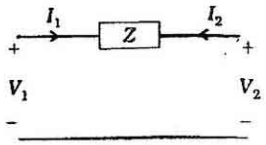
ELECTRONICS & TELECOMMUNICATION ENGINEERING

IES PAPER–I (2001)

1.



Which one of the following parameters does not exist for the two-port network shown in the given figure?

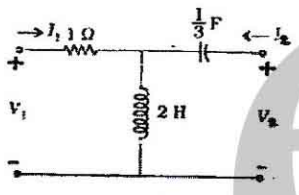
a. ABCD

b. y

c. h

d. z

2.



z-matrix for the network shown in the given figure is

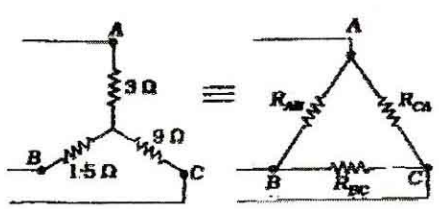
a. $\begin{bmatrix} 2s+1 & 2s \\ 2s & 2s+\frac{3}{s} \end{bmatrix}$

b. $\begin{bmatrix} 2s+1 & -2s \\ -2s & 2s+\frac{3}{s} \end{bmatrix}$

c. $\begin{bmatrix} 2s+1 & +2s \\ -2s & 2s+3/s \end{bmatrix}$

d. $\begin{bmatrix} 2s+\frac{3}{2} & -2s \\ 2s & 2s+3/s \end{bmatrix}$

3.



For the equivalent Y=Δ circuit shown in the given figure, the values of R_{AB} and R_{BC} are respectively

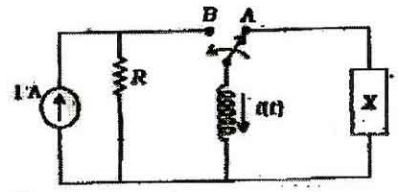
a. 5Ω and 15Ω

b. 30Ω and 5Ω

c. 15Ω and 30Ω

d. 20Ω and 35Ω

4. For the circuit shown in the given figure, when the switch is at position A, the current i(t) = I sin (ωt + 300) A. When switch is moved to position B at time t = 0, the power dissipated at the switching instant in the resistor R remains unchanged



The value of I and the element X would respectively, be

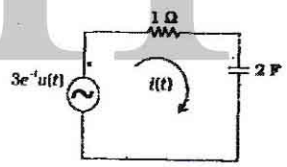
a. 1 A and resistor

b. 2 A and capacitor

c. 3 A and resistor

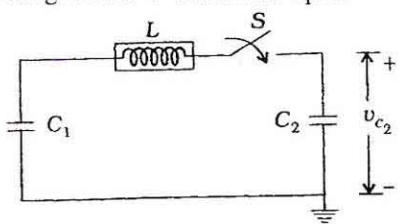
d. 4 A and capacitor

5.



In the circuit shown in the given figure, the values of $i(0^+)$ and $I(\infty)$ will be, respectively

6. In the circuit shown in the given figure, $C_1 = C_2 = 2F$ and the capacitor C_1 has a voltage of 20 V when S is open.



It the switch S is closed at t = 0 the voltage V_{C_2} will be a

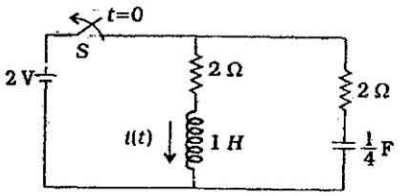
a. Fixed voltage of 20 V

b. fixed voltage of 10 V

c. fixed voltage of -10 V

d. sinusoidal voltage

7. The circuit shown in the given figure is in the steady state with the switch S closed



The current 1(t) after S is opened at t = 0 is

a. a decreasing exponential
b. an increasing exponential
c. a damped sinusoid
d. oscillatory

8. A resistor R of 1 Ω and two inductors L_1 and L_2 of inductances 1H and 2H, respectively, are connected in parallel. At some time, the currents through L_1 and L_2 are 1A and 2A, respectively. The current through R at time t = will be

a. zero
b. 1 A
c. 2 A
d. 3 A

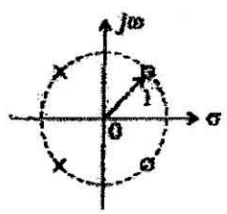
9. A unit step current is applied to a network consisting of only passive elements. The voltage across the current source observed is $v(t) = (1 + e^{-t/\tau})$. The simplest possible network will consist of the elements

a. 1 resistor and 2 capacitors
b. 1 resistor and 2 inductors
c. 2 resistors and 1 capacitor
d. 2 resistors and 1 inductor

10. If the numerator of a second -order transfer function F(s) a constant, then the filter is a is

a. band - pass filter
b. band - stop filter
c. high - pass filter
d. low - pass filter

11.



