\text{ m}$  it has been found

1. At 6 GHz dominant mode will propagate.
2. At 4 GHz all the modes are evanescent.
3. At 11 GHz only dominant modes and no higher order mode will propagate.
4. At 7 GHz degenerate modes will propagate.

Which of the above statements are correct ?

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

89. Match List I with List II and select the correct answer using the code given below the lists :

List I  
(Modes)

List II  
(Characteristic)

- |                            |   |
|----------------------------|---|
| A. Evanescent mode         | 1. Rectangular waveguide does not support |
| B. Dominant mode           | 2. No wave propagation                    |
| C. $TM_{10}$ and $TM_{01}$ | 3. Lowest cut-off frequency               |

Code :

- |     | A | B | C |
|-----|---|---|---|
| (a) | 1 | 2 | 3 |
| (b) | 2 | 3 | 1 |
| (c) | 1 | 3 | 2 |
| (d) | 2 | 1 | 3 |

90. Multiple member of antennas are arranged in arrays in order to enhance what property ?

- (a) Both directivity and bandwidth
- (b) Only directivity
- (c) Only bandwidth
- (d) Neither directivity nor bandwidth

91. Consider the following statements regarding an antenna :
1. It is a transducer.
  2. Its performance is essentially frequency sensitive.
  3. It is a reciprocal device.
  4. With increase in its effective aperture area, width of the radiated beam increases.
- Which of the above statements are correct ?
- (a) 1, 2 and 3
  - (b) 1, 2 and 4
  - (c) 2 and 3 only
  - (d) 1 and 4 only
92. What is the minimum value of VSWR that may exist on a transmission line ?
- (a) Less than zero
  - (b) Zero
  - (c) One
  - (d) 10
93. For a second order instrument, the optimum range of  $\xi$  (damping ratio), which gives good frequency response over a wide range of frequencies is
- (a) 0.5 to 0.6
  - (b) 0.6 to 0.7
  - (c) 0.7 to 0.8
  - (d) 0.8 to 1.0
94. The Wheatstone bridge method of measuring resistance is ideally suited for the measurement of resistance values in the range of
- (a) 0.001 to 1  $\Omega$
  - (b) 0.1 to 100  $\Omega$
  - (c) 100  $\Omega$  to 10 k $\Omega$
  - (d) 100 k $\Omega$  to 10 M $\Omega$
95. What is the major cause of creeping in an energy-meter ?
- (a) Over compensation for friction
  - (b) Mechanical vibrations
  - (c) Excessive voltage across the potential coil
  - (d) Stray magnetic fields
96. A compensated wattmeter has its reading corrected for error due to which one of the following parameters ?
- (a) Frequency
  - (b) Friction
  - (c) Power consumed in current coil
  - (d) Power consumed in pressure coil
97. Which of the following bridges is also used in an oscillator ?
- (a) Maxwell
  - (b) Schering
  - (c) Hay
  - (d) Wien

98. Which of the following meters *cannot* measure a.c. quantities ?

- (a) Thermocouple
- (b) Hot wire
- (c) P.M.M.C.
- (d) Electrodynamometer

99. Which of the following meters requires an external power source for its operation ?

- (a) P.M.M.C. meter
- (b) Hot wire ammeter
- (c) Electronic voltmeter
- (d) Electrodynamometer

100. Which of the following statements is *not* correct for thermistors ?

- (a) They have negative temperature coefficient of resistance.
- (b) The sensing element is made of sintered ceramics, which are oxides of metals in the form of beads.
- (c) The variation of resistance with temperature is linear.
- (d) The resistance value at ambient temperature may range from  $100 \Omega$  to  $100 \text{ k}\Omega$ .

101. Which of the following devices is used at the first stage of an electronic voltmeter ?

- (a) BJT
- (b) SCR
- (c) MOSFET
- (d) UJT

102. Consider the following statements regarding sources of error in a Q-meter :

1. If a coil with resistance  $R$  is connected in direct measurement mode and if the residual resistance of Q-meter is  $0.1 R$ , then the measure  $Q$  of the coil would be 1.1 times the actual  $Q$ .
2. If the inductance to be measured is less than  $0.1 \text{ mH}$ , the error due to presence of residual inductance cannot be neglected.
3. The presence of distributed capacitance in a coil modifies the effective  $Q$  of the coil.

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

103. What is an advantage of an electronic voltmeter over a non-electronic voltmeter ?

- (a) Low power consumption
- (b) Low input impedance
- (c) The ability to measure wide ranges of voltages and resistances
- (d) Large portability

104. An average response rectifier type electronic voltmeter has a d.c. voltage of 10 V applied to it. What is the meter reading ?
- 7.1 V
  - 10 V
  - 11.1 V
  - 22.2 V
105. Which one of the following oscillators is used for the generation of high frequencies ?
- R-C phase shift oscillator
  - Wien bridge oscillator
  - L-C oscillator
  - Blocking oscillator
106. Which of the following transducers requires a high input impedance preamplifier for proper measurements ?
- Thermocouple
  - Piezoelectric
  - Thermistor
  - L.V.D.T.
107. In a digital voltmeter the oscillator frequency is 400 kHz and the ramp voltage falls from 8 V to 0 V in 20 ms. What is the number of pulses counted by the counter ?
- 800
  - 2000
  - 4000
  - 8000
108. Which of the following *cannot* provide as much time interval accuracy as the oscilloscope but can capture and display eight or more signals simultaneously, something that scopes cannot do ?
- Logic analyzer
  - Digital oscilloscope
  - Frequency analyzer
  - Wave analyzer
109. Which of the following transducers is most suitable for monitoring continuous variations in very fine thickness of a material ?
- Diaphragm
  - Capacitor
  - L.V.D.T.
  - Piezoelectric crystal
110. Consider the following statements about ultrasonic flowmeters :
- The measurement is insensitive to viscosity, pressure and temperature variations.
  - It has bidirectional measuring capability and can be used for any pipe size.
  - It has a relatively lower cost.
  - It has good accuracy, fast response and wide frequency range.
- Which of the above statements is/are correct ?
- 1 only
  - 1 and 2 only
  - 1, 2 and 4
  - 3 and 4 only

**Directions :** Each of the next ten (10) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

**Codes :**

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is *not* the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

111. **Assertion (A) :** An unbiased p-n junction develops a built-in potential at the junction with the n-side positive and the p-side negative.

