ELECTRONICS & TELECOMMUNICATION ENGINEERING

PAPER-I

1. Why are askerals not used as transformer or capacitor insulation?
   a. They have low dielectric strength
   b. Their density is high
   c. They decomposes easily giving out toxic gases
   d. They are highly inflammable

2. A solid specimen of dielectric has relative permittivity $\varepsilon_r = 4.2$ and loss angle $\tan \delta = 0001$ at 50 Hz frequency. If it is subjected to an electrical stress of 50 k V/cm, what is the heat generated in the specimen due to dielectric loss?
   a. 291 W/cm^3
   b. 5.82 mW/cm^3
   c. 19.5 W/cm^3
   d. 0.291 mW/cm^3

3. Match List-I (Material/Characteristics) with List-II (Superconductor kind) and select the correct answer using the code given below the Lists

   List-I
   A. Incomplete Meissner's effect, high critical field and transition temperature. Absence of Silsbee's rule
   B. Meissners effect and Silsbee's Rule
   C. Amorphous thin films of Be, Bi and Fi

   List-II
   1. Hard superconductor
   2. Soft superconductor
   3. Superconductor

   Codes:

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

4. The dielectric constant of an insulating material is given by $\varepsilon = \varepsilon' - i\varepsilon''$
   If a parallel plate capacitor of plate area A and separator d is filled with this material, what would be the loss factor?
   a. $\tan^{-1}\left[(A\varepsilon')/(d\varepsilon'')\right]$
   b. $(A\varepsilon')/(d\varepsilon'')$
   c. $\varepsilon''/\varepsilon'$
   d. $\tan^{-1}\left[(d\varepsilon'')/(A\varepsilon')\right]$

5. Consider the following statements
   Electrical conductivity of a metal has negative temperature coefficient since
   1. Electron concentration increases with temperature.
   2. Electron mobility decreases with temperature.
   3. Electron-lattice scattering increases with temperature.

   Which of the statements given above are correct?
   a. 1, 2 and 3
   b. Only 1 and 2
   c. Only 2 and 3
   d. Only 1 and 3

6. What is the correct arrangement of the following alloys in decreasing order of resistivity?
   a. German silver — constantan — monel metal
   b. German silver — monel metal — constantan
   c. Constantan — monel metal — German silver
   d. Constantan — German silver — monel metal

7. Match List-I (Material) with List-II (Carrier Concentration/m^3) and select the correct answer using the code given below
   List-I
   A. Intrinsic semiconductor
   B. Insulator
   C. Extrinsic semiconductor
   D. Conductor
   List-II
   1. 10^{28}

2. 10^{22}

3. 10^{18}

4. 10^{14}

Codes:

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

8. Mobility is defined as
   a. Diffusion velocity per unit field
   b. Drift velocity per unit field
   c. Displacement per unit field
   d. Number of free electrons/number of bound electrons

9. In a crystal lattice, what are the vacancies created by the absence of certain atoms known as?
   a. Hertz defects
   b. Schottky defects
   c. Pauli defects
   d. Crystal defects

10.
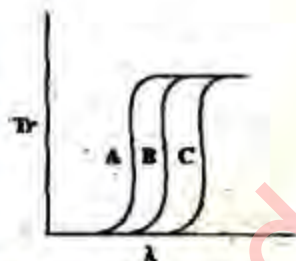
Photovoltaic devices may be made from various semiconductors as optical materials for which the transmission coefficient (Tr) is shown in the figure given above as a function of photon wavelength.

Which one of the following is the correct sequence of A, B and C pertaining to Ge. GaAs and Si, respectively?
   a. A – B – C
   b. B – A – C
   c. C – A – B
   d. C – B – A

11. Piezoelectricity is the reverse effect of:
   a. Electroluminescence
   b. Electrostriction
   c. Peltier effect
   d. Hall effect

12. Consider the following statements related to a shunt generator
   1. The full load voltage is lower than no load voltage.
   2. The above lowering is partly due to voltage drop in armature resistance.
   3. The field current does not change with load and has no effect on generated voltage.

   Which of the statements given above are correct?
   a. 1, 2 and 3
   b. Only 1 and 2
   c. Only 2 and 3
   d. Only 1 and 3

13. The piezoelectric effect is the polarization of a dielectric under the influence of:
   a. Light
   b. Mechanical stress
   c. Electrical stress
   d. Heat

14. Consider the following statements in respect of a quartz crystal.
   1. Quartz displays ferroelectric behaviour
   2. Quartz is used in electric oscillator circuits.
   3. Quartz crystal is formed by repeating silicate tetrahedrons.