The pole-zero patterns shown in the given figure is for

a. a low - pass filter
b. a high-pass filter
c. an all - pass filter
d. a band - pass filter

12. If a function $f(t)u(t)$ is shifted to right side by t_0, then the function can be expressed as

a. $f(t-t_0)u(t)$
b. $f(t)u(t-t_0)$
c. $f(t-t_0)u(t-t_0)$
d. $f(t+t_0)u(t+t_0)$

13. The dual of a parallel R – C circuit is a

a. Series R – C circuit
b. Series R – L circuit
c. Parallel R – C circuit
d. Parallel R – L circuit

14. Driving point impedance $Z(s)=\dfrac{s(s^2+1)}{s^2+4}$ is not realizable because the

a. number of zeros is more than the number of poles
b. poles and zeros lie on the imaginary axis
c. poles and zeros do not alternate on imaginary axis
d. poles and zeros are not located on the real axis

15. The function $s+2+\dfrac{3}{s}$ can be realized

a. both as a driving point impedance and as a driving point admittance
b. as an impedance, but not as an admittance
c. as an admittance, but not as an impedance neither
d. as an impedance nor as an admittance

16. If $F(s)=\dfrac{2s+5}{s^2+5s+6}$, then $f(t)$ is given by

a. $e^{-2.5t}[\cosh 0.5t+\sinh 0.5t]$
b. $e^{2.5t}[\cosh 0.5t+\sinh 0.5t]$
c. $\sqrt{2}e^{-2.5t}\sin(0.5t+45°)$
d. $e^{-2.5t}[\cos 0.5t+\sin 0.5t]$

17. If R, L, C and G are the resistance, inductance, capacitance and conductance of a transmission line respectively, then

the condition for distortion less transmission line is

a. $R/C = GIL$

b. $RC = LG$

c. $R^2C = G^2L$

d. $RC^2 = GL^2$

18. 18. The energy stored per unit volume in an electric field (with usual notations) is given by

a. $1/2\ \varepsilon H^2$

b. $1/2\ \varepsilon E$

c. $1/2\ \varepsilon E^2$

d. εE^2

19. A positive charge of Q coulombs is located at point A(0, 0, 3) and, a negative charge of magnitude Q coulombs is located at point B(0, 0, -3). The electric field intensity at point C(4, 0, 0) is in the

a. negative x-direction

b. negative z-direction

c. positive x-direction

d. positive z-direction

20. The 'force between two points charges of 1 nC each with a 1 mm separation in air is

a. 9×10^{-3} N

b. 9×10^{-6} N

c. 9×10^{-9} N

d. 9×10^{-12} N

21. A 3 μF capacitor is charged by a constant current of 2 μA for 6 seconds. The voltage across the capacitor at the end of charging will be

a. 3 V

b. 4 V

c. 6 V

d. 9 V

22. Consider the following statements:

A parallel plane capacitor is filled with a dielectric of relative permittivity εr_1 and connected to a d.c. voltage of V volts. If the dielectric is changed to another with relative permittivity $\varepsilon r_2 = 2\varepsilon r_1$ keeping the voltage constant; then

1. the electric field intensity $\bar{E}$ within the capacitor doubles.
2. the displacement flux density D doubles.
3. the charge Q on the plates is reduced to half.
4. the energy stored in the capacitor is doubled.

Select the correct answer using the codes given below

a. 1 and 2

b. 2 and 3

c. 2 and 4

d. 3 and 4

23. Laplace equation in cylindrical coordinates is given by

a. $\nabla^2 V = \frac{1}{r}\frac{\partial}{\partial r}\left(\frac{r\partial V}{\partial r}\right) + \frac{1}{r^2}\left(\frac{\partial^2 V}{\partial \phi^2}\right) + \frac{\partial^2 V}{\partial z^2} = 0$

b. $\nabla^2 V = \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2}$

c. $\nabla^2 V = \frac{\rho}{\varepsilon}$

d. $\nabla^2 V = \frac{1}{r}\frac{\partial}{\partial r}\left(\frac{r^2\partial V}{\partial r}\right) + \frac{1}{r^2 \sin\theta}\frac{\partial}{\partial \theta}\left(\sin\theta \frac{\partial V}{\partial \theta}\right) + \frac{1}{r^2 \sin^2\theta}\frac{\partial^2 V}{\partial \phi^2} = 0$

24. Gauss law relates the electric field intensity $\bar{E}$ with the volume charge density ρ at a point as

a. $\nabla \times \bar{E} = \varepsilon_0 \rho$

b. $\nabla . \bar{E} = \varepsilon_0 \rho$

c. $\nabla \times \bar{E} = \rho / \varepsilon_0$

d. $\nabla . \bar{E} = \rho / \varepsilon_0$

25. The input impedance of $\lambda/8$ long short-circuited section of a lossless transmission line is

a. zero

b. inductive

c. capacitive

d. infinite

26. Match List I (Parameters) with List II (Values) for a transmission line with a series impedance $Z = R + j\omega L\ \Omega/m$ and a shunt admittance $Y = G + j\omega C$ mho/m, and select the correct answer:

List I

A. Characteristic impedance Z_0

B. Propagation constant y

C. The sending-end input impedance Z_0 when the line is terminated in its characteristic impedance Z_0

List II

1. $\sqrt{ZY}$

2. $\sqrt{Z/Y}$
3. $\sqrt{Y/Z}$

Codes;

	A	B	C
a.	3	1	1
b.	2	3	3
c.	2	1	2
d.	1	2	2

27. A boundary separates two magnetic materials of permeability μ_1 and μ_2. The magnetic field vector in μ_1 is H_1 with a normal component Hn_1 and tangential component Ht_1 while that in μ_2 is H_2 with a normal component Hn_2, and a tangential component Ht_2. Then the derived conditions would be

a. $H_1 = H_2$ *and* $H_{t_2} = H_{t_2}$

b. $H_{t_1} = H_2$ *and* $\mu_1 H_{n_1} = \mu_2 H_{n_2}$

c. $H_1 = H_2$ *and* $\mu_1 H_{n_1} = \mu_2 H_{n_2}$

d. $H_1 = H_2, H_{t_1} = H_{t_2}$ *and* $\mu_1 H_{n_1} = \mu_2 H_{n_2}$

28. For frequencies up to 1650 kHz, the transmitting antenna used is a

a. Parabolic dish
b. Vertical antenna
c. Yagi antenna
d. Turnstile antenna

29. The radiation field of an antenna at a distance r varies as

a. 1/r
b. $1/r^2$
c. $1/r^3$
d. $1/r^4$

30. The wave radiate by a helical antenna is

a. Linearly polarized
b. Right circularly polarized
c. Left circularly polarized
d. Elliptically polarized

31. Which one of the following is NOT a correct Maxwell equation?

a. $\nabla \times \bar{H} = \frac{\partial \bar{D}}{\partial t} + \bar{J}$

b. $\nabla \times \bar{E} = \frac{\partial \bar{H}}{\partial t}$

c. $\bar{\nabla}.\bar{D} = \rho$

d. $\bar{\nabla}\,\bar{B} = 0$

32. In a certain micro strip path antenna, the unexcited patch is of length L, width W, thickness of the substrate being h and its relative permittivity ε_r. Then, the capacitance of the unexcited patch is

a. $LW/\varepsilon_r h$

b. $LW/\varepsilon_0 \varepsilon_r h$

c. $\varepsilon_r LW/h$

d. $\varepsilon_0 \varepsilon_r LW/h$

33. Match List I (Maxwell equation) with List II (Description) and select the correct answer:

List I

A. $\oint \vec{B}.d\vec{a} = 0$

B. $\oint \vec{D}.d\vec{a} = \int_v \rho dV$

C. $\oint \vec{E}.d\vec{s} = -\oint B.da$

D. $\oint \vec{H}.d\vec{s} = \oint (D + J).da$

List II

1. The mmf around a closed path is equal to the conduction current plus the time derivative of the electric displacement current through any surface bounded by the path
2. The emf around a closed path is equal to the time derivative of the magnetic displacement through any surface bounded by the path
3. The total electric displacement through the surface enclosing a volume is equal to the total charge within the volume
4. The net magnetic flux emerging through any closed surface is zero

Codes;

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

34. In a uniform plane wave the value of $|E|/|H|$ is

a. $\sqrt{\mu/\varepsilon}$

b. $\sqrt{\varepsilon/\mu}$

c. 1

d. $\sqrt{\mu\varepsilon}$

35. For a hollow waveguide, the axial current must necessarily be
    a. a combination of conduction and displacement currents
    b. conduction current only
    c. time - varying conduction current and displacement current
    d. displacement current only

36. A cylindrical cavity resonates at 9 GHz in the T_{111} mode. The bandwidth 3 dB is measured to be 2.4 MHz. The Q of the cavity at 9 GHz is
    a. $9000/2.4\sqrt{3}$
    b. $9000/2.4\sqrt{2}$
    c. $9000 \times 2.4\ \sqrt{3}/\sqrt{2}$
    d. 9000/2.4

37. The phenomenon of microwave signals following the curvature of earth is known as
    a. Faraday effect
    b. ducting
    c. wave tilt
    d. troposcatter

38. A radio communication link is to be established via the ionosphere. The virtual height at the mid-point of the path is 300 km and the critical frequency is 9 MHz. The maximum usable frequency for the link between the stations of distance 800 km assuming flat earth. is
    a. 11.25 MHz
    b. 12 MHz
    c. 15 MHz
    d. 25.5 MHz

39. Which one of the following statements is NOT correct for a plane wave with $\bar{H} = 0.5e^{-0.1x}\cos\left(10^6 t - 2x\right)\hat{a}_z A/m$
    a. The wave frequency is 10^6 r.p.s.
    b. The wavelength is 3.14 m
    c. The wave travels along + x-direction
    d. The wave is polarized in the z-direction

40. A coil of resistance of 5 Ω and inductance 0.4 H is connected to a 50 V d.c. supply. The energy stored in the field is
    a. 10 joules
    b. 20 joules
    c. 40 joules
    d. 80 joules