**Reason (R) :** The p-n junction behaves as a battery and supplies current to a resistance connected across its terminals.

112. **Assertion (A) :** Cut-in voltage for Germanium diode is greater than that for Silicon diode.

**Reason (R) :** Germanium diode has a higher reverse saturation current than Silicon diode.

113. **Assertion (A) :** The h-parameter model of a BJT can be derived from its hybrid- $\pi$  model and vice-versa.

**Reason (R) :** The hybrid- $\pi$  model has many more additional elements as compared to h-parameter model of the BJT.

114. **Assertion (A) :** For same drain current rating N-channel MOSFET occupies more area than p-channel MOSFET.

**Reason (R) :** Electron mobility is much higher than hole mobility.

115. **Assertion (A) :** There are no convergence issues with the discrete-time Fourier series in general.

**Reason (R) :** A discrete-time signal is always obtained by sampling a continuous-time signal.

116. **Assertion (A) :** Ideal current sources and ideal voltage sources do not exist in reality.

**Reason (R) :** All sources have finite internal impedances.

117. Assertion (A) : Capacitance of a solid conducting spherical body of radius 'a' is given by  $4\pi\epsilon_0 a$  in free space.

Reason (R) :  $\nabla \times \mathbf{H} = \mathbf{j} \nabla \cdot \mathbf{E} + \mathbf{J}$

118. Assertion (A) : The expression  $\mathbf{E} = -\nabla V$ , where  $\mathbf{E}$  is the electric field and  $V$  is the potential is not valid for time varying fields.

Reason (R) : The curl of a gradient is identically zero.

119. Assertion (A) : A z-directed rectangular waveguide with cross-sectional dimensions  $3 \text{ cm} \times 1 \text{ cm}$  will support propagation at 4 GHz.

Reason (R) :  $k_z^2 + \left(\frac{m\pi}{3}\right)^2 + \left(\frac{n\pi}{1}\right)^2 = \left(\frac{2\pi}{\lambda}\right)^2$  where  $\lambda$  is the wavelength.

120. Assertion (A) : As the length of the resonant antenna is increased, the number of lobes increases and the direction of the major lobes is closer and closer to the direction of the dipole.

Reason (R) : As the length increases, the current distribution along the wire becomes more and more uniform.

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T.B.C. : O-FTF-J-FUB

Test Booklet Series

Serial No.

**58033**



**TEST BOOKLET**

**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. ENCODE CLEARLY THE TEST BOOKLET SERIES A, B, C OR D AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
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 IN THE OBJECTIVE TYPE QUESTION PAPERS.**
  - (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. Consider the following :

1. Oscillator
2. Emitter follower
3. Cascaded amplifier
4. Power amplifier

Which of these use feedback amplifiers ?

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

2. Why npn-transistors are preferred over pnp-transistors ?

- (a) Leakage current in npn-transistors is less than pnp-transistors
- (b) Mobility of majority carrier in npn-transistors is greater than the mobility of majority carrier in pnp-transistors
- (c) Bias voltage required in npn is less than in pnp-transistors
- (d) Bias voltage required in npn is greater than in pnp-transistors

3. Consider the following statements :

To draw a.c. equivalent circuit of a transistor, all

1. d.c. sources are shorted
2. a.c. sources are shorted
3. d.c. sources are opened
4. a.c. sources are connected to d.c. sources

Which of the above statements is/are correct ?

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

4. Which one of the following statements is *not* correct with regard to power amplifiers ?

- (a) The collector current is large
- (b) They are used as the front end of multi-stage amplifiers
- (c) They are used near the end of the multi-stage amplifiers
- (d) They have a high power rating

$$\left( > \frac{1}{2} W \right)$$

5. Consider the following statements regarding the class-B power amplifiers (Complementary symmetry type) :

1. The efficiency of the amplifier is higher than that of class-A amplifier.
2. The power output is low.
3. Cross over distortion is present.
4. The standby power dissipation is absent.

Which of the above statements are correct ?

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

6. Consider the following :

1. Distortion
2. Gain
3. Bias stabilization
4. Sensitivity
5. Frequency response

Which of these properties of the power amplifier one should concentrate upon while designing a good power amplifier circuit ?

- (a) 1, 2 and 3
- (b) 1, 3 and 5
- (c) 2, 3 and 4
- (d) 4 and 5

7. Consider the following :

1. Coupling capacitor
2. Emitter by-pass capacitor
3. Emitter to base diffusion capacitance of the BJT.
4. Stray capacitance of the circuit.

Which of these components in a R-C coupled amplifier control the lower cut-off frequency of the amplifier ?

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

8. Which one of the following is a regulated power supply ?

- (a) IC 555
- (b) IC 844
- (c) IC 3080
- (d) IC 723

9. Consider the following statements, regarding an OP AMP :

1. All types of negative feedback reduce non-linear distortion.
2. All types of negative feedback reduce the output offset voltage.
3. Non-inverting (current and voltage) feedback increases the input impedance.
4. Inverting (current and voltage) feedback decreases input impedance.

Which of the above statements is/are correct ?

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

10. Consider the following statements :

The bias stability of an emitter-bias amplifier circuit improves by

1. decreasing the value of  $R_B$ .
2. increasing the value of  $R_E$ .
3. decreasing the value of  $R_E$ .
4. increasing the value of  $R_B$ .
5. increasing the value of  $R_C$ .

Which of the above statements are correct ?