   Which of the statements given above are correct?
   a. 1, 2 and 3
   b. Only 1 and 2
   c. Only 2 and
   d. 3 Only 1 and 3

15. Which of these ceramic materials have relative permittivity ε_r between 3 to 6 and loss angle tan δ between 50×10^{-4} to 100×10^{-4}?
   a. Strontium zirconate ($SrZrO_3$) (b) Titanium oxide (TiO_2)
   b. Calcium titanate ($CaTiO_3$)
   c. Barium titanate ($BaTiO_3$)

16. Potassium Dihydrogen Phosphate (KDP) crystals are used to produce second harmonics of optical frequencies. Which one of the following is an important requirement?

a. Their susceptibility should be a constant

b. Their susceptibility should be an odd function of applied electric field

c. Their susceptibility should vary with square of the applied electric field

d. Their susceptibility should exhibit a peak at the second harmonic frequency

17. When a positive d.c. voltage is applied to the n-side relative to p-side, a diode is said to be given a

a. Forward bias

b. Reverse bias

c. Zero bias

d. Neutral bias

18. A parallel plate capacitor has a homogeneous dielectric slab of area 4 cm^2 and thickness 1 cm with $\varepsilon_r = 4$. If a cubic air void of 1 mm^3 is developed in the volume of the dielectric slab, then

a. the average voltage stress in the dielectric material will increase and discharge free rating of the capacitor will increase

b. the average voltage stress in the dielectric material will increase and discharge free rating of the capacitor will decrease

c. the average voltage stress in the dielectric material will decrease and discharge free rating of the capacitor will decrease

d. the average voltage stress in the dielectric material will decrease and discharge free rating of the capacitor will increase

19. Match List-I (Material) with List-II (Energy Level) and select the correct answer using the code given below

List-I

A. p-type semiconductor at 0 K temperature

B. Intrinsic semiconductor at 0 K temperature

C. n-type semiconductor at room temperature

D. p-type semiconductor at room temperature

List - II

1. Donor energy level is close to the conduction band

2. Acceptor energy level is close to the valence band

3. Fermi-level is very close to valence band

4. Fermi-level is half-way between the valence band and the conduction band

Codes;

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

20. In addition to conduction, which one of the following mechanisms can account for the transport of charges in a semiconductor (not ordinarily encountered in metals)?

a. E.M.F. generated within the body of the semiconductor

b. Mutual attraction between charges

c. Mutual repulsion between charges

d. Diffusion

21. The electron concentration in a silicon sample doped with 10^{15} cm^{-3} P atoms, will vary, in the temperature range of 4.2 - 1000 K, as follows:

a. It will be 10^{15} cm^3 over the whole range

b. It will be 10^{15} cm^3 upto a temperature T at which intrinsic concentration is 10^{15} cm^3 and then it will increase exponentially

c. It will first increase exponentially upto a temperature T then remain constant at 10^{15} cm^3 over the remaining range

d. It will first increase exponentially upto a temperature T_1 then remain constant at 10^{15} cm^{-3} upto a temperature T_2 and then increase exponentially

22. Match List-I (Current) with List-II (Variation) and select the correct answer using the code given below the lists

List-I

A. Hole fission current

B. Electron drift current

C. Hole drift current

D. Electron diffusion current

List - II

1. n.E
2. p.E
3. - dp/dx
4. dn/dx

Codes:

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

23. Match List-I (Device) with List-II (Application) and select the correct answer using the code given below the lists

List-I

A. Hall element
B. Varactor diode
C. SCR
D. Schottky barrier diode

List - II

1. Power control
2. Microwave mixer
3. Tuning element in tank circuit
4. Sensor

Codes:

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

24. Which of the following can be determined by using a Hall crystal?

1. Concentration of holes in a p-type semiconductor.
2. Concentration of electrons in an n-type semiconductor.
3. Temperature of the setup with any type of semiconductor.
4. Diffusion constant and life-time of minority carriers of any type of semiconductor.

Select the correct answer using the code given below

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

25. Consider a Ge diode operating at 27°C and just beyond the threshold voltage of Ge. What is the value of dv/dT?

a. − 1.9 mV/°C
b. − 2.0 mV/°C
c. − 2.1 mV/°C
d. − 2.3 mV/°C

26. The widths of the base in a GaAs transistor and in a Si transistor (both n-p-n type) are equal. GaAs transistor works at higher frequency.

Which one of the following is the correct statement?

a. The band gap of GaAs is higher than that of Si.
b. The base transit time is lower in GaAs.
c. The negative differential mobility in GaAs favours operation at very high frequency
d. Si transistor works at higher frequency compared to GaAs transistor

27. Match List-I (Device) with List-II (Associated Term) and select the correct answer using the code given below the lists:

List-I

A. Diode
B. S.C.R
C. BJ.T.
D. F.E.T.

List-II

1. Pinch off voltage
2. Holding current
3. Forward resistance
4. Active region

Codes:

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

28. Consider the following statements:

FETs when compared to BJTs have

1. high input impedance.
2. current flow due to majority carriers.
3. low input impedance.
4. current flow due to minority carriers.

Which of the statements given above are correct?

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

29. The di/dt protection for an SCR is achieved through the use of

a. R in series with SCR
b. RL in series with SCR
c. RL across SCR
d. L in series with SCR

30. What are the different methods followed to take p — n — p — n device from its conducting state to the non-conducting state?

1. Reducing 'the anode current below the holding value.
2. Reducing the gate current to zero.
3. Reducing the gate voltage to zero.
4. Reducing anode voltage below the holding value.

