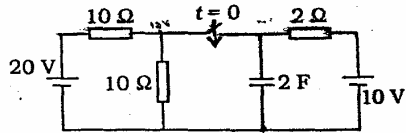


# ELECTRONICS & TELECOMMUNICATION ENGINEERING

## PAPER-I

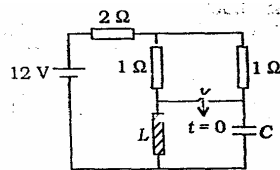
1.



In the circuit shown above, the switch is open for a long time and closed at time  $t = 0$ . What is the current through the switch after the switch is closed?

- Zero
- 1 A
- 2 A
- 5 A

2.



In the circuit shown above, the switch is closed at  $t = 0$ . What is the initial value of the current through the capacitor?

- 0.8 A
- 1.6 A
- 2.4 A
- 3.2 A

3.

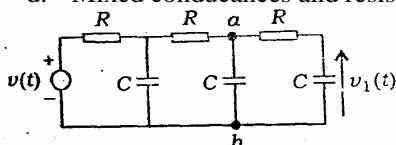
Consider a circuit which consists of resistors and independent current sources, and one independent voltage source connected between the nodes  $i, j$ . The equations are obtained for voltages of  $n$  unknown nodes with respect to one reference node in the form

$$[\Delta] \begin{bmatrix} V_1 \\ V_2 \\ \vdots \\ V_n \end{bmatrix} = \begin{bmatrix} \vdots \\ \vdots \\ \vdots \\ \vdots \end{bmatrix}$$

What are the elements of the  $\Delta$ ?

- All conductances
- All resistances
- Mixed conductances and constants
- Mixed conductances and resistance

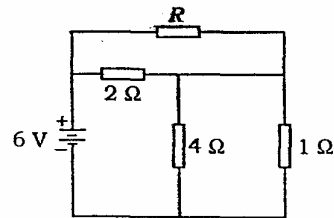
4.



In the circuit shown above, what is the voltage  $v_{ab}(t)$ ?

- $\frac{dv_1}{dt} + v_1$
- $v_1$
- $\frac{dv_1}{dt} + RCv_1$
- $RC \frac{dv_1}{dt} + v_1$

5.



In the circuit shown above, when is the power absorbed by the 4Ω resistor maximum?

- $R = 0$
- $R = 2\Omega$
- $R = 4\Omega$
- $R = \infty$

6.

The line integral of the vector potential  $\vec{A}$  around the boundary of a surface  $S$  represents which one of the following?

- Flux through the surface  $S$
- Flux density in the surface  $S$
- Magnetic field intensity
- Current density

7.

What is the electric flux density (in  $\mu\text{C}/\text{m}^2$ ) at a point  $(6, 4, -5)$  caused by a uniform surface charge density of  $60\mu\text{C}/\text{m}^2$  at a plane  $x = 8$ ?

- $-30\vec{a}_x$
- $-60\vec{a}_x$
- $30\vec{a}_x$
- $60\vec{a}_x$

8.

An infinitely long straight conductor located along  $Z$ -axis carries a current  $I$  in the  $+ve Z$ -direction. The magnetic field at any point  $P$  in the  $X$ - $Y$  plane is in which direction?