- (a) 1 and 2
- (b) 2 and 3
- (c) 3 and 4
- (d) 4 and 5

11. Which of the following will be true for a CE transistor amplifier if the emitter resistor value is made equal to zero ?

1. Its gain will increase.
2. Its stability will increase.
3. Its gain will decrease.
4. Its stability will decrease.

Select the correct answer from the codes given below :

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

12. Which one of the following circuits is used for converting a sine wave into a square wave ?

- (a) Astable multivibration
- (b) Monostable multivibration
- (c) Bistable multivibration
- (d) Schmitt trigger

13. Which of the transistor models is most preferred for the analysis of a transistor circuit both at mid-band and at high frequencies ?

- (a) h-parameter model
- (b) y-parameter model
- (c) s-parameter model
- (d) hybrid- $\pi$  model

14. Which of the following describe the correct properties of an emitter follower circuit ?

1. It is a voltage series feedback circuit.
2. It is a current series feedback circuit.
3. Its voltage gain is less than unity.
4. Its output impedance is very low.

Select the correct answer from the codes given below :

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

15. Which one of the following type of negative feedback increases the input resistance and decreases the output resistance of an amplifier ?

- (a) Current series feedback
- (b) Voltage series feedback
- (c) Current shunt feedback
- (d) Voltage shunt feedback

16. Which one of the following oscillators is well suited for the generation of wide range audio-frequency sine waves ?

- (a) RC phase-shift oscillator
- (b) Wien-bridge oscillator
- (c) Colpitts oscillator
- (d) Hartley oscillator

17. Consider the following statements about a good power supply :

1. The a.c. ripple should be high.
2.  $S_V$ , (Voltage stability factor) should be low
3.  $S_T$ , (Temperature stability factor) should be low.

Which of the above statements are correct ?

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

18. Which of the following are the non-linear applications of OP amp ?

1. Current-to-voltage converter
2. Comparator
3. Peak detector
4. Limiter

Select the correct answer from the codes given below :

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

19. Consider a 565 PLL with  $R_T = 10 \text{ k}\Omega$  and  $C_T = 0.01 \mu\text{F}$ . What is the output frequency of the  $V_{CO}$  ?

- (a) 10 kHz
- (b) 5 kHz
- (c) 2.5 kHz
- (d) 1.25 kHz

20. Which of the following does not show non-linear V-I characteristics ?

- (a) Schottky diode
- (b) Tunnel diode
- (c) Thermister, at a fixed temperature
- (d) p-n junction diode

21. Which of the following conditions must be satisfied for a transistor to remain under saturation ?

1. Its collector to base junction should be under forward bias.
2. Its collector to base junction should be under reverse bias.
3. Its emitter to base junction should be under reverse bias.
4. Its emitter to base junction should be under forward bias.

Select the correct answer from the codes given below :

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

22. Which of the following Boolean algebra rules is correct ?

- (a)  $A \cdot \bar{A} = 1$
- (b)  $A + AB = A + B$
- (c)  $A + \bar{A}B = A + B$
- (d)  $A(A + B) = B$

23. What are the ultimate purposes of minimizing logic expressions ?

1. To get a small size expression.
2. To reduce the number of variables in the given expression.
3. To implement the function of the logic expression with least hardware.
4. To reduce the expression for making it feasible for hardware implementation.

Select the correct answer from the codes given below :

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

24. Which of the following factors are responsible to design IC logic gates to operate at a fixed supply voltage of 5 volts ?

1. Low heating of IC logic gates.
2. Compatibility with other logic gates.
3. Satisfactory and safe operation.
4. Standardization from IC manufacturing point of view.

Select the correct answer from the codes given below :

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

25. Which of the following statements is *not* correct ?

- (a) Propagation delay is the time required for a gate to change its state
- (b) Noise immunity is the amount of noise which can be applied to the input of a gate without causing the gate to change state
- (c) Fan-in of a gate is always equal to fan-out of the same gate
- (d) Operating speed is the maximum frequency at which digital data can be applied to a gate

26. Which junction has least junction capacitance ?

- (a) Alloy
- (b) Grown
- (c) Diffused
- (d) Point contact

27. Which of the following are universal gates ?

- 1. NAND
- 2. NOR
- 3. XOR

Select the correct answer from the codes given below :

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

28. Which of the following output configurations are available in a TTL gate ?

- 1. Open collector output
- 2. Totem-pole output
- 3. Tristate output

Select the correct answer from the codes given below :

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

29. Which one of the following logic families can be operated using a supply voltage from 3 V to 15 V ?

- (a) TTL
- (b) ECL
- (c) PMOS
- (d) CMOS

30. Which of the following circuits come under the class of combinational logic circuits ?

- 1. Full adder
- 2. Full subtractor
- 3. Half adder
- 4. J-K flip-flop
- 5. Counter

Select the correct answer from the codes given below :

- (a) 1 only
- (b) 3 and 4
- (c) 4 and 5
- (d) 1, 2 and 3

31. Consider a multiplexer with X and Y as data inputs and Z as control input. Z = 0 selects input X and Z = 1 selects input Y. What are the connections required to realize the 2-variable Boolean function  $f = T + R$ , without using any additional hardware ?

- (a) R to X, 1 to Y, T to Z
- (b) T to X, R to Y, T to Z
- (c) T to X, R to Y, 0 to Z
- (d) R to X, 0 to Y, T to Z

32. With which decoder it is possible to obtain many code conversions ?

- (a) 2 line to 4 line
- (b) 3 line to 8 line
- (c) not possible with any decoder
- (d) 4 line to 16 line decoder

33. Match List I with List II and select the correct answer using the code given below the Lists :

List I (Application of Circuit)	List II (Circuit Name)
A. Divider	1. Astable multivibrator
B. Clips input voltage at two Predetermined levels	2. Schmitt trigger
C. Square wave generator	3. Bistable multivibrator
D. Narrow current pulse generator	4. Blocking oscillator

Code :

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 2 | 1 | 3 |
| (b) | 3 | 2 | 1 | 4 |
| (c) | 4 | 1 | 2 | 3 |
| (d) | 3 | 1 | 2 | 4 |

34. Consider the following statements :

For a master-slave J-K flip-flop,

1. the toggle frequency is the maximum clock frequency at which the flip-flop will toggle reliably.
2. the data input must precede the clock triggering edge transition time by some minimum time.
3. the data input must remain fixed for a given time after, the clock triggering edge transition time for reliable operation.
4. propagation delay time is equal to the rise time and fall time of the data.