41. The resistivity of the wire material can be expressed in terms of LMTI system of dimensional parameter as
    a. $ML^2T^{-2}I^{-2}$
    b. $ML^2T^{-3}I^{-2}$
    c. $ML^3T^{-3}I^{-2}$
    d. $ML^3T^{-2}I^{-2}$

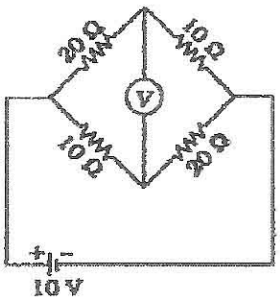
42. A 0 - 150 V voltmeter has an accuracy of 1% of full-scale reading. The voltage measured by the instrument is 75 V. The limiting error is
    a. 1%
    b. 2%
    c. 2.5%
    d. 3%

43. Which one of the following is the best definition of accuracy?
    a. It is the measure of consistency or reproducibility of measurements
    b. it is the ratio of the change in output signal to the change in input signal
    c. It is the smallest change in measurable input
    d. It is the closeness with which an instrument reading approaches the true value of the quantity being measured

44. 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 was a circle. The value of ϕ is
    a. Zero
    b. $\pi/4$
    c. $\pi/2$
    d. π

45. An op-amp has open-loop gain 100000 and the open- loop upper cut-off frequency is 20 Hz. The unity-gain frequency of the op-amp is
    a. 2MHz
    b. 1 MHz
    c. 3 kHz
    d. 2 kHz

46.



The reading of high impedance voltmeter V in the bridge circuit shown in the given figure is

a. zero
b. 3.33 V
c. 4.20 V
d. 6.66 V

47. Digital measuring instruments use the following three types of A to D converters

1. Dual Slope Type
2. Counter Type
3. Flash Type

The correct sequence for .these converters in decreasing order of their speed (fastest to slowest) is

a. 3, 1, 2
b. 1, 2, 3
c. 2, 3, 1
d. 3, 2, 1

48. Consider the following statements regarding the advantages of Anderson bridge:

1. It is the modification of the Maxwell's inductance-capacitance bridge.
2. For measuring the low Q of coils, it is superior to the Maxwell's bridge.
3. It is simple compared to Maxwell's bridge.
4. It can be used to determine mutual inductance also

Which of these statements are correct?

a. 1, 2 and 3
b. 1, 2 and 4
c. 2 and 4
d. 1, 3 and 4

49. Match List I (Bridges) with List II (Quantities) and select the correct answer

List I

A. Maxwell's bridge
B. Wien bridge
C. Hay's bridge
D. Schering bridge

List II

1. Frequency
2. Inductance with value of Q < 10
3. Capacitance
4. Inductance with value of Q > 10

Codes;

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

50. Consider the following statements associated with electrical/electronic transducers

1. Mass-inertia effects are minimized.
2. These transducers consume very little power.
3. The response time is large.
4. Transmission and processing the signal for the purpose of measurement are easier.

Select the correct answer using the codes given below

a. 1, 2 and 3
b. 2, 3 and 4
c. 1, 3 and 4
d. 1, 2 and 4

51. Consider the following statements:

A transducer converts

1. mechanical energy mo electrical energy.
2. mechanical displacement into electrical signal.
3. one form of energy into another form of energy:
4. electrical energy into mechanical form.

Which of these statements is/are correct?

a. 1 and 4
b. 1 and 2
c. 3 alone
d. 1 alone

52. Match list I (Transducers) with List II (Measured Quantities) and select the correct answer

List I

A. Capacitive transducer
B. Thermocouple
C. Load cell

D. Diaphragm

List II

1. Pressure
2. Torque
3. Displacement
4. Temperature

Codes;

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

53. Gauge factor of a strain gauge is defined as the ratio of a per unit change in the
   a. conductivity to the per unit change in applied force acting on the element
   b. resistance to the per unit change in the length of the element
   c. stress to the per unit change in strain of the element
   d. current to the per unit change in the length of the element

54. A variable reluctance type tachometer has 60 rotor teeth, the records 3600 counts/minutes. The device speed is
   a. 60 r.p.s.
   b. 1800 r.p.s.
   c. 3600 r.p.s.
   d. 7200 r.p.s.

55. Hot wire anemometer is a device used to measure the
   a. pressure in gases
   b. liquid discharge
   c. gas velocities
   d. temperature

56. Consider the following devices
   1. Anemometer
   2. Stroboscope
   3. Accelerometer

   The correct sequence of these devices to measure the rotational speed, vibration and airflow, respectively is,
   a. 2, 3 and 1
   b. 2, 1 and 3
   c. 1, 3 and 2
   d. 3, 2 and 1

57. The pH value of a solution is defined as
   a. - log (H^+ on concentration)
   b. log (H^+ ion concentration)
   c. - $\log^{-1}$ / (OH^- ion concentration)
   d. - log (OH^- ion concentration)