Select the correct answer using the codes given below:

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

31. Match List-I (Power Device) with List-II (Maximum Operating Frequency) and select the correct answer using the code given below the lists

List-I
A. Bipolar transistors
B. Power MOSFET
C. Silicon controlled rectifier
D. Insulated gate bipolar transistor

List-II
1. 1 MHz
2. 100 kHz
3. 1 kHz
4. 10 khz

Codes:

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

32. An I.C. operational amplifier has a typical open loop gain of 1200 and the common mode rejection of 55 dB. What is the common mode rejection ratio (CMRR)?

a. 550
b. 560
c. 570
d. 580

33. In integrated circuits, the design of electronic circuits is based on the approach of the use of

a. maximum number of resistors in the circuit
b. large sized capacitor
c. minimum chip area irrespective of the type of components in the design
d. use of only bipolar transistors

34. Consider the following statements describing the property of a complementary MOS (CMOS) inverter

1. It is a combination of an n-channel FET and a p-channel FET
2. There is power dissipation when the input carries the logical 1 signal.
3. There is no power -dissipation when the input carries the logical 0 signal.
4. There is power dissipation during transition from 0 to 1 or from 1 to 0.

Which of the statements given above are correct?

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

35. Photons of energy 1.53×10^{-19} Joule are incident on a photodiode which has a responsivity of 065 A/W. If the optical power level is 10 µW. what is the photo current generated?

a. 64 nA
b. 1.5 µA
c. 2.1 µA
d. 6.5 µA

36. x[n] is defined as

$$x[n] = \begin{cases} 0 & for < -4 \ and \ n > 2 \\ 1 & otherwise \end{cases}$$

Determine the value of n for which x[- n - 2] is guaranteed to be zero.

a. n < 1 and n > 7

b. n <- 4 and n > 2

c. n <- 6 and n > 0

d. n <- 2 and n > 4

37. Match List-I (Application of Signals) with List-II (Defamation) and select the correct answer using the code given below

List-I

A. Reconstruction

B. Over sampling

C. Interpolation

D. Decimation

List -II

1. Sampling rate is chosen significantly greater than the Nyquist rate

2. A mixture of continuous and discrete time signals

3. To convert the discrete time sequence back to a continuous time signal and then resample

4. Assign values between samples and signals

Codes:

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

38. Which one of the following is the correct statement?

The continuous time system described by $y(t) = x(t^2)$ is

a. causal, linear and time-varying

b. causal, non-linear and time-varying

c. non-causal, non-linear and time-invariant

d. non-causal and time-variant

39. The discrete-time signal x[n] is given as

$$x[n] = \begin{cases} 1 & n=1,2 \\ -1 & n=-1,-2 \\ 0, & n=0 \text{ and } |n|>2 \end{cases}$$

Which one of the following is the time-shifted signal $y[n] = x[n+3]$?

a. $y[n] = \begin{cases} 1 & n=-1,-2 \\ -1, & n=-4,-5 \\ 0, & n=-3, n<-5 \text{ and } n>-1 \end{cases}$

b. $y[n] = \begin{cases} 1 & n=-1,-2 \\ -1, & n=-4,-5 \\ 1, & n=-3, n<-5 \text{ and } n>-1 \end{cases}$

c. $y[n] = \begin{cases} 1 & n=-1,-2 \\ 0 & n=-4,-5 \\ -1. & n=-3, n<-5 \text{ and } n>-1 \end{cases}$

d. $y[n] = \begin{cases} -1 & n=1,2 \\ 1. & n=4,5 \\ 0. & n=3, n>5 \text{ and } n<1 \end{cases}$

40.
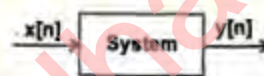
For the system shown, x[n] = kδ[n], and y[n] is related to x[n] as y[n] - 1/2y[n – 1] = x[n]

What is y[n] equal to?

a. k

b. $(1/2)^n$k

c. nk

d. 2^n

41. For continuous-time systems, state variable representation is

$$\frac{d}{dt}q(t) = Aq(t) + bx(t)$$

What is the corresponding representation for discrete-time system?

a. d/dt q[n] = A q[n] + bx[n]

b. q[n + 1] = A q[n] + bx[n]

c. q[n] = Aq[n - 1] + bx[n]

d. d/dn[q(n + 1)] = Aq[n - 1] + bx[n - 1]

42. If the Fourier transform of x(t) is 2/ω sin (πw) then what is the Fourier transform of $e^{i5t}x(t)$?

a. $\frac{2}{\omega - 5}\sin(\pi\omega)$

b. $\frac{2}{\omega}\sin\{\pi(\omega - 5)\}$

c. $\frac{2}{\omega + 5}\sin\{\pi(\omega + 5)\}$

d. $\dfrac{2}{\omega-5}\sin\{\pi(\omega-5)\}$

43. What is $F(s)=\dfrac{8s+10}{(s+1)(s+2)^3}$ equal to?

a. $\dfrac{2}{s+1}+\dfrac{4}{(s+2)^3}-\dfrac{4}{(s+2)^2}-\dfrac{2}{s+2}$

b. $\dfrac{2}{s+1}+\dfrac{6}{(s+2)^3}-\dfrac{2}{(s+2)^2}-\dfrac{2}{s+2}$

c. $\dfrac{2}{s+1}+\dfrac{6}{(s+2)^3}-\dfrac{2}{(s+2)^2}+\dfrac{2}{s+2}$

d. $\dfrac{4}{s+1}+\dfrac{6}{(s+2)^3}-\dfrac{2}{(s+2)^2}-\dfrac{4}{s+2}$

44. For the function x(t), x(s) is given by:

$$x(s)=e^{-s}\left[\dfrac{-2}{s(s+2)}\right]$$

Then, what are the initial and final values of x(t), respectively?