Which of the above statements is/are correct ?

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

35. Consider the following statements :

1. A flip-flop is used to store 1-bit of information.
2. Race-around condition occurs in a J-K flip-flop when both the inputs are 1.
3. Master-slave configuration is used in flip-flops to store 2-bits of information.
4. A transparent latch consists of a D-type flip-flop.

Which of the above statements is/are correct ?

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

36. Which of the following flip-flop is used as a latch ?

- (a) J K flip-flop
- (b) R S flip-flop
- (c) T flip-flop
- (d) D flip-flop

37. Which of the following conditions should be satisfied to call an astable multivibrator circuit using discrete components as a digital circuit ?

- 1. A flip-flop is always a digital circuit.
- 2. Only when we assign 1 and 0 to the high and low levels of the output, a flip-flop is called a digital circuit.
- 3. Only if the power supply voltage is maintained at +5 V or -5 V, it is called a digital circuit.
- 4. Only if it is in IC form, following the technology of IC manufacture, it is called a digital circuit.

Select the correct answer from the codes given below :

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

38. Which of the following circuits come under the class of sequential logic circuits ?

- 1. Full adder
- 2. Full subtractor
- 3. Half adder
- 4. J-K flip-flop
- 5. Counter

Select the correct answer from the codes given below :

- (a) 1 and 2
- (b) 2 and 3
- (c) 3 and 4
- (d) 4 and 5

39. Consider the following statements regarding registers and latches :

- 1. Registers are made of edge-triggered FFs, whereas latches are made from level-triggered FFs.
- 2. Registers are temporary storage devices whereas latches are not.
- 3. A latch employs cross-coupled feedback connections.
- 4. A register stores a binary word whereas a latch does not.

Which of the above statements is/are correct ?

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

40. Which of the following capabilities are available in a Universal Shift Register ?

- 1. Shift left
- 2. Shift right
- 3. Parallel load
- 4. Serial add

Select the correct answer from the codes given below :

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

41. Which of the following measurements can be done using a counter ?

1. Pulse duration
2. Interval between two pulses
3. Amplitude of the pulse
4. Rise time of a pulse

Select the correct answer from the codes given below :

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

42. Match List I with List II and select the correct answer using the code given below the Lists :

List I (Type of N-bit ADC)	List II (Characteristics)
A. Flash converter	1. Integrating Type
B. Successive approximation	2. Fastest converter
C. Counter ramp	3. Maximum conversion time = N bits
D. Dual slope	4. Uses a DAC in its feedback path

Code :

	A	B	C	D
(a)	2	3	4	1
(b)	1	3	4	2
(c)	2	4	3	1
(d)	1	4	3	2

43. In which one of the following types of analog to digital converters the conversion time is practically independent of the amplitude of the analog signal ?

- (a) The dual slope integrating type
- (b) Successive approximation type
- (c) Counter ramp type
- (d) Tracking type

44. Consider the function  $F(s) = \frac{\omega}{s^2 + \omega^2}$  where  $F(s)$  is the Laplace transform of  $f(t)$ . What is the steady-state value of  $f(t)$  ?

- (a) Zero
- (b) One
- (c) Two
- (d) A value between -1 and +1

45. The transfer function of a linear-time-invariant system is given as  $\frac{1}{(s+1)}$ . What is the steady-state value of the unit-impulse response ?

- (a) Zero
- (b) One
- (c) Two
- (d) Infinite

46. What is the characteristic of a good control system ?

- (a) Sensitive to parameter variation
- (b) Insensitive to input command
- (c) Neither sensitive to parameter variation nor sensitive to input commands
- (d) Insensitive to parameter variation but sensitive to input commands

47. How can the bandwidth of a control system be increased ?
- By the use of phase lead network
  - By the use of phase lag network
  - By the use of both phase-lag and phase-lead network
  - By the use of cascaded amplifiers in the system
48. Which of the following may result in instability problem ?
- Large error
  - High selectivity
  - High gain
  - Noise
49. A negative-feedback closed-loop system is supplied to an input of 5 V. The system has a forward gain of 1 and a feedback gain of 1. What is the output voltage ?
- 1.0 V
  - 1.5 V
  - 2.0 V
  - 2.5 V
50. For what positive value of  $K$  does the polynomial  $s^4 + 8s^3 + 24s^2 + 32s + K$  have roots with zero real parts ?
- 10
  - 20
  - 40
  - 80
51. How many roots with positive real parts do the equation  $s^3 + s^2 - s + 1 = 0$  have ?
- Zero
  - One
  - Two
  - Three
52. The characteristic equation of a control system is given as  $s^4 + 8s^3 + 24s^2 + 32s + K = 0$ . What is the range of values of  $K$  for this system to be stable ?
- $0 \leq K < 80$
  - $0 \leq K < 100$
  - $0 \leq K < 300$
  - $0 \leq K < 600$
53. Consider the equation  $s^2 + 2s + 2 + K(s + 2) = 0$ . Where do the roots of this equation break on the root loci plot ?
- 3.414
  - 2.414
  - 1.414
  - 0.414
54. How many number of branches the root loci of the equation  $s(s + 2)(s + 3) + K(s + 1) = 0$  have ?
- Zero
  - One
  - Two
  - Three

55. The characteristic equation of a control system is given as

$$s^4 + 4s^3 + 4s^2 + 3s + K = 0.$$

What is the value of  $K$  for which this system is marginally stable ?