- a. In the positive Z-direction  
 b. In the negative Z-direction  
 c. In the direction perpendicular to the radial line OP (in X-Y plane) joining the origin O to the point P  
 d. Along the radial line OP
9. A 5 A current enter a right circular cylinder of 5 cm radius. What is the linear surface current density at the end surface?  
 a.  $(50/\pi)A/m$   
 b.  $(100/\pi)A/m$   
 c.  $(1000/\pi)A/m$   
 d.  $(2000/\pi)A/m$
10. Of two concentric along conducting cylinders, the inner one is kept at a constant positive potential  $+V_0$  and the outer one is grounded. What is the electric field in the space between the cylinders/  
 a. Uniform and directed radially outwards  
 b. Uniform and directed radially inwards  
 c. Non-uniform and directed radially outwards  
 d. Non-uniform and directed parallel to the axis of the cylinders.
11. In a charge-free space, the Poisson's equation results in which one of the following?  
 a. Continuity equation  
 b. Maxwell's equation  
 c. Laplace equation  
 d. None of the above
12. Consider the following statements relating to the microstrip lines:  
 1. There is no radiation loss problem in microstrip lines.  
 2. Modes on microstrip line are only quasi-transverse electric and magnetic  
 3. Microstrip line is also called as open strip line.  
 Which of the statements given above are correct?  
 a. 1, 2 and 3  
 b. 1 and 2 only  
 c. 1 and 3 only  
 d. 2 and 3 only
13. A lossless transmission line of characteristic impedance  $Z_0$  and length  $l < \lambda/4$  is terminated at the loaded end by an open circuit. What is its input impedance  $Z_s$ ?  
 a.  $Z_s = j Z_0 \tan \beta l$   
 b.  $Z_s = j Z_0 \cot \beta l$   
 c.  $Z_s = -j Z_0 \tan \beta l$   
 d.  $Z_s = -j Z_0 \cot \beta l$
14. Consider the following elements associated with boundary conditions between two media:  
 1. Normal component of B is continuous at the surface of discontinuity.  
 2. Normal component of D may or may not be continuous.  
 Which of the statements given above is/are correct?  
 a. 1 only  
 b. 2 only  
 c. Both 1 and 2  
 d. Neither 1 nor 2
15. In a LDVT, here are two secondary coils which are connected for a single output. Which one of the following is correct?  
 a. The coils are in series and in phase opposition  
 b. The coils are in parallel and in phase opposition  
 c. The coils are in series and in the same phase condition  
 d. The coils are in parallel and in the same phase condition.
16. A resistance strain gauge of gauge factor 2 is used as a transducer element. Neglecting piezoresistive effect, what is the value of Poisson's ratio?  
 a. 0.5  
 b. 1  
 c. 1.6  
 d. 2
17. Match List I with List II and select the correct answer using the code given below the lists:  
 List I  
 (Thermo couple)  
 A. Copper Constantan  
 B. (Platinum Rhodium) Platinum  
 C. (Rhodium Indium) Indium  
 D. Iron-Constantan  
 List II  
 (Temperature range)  
 1.  $-200^{\circ}C$  to  $+850^{\circ}C$   
 2.  $-200^{\circ}C$  to  $+350^{\circ}C$   
 3.  $0^{\circ}C$  to  $1000^{\circ}C$   
 4.  $1200^{\circ}C$  to  $2000^{\circ}C$   
 Code:  

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

18. Which one of the following statements is not correct?
- Data loggers are usually of digital types
  - A digital voltmeter is essentially an A-D converter
  - A servo-type potentiometric recorder has a frequency response better than that of a galvanometric recorder
  - In digital transducers, there are ergonomic advantages in presenting digital data.
19. A coil is tuned to resonance of 500 kHz with a resonating capacitor of 36 pF. At 250 kHz, the resonance is obtained with resonating capacitors of 160 pF. What is the self-capacitance of the coil?
- 2.66 pF
  - 5.33 pF
  - 8 pF
  - 10.6 pF
20. A compensated probe of a CRO contains which of the following?
- An amplifier
  - R-C network
  - Only resistive network
  - Only capacitive network
- Select the correct answer using the code given below:  
Code:
- 1 and 2 only
  - 2 only
  - 3 only
  - 4 only
21. The accuracy of a 0.10 mA meter is  $\pm 2\%$ . What is its accuracy while taking a reading of 5 mA?
- $\pm 0.5\%$
  - $\pm 1\%$
  - $\pm 2\%$
  - $\pm 4\%$
22. Match List I with List II and select the correct answer using the code given below the lists:
- List I  
(Term)
- Relative error
  - Precision
  - Calibration
  - Resolution
- List II  
(Statement)
- The ability of the device to give identical output when repeat measurements are made with the same input signal
  - The ratio of difference between measured value and the true value to the true value of the measured
  - The smallest increment in measured that can be detected with certainty by the instrument
  - The process of making adjustments on the scale so that the instrument readings conform to an accepted standard
- Code:
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 2 | 3 | 4 | 1 |
| b. | 4 | 1 | 2 | 3 |
| c. | 4 | 3 | 2 | 1 |
| d. | 2 | 1 | 4 | 3 |
23. Two capacitances,  $C_1 = 150 \pm 2.4 \mu\text{F}$  and  $C_2 = 120 \pm 1.5 \mu\text{F}$  are connected in parallel. What is the limiting error of the resultant capacitance C?
- 0.9  $\mu\text{F}$
  - 1.95  $\mu\text{F}$
  - 3.9  $\mu\text{F}$
  - 4.8  $\mu\text{F}$
24. The expression for mean torque T of an electrodynamic wattmeter can be expressed as  $T \propto M^a V^b Z^c$ , where M is mutual inductance between fixed and moving coils, V is applied voltage and Z is impedance of coil. What are the value of the constants a, b and c?
- a = 1, b = 2 and c = -2
  - a = 1, b = 2 and c = -1
  - a = 1, b = -2 and c = 2
  - a = 2, b = 2 and c = -1
25. If R, L and C are the parameters of a resistor, what is the condition for the resistor to be non-inductive?
- $L = CR$
  - $L = CR^2$
  - $C = LR^2$
  - $C = R/L$
26. What precaution(s) is/are required for absolute measurement of current by Rayleigh current balance?
- Precision balance of special form must be used for the accuracy of measurement
  - The flexible leads, used for taking current into the moving coil, must not exert appreciable torque upon the moving system
- Select the correct answer using the code given below:  
Code:

- a. 1 only  
b. 2 only  
c. Both 1 and 2  
d. Neither 1 and 2
27. In a rectangular waveguide
- TE and TEM waves can exist but TM waves cannot exist
  - TM and TEM waves can exist but TE waves cannot exist
  - TE and TM waves can exist but TEM waves cannot exist
  - TE, TM and TEM all can exist.
28. Which one has the lowest attenuation in a circular waveguide?
- TM<sub>11</sub>
  - TE<sub>11</sub>
  - TE<sub>10</sub>
  - TE<sub>01</sub>
29. In a parallel plate waveguide, what is the principal wave?
- TEM wave
  - T wave
  - TM wave
  - Combination of TE and TM waves having axial components of both electric and magnetic fields
30. According to Poynting theorem, the vector product  $\vec{E} \times \vec{H}$  is a measure of which one of the following?
- Stored energy density of the electric field
  - Stored energy density of the magnetic field
  - Power dissipated per unit volume
  - Rate of energy flow per unit area
31. If the total input power to an antenna is  $W_t$ , the radiated power is  $W_r$  and the radiation intensity is  $\phi$ , then match List I with List II and select the correct answer using the code given below the lists:
- List I
- Power gain
  - Directive gain
  - Average power radiated
  - Efficiency of the antenna
- List II
- $W_r/W_t$
  - $W_r/4\pi$
  - $4\pi\phi/W_t$
  - $4\pi\phi/W_r$
- Code:
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 3 | 4 | 2 | 1 |
| b. | 4 | 3 | 2 | 1 |
| c. | 3 | 4 | 1 | 2 |
| d. | 4 | 3 | 1 | 2 |
32. When does the maximum radiation for an end-fire array occur?
- Perpendicular to the line of the array only
  - Along the line of the array only
  - At 45° to the line of the array
  - Both perpendicular to and along the line of the array
33. As the aperture area of an antenna increases, its gain
- Increases
  - Decreases
  - Remain steady
  - Behaves unpredictably
34. Which of the following capacitors are made use of widely for a capacitance application in monolithic ICs?
- MOS capacitor
  - Collector-Substrate capacitor
  - Collector-Base capacitor
  - Base-Emitter capacitor
- Select the correct answer using the code given below:
- Code:
- 1 and 2 only
  - 2 and 3 only
  - 3 and 4 only
  - 1 and 4 only
35. In a network containing active components, output voltage
- will always be greater than input voltage
  - will always be equal to the input voltage
  - can be less than or greater than input voltage only
  - will be less than, equal to or greater than input voltage
36. An intrinsic semiconductor is doped lightly with p-type impurity. It is found that the conductivity actually decreases till a certain doping level is reached. Why does this occur?
- The mobility of holes decreases
  - The mobility of both electrons and holes decreases
  - The hole density actually reduces
  - Effect of reduction in electrons due to increase in holes compensates more than