a. 0 and 1
b. 0 and -1
c. 1 and 1
d. -1 and 0

45. The Laplace transform X(s) of a function x(t) is

$$X(s)=(1-e^{-sT})/s$$

What is the wave shape of x(t)?

a.
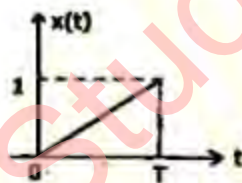
b.
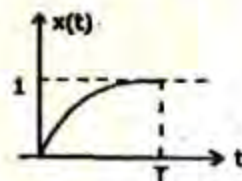
c.
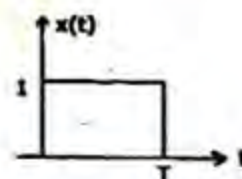
d.
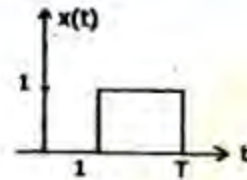
46. What is the inverse Fourier transform of u(ω)?

a. $\dfrac{1}{2}\delta(t)+\dfrac{1}{\pi t}$

b. $\dfrac{1}{2}\delta(t)$

c. $2\delta(t)+\dfrac{1}{\pi t}$

d. $2\delta(t)+\sin(t)$

47. Match List-I (CT Function) with List-II (CT Fourier Transform) and select the correct answer using the code given below the lists:

List I

A. $e^{-t}u(t)$

B. $x(t)=\begin{cases}1 & |t|\le1\\0, & |t|>1\end{cases}$

C. $\dfrac{dx(t)}{dt}$

D. $\dfrac{2}{1+t^2}$

List II

1. $\dfrac{2}{1+\omega^2}$

2. $j\omega X(j\omega)$

3. $\dfrac{1}{1+j\omega}$

4. $\dfrac{2\sin\omega}{\omega}$

Codes:

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

48. Which one of the following is the correct statement?

The system characterized by the equation $y(t) = ax(t) + b$ is

a. linear for any value of b
b. linear if $b > 0$
c. linear if $b < 0$
d. non-linear

49. What is the Laplace transform of $x(t) = -e^{2t}u(t) * (tu(t))$?

a. $\dfrac{-1}{s^2(s+2)}$

b. $\dfrac{-1}{s^2(s-2)}$

c. $\dfrac{1}{s^2(s-2)}$

d. $\dfrac{-1}{s(s-2)}$

50. What is the inverse z transform of $X(z)$?

a. $\dfrac{1}{2\pi j}\oint X(z)z^{n-1}dz$

b. $2j\oint X(z)z^{n+1}dz$

c. $\dfrac{1}{2\pi j}\oint X(z)z^{1-n}dz$

d. $2\pi j\oint X(z)z^{-(1+n)}dz$

51. The impulse response of a system $h(n) = a^n u(n)$. What is the condition for the system to be BIBO stable?

a. a is real and positive
b. a is real and negative
c. $|a| > 1$
d. $|a| < 1$

52. Which one of the following statements is the correct statement?

The region of convergence of z transform of $x[n]$ consists of the values of z for which $x[n]\, r^{-n}$ is

a. absolutely integrable
b. absolutely summable
c. unity
d. < 1

53. Match List-I (Type) with List-II (Application) and select the correct answer using the code given below the lists:

List-I
A. Speech signal
B. Non-stationary signal
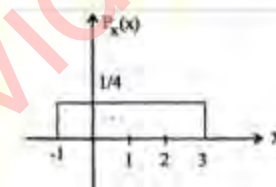C. Random signal
D. Chaotic signal

List I
1. The received signal of a radar system monitoring variation in prevalent weather condition
2. One dimensional signal where amplitude varies with time
3. Signals of coupled system of nonlinear difference equation
4. Ensemble of unpredictable waveforms

Codes:

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

54.

For a random variable x having the probability density function (PDF) as shown in the above figure, what are the values of the mean and the variance, respectively?

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

55. Which of the following terms can be applied to any network - linear or non-linear, active or passive, time-variant or time- invariant?

a. Thevenin theorem
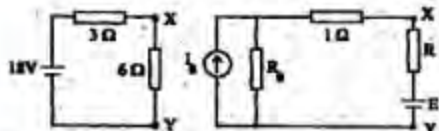b. Norton theorem
c. Tellegen theorem
d. Superposition theorem

56.
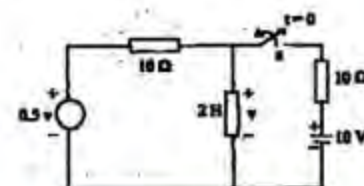
The circuit shown above is under steady-state condition with the switch closed. The switch is opened at t = 0. What is the time constant of the circuit?

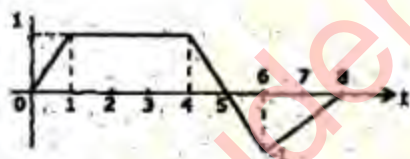a. 0.1 s
b. 0.2s
c. 5 s
d. 10 s

57.

If the two circuits shown above are equivalent, then which of the following is/are correct?