(a)  $\frac{9}{16}$

(b)  $\frac{19}{16}$

(c)  $\frac{29}{16}$

(d)  $\frac{39}{16}$

56. Which of the following can be used as a tachogenerator in control systems ?

(a) Microsyn

(b) DC servomotor

(c) AC servomotor

(d) Magnetic amplifier

57. The transfer function of a controller is given as  $K_p + K_d \cdot s$  where  $K_p$  and  $K_d$  are constants. What type of controller is this ?

(a) Proportional

(b) Proportional plus integral

(c) Proportional plus derivative

(d) Integral plus derivative

58. The transfer function of a controller is

given as  $K_p + K_d \cdot s + \frac{K_i}{s}$  where  $K_p$ ,  $K_d$

and  $K_i$  are constants. What type of controller is this ?

(a) Proportional

(b) Proportional plus derivative

(c) Proportional plus integral

(d) Proportional plus integral plus derivative

59. In closed loop control system, what is the sensitivity of the gain of the overall system,  $M$  to the variation in  $G$  ?

(a)  $\frac{1}{1 + G(s)H(s)}$

(b)  $\frac{1}{1 + G(s)}$

(c)  $\frac{G(s)}{1 + G(s)H(s)}$

(d)  $\frac{G(s)}{1 + G(s)}$

60. Which of the following statements about the matched filter in a communication receiver are correct ?

1. Its impulse response depends on the signal shape.

2. It maximizes the SNR at the detection instant.

3. It produces ISI.

4. It may produce phase error if synchronization is improper.

Select the correct answer from the codes given below :

(a) 1 and 4 only

(b) 1 and 2 only

(c) 2, 3 and 4

(d) 1, 2 and 4

61. A single mode fibre does not suffer from which type of dispersion ?
- Waveguide dispersion
  - Material dispersion
  - Intermodal dispersion
  - Polarization mode dispersion
62. A balanced modulator is used in the generation of which of the following ?
- DSB-SC signal
  - FM signal
  - PM signal
  - PAM signal
63. An amplitude modulated signal occupies a frequency range from 395 kHz to 405 kHz. It can be demodulated by which of the following ?
- Using an envelope detector and filter
  - Multiplying with a 395 kHz local signal
  - Multiplying with a 405 kHz local signal
  - Low pass filtering with cut off at 400 kHz
64. An audio signal is band limited to 4 kHz. It is sampled at 8 kHz. What will be the spectrum of the sampled signal ?
- 4 kHz to 4 kHz
  - 8 kHz to 8 kHz
  - every  $4n$  kHz and repeating
  - every  $\pm 8$  kHz and repeating as well as at zero ( $k$  integer)
65. A signal occupies a band 5 kHz to 10 kHz. For proper error free reconstruction at what rate it should be sampled ?
- 10 kHz
  - 20 kHz
  - 5 kHz
  - $(10 + 5) \times 2$  kHz
66. The spectral range of a band pass signal extends from 10 MHz to 10.4 MHz. What is the minimum sampling frequency required for reconstruction ?
- 20 MHz
  - 20.8 MHz
  - 20.4 MHz
  - 0.8 MHz
67. An audio signal is to be transmitted digitally. Which is the system best suited for good fidelity ?
- 8 bit PCM
  - 13 bit PCM
  - 32 bit PCM
  - PCM system with non-uniform quantizer
68. For good quality signal transmission all frequency components should have the same transmission delay,  $t_d$  and same phase shift- $\phi_s$ . What can be said about the statement ?
- Correct
  - True for  $t_d$  but not for  $\phi_s$
  - Not true for  $t_d$  but true for  $\phi_s$
  - Both  $t_d$  and  $\phi_s$  are not involved in quality

69. Which of the following introduces mode partition noise ?

- (a) Coaxial line
- (b) Wave guide
- (c) Fibre transmission line
- (d) Both coaxial line and wave guide

70. Which of the following does not cause losses in optical fibre cables ?

- (a) Impurities
- (b) Microbending
- (c) Attenuation in glass
- (d) Stepped index operation

71. On which bands, do the optical fibres operate ?

- 1. Ultra violet band
- 2. Ultra high frequency band
- 3. Visible light band
- 4. Infra red band

Select the correct answer from the codes given below :

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

72. Which one of the following photo-detector does not provide gain ?

- (a) Photo-transistor
- (b) Photo conductor
- (c) Avalanche photodiode
- (d) p-i-n photodiode

73. Consider the following statements :

In the case of space wave propagation, the signal strength at the receiver is

- 1. Directly proportional to transmitter and receiver heights.
- 2. Inversely proportional to distance between transmitter and receiver.
- 3. Directly proportional to frequency.

Which of the above statements is/are correct ?

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

74. What was the first commercial geostationary communication satellite ?

- (a) INTELSAT 1
- (b) ECHO
- (c) INSAT-1A
- (d) SPUTNIK

75. What does a link budget for satellite communication include ?

- (a) Total cost of satellite
- (b) Cost of satellite plus launch vehicle
- (c) Signal and noise levels in dB
- (d) Margins of error permitted