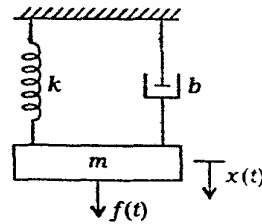
- the effect of increase in holes on conductivity
37. Assuming that the electron mobility in intrinsic silicon is  $1500 \text{ cm}^2/\text{Vs}$  at room temperature ( $T=300 \text{ K}$ ) and the corresponding 'voltage equivalent of temperature'  $V_T = 25.9 \text{ mV}$ , what is the approximate value of the electron diffusion constant?
- $40 \text{ cm}^2/\text{s}$
  - $4 \text{ cm}^2/\text{s}$
  - $400 \text{ cm}^2/\text{s}$
  - $4000 \text{ cm}^2/\text{s}$
38. The 'voltage stability with time' of reference diodes incorporating Zener diodes is comparable to that of which of the following?
- Dry cells
  - Nickel-cadmium cells
  - Lead-acid accumulator batteries
  - Conventional standard cells
39. In a MOSFET, the transfer characteristics can be used to determine which of the following device parameters?
- Threshold voltage and output resistance
  - Trans-conductance and output resistance
  - Threshold voltage and trans-conductance
  - Trans-conductance and channel length modulation parameter
40. Assuming an operating temperature  $T = 300 \text{ K}$  and corresponding  $V_T = 25 \text{ mV}$ , what is the change in semiconductor silicon diode forward voltage  $V_D$  to produce a 10:1 change in diode current  $I_D$ , while operating in the forward bias region ( $< 25 \text{ mA}$ )?
- $60 \text{ mV}$
  - $120 \text{ mV}$
  - $180 \text{ mV}$
  - $240 \text{ mV}$
41. The doping concentration on the n-side of a p-n junction diode is enhanced. Which one of the following will get affected?
- Width of the depletion region on n-side
  - Width of the depletion region on p-side
  - Width of the depletion region on both sides
  - No change in width of depletion regions
42. When a junction diode is used as a half-wave rectifier with purely resistive load and sinusoidal input voltage, what is the value of diode conduction angle (where  $\phi_i$  is the ignition angle corresponding to the cut-in voltage)?
- $\pi$
  - $\pi - \phi_i$
  - $\pi - 2\phi_i$
  - Slightly greater than  $\pi$
43. In a step-graded p-n junction diode, what is the ratio of depletion region penetration depths into p and n regions (if the ratio of acceptor to donor impurity atoms' densities of 1:2)?
- 2 : 1
  - 4 : 1
  - 1 : 2
  - 1 : 4
44. What is the most noticeable effect of a small increase in temperature in the common emitter connected BJT?
- Increase in  $I_{\text{CEO}}$
  - Increase in output resistance
  - Decrease in forward current gain
  - Increase in forward current gain
45. For a BJT, early voltage  $V_A$  is 100 V. In common emitter configuration, quiescent  $V_{\text{CE}}$  is 10 V. what percentage change in quiescent  $I_C$  would occur, if early voltage  $V_A$  is made  $\infty$ ?
- 10%
  - 20%
  - 5%
  - 0%
46. While using a bipolar junction transistor as an amplifier, the collector and emitter terminals got interchanged mistakenly. Assuming that the amplifier and the biasing is suitably adjusted, the interchange of terminals will result into which one of the following?
- Zero gain
  - Infinite gain
  - Reduced gain
  - No change in gain at all
47. In n-channel enhancement MOSFET, at a fixed drain voltage
- the drain current is maximum at zero gate voltage and it decreases with applied negative gate voltage
  - the drain current has a finite value at zero gate voltage and it increases or decreases with the applied voltage of proper polarity
  - the drain current is zero at zero gate voltage and it increases with the positive applied gate voltage
  - the drain current is zero for negative bias voltage to gate and it increases as negative gate bias is decreased in magnitude

48. The data sheet for a certain JFET (Junction Field Effect Transistor) indicates that  $I_{DSS}$  (drain to source current with gate shorted) = 15 mA and  $V_{GS}$  (off) (cut-off value of gate to source voltage) = -5 V. What is the drain current for  $V_{GS} = -2$  V?
- 58.8 mA
  - 29.4 mA
  - 9.6 mA
  - 5.4 mA
49. What one of the following devices can be turned 'ON' or 'OFF' by applying gate signal?
- CSR
  - SCS
  - Triac
  - UJT
50. Why is silicon dioxide ( $\text{SiO}_2$ ) layer used in ICs?
- To protect the surface of the chip from external contaminants and to allow for selective formation of the n and p regions by diffusion
  - Because it facilitates the penetration of the desired impurity by diffusion
  - To control the concentration of the diffused impurities
  - Because of its high heat conduction
51. Why is the term 'planner technology' for fabrication of devices in ICs used?
- The variety of manufacturing processes by which devices are fabricated, takes place through a single plane
  - The aluminum contacts to the collector, base and emitter regions of the transistors in the ICs are laid in the same plane
  - The collector, base and emitter regions of the transistors in ICs are laid in the same plane
  - The device looks like a thin plane wafer
52. In an optical fibre, the light beam propagates due to which one of the following?
- Simply reflection of light at a boundary between two media
  - Reflection of light in the medium
  - Total internal reflection at the boundary of the fibre
  - Scattering of light in the medium
53. Dispersion in an optical fibre used in a communication link is of which type?
- Angular dispersion
  - Modal dispersion

- Chromatic dispersion
- Dispersion arising due to structural irregularities in the fibre.

54. If  $v$ - $i$  characteristic of a circuit is given by  $v(t) = ti(t) + 2$ , the circuit is of which type?
- Linear and time invariant
  - Linear and time variant
  - Non-linear and time invariant
  - Non-linear and time variant

55.



Which one of the following represents the linear mathematical model of the physical system shown in the above figure?

- $m \frac{d^2 x(t)}{dt^2} + b \frac{dx(t)}{dt} + kx(t) = f(t)$
- $m \frac{d^2 x(t)}{dt^2} + b \frac{dx(t)}{dt} + kx(t) = 0$
- $m \frac{d^2 x(t)}{dt^2} + b \frac{dx(t)}{dt} + kx(t) + f(t) = 0$
- $m \frac{d^2 x(t)}{dt^2} + b \frac{dx(t)}{dt} - kx(t) - f(t) = 0$

56. If the state space equation of a system is

$$\dot{x} = \begin{bmatrix} -3 & 1 \\ 0 & -2 \end{bmatrix} x$$

and the initial state value  $x(0) = [10 \ 0]^T$ , the steady-state value is  $[A \ B]^T$ , what are the respective value of A and B?