1. E = 2V, R = 5Ω
2. E = 4V, R = 4Ω
3. E = 6V, R = 3Ω
4. E = 10V, R = 1Ω

Select the correct answer using the codes given below:
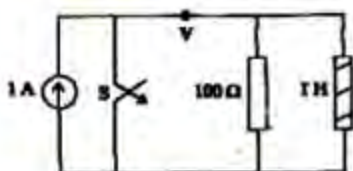
a. Only 1 and 2
b. Only 3
c. 1, 2, 3 and 4
d. None

58.

The Laplace transform of the waveform shown in the figure is

$$\frac{1}{s^2}\left(1 + Ae^{-s} + Be^{-3s} + Ce^{-6s} + De^{-8s}\right)$$
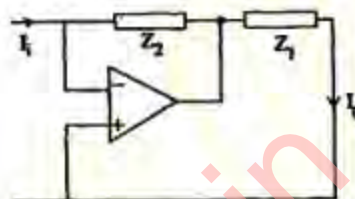
What is the value of D?

a. −0.5
b. −1.5
c. 0.5
d. 2.0

59.

If the switch S in the circuit shown above is opened at t = 0, what are the values of v(0⁺) and dv/dt (0⁺), respectively?

a. 100 V, 10,000 V/s
b. 100 V, −10,000 V/s
c. −100 V, 10,000 V/s
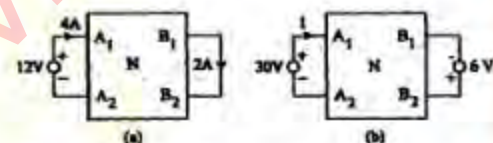d. −100 V, −10,000 V/s

60.

In the circuit shown above, what is the value of transfer function I_0/I_i?

a. $-Z_2/Z_1$
b. $-Z_1/Z_2$
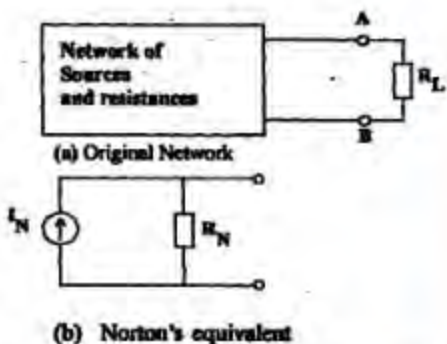c. $1 - (Z_2/Z_1)$
d. $1 - (Z_1/Z_2)$

61.

(a)   (b)

The terminal volt-ampere conditions of a linear reciprocal network N are shown in the figure (a). What is the current I corresponding to the terminal conditions shown in the figure (b)?

a. −1A
b. 9A
c. 10 A
d. 11 A
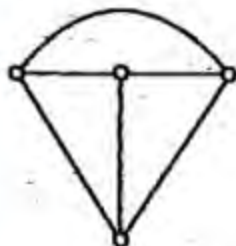
62.

(a) Original Network

(b) Norton's equivalent

A network with independent sources and resistors shown above in figure (a) has a Thevenin voltage V_T and Thevenin

resistance R_T. What are the Norton equivalent current I_N and resistance R_N in the figure (b)?

a. $\dfrac{V_T}{\left(\dfrac{R_T R_L}{R_T + R_L}\right)}, \dfrac{R_T R_L}{R_T + R_L}$

b. $\dfrac{V_T}{R_T}, R_N = R_T$
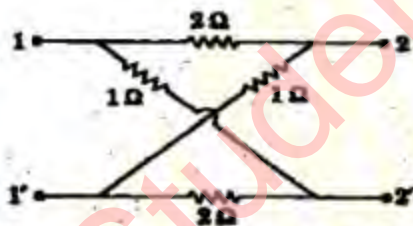
c. $\dfrac{V_T}{R_L}, R_N = R_L$

d. None of the above

63.

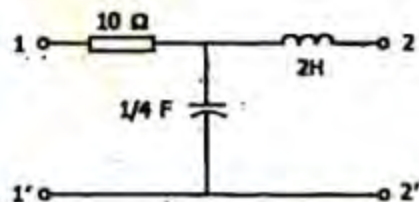What is the total number of trees for the graph shown above?

a. 4
b. 8
c. 12
d. 16

64.

What is the value of z_{21} for the network shown above?

a. $-2\,\Omega$
b. $-1/2\,\Omega$
c. $1\,\Omega$
d. $2\,\Omega$

65.

What is the open circuit impedance $Z'_{11}(s)$ of the network shown in the figure given above?

a. $10 + 2s$

b. $\left(10 - \dfrac{4}{s}\right)$

c. $\left(10 + \dfrac{4}{s}\right)$

d. $10 - 2s$

66. Which of the following are the conditions for a two port passive network to be reciprocal one?

1. $z_{12} = z_{21}$
2. $y_{12} = y_{21}$
3. $h_{12} = -h_{21}$

Select the correct condition from the code given below:

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

67. What is the characteristic impedance Z_0 of a line having resistance R, inductance L, capacitance C and conductance G?
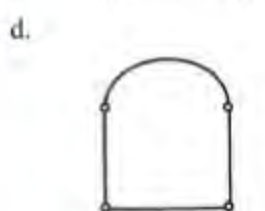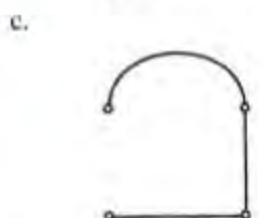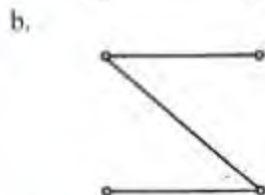
a. $\sqrt{\dfrac{R + j\omega L}{G + j\omega C}}$

b. $\sqrt{\dfrac{G + j\omega C}{R + j\omega L}}$

c. $R + j\omega L - \dfrac{G}{\omega C}$

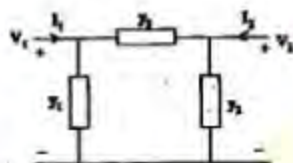d. $\sqrt{R^2 + \left(\omega L - \dfrac{1}{\omega C}\right)^2}$

68.