76. Which one of the following is a transferred electron device ?

- (a) BARITT diode
- (b) IMPATT diode
- (c) TRAPATT diode
- (d) Gunn diode

77. Consider the transmission line of length 37.5 cm, which is terminated into zero resistance. This line is being excited by a source of 1 GHz which has an internal impedance of  $50 \Omega$ . What is the input impedance of the line as seen by the source ?
- $50 \Omega$
  - Zero  $\Omega$
  - $100 \Omega$
  - Infinite  $\Omega$
78. Which of the following is a microwave source with a 'cross-field' structure ?
- Double cavity klystron
  - Reflex klystron
  - Magnetron
  - Travelling wave tube
79. Which of the following devices has the 'negative resistance' characteristic ?
- Reflex klystron
  - Gunn diode
  - P-N-P transistor
  - Magnetron
80. Which of the following devices is a 'hot-electron' diode ?
- Thermionic tube diode
  - Schottky-Barrier diode
  - Thomson-Deletion diode
  - Thermal electron diode
81. Which of the following uses 'transferred electron effect' for production of micro-waves ?
- Silicon
  - Germanium
  - Metal-semiconductor Junction
  - Gallium Arsenide
82. Which of the following is a microwave power amplifier ?
- Gunn diode
  - Reflex klystron
  - Magnetron
  - Travelling wave tube
83. Consider the following statements :
- The Klystron and travelling wave tube differ from each other,
- In TWT the microwave circuit is non resonant.
  - In Klystron the microwave circuit is resonant.
  - TWT uses attenuator.
  - The wave in TWT is a non-propagating wave.
- Which of the above statements are correct ?
- 1 and 2 only
  - 3 and 4 only
  - 1, 2 and 3
  - 2, 3 and 4

84. Which device can detect the presence of both forward and backward waves in a waveguide ?

- (a) Filter
- (b) Detector
- (c) Directional coupler
- (d) Magic T

85. Which of the following modes can exist in a rectangular wave guide ?

- (a)  $TM_{10}$
- (b)  $TE_{10}$
- (c)  $TM_{00}$
- (d)  $TM_{01}$

86. Which of the following does not apply to Yagi-Uda antenna

- (a) High gain
- (b) Reasonably good bandwidth
- (c) Folded dipole
- (d) Parasitic elements

87. Which of the following antenna is obtained by modifying a wave guide ?

- (a) Microstrip Antenna
- (b) Helical Antenna
- (c) Horn Antenna
- (d) Dipole Antenna

88. Which of the following is a circularly polarized antenna ?

- (a) Horn
- (b) Dipole
- (c) Helical
- (d) Pyramidal

89. Which of the following antennas uses a number of varying length parallel elements ?

- (a) Helical antenna
- (b) Pyramidal Horn
- (c) Corner reflection antenna
- (d) Yagi-Uda antenna

90. The following components are used to measure power output of a 2 kW TWT amplifier :

1. TWTA
2. Low pass / high pass filter
3. 20 dB attenuator
4. 40 dB directional coupler with matched load
5. Power meter

What is the correct sequence of connection of these components ?

- (a) 2 - 4 - 1 - 3 - 5
- (b) 1 - 3 - 4 - 2 - 5
- (c) 1 - 2 - 4 - 3 - 5
- (d) 2 - 4 - 1 - 5 - 3

91. Match List I with List II and select the correct answer using the code given below the Lists :

List I (Microwave Measuring Instruments)	List II. (Measurements effected)
---	--

- |                      |                            |
|----------------------|----------------------------|
| A. Bolometer         | 1. Reflection coefficients |
| B. VSWR meter        | 2. Half power beam widths  |
| C. Cavity wave meter | 3. Microwave power         |
| D. Pattern recorder  | 4. Microwave frequency     |

Code :

- |     |   |   |   |   |
|-----|---|---|---|---|
|     | A | B | C | D |
| (a) | 2 | 1 | 4 | 3 |
| (b) | 3 | 1 | 4 | 2 |
| (c) | 2 | 4 | 1 | 3 |
| (d) | 3 | 4 | 1 | 2 |

92. Which one of the following statements is correct ?

- AGC in radio receivers will keep the total signal output fairly constant but the noise component will be reduced; with the result the  $\frac{S}{N}$  ratio will improve
- AGC in radio receivers is a linear operation w.r.t. both signals and noise
- Sudden changes in the output while tuning, which may cause damage to the components, is an unavoidable feature of AGC
- AGC operation is independent of the filter components used in AGC circuit

93. Consider the following statements :

- Taking 2's complement is equivalent to sign change.
- In the 2's complement representation the most significant bit (MSB) is zero for a positive number.
- In a 4 bit binary representation of a binary number A, A + 1's complement of A =  $2^4$ .

Which of the above statements are correct ?

- 1 and 2 only
- 1 and 3 only
- 2 and 3 only
- 1, 2 and 3

94. Consider the following statements :

- Strictly speaking C supports 1-dimensional arrays only.
- An array element may be an array by itself.
- Array elements need not occupy contiguous memory locations.

Which of the above statements is/are correct ?

- 1 only
- 2 only
- 1 and 2
- 2 and 3

95. What can be the maximum dimension of an array in C language program ?

- (a) 3
- (b) 4
- (c) 5
- (d) It is compiler dependent

96. With reference to C programming language, which of the following statements are correct ?

1. An identifier may start with an underscore.
2. An identifier may end with an underscore.
3. IF is a valid identifier.
4. The number of significant characters in an identifier is implementation dependent.

Select the correct answer from the codes given below :

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

97. How many distinct binary trees can be constructed with three nodes ?

- (a) 1
- (b) 2
- (c) 3
- (d) 5

98. Consider the following statements :

1. Internal sorting is used if the number of items to be sorted is very large.
2. External sorting is used if the number of items to be sorted is very large.
3. External sorting needs auxiliary storage.
4. Internal sorting needs auxiliary storage.

Which of the above statements are correct ?

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

99. Which of the following has a major role in implementation of function calls in C ?

- (a) Processor's registers
- (b) Data segment
- (c) The heap
- (d) System stack

100. Which one of the following algorithms design techniques is used in quick sort algorithm ?

- (a) Dynamic programming
- (b) Backtracking
- (c) Divide and conquer
- (d) Greedy

101. There are four different algorithms A1, A2, A3 and A4 to solve a given problem with the complexity order  $\log(n)$ ,  $\log(\log(n))$ ,  $n \log(n)$  and  $n/\log(n)$  respectively. Which is the best algorithm ?