- 0, 0
- 3, -2
- 0, 1
- $\infty, \infty$

57. Which one of the following function is a periodic one?
- $\sin(10\pi t) + \sin(20\pi t)$
  - $\sin(10t) + \sin(20\pi t)$
  - $\sin(10\pi t) + \sin(20t)$
  - $\sin(10t) + \sin(25t)$

58. What is the average power for periodic non-sinusoidal voltage and currents?
- The average power of the fundamental component alone

- b. The sum of the average powers of the harmonics excluding the fundamental
- c. The sum of the average powers of the sinusoidal components including the fundamental
- d. The sum of the root mean square power of the sinusoidal components including the fundamental
59. Which one of the following is the correct relation?
- $F(at) \leftrightarrow aF(\omega/a)$
  - $F(at) \leftrightarrow aF(a\omega)$
  - $F(t/a) \leftrightarrow aF(\omega/a)$
  - $F(at) \leftrightarrow (1/a)F(\omega/a)$
60. The Fourier transform of a function is equal to its two-sided Laplace transform evaluated
- on the real axis of the  $s$ -plane
  - on a line parallel to the real axis of the  $s$ -plane
  - on the imaginary axis of the  $s$ -plane
  - on a line parallel to the imaginary axis of the  $s$ -plane
61. For matching of a radio frequency coaxial line to a purely reactive load
- quarter-wave transformer would work better than stub matching
  - stub matching would work better than quarter wave transformer
  - both quarter wave transformer and stub matching techniques would work equally well
  - both quarter-wave transformer and stub matching techniques would fail
62. If an infinite homogeneous isotropic medium is modeled as an equivalent transmission line, the characteristic impedance of the corresponding transmission line is known as its
- characteristics impedance
  - iterative impedance
  - wave impedance
  - intrinsic impedance
63. Match List I with List II with respect to the synthesis of R-C driving point function  $Z(s) = 1/Y(s)$  and select the correct answer using the code give below the lists:
- List I  
(Form)
- Foster I form
  - Foster Ii form
  - Cauer I form
- D. Cauer II form
- List II  
(Method)
- Continued fraction expansion of  $Z(s)$  around  $s = \infty$
  - Partial fraction expansion of  $Y(s)/s$
  - Continued fraction expansion of  $Z(s)$  around  $s = 0$
  - Partial fraction expansion of  $Z(d)$
- Code:
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 1 | 2 | 4 | 3 |
| b. | 4 | 3 | 1 | 2 |
| c. | 1 | 3 | 4 | 2 |
| d. | 4 | 2 | 1 | 3 |
64. The lowest and the highest critical frequencies of an R-L driving point impedance are, respectively
- a zero, a pole
  - a pole, a pole
  - a zero, a zero
  - a pole, a zero
65. For an RC driving point impedance function  $Z_{RC}(s)$
- $Z_{RC}(0) \geq Z_{RC}(\infty)$
  - $Z_{RC}(0) = Z_{RC}(\infty)$  only
  - $Z_{RC}(0) \leq Z_{RC}(\infty)$
  - $Z_{RC}(0) > Z_{RC}(\infty)$  only
66. Laplace transform of  $\sin(\omega t + \alpha)$
- $\frac{s \cos \alpha + \omega \sin \alpha}{s^2 + \omega^2}$
  - $\frac{\omega}{s^2 + \omega^2} \cos \alpha$
  - $\frac{s}{s^2 + \omega^2} \sin \alpha$
  - $\frac{s \sin \alpha + \omega \cos \alpha}{s^2 + \omega^2}$
67. A two port network has  $z_{11} = 11/35$ ,  $z_{12} = z_{21} = 2/35$ ,  $z_{22} = 3/35$ . Its  $y_{11}$  and  $y_{12}$  parameter will, respectively, be
- 3, -2
  - 3, 2
  - 13, -2
  - 13, 2
68. A reciprocal two-port network is symmetrical if
- $\Delta A = 1$
  - $A = C$
  - $z_{11} = z_{22}$



d.  $\Delta y = 1$

69. Inside a waveguide with perfectly conducting walls, any current present is in the form of
- displacement current only
  - conduction current only
  - partially displacement current and partially conduction current
  - sometimes displacement current and sometimes conduction current
70. Which one of the following is a passive transducer?
- Piezoelectric
  - Thermocouple
  - Photovoltaic cell
  - LVDT
71. A 0-250V voltmeter has a guaranteed accuracy of 1% full scale reading (deflection). The voltage measured by this instrument is 100V. The limiting error is given by
- 1.25%
  - 25%
  - 0.25%
  - 2.5%
72. Which one of the following materials is not used as a piezoelectric transducer?
- Rochelle salt
  - Lithium sulphate
  - Barium titanate
  - Tungsten oxide
73. Which one of the following modulation techniques is the most efficient for pulse telemetry?
- PAM
  - PCM
  - PDM
  - PPM