58. The piezoelectric crystal voltage sensitivity is defined as a
   a. voltage developed per unit stress
   b. field developed per unit stress
   c. voltage developed per unit force
   d. field developed per unit force

59. The bandwidth of an n-bit binary coded PCM signal for an original signal bandwidth of B Hz is
   a. B Hz
   b. nB Hz
   c. $\frac{B}{n}Hz$
   d. n^2B Hz

60. For an AM wave, the maximum voltage was found to be 10 V and the minimum voltage was found to be 5 V. The modulation index of the wave would be
   a. 0.33
   b. 0.52
   c. 0.40
   d. 0.1

61. The FM telemetry as compared with AM telemetry requires a channel that is
   a. equal to that of AM telemetry
   b. smaller than what is. required for AM telemetry
   c. 100 times of. that required for AM telemetry
   d. 10 times of that required for AM telemetry

62. As the Fermi energy of silver is 8.8×10^{-19} joule, the velocity of the fastest electron in silver at 0 K (Given : Rest mass of electron = 9.1×10^{-31} kg) is
   a. 3.33×10^5 m/s
   b. 1.39×10^6 m/s
   c. 4.40×10^7 m/s
   d. 3×10^8 m/s

63. A four-point probe method is used to evaluate the sheet resistance of a semiconductor epitaxial layer. If a probe current of 10 mA produces a voltage drop of 0.22 V between the inner probes, then. the sheet resistance of the layer is
   a. 100 Ω/square
   b. 215 Ω/square

c. 572 Ω/square
d. 1000 Ω/square

64. For which of the following semiconductors, resistance does not follow Ohm's law over some specific range of the applied voltage?
1. Germanium
2. Gallium arsenide
3. Iridium phosphide
Select the correct answer using the codes given below:
a. 1, 2 and 3
b. 1 and 2
c. 2 and 3
d. 1 and 3

65. Electron mobility and life-time In a semiconductor at room temperature are respectively 0.36 $m^2/(V\ s)$ and 340 μs. The diffusion length is
a. 3.13 mm
b. 1.77 mm
c. 3.55 mm
d. 3.13 cm

66. A piezoelectric crystal has Young's modulus of 130 GPa. The uniaxial stress that must be applied to increase its polarization from 550 to 555 C m^2 is, nearly
a. 2.798 GPa
b. 2.175 GPa
c. 1.593 GPa
d. 1.182 GPa

67. The outermost electronic configuration of a cobalt atom is $3d^24s^2$. Its magnetic moment is
a. 9 Bohr magnetons
b. 7 Bohr magnetons
c. 5 Bohr magnetons
d. 3 Bohr magnetons

68. Match list I with List II and select the correct answer:
List I (Applications)
A. Permanent magnets
B. High frequency (MHz) applications
C. Electromagnets
D. Very high frequency(GHz)applications
List II (Magnetic materials)
1. Ferrites
2. Hard magnetic material
3. Garnets
4. Soft magnetic materials
Codes;

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

69. Match list I with list II and select the correct answer:
A. Ferro-magnetism
B. Semiconductor
C. Optical property of solid
D. Superconductivity
List II.
1. d.c. electrical resistivity vanishes at the critical temperature T_C
2. Doping with impurity increases the electrical conductivity
3. An internal molecular field B_M which is proportional to magnetization M exists at each dipole ar 'igns it parallel to other dipoles
4. Above the Neel temperature the dipoles become randomly oriented
5. The conductivity of crystalline semiconductors and dielectrics increased by radiation incident
Codes;

	A	B	C	D
a.	3	5	2	1
b.	3	2	5	1
c.	4	5	2	3
d.	4	2	5	3

70. Consider the following statements:
The dielectric constant of an insulator depends on
1. applied voltage
2. frequency of the alternating field applied.
3. temperature
4. maximum current density in insulator.
Select the correct answer using the codes given below:
a. 1 and 2
b. 1 and 3
c. 2 and 3
d. 3 and 4

71. Which of the following statements are correct for ceramic materials?
1. They are inorganic substances.
2. They are brittle.
3. They are good thermal insulators.

Select the correct answer using the codes given below:
a. 1, 2 and 3
b. 1 and 2
c. 2 and 3
d. 1 and 3

72. Laser emission from Ruby crystal is because of transition
a. from conduction band to valence band Al_2O_3
b. from conduction band to one of the levels due to Cr ions
c. between energy levels introduced by Cr ions
d. between one of the levels due to Cr ion and valence band of Al_2O_3

73. Wire-wound resistances are used only when
a. Precision is essential
b. low values are required
c. high power rating is necessary
d. costly equipments are manufactured

74. Consider the following statements:
In a transformer, the core material should have low
1. coercivity
2. retentivity
3. permeability

Which of these statements are correct?
a. 1 and 2
b. 2 and 3
c. 1 and 3
d. 1, 2 and 3

75. Consider the following statements:
Impurity diffusion is used in semiconductor to control the conductivity. The nature of the impurity profile should be such that the
1. Impurity concentration decreases with diffusion depth.
2. Profile results in an internal electric field.
3. Impurity concentration is homogeneous with no internal electric field.
4. Which of these statements are correct?
a. 1, 2 and 3
b. 1 and 3
c. 2 and 3
d. 1 and 2