- (a) A1
- (b) A2
- (c) A3
- (d) A4

102. Which of the following is/are correct statement(s) ?

- 1. Bus is a group of wires carrying information.
- 2. Bus is needed to achieve reasonable speed of operation.
- 3. Bus can carry data or address.
- 4. A bus can be shared by more than one device.

Select the correct answer from the codes given below :

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

103. Which of the following are included in the architecture of a computer ?

- 1. Addressing modes, CPU
- 2. Instruction set, data formats
- 3. Secondary memory, operating system

Select the correct answer from the codes given below :

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

104. A  $3 \times 8$  decoder with two enable inputs is to be used to address 8 blocks of memory. What will be the size of each memory block when addressed from a sixteen bit bus with two MSBs used to enable the decoder ?

- (a) 2 K
- (b) 4 K
- (c) 16 K
- (d) 64 K

105. Match List I with List II and select the correct answer using the code given below the Lists :

List I  
(Type of Memory)

List II  
(Used As)

- |                              |                  |
|------------------------------|------------------|
| A. DRAM                      | 1. Cache memory  |
| B. SRAM                      | 2. Main memory   |
| C. Parallel Access Registers | 3. BIOS memory   |
| D. ROM                       | 4. CPU registers |

Code :

- |     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 4 | 2 | 3 |
| (b) | 3 | 4 | 2 | 1 |
| (c) | 1 | 2 | 4 | 3 |
| (d) | 3 | 2 | 4 | 1 |

106. Which of the following are the memory performance parameters ?

1. Access time and latency
2. Block size and Block access time
3. Cycle time and Bandwidth

Select the correct answer from the codes given below :

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

107. What is the address space of 8086 CPU ?

- (a) One Megabyte
- (b) 256 Kilobyte
- (c) 1 K Megabytes
- (d) 64 Kilobytes

108. Which of the following counters can be used to divide the clock frequency of a microprocessor by 5 ?

- (a) 3 bit counter
- (b) 5 bit counter
- (c) mod 3 counter
- (d) mod 5 counter

109. Identification of highest priority interrupt can be achieved in a minimum time by which of the following schemes ?
- (a) Hardwired polling
  - (b) Priority encoder circuit
  - (c) Software polling
  - (d) Subdivision of interrupt register into a number of sub-registers which are checked parallelly
110. Which one of the following is used as the interface chip for data transmission between 8086 and a 16-bit ADC ?
- (a) 8259
  - (b) 8255
  - (c) 8253
  - (d) 8251
111. Which one of the following addressing modes is used in the instruction PUSH B ?
- (a) Direct
  - (b) Register
  - (c) Register indirect
  - (d) Immediate
112. What is the purpose of a start bit in RS232 serial communication protocol ?
- (a) To synchronise receiver for receiving every byte
  - (b) To synchronise receiver for receiving a sequence of byte
  - (c) Acts as a parity bit
  - (d) To synchronise receiver for receiving the last byte
113. The resolution of a DAC depends on which of the following ?
- (a) The number of bits
  - (b) Monotonicity
  - (c) Reference voltage
  - (d) The values of resistance
114. What is the purpose of DMA facility in microprocessor based systems ?
- (a) To increase the speed of data transfer between the  $\mu P$  and the I/O devices
  - (b) To increase the speed of data transfer between the  $\mu P$  and the memory
  - (c) To increase the speed of data transfer between the memory and the I/O devices
  - (d) To improve the reliability of the system

115. Personal computer cannot be used for which one of the following ?

- (a) Game playing
- (b) Weather forecasting
- (c) Office Automation
- (d) Home computing

**Directions :**

Each of the next Five (5) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

Codes :

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is *not* the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

116. Assertion (A) : A fixed bias BJT circuit exhibits better performance as compared to a self bias BJT circuit.

Reason (R) : A fixed bias BJT circuit uses less components as compared to a self bias BJT circuit.

117. Assertion (A) : The small signal analysis of a transistor amplifier is done to obtain the current gain, voltage gain and the conversion efficiency of an amplifier.

Reason (R) : The small signal analysis of a transistor amplifier uses the small signal parameters of the transistor.

118. Assertion (A) : A rectifier with inductor filter is more efficient for high load current.

Reason (R) : In rectifier with inductor filter we can use a larger choke to reduce ripple, larger choke will have higher dc resistance which will result in lower dc output voltage for higher load current.

119. Assertion (A) : It is not desirable to drive a transistor into hard saturation in high speed switching circuits.

Reason (R) : It may not be possible to bring it back to cut off state, if it is driven into hard saturation.

120. Assertion (A) : When all inputs of a NAND-gate are shorted to get a one input, one output gate, it becomes an inverter.

Reason (R) : When all inputs of a NAND-gate are at logic '0' level, the output is at logic '1' level.

# IES 2009 Solutions

## Electronics & Telecommunication Engineering (Paper-I)

Q. No.	Booklet Series			
	A	B	C	D
1.	b	a	b	a
2.	a	d	b	c
3.	b	b	b	a
4.	c	d	a	c
5.	c	a	a	a
6.	c	d	c	d
7.	d	c	a	d
8.	d	d	c	c
9.	d	d	c	c
10.	b	a	a	c
11.	a	a	b	c
12.	a	b	a	c
13.	c	c	d	a
14.	a	b	d	c
15.	d	b	a	c
16.	c	a	c	b
17.	b	c	c	d
18.	a	a	c	a
19.	d	c	c	b
20.	c	c	a	c
21.	b	b	b	c
22.	b	a	a	d
23.	b	a	c	b
24.	d	c	c	d
25.	d	d	b	d
26.	d	c	a	a
27.	c	d	a	b
28.	c	a	a	b
29.	a	d	b	d
30.	b	b	b	c