For the network graph shown in the figure given above, which one of the following is not a tree?

a.

b.

c.

d.

69.

Equivalent π network

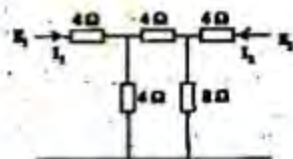The currents I_1 and I_2 at the output of 2-port network can be written as

$I_1 = 5V_1 - V_2$

$I_2 = -V_1 + V_2$

Which one of the following gives the parameters of an equivalent π network shown above?

a. $y_1 = 4\,\mho, y_2 = 0, y_3 = 1\,\mho$

b. $y_1 = 4\,\mho, y_2 = 4\,\mho, y_3 = 1\,\mho$

c. $y_1 = 1\,\mho, y_2 = 1\,\mho, y_3 = 1\,\mho$

d. $y_1 = 4\,\mho, y_2 = 0, y_3 = 2\,\mho$

70.

What is the value of the parameter h12 for the 2-port network shown in the figure give above?

a. 0.125Ω

b. $0.167\ \Omega$

c. $0.250\ \Omega$

d. 0.625 mho

71.
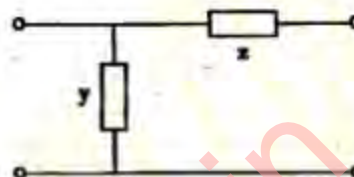
Which one of the following is the transmission matrix for the network shown in the figure given above?

a. $\begin{bmatrix} 1 & 1+yz \\ y & z \end{bmatrix}$

b. $\begin{bmatrix} 1+yz & z \\ y & 1 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 2 \\ 0.1 & 4 \end{bmatrix}$

d. $\begin{bmatrix} 1 & 1+yz \\ z & y \end{bmatrix}$

72. Two 2-port networks with transmission matrices,

$T_A = \begin{bmatrix} 1 & 2 \\ 0.1 & 4 \end{bmatrix}$ and $T_B = \begin{bmatrix} 2 & 4 \\ 0.5 & 3 \end{bmatrix}$

are connected in cascade. Which is the transmission matrix of the combination?

a. $\begin{bmatrix} 3 & 10 \\ 2.2 & 12.4 \end{bmatrix}$

b. $\begin{bmatrix} 3 & 6 \\ 0.2 & 12.4 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 10 \\ 2.0 & 12.0 \end{bmatrix}$

d. $\begin{bmatrix} 3 & 10 \\ 12.4 & 2.2 \end{bmatrix}$

73.
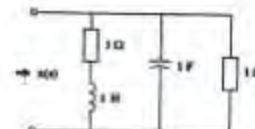
For the network shown in the figure given above, what is the value of z/s?

a. $\dfrac{s^2 + 2s + 2}{s + 1}$

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

c. $\dfrac{s + 1}{s^2 + 2s + 2}$

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

74. If Y_1 and Y_2 are the RC driving point admittance and impedance function, respectively, such that $\dfrac{Y_1}{Y_2} = \dfrac{(s + 1)(s + 3)}{(s + 2)^2}$

then, the value of Y_2 can be

1. $\dfrac{s + 3}{s + 2}$

2. $\dfrac{s + 2}{s + 1}$

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

4. $s + 2$

Which of the above are correct?

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

75. A parallel plate capacitor of 5 pF capacitance has a charge of 0.1 μC on its plates. What is the energy stored in the capacitor?

a. 1 mJ
b. 1 μJ
c. 1 nJ
d. 1 pJ

76. Equipotential surfaces about a point charge are in which one of the following forms?

a. Spheres
b. Planes
c. Cylinders
d. Cubes

77. Which one of the following is the correct expression for torque .on a loop in magnetic field $\vec{B}$? (Here $\vec{M}$ is the loop moment)

a. $\vec{T} = \nabla . \vec{B}$
b. $\vec{T} = \vec{M} . \vec{B}$
c. $\vec{T} = \vec{M} \times \vec{B}$
d. $\vec{T} = \vec{B} . \vec{M}$

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

List-I

A. Line charge
B. Magnetic flux density
C. Displacement current
D. Power flow

List-II

1. Maxwell
2. Poynting vector
3. Biot-Savart's law
4. Gauss's law

Codes:

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

79. What does the expression $\dfrac{1}{2} \vec{J} \vec{A}$ represent?

a. Electric energy density
b. Magnetic energy density
c. Power density
d. Radiation resistance

80. Consider the following statements regarding an electrostatic field:

1. It is irrotational.
2. It is solenoidal.
3. It is static only from a macroscopic view point.
4. Work done in moving a charge in the field from one point to another is independent of the path of movement.