76. An one - sided abrupt junction has 10^{21} per m^3 of dopants on the lightly doped side, zero bias voltage and a built- in potential of 0.2 V. The depletion width of the abrupt junction (taking $q = 1.6 \times 10^{-19}$ C, $\varepsilon_0 = 16$ and $\varepsilon_0 = 8.875 \times 10^{-12}$ F/m) is
a. 0.036 nm
b. 0.6 μm
c. 3 μm
d. 1.5 mm

77. Which of the following statements relate to the Hall effect?
1. A potential difference is developed across a current-carrying metal strip when the strip is placed in a transverse magnetic field.
2. The Hall effect is very weak in metals but is large in semiconductors.
3. The Hall effect is very weak in semiconductors but is large in metals.
4. it is applied in the measurement of the magnetic field intensity.
a. 1, 2 and 3
b. 2 and 4
c. 1, 3 and 4
d. 1, 2 and 4

78. The output current versus input voltage transfer characteristic of an n-channel JFET is such that there is
a. zero current flow t zero input voltage bias
b. current flow only when a positive input threshold voltage is crossed
c. current flow only when a negative input cut-off voltage bias is crossed
d. no cut-off input voltage

79. An. SCR triggered by a current pulse through its gate can be turned off by
a. giving another pulse of the same polarity to the. gate
b. by giving pulse to the cathode
c. by giving pulse to the anode

d. by reversing the polarity of anode and cathode voltage

80. In an MOS transistor, the gate source input impedance is

1. lower than the input impedance of a BJT
2. higher than the input impedance of a BJT
3. lower than the input impedance of a JFET
4. higher than the input impedance of a JFET

a. 1 alone
b. 2 and 3
c. 4 alone
d. 2 and 4

81. At 25°C, the collector-emitter voltage drop of a silicon transistor at saturation is approximately

a. 0.1 V
b. 0.3 V
c. 0.5 V
d. 0.7 V

82. The reverse bias breakdown of high speed silicon transistors is due to

a. avalanche breakdown mechanism at both the junctions
b. Zener breakdown mechanism at both the junctions
c. Zener breakdown mechanism at base-collector junction and avalanche breakdown mechanism at base-emitter junction
d. Zener breakdown mechanism at base-emitter junction and avalanche breakdown mechanism at base-collector junction

83. In the fabrication of a buried layer n-p-n transistor, the processes involved are

1. diffusion
2. oxidation
3. epitaxy
4. lithography

The correct sequence in which these processes are to be carried out, is

a. 2, 4, 3, 1
b. 4, 2, 1, 3
c. 2, 4, 1, 3
d. 4, 2, 3, 1

84. Match List I (Operating point on the I -V characteristic) with List II (Devices) and select the correct answer:

List I

A. 1st quadrant
B. 2nd quadrant
C. 3rd quadrant
D. 4th quadrant

List II

1. Solar cell
2. Photo detector with high sensitivity
3. Photo detector with low sensitivity
4. Rectifier diode

Codes;

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

85. Assertion (A): A circuit containing reactances is said to be in resonance if the voltage across the circuit is in phase with the current through it.

Reason (R): At resonance, the power factor of the circuit s zero.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

86. Assertion (A): Programmes broadcast by radio stations operating in the medium wave band of 550 to 1650 kHz situated at long distances in excess of 500 km cannot be heard during day-time but may be heard during night-time.

Reason (R): In the night-time, radio waves reflected from the F-layer suffer negligible attenuation since D- and E-layers are absent during the night-time.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

87. Assertion (A): For an end-fire array, the current in successive antennas must lag in phase.

Reason (R): Radiation of successive antennas will

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

88. Assertion (A): The radio horizon for space wave is more than the optical horizon.

Reason(R): The atmosphere has varying density

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

89. Assertion (A): Any indicating instrument should have a damping torque.

Reason (R): Without a damping torque, the pointer takes more settling time.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

90. Assertion (A): Potentiometric type accelerometers have higher resolution than LVDT accelerometer.

Reason (R): The resistance offered to the motion is less in LVDT accelerometers than in Potentiometric accelerometer.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

91. Assertion (A): In superconducting state, both entropy and thermal conductivity decrease.

Reason (R): Superconductivity results basically due to zero atomic vibration of crystal structure.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

92. Assertion (A): Copper as an impurity in germanium has an ionization energy of 0.25 eV whereas Boron has ionization energy of 0.01 eV.

Reason (R): Copper is an interstitial impurity whereas Boron is a substitutional impurity.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

93. Assertion (A): The semiconductor devices like BJTs have a maximum temperature of operation, beyond which they do no function.