Q. No.	Booklet Series			
	A	B	C	D
31.	a	b	a	b
32.	d	b	c	a
33.	b	b	a	b
34.	d	a	c	c
35.	a	a	a	c
36.	d	c	d	c
37.	c	a	d	d
38.	d	c	c	d
39.	d	c	c	d
40.	a	a	c	b
41.	a	b	c	a
42.	b	a	c	a
43.	c	d	a	c
44.	b	d	c	a
45.	b	a	c	d
46.	a	c	b	c
47.	c	c	d	b
48.	a	c	a	a
49.	c	c	b	d
50.	c	a	c	c
51.	b	b	c	b
52.	a	a	d	b
53.	a	c	b	b
54.	c	c	d	d
55.	d	b	d	d
56.	c	a	a	d
57.	d	a	b	c
58.	a	a	b	c
59.	c	a	d	d
60.	b	b	c	b

Q. No.	Booklet Series			
	A	B	C	D
61.	b	a	b	a
62.	b	c	a	d
63.	b	a	b	b
64.	a	c	c	d
65.	a	a	c	a
66.	c	d	c	d
67.	a	d	d	c
68.	c	c	d	d
69.	c	c	d	b
70.	a	c	b	a
71.	b	c	a	a
72.	a	c	a	b
73.	d	a	c	c
74.	d	c	a	b
75.	a	c	d	b
76.	c	b	c	a
77.	c	d	b	c
78.	c	a	a	a
79.	c	b	d	c
80.	a	c	c	c
81.	b	c	b	b
82.	a	d	b	a
83.	c	b	b	a
84.	c	d	d	c
85.	b	d	d	d
86.	a	a	d	c
87.	a	b	c	d
88.	a	b	c	a
89.	a	d	a	d
90.	b	c	b	b

Q. No.	Booklet Series			
	A	B	C	D
91.	a	b	a	b
92.	c	a	d	b
93.	a	b	b	b
94.	c	c	d	a
95.	a	c	a	d
96.	d	c	d	c
97.	d	d	c	a
98.	c	d	d	b
99.	c	d	d	c
100.	c	b	a	a
101.	c	a	a	b
102.	c	a	b	a
103.	a	c	c	d
104.	c	a	b	d
105.	c	d	b	a
106.	b	c	a	c
107.	d	b	c	c
108.	a	a	a	c
109.	b	d	c	c
110.	c	c	c	a
111.	c	b	b	b
112.	d	b	a	a
113.	b	b	a	c
114.	d	d	c	c
115.	d	d	d	b
116.	a	d	c	a
117.	b	c	d	a
118.	b	c	a	a
119.	d	a	d	b
120.	c	b	b	b

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Q. No.	Booklet Series			
	A	B	C	D
1.	a	a	c	b
2.	b	d	a	c
3.	c	d	d	a
4.	b	a	c	b
5.	c	c	a	d
6.	a	d	d	c
7.	a	a	d	d
8.	d	d	d	b
9.	d	b	b	d
10.	a	b	d	c
11.	d	a	d	b
12.	d	a	d	d
13.	d	b	b	a
14.	a	d	a	a
15.	b	a	c	c
16.	b	d	d	d
17.	d	a	d	a
18.	b	c	c	d
19.	a	d	b	a
20.	c	d	b	b
21.	d	c	d	c
22.	c	a	d	a
23.	d	a	c	a
24.	c	d	c	c
25.	c	d	b	b
26.	d	c	b	d
27.	a	c	c	d
28.	d	d	c	a
29.	d	a	d	c
30.	d	b	b	b

Q. No.	Booklet Series			
	A	B	C	D
31.	a	c	b	a
32.	d	a	c	b
33.	d	d	a	c
34.	a	c	b	b
35.	c	a	d	c
36.	d	d	c	a
37.	a	d	d	a
38.	d	d	b	d
39.	b	b	d	d
40.	b	d	c	a
41.	a	d	b	d
42.	a	d	d	d
43.	b	b	a	d
44.	d	a	a	a
45.	a	c	c	b
46.	d	d	d	b
47.	a	d	a	d
48.	c	c	d	b
49.	d	b	a	a
50.	d	b	b	c
51.	c	d	c	d
52.	a	d	a	c
53.	a	c	a	d
54.	d	c	c	c
55.	d	b	b	c
56.	c	b	d	d
57.	c	c	d	a
58.	d	c	a	d
59.	a	a	c	b
60.	b	b	b	d

Q. No.	Booklet Series			
	A	B	C	D
61.	c	b	a	a
62.	a	c	b	d
63.	d	a	c	d
64.	c	b	b	a
65.	a	d	c	c
66.	d	c	a	d
67.	d	d	a	a
68.	d	b	d	d
69.	b	d	d	b
70.	d	c	a	b
71.	d	b	d	a
72.	d	d	d	a
73.	b	a	d	b
74.	a	a	a	d
75.	c	c	b	a
76.	d	d	b	d
77.	d	a	d	a
78.	c	d	b	c
79.	b	a	a	d
80.	b	b	c	d
81.	d	c	d	c
82.	d	a	c	a
83.	c	a	d	a
84.	c	c	c	d
85.	b	b	c	d
86.	b	d	d	c
87.	c	d	a	c
88.	c	a	d	d
89.	d	c	d	b
90.	b	b	d	b

Q. No.	Booklet Series			
	A	B	C	D
91.	b	a	a	c
92.	c	b	d	a
93.	a	c	d	d
94.	b	b	a	c
95.	d	c	c	a
96.	c	a	d	d
97.	d	a	a	d
98.	b	d	d	d
99.	d	d	b	b
100.	c	a	b	d
101.	b	d	a	d
102.	d	d	a	d
103.	a	d	b	b
104.	a	a	d	a
105.	c	b	a	c
106.	d	b	d	d
107.	a	d	a	d
108.	d	b	c	c
109.	a	a	d	b
110.	b	c	d	b
111.	c	d	c	d
112.	a	c	a	d
113.	a	d	a	c
114.	c	c	d	c
115.	b	c	d	b
116.	d	d	c	b
117.	d	a	c	c
118.	a	d	d	c
119.	c	d	a	d
120.	b	d	b	b