**Direction:**

Each of the following seven (7) items consists of two statements, one labeled as '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 code given below:

Code:

- Both A and R are individually true and R is the correct explanation of A
- Both A and R are individually true but R is not the correct explanation of A
- A is true but R is false
- A is false but R is true

74. **Assertion (A):** The z-transform of the output of an ideal samplers is given by

$$Z[f(t)] = K_0 + \frac{K_1}{z} + \frac{K_2}{z^2} + \dots + \frac{K_n}{z^n}$$

**Reason (R):** The relationship is the result of application of  $z = e^{-sT}$ , where T stands for the time gap between the samples.

75. **Assertion (A):** The Kirchhoff's current law states that the sum of currents entering at any node is equal to the sum of currents leaving that node.

**Reason (R):** The Kirchhoff's current law is based on the law of conservation of charge.

76. **Assertion (A):** In a linear network, the superposition theorem can be used to calculate power dissipation in a resistive branch of the network.

**Reason (R):** Superposition theorem is valid for currents and voltages, and therefore is valid also for power dissipation.

77. **Assertion (A):** Power factor is defined as the ratio of apparent power to the average power in an a.c. circuit.

**Reason (R):** The magnitude of power factor is always less than unity.

78. **Assertion (A):** Sinusoidal response in an a.c. circuit can be represented in rectangular form as  $v = V \cos \theta + jV \sin \theta$ , exactly in a way similar to vectors which we come across for force analysis in mechanics.

**Reason (R):** Phasors are nothing but vectors.

79. **Assertion (A):** A high-pass R-C circuit has a lower cut-off frequency but does not have any upper cut-off frequency.

**Reason (R):** The transfer function of a high-pass R-C circuit can be written as

$$|H| = \frac{1}{\sqrt{1+(f_1/f)^2}}, \theta = \arctan(f_1/f)$$

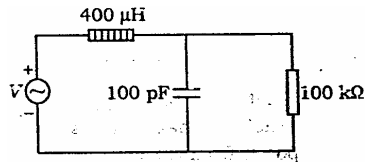
$$\text{where } f_1 = \frac{1}{2\pi RC}$$

80. **Assertion (A):** VTVM gives more accurate reading compared to the accuracy of PMMC type of indicating instrument used in it, while measuring voltages across high resistances.

**Reason (R):** The electronic circuits used in VTVM make it more accurate by increasing its sensitivity.

81.





For the circuit shown in the above figure, what is the natural frequency?

- 1 M rad/s
- 2 M rad/s
- 3 M rad/s
- 5 M rad/s

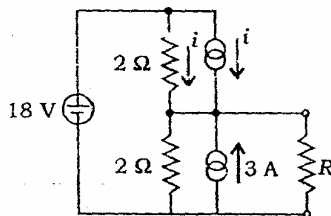
82. Which one of the following relations for power is not correct?

- $P = VI \cos \theta$
- $P = \text{Re part of } [VI^*]$
- $P = \text{Re part of } [V^*I]$
- $P = VI \sin \phi$

83. What is the number of chords of a connected graph  $G$  of  $n$  vertices and  $e$  edges?

- $n(n-1)/2$
- $n-1$
- $e-n-1$
- $e-n+1$

84.



What is the appropriate load resistor that draws maximum power from the source in the circuit given above?

- $(5/6) \Omega$
- $(1/3) \Omega$
- $(2/3) \Omega$
- None of the above

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

List-I

(Theorem/Law)

- Norton's theorem
- Superposition theorem
- Thevenin's theorem
- Kirchhoff's current law

List II

(Property)

- Effect of independent sources in a linear circuit are additive
- Law of non-accumulation of charge holds good at nodes

3. Current source with shunt resistor

4. Voltage source with series resistor

Code:

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

86. Which of the following statements are associated with Thevenin's theorem?

- Impedance through which current is required is removed and open-circuit voltage is found
- It is applicable to only d.c. circuits
- The network is replaced by a voltage source and a series impedance remains after removing the load impedance.

Select the correct answer using the code given below:

Code:

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

87. A random variable  $X$  is defined by the double exponential distribution

$$P_x(x) = ae^{-bx|x|}, -\infty < x < \infty$$

where  $a$  and  $b$  are +ve constants. What is the relation between  $a$  and  $b$  so that  $p_x(x)$  is a probability density function?