Reason (R): Extrinsic, *p*-type and *n*-type semiconductors behave as intrinsic beyond that temperature and the effect of doping is lost.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

94. The discrete time system described by $y(n) = x(n^2)$ is

a. causal, linear and time-varying
b. causal, non-linear and time-varying
c. non-causal, linear and time-invariant
d. non-causal, non-linear and time-variant

95. Which one of the following transfer functions does correspond to a non-minimum phase system?

a. $\frac{s}{s^2+2s+1}$
b. $\frac{s+1}{s^2+2s+1}$
c. $\frac{s+1}{s^2+2s-1}$
d. $\frac{s-1}{s^2+2s+1}$

96. The signal $x(t) = A\cos(\omega_0 t + \phi)$ is

a. an energy signal
b. a power signal

c. an energy as well as a power signal
d. neither an energy nor a power signal

97. Which one of the following digital filters does have a linear phase response?
a. $y(n) + y(n-1) = x(n) - x(n-1)$
b. $y(n) = 1/6\,[3x(n) + 2x(n-1) + x(n-2)]$
c. $y(n) = 1/6\,[x(n) + 2x(n-1) + 3x(n-2)]$
d. $y(n) = 1/4\,[x(n) + 2x(n-1) + x(n-2)]$

98. For the system described by X = AX match List I (Matrix A) with List II (Position of eigenvalues) and select the correct answers:

List I

A. $\begin{bmatrix} -1 & 2 \\ 0 & -2 \end{bmatrix}$

B. $\begin{bmatrix} -1 & -2 \\ -2 & -4 \end{bmatrix}$

C. $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 \\ 2 & 4 \end{bmatrix}$

List II

1. One eigenvalue at the origin
2. Both the eigenvalues in the LHP
3. Both the eigenvalues in RHP
4. Both the eigenvalues on the imaginary axis

Codes;

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

99. For the system dynamics described by differential equation $y + 3y + 2y = u(t)$ the transfer function of the system represented in controllable canonical form is $C[sI - A]^{-1} B$. The matric A would be

a. $\begin{bmatrix} 0 & 1 \\ -3 & -2 \end{bmatrix}$

b. $\begin{bmatrix} 0 & 1 \\ 2 & 3 \end{bmatrix}$

c. $\begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$

d. $\begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$

100. If $x_1(t) = 2\sin \pi t + \cos 4\pi t$ and $x_2(t) = \sin 5\pi t + 3\sin 13\pi t$, then
a. x_1 and x_2 both are periodic
b. x_1 and x_2 both are not periodic
c. x_1 is periodic, but x_2 is not periodic
d. x_1 is not periodic, but x_2 is periodic

101. The Fourier transform of a double-sided exponential signal $x(t) = e^{-b|t|}$
a. is $2b/(b^2 + \omega^2)$
b. $\dfrac{e^{-j^{-\tan^{(\omega/b)}}}}{(b^2 + \omega^2)}$
c. does not exist
d. exists only when it is single sided

102. The Fourier transform of ii(t) is
a. $1/j\omega$
b. $j\omega$
c. $1/(1 + j\omega)$
d. $\pi\delta(\omega) + 1/j\omega$

103. Match List I with List II and select the correct answer:

List I

A. e^{-as}

B. $\dfrac{1-s}{1+s}$

C. $\dfrac{1+as}{1+bs}, a < b$

D. $\dfrac{K}{s(1+as)}$

List II

1. All-pass filter
2. Transport delay
3. Lag network
4. Servomotor

Codes;

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

104. A linear network has the system function $H\dfrac{(s+c)}{(s+a)(s+b)}$

The outputs of the network with zero initial conditions for two different inputs are tabled as

Input x(t)	Output y(t)
u(t)	$2 + De^{-t} + Ee^{-3t}$
e^{-2t} u(t)	$Fe^{-t} + Ge^{-3t}$

Then the values values of c and H are, respectively
a. 2 and 3
b. 3 and 2
c. 2 and 2
d. 1 and 3

105. Two identical first-order systems have been cascaded non-interactively. The unit step response of the systems will be
a. oveixiamped
b. underdamped
c. undamped
d. critically damped

106. Which one of the following is the response y(t) of a causal LTI system described by

$$H(s)=\frac{(s+1)}{s^2+2s+2}$$

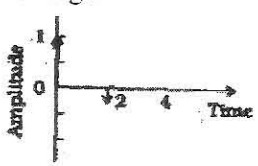
For a given input $x(t)=e^{-t}t(t)$?
a. $y(t)=e^{-t}\sin tu(t)$
b. $y(t)=e^{-(t-1)}\sin(t-1)u(t-1)$
c. $y(t)=\sin(t-1)u(t-1)$
d. $y(t)=e^{-t}\cos tu(t)$

107. The poles of a digital filter with linear phase response can lie
a. Only at z = 0
b. Only on the unit circle
c. Only inside the unit circle but not at z = 0
d. On the left side of Real (z) = 0 line

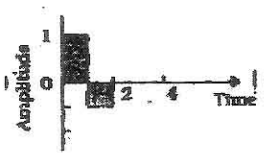
108. If $y(t)+\int_0^t y(\tau)\times(t-\tau)d\tau=\delta(t)+x(t)$, is
a. u(t)
b. τ(t)
c. r(t)
d. 1