Which of the statements given above are correct?

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

c. Only 2 and 4

d. 1, 3 and 4

81. Which one of the following statements is correct?

   a. Both Laplace's and Poisson's equations are non-linear equations

   b. Laplace's equation is non-linear but Poisson's equation is linear

   c. Laplace's equation is linear but Poisson's equation is non-linear

   d. Both Laplace's and Poisson's equations are linear

82. A charge of 1 Coulomb is placed near a grounded conducting plate at a distance of 1 m. What is the force between them?

   a. $\dfrac{1}{4\pi\varepsilon_0}N$

   b. $\dfrac{1}{8\pi\varepsilon_0}N$

   c. $\dfrac{1}{16\pi\varepsilon_0}N$

   d. $4\pi\varepsilon_0 N$

83. Which one of the following is the correct statement?

   A rectangular coaxial line can support

   a. only TEM mode of propagation

   b. both TEM and TE modes of propagation

   c. either TE or TM mode of propagation

   d. TEM, TE or TM mode of propagation

84. Match List-I (Electromagnetic Law) with List-II (Differential Form) and select the correct answer using the code given below the lists:

List-I

A. Ampere's law

B. Faraday's law

C. Gauss Law

D. Current continuity equation

List II

1. $\nabla \cdot \vec{D} = \rho_v$

2. $\nabla \cdot \vec{J} = -\dfrac{\partial h}{\partial t}$

3. $\nabla \times \vec{H} = \vec{J} + \dfrac{\partial \vec{D}}{\partial t}$

4. $\nabla \times \vec{E} = -\dfrac{\partial \vec{B}}{\partial t}$

Codes;

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

85. Which one of the following modes has the highest cut-off wavelength in a rectangular waveguide?

   a. TE_{10}

   b. TE_{01}

   c. TM_{01}

   d. TM_{11}

86. The electric field component of a wave in free space is given by $E = 50\sin\left(10^7 t + kz\right)\hat{j}V/m.$

Which one of the following is the correct inference that can be drawn from this expression?

   a. The wave propagates along y-axis

   b. The wavelength is 188.5 m

   c. The wave number k = 0.33 rad/m

   d. The wave attenuates as it travels

87. Which one of the following is the characteristic impedance of lossless transmission line?

   a. $\sqrt{R/G}$

   b. $\sqrt{L/G}$

   c. $\sqrt{L/C}$

   d. $\sqrt{R/C}$

88. Match List-I (Quantity) with List-II (Range of Values) and select the correct answer using the code given below the lists:

List-I

A. Input impedance

B. Reflection coefficient

C. VSWR

List II

1. -1 to $+1$

2. 1 to ∞

3. 0 to ∞

Codes:

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

89. A quarter wave impedance transformers is a terminated by short circuit. What would its input impedance be equal to?

a. The line characteristic impedance

b. Zero

c. Infinity

d. Square root of the line characteristic impedance

90. Scattering parameters are more suited than impedance parameters to describe a waveguide junction because

a. the scattering parameters are frequency invariant whereas the impedance parameters are not so

b. scattering matrix is always unitary

c. impedance parameters vary over unacceptably wide ranges

d. scattering parameters are directly measurable but impedance parameters are not so

91. Match List-I (Type of Antenna) with List-II (Example) and select the correct answer using the code given below the lists:

List I

A. Aperture antenna

B. Circularly polarized antenna

C. Frequency independent antenna

D. Isotropic antenna

List -II

1. Helical antenna

2. Point source

3. Log periodic antenna

4. Microstrip antenna

Codes

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

92. A meter having a sensitivity of 2 k Ω/V is used for the measurement of voltage across a circuit having an output resistance of 1 kΩ and an open circuit voltage of 8 V. What is the reading of the meter at its 10 V scale?

a. 5.72V

b. 6.51V

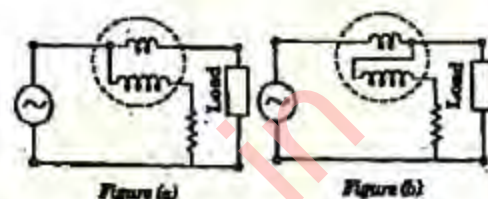c. 7.62 V

d. 7.91 V

93.

Figure (a)   *Figure (b)*

Consider the following statements in respect of two types of a dynamometer wattmeter connection as shown above in figure (a) and figure (b):

1. Figure (a) is used when applied voltage is high and load current flowing is low.

2. Figure (b) is used when applied voltage is low and load current flowing is high.

3. If the order of connections in Statements 1 and 2 are in opposite order, gross error will be increased.

4. If the order of connections in Statements 1 and 2 are in opposite order, gross error will be reduced.
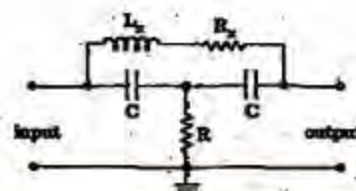
Which of the statements given above are correct?

a. Only 1 and 2

b. Only 1 and 3

c. 1, 2 and 3

d. 1, 2 and 4

94. Kelvin's double bridge is used for measurement of:

a. Very high resistance

b. Very low resistance

c. Quality factor of a coil

d. Inductance

95.