- $a = b/2$
- $b = a/2$
- $a = b$
- $a = 1/b$

88. What is the spectral density of white noise?

- A constant
- $\delta(\omega)$
- $[\delta(\omega)]^2$
- A step function is  $\omega$

89. If  $X(z)$  is  $\frac{1}{1-z^{-1}}$  with  $|z| > 1$ , then what is the corresponding  $x(n)$ ?

- $e^{-n}$
- $e^n$
- $u(n)$
- $\delta(n)$

90. The convolution of  $f(t)$  with itself is given to be  $\int_0^t F(\tau) d\tau$ . Then what is  $f(t)$ ?

- The unit ramp function

- b. Equal to 1  
c. The unit step function  
d. The unit impulse function
91. Which one of the following is the impulse response of the system whose step response is given as  $C(t) = 0.5(1 - e^{-2t})u(t)$ ?
- a.  $e^{-2t}u(t)$   
b.  $0.5\delta(t) + e^{-2t}u(t)$   
c.  $0.5\delta(t) - 0.5 e^{-2t}u(t)$   
d.  $0.05e^{-2t}u(t)$
92. Match List-I with List-II and select the correct answer using the code given below the lists:
- List I  
[Function in time domain  $f(t)$ ]
- A.  $\sin \omega_0 t u(t - t_0)$   
B.  $\sin \omega_0 t (t - t_0) u(t - t_0)$   
C.  $\sin \omega_0 (t - t_0) u(t)$   
D.  $\sin \omega_0 t u(t)$
- List-II  
[Corresponding Laplace transform  $F(s)$ ]
1.  $\frac{\omega_0}{s^2 + \omega_0^2}$   
2.  $\left\{ \frac{\omega_0}{s^2 + \omega_0^2} \right\} e^{-t_0 s}$   
3.  $\frac{e^{-t_0 s}}{\sqrt{s^2 + \omega_0^2}} \sin \left( \omega_0 t_0 + \tan^{-1} \frac{\omega_0}{s} \right)$   
4.  $\frac{1}{\sqrt{s^2 + \omega_0^2}} \sin \left( \omega_0 t_0 - \tan^{-1} \frac{\omega_0}{s} \right)$
- Code:
- |    | A | B | C | D |
|----|---|---|---|---|
| a. | 3 | 1 | 4 | 2 |
| b. | 4 | 2 | 3 | 1 |
| c. | 3 | 2 | 4 | 1 |
| d. | 4 | 1 | 3 | 2 |
93. A voltage having the Laplace transform  $\frac{4s^2 + 3s + 2}{7s^2 + 6s + 5}$  is applied across a 2 H inductor having zero initial current. What is the current in the inductor at  $t = \infty$ ?
- a. Zero  
b. (1/5) A  
c. (2/7) A  
d. (2/5) A
94. What is the Laplace transform of  $\cos \omega_0 t$ ?
- a.  $\frac{\omega_0}{s^2 + \omega_0^2}$   
b.  $\frac{s}{s^2 + \omega_0^2}$   
c.  $\frac{\omega}{(s + \omega_0)^2}$   
d.  $\frac{s}{(s + \omega_0)^2}$
95. If  $f(t)$  is an even function, then what is its Fourier transform  $F(j\omega)$ ?
- a.  $\int_0^\infty f(t) \cos(2\omega t) dt$   
b.  $2 \int_0^\infty f(t) \cos(\omega t) dt$   
c.  $2 \int_0^\infty f(t) \sin(\omega t) dt$   
d.  $\int_0^\infty f(t) \sin(2\omega t) dt$
96. If the Fourier transform of  $f(t)$  is  $F(j\omega)$ , then what is the Fourier transform of  $f(-t)$ ?
- a.  $F(j\omega)$   
b.  $F(-j\omega)$   
c.  $-F(j\omega)$   
d. Complex conjugate of  $F(j\omega)$
97. Epitaxial III-V group semiconductor compounds have which one of the following crystal structures?
- a. BCC  
b. FCC  
c. Hexagonal  
d. Zinc blende
98. What is the unit of measurement of surface/sheet resistivity?
- a. ohm/metre  
b. ohm metre  
c. ohm/sq. metre  
d. ohm
99. An intrinsic semiconductor with energy gap 1eV has a carrier concentration  $N$  at temperature 200 K. Another intrinsic semiconductor has the same value of carrier concentration  $N$  at temperature 600 K. What is the energy gap value for the second semiconductor?
- a. (1/3)eV  
b. (3/2) eV  
c. 3 eV  
d. 9 eV