109. The impulse response of a system is h(t) = δ(t - 0.5) If two such systems are cascaded, the impulse response of the overall system will be
a. 0.5δ(t - 0.25)
b. δ (t - 0.25)
c. δ (t - 1)
d. 0.5δ(t - 1)

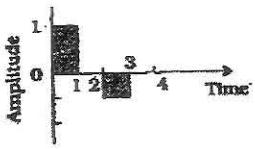
110. The impulse response of a system consists of two delta functions as shown in the given figure



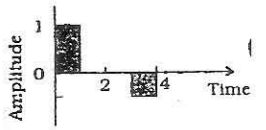
The input to the system is a unit amplitude square pulse of one unit time duration. Which one of the following diagrams depicts the correct output?
a.



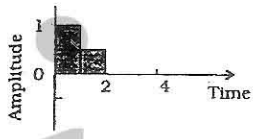
b.



c



d.

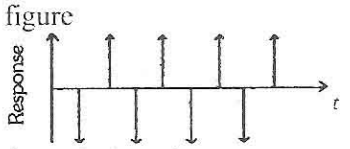


111. The minimum, number of delay elements required in realizing a digital filter with the transfer function

$$H(z)=\frac{1+az^{-1}+bz^{-2}}{1+cz^{-1}+dz^{-2}+ez^{-3}}$$ is
a. 2
b. 3
c. 4
d. 5

112. A signal x(t) = 6 cos 10πt is sampled at the rate of 14 Hz. To recover the original signal, the cut-off frequency f_c of the ideal low-pass filter should be
a. $5Hz < f_c < 9Hz$
b. 9 Hz
c. 10 Hz
d. 14 Hz

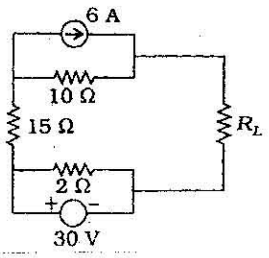
113. The impulse response of a discrete system with a simple pole is shown in the given figure



The pole must be located
a. on the real axis at z = 1
b. at the origin of the z-plane
c. on the real axis at z = - 1

d. at $z = \infty$

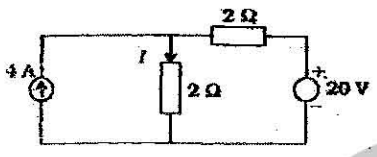
114.



In the circuit shown in the given figure, RL will absorb maximum power when its value is

a. 2.75 Ω
b. 7.5 Ω
c. 25 Ω
d. 27 Ω

115.



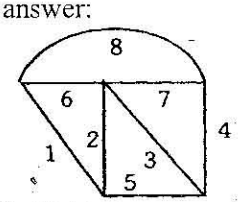
For the given circuit, the current I is

a. 2 A
b. 5 A
c. 7 A
d. 9 A

116. In a linear circuit, the principle can be superposition applied to calculate the

a. voltage and power
b. voltage and current
c. current and power
d. voltage, current and power

117. Match List X with List Y for the tree branches 1, 2, 3 and 8 of the graph shown in the given figure and select the correct answer:



List X

A. Twigs
B. Links
C. Fundamental cutset
D. Fundamental loop

List Y

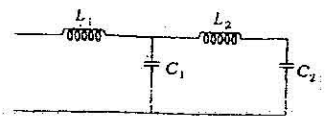
1. 4, 5 6, 7
2. 1, 2, 3, 8
3. 1, 2, 3, 4
4. 6, 7, 8

Codes;

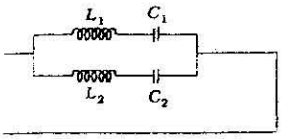
	A	B	C	D
a.	1	2	3	4
b.	3	2	1	4
c.	1	4	3	2
d.	3	4	1	2

118. The first Cauer form realization of the driving point reactance $\frac{2(s^2+a)(s^2+c)}{s(s^2+b)}; a<b<c$ is

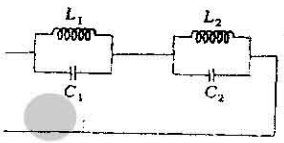
a.



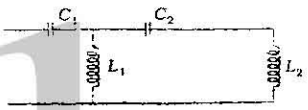
b.



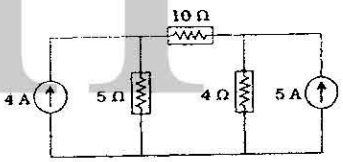
c.



d.



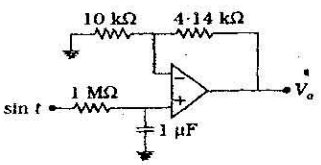
119.



In the circuit shown in the given figure, power dissipated in the 5 Ω resistor is

a. zero
b. 80 W
c. 125 W
d. 405 W

120.



In the circuit shown n the given figure, V_0 is given by

a. sin (t - π/4)
b. sin (t + π/4)
c. sin t
d. cos t