The bridged-T network circuit shown above can be used for determination of inductance and Q of R.F coils. L_x and R_x are unknown parameters of the coil. Using equations for balance, what are the values of L_x and R_x?

a. $L_x = \dfrac{2}{\omega^2 C}, R_x = \dfrac{1}{R(\omega C)^2}$

b. $L_x = \dfrac{1}{\omega^2 C}, R_x = \dfrac{1}{R(\omega C)^2}$

c. $L_x = \dfrac{1}{\omega^2 C}, R_x = \dfrac{1}{\omega^2 CR}$

d. $L_x = \dfrac{2}{\omega^2 C}, R_x = \dfrac{2}{R(\omega C)^2}$

96. Which one of the following transducers is the most suitable for the measurement of linear displacement?

a. Strain gauge
b. LVDT
c. Piezoelectric crystal
d. Microphone

97. OTDR is the acronym for

a. Optical time domain reflectometery
b. Optical transmission and detection ratio
c. Optical time deflection region
d. Optimum transmission and detection ratio

98. Which of the following meters does not exhibit square law response?

a. Moving coil
b. Moving iron
c. Electrodynamometer
d. Hot wire instrument

99. A certain oscilloscope with 4 cm × 4 cm screen has its own sweep output fed to its input. If the X and Y sensitivities are same, what will the oscilloscope display?

a. Triangular wave
b. Straight line
c. Sine wave
d. Circle

100. The sine wave output of a function generator is fed to both the horizontal (X) and vertical (Y) inputs of a CRO. What will be the pattern on the cathode ray screen?

a. A circle
b. An ellipse
c. A straight line with 45° slope
d. Sinusoidal

101. What is the reading of 0.5245 on 1 V range in four and a half digit voltmeter displayed as?

a. 0.5245
b. 00.524
c. 000.52
d. 0000.5

102. The working principle of a Pirani gauge pressure transducer is based on which one of the following?

a. Humidity of the medium
b. Thermal conductivity of the medium
c. Combustibility of the medium
d. Electrical resistivity of the medium

103. Which one of the following is the most sensitive device?

a. Thermocouple
b. RTD
c. Thermistor
d. Pyrometer

104. Which one of the following is the correct statement?

Thermistor

a. is a non-metallic resistor
b. has positive temperature coefficient
c. is chemically unstable
d. requires cold junction compensation

105. Which one of the following is the best method of measurement of temperature of hot bodies radiating energy in visible spectrum?

a. Thermocouple
b. Thermopile

c. Optical pyrometer

d. Bolometer

106. Which one of the following is the correct statement?

Active probe used in a CRO

a. is bulkier than passive ones

b. cannot measure small signals

c. cannot couple high frequency signals

d. can attenuate more

107. The piezoelectric crystal voltage sensitivity is defined as:

a. Field developed per unit force

b. Field developed per unit stress

c. Voltage developed per unit stress

d. Voltage developed per unit force

108. Which is the most suitable thermocouple transducer for the measurement of temperature in the range of 1300°C to 1500°C?

a. Chromel-alumel

b. Platinum-rhodium

c. Iron-constantan

d. Chromel-constantan

109. Match List-I (Type of Hygrometer) with List-II (Related Process/Material) and select the correct answer using the code given below the lists:

List-I

A. Resistive hygrometer

B. Capacitive hygrometer

C. Microwave refract meter

D. Crystal hygrometer

List - II

1. Quartz crystal

2. Lithium chloride crystal

3. Change in dielectric constant

4. Change in frequency of oscillator

Codes:

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

110. Assertion (A): Electron mobility in metals decreases with increasing temperature.

Reason (R): In metals electron concentration is high.

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): Ferrite cores are used in inductances for high frequencies.

Reason (R): Ferrites provide high flux density with minimum eddy current loss and are insulators.

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

112. Assertion (A): An n-type semiconductor behaves as an intrinsic semiconductor at very high temperatures.

Reason (R): The breaking of the covalent bonds becomes a significant phenomenon at high temperatures.

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

113. Assertion (A): The maximum voltage that a solar cell can generate cannot exceed the built-in potential of the diode.

Reason (R): The voltage generated by a solar cell can be measured by connecting a voltmeter across its terminals exactly in a manner as the contact potential of a p-n junction diode is measured.

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

114. Assertion (A): An IC is more reliable as compared to its discrete circuit equivalent.

Reason (R): All the joints in an IC are soldered simultaneously.

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

115. Assertion (A): The impulse response is only a function of the terms in natural response.

Reason (R): The differentiation and differencing operations eliminate the constant terms associated with the particular solution in the step response and change only the constants associated with exponential terms in the natural response.

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): Time varying electric field produces magnetic fields.

Reason (R): Time varying magnetic field produces electric fields.

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

117. Assertion (A): Magnetic current consists of entirely a displacement component and no conduction component.

Reason (R): Magnetic flux lines are always continuous.

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

118. Assertion (A): The electrodynamometer type instruments have high power consumption.

Reason (R): The current under measurement has to provide the field flux.

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

119. Assertion (A): Instrument probes are used in conjunction with measuring instruments to improve frequency response.

Reason (R): A probe introduces attenuation.

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

120. Assertion (A): Potential everywhere on a conducting surface of infinite extent is zero.

Reason (R): Displacement density on a conducting surface is normal to the surface.

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