100. Consider the following statements :  
n-type of silicon can be
1. formed by adding impurity of phosphorus
  2. formed a adding impurity of arsenic
  3. formed by adding impurity of boron
  4. formed by adding impurity of aluminum
- Which of the statements given above are correct?
- a. 1 and 3 only
  - b. 3 and 4 only
  - c. 1 and 2 only
  - d. 1, 2, 3 and 4 only
101. Which one of the following materials is not a piezoelectric material?
- a. BaTiO<sub>3</sub>
  - b. Quartz
  - c. Rochelle salt
  - d. Yttrium garnet
102. Consider the following statements for the piezoelectric materials:
1. All piezoelectric materials are ferroelectric materials also
  2. Piezoelectric materials have high value of dielectric constant
- Which of the statements given below is/are correct?
- a. 1 only
  - b. 2 only
  - c. Both 1 and 2
  - d. Neither 1 nor 2
103. Consider the following statements:  
An insulating material shows polarization due to charged atoms. Its polarizability
1. decreases with applied electric field
  2. remains independent of temperature at a given field
  3. increases with applied electric field at constant temperature
- Which of the statements given above is/are correct?
- a. 1 only
  - b. 1 and 2 only
  - c. 3 only
  - d. 2 and 3 only
104. Consider the following statements for a photoconducting material:
1. Its dark conductivity is small
  2. With the absorption of radiation, equal numbers of electrons and of holes are produced
- Which of the statements given above is/are correct?
- a. 1 only
  - b. 2 only
  - c. Both 1 and 2
  - d. Neither 1 nor 2
105. The transition temperature of superconducting material is changed by which one of the following?
- a. Electric field
  - b. Magnetic field
  - c. Mechanical stress
  - d. None of the above
106. Width of resonance curve in an R-L-C network is determined by which one of the following?
- a. R alone
  - b. L alone
  - c. C alone
  - d. All R, L and C
107. What is the typical value for the ratio of current in a p-n junction diode in the forward bias and that in the reverse bias?
- a. 1
  - b. 10
  - c. 100
  - d. 1000
108. Consider the following statements for a p-n junction diode:
1. It is an active component
  2. Depletion layer width decrease with forward biasing
  3. In the reverse biasing case, saturation current increases with increasing temperature
- Which of the statements given above are correct?
- a. 1, 2 and 3
  - b. 1 and 2 only
  - c. 2 and 3 only
  - d. 1 and 3 only
109. Illumination is measured using which one of the following?
- a. Millivoltmeter
  - b. Stroboscope
  - c. Luxmeter
  - d. pH meter
110. A capacitive transducer is made of two concentric cylindrical electrodes. The outer diameter of the inner cylindrical electrode is 4

- mm and dielectric medium is air. The inner diameter of the outer electrode is 4.1 mm. When 150 V is applied across the electrodes, what is the electric field intensity?
- 1500 V/mm
  - 3000 V/mm
  - 4500 V/mm
  - 6000 V/mm
111. A single even parity check but in telemetry data transmission has which capability?
- Only detection of a single error
  - Both detection and correction of a single error
  - Detection of even number of errors only
  - Detection of any number of errors
112. When system noise is large and signal power is low in a telemetry system, what is the preferred form of modulation?
- Pulse-width modulation
  - Pulse-amplitude modulation
  - Pulse-code modulation
  - Pulse-position modulation
113. The resonance frequency of a quartz crystal oscillator shows least variation with temperature when the orientation of the crystal is chosen to have
- X-cut
  - Y-cut
  - NT-cut
  - At-cut
114. The capacitance per unit volume is maximum for
- air capacitor
  - mica capacitor
  - ceramic capacitor
  - electrolytic capacitor
115. Consider the following statements pertaining to tunnel diodes:
- Impurity concentration is high
  - Carrier velocities are low
  - They have current controlled V-I characteristics
- Which of the statements given above is/are correct?
- 1 only
  - 2 and 2 only
  - 1 and 3 only
  - 1 and 2 only
116. Which one of the following is not a power MOSFET type?
- Lateral construction (LMOSFET)
  - Lateral double diffusion construction (LDMOSFET)
  - T construction (TMOSFET)
  - Enhancement mode construction (EMOSFET)
117. A system defined by  $y[n] = \sum_{k=-\infty}^n x[k]$  is an example of
- invertible system
  - memoryless system
  - non-invertible system
  - averaging system
118. Let  $x[n]$  be a real value sequence that is a sample sequence of a wide-sense stationary distance time random process. The power density function of this signal is
- real, odd and non-negative
  - real, even and non-negative
  - purely imaginary, even and negative
  - purely imaginary, odd and negative
119. Consider the following statements:  
When a series R-L-C circuit is under resonance
- current is maximum through R
  - magnitude of the voltage across L is equal to that across C
  - the power factor of the circuit is unity
- Which of the statements given above are correct?
- 1, 2 and 3
  - 1 and 2 only
  - 2 and 3 only
  - 1 and 3 only
120. Consider the following statements with regard to a complete incidence matrix:
- The sum of the entries in any column is zero
  - The rank of the matrix is  $n-1$  where  $n$  is the number of nodes
  - The determinant of the matrix of a closed loop is zero
- Which of the statements given above are correct?
- 1 and 2 only
  - 2 and 3 only
  - 1 and 3 only
  - 1, 2 and 3