

OBJECTIVE PAPER-I

1. Which one of the following helps experimental confirmation of the Crystalline state of matter?
 (A) Shock compression
 (B) Photo emission
 (C) Conductivity measurements
 (D) X-ray diffraction

Key: (D)

Sol: X-ray diffraction method determines the crystalline state or the crystal structure of any materials.

2. The electrical conductivity of pure semiconductor is:
 (A) Proportional to temperature
 (B) Increases exponentially with temperature
 (C) Decreases exponentially with temperature
 (D) Not altered with temperature

Key: (B)

Sol: The dependence of the electrical conductivity σ of a pure semiconductor on temperature is given by

$$\sigma = Ce^{-E_g/2kT}$$

Or

Taking log on both sides,

$$1.09 \frac{Vr^3}{Ebt^3}$$

Hence a plot of $\ln \sigma$ Vs $(1/T)$ must be a straight line. Hence the dependence of conductivity of an intrinsic semiconductor with temperature is exponential.

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

1. Resistance can be simply defined as the ratio of voltage across the conductor to the current through the conductor. This is, in fact, Georg Ohm's law
 2. Resistance is a function of voltage and current
 3. Resistance is a function of conductor geometry and its conductivity.

Which of the above statements are correct?

- (A) 1 and 2 only (B) 2 and 3 only
 (C) 1 and 3 only (D) 1, 2 and 3

Key: (C)

Sol: When the ends of a conductor are subjected to a potential difference, a current flows through the conductor. The current through the conductor increases linearly on increasing the voltage. A plot of the voltage against current is a straight line. Thus the current I is directly proportional to the voltage V .

$$I \propto V \text{ or } I = (V/R)$$

$$V = IR, R \text{ is called the resistance.}$$

Hence R occurs as a constant of proportionality. It does not depend upon I or V . It depends only upon the dimensions of the conductor and the material of the conductor as $R = (\rho l/A)$.

4. The ratio of ionic radii of Cations i.e., r_c and that of Anions i.e., r_A for stable and unstable ceramic crystal structure, is:
 (A) Less than unity
 (B) Greater than unity
 (C) Unity
 (D) Either lesser or greater than unity

Key: (A)

Sol: Ceramic crystals are mostly ionic, the ionic bond is formed by the transfer of the electrons. The one which loses an electron and becomes positively charged is called the cation. Due to the excess number of protons

the attractive force on electrons is more and hence the radius of cation is smaller than the neutral atom. Similarly the one which gains that electron becomes negatively charged and is called the anion. Hence the ratio of the cation radius to that of anion radius is less than unity.

5. Which one of the following statements is correct?
- (A) For insulators the band-gap is narrow as compared to semiconductors
 (B) For insulators the band-gap is relatively wide whereas for semiconductors it is narrow
 (C) The band-gap is narrow in width for both the insulators and conductors
 (D) The band-gap is equally wide for both conductors and semiconductors

Key: (B)

Sol: From band theory of solids, in case of conductors the valence band and conduction band overlap in a semiconductor there is a small gap between the valence band and conduction band. In the case of insulators, there is large gap between the two bands.

6. In an extrinsic semiconductor the conductivity significantly depends upon:
- (A) Majority charge carriers generated due to impurity doping
 (B) Minority charge carriers generated due to thermal agitation
 (C) Majority charge carriers generated due to thermal agitation
 (D) Minority charge carriers generated due to impurity doping

Key: (A)

Sol: In an extrinsic semiconductor, majority carrier concentration is due to doping. Hence the conductivity is due to majority carriers.

7. Necessary condition for photo-electric emission is:

- (A) $h\nu \geq e\phi$ (B) $h\nu \geq mc$
 (C) $h\nu \geq e\phi^2$ (D) $h\nu \geq \frac{1}{2}mc$

Key: (A)

Sol: According to Einstein's photo electric equation, $h\nu = e\phi + \text{kinetic energy of emitted electron}$. Here $e\phi$ is the work function of the given conductor. For photo electric emission, $h\nu$ must be greater than or equal to $e\phi$.

8. In some substances when an electric field is applied the substance becomes polarized. The electrons and nuclei assume new geometrical positions and the mechanical dimensions are altered. This phenomenon is called:
- (A) Electrostriction (B) Hall-Effect
 (C) Polarization (D) Magnetization

Key: (A)

Sol: The mechanical deformation produced as a result of electric field in a material is called Electrostriction. It is to be distinguished from piezoelectric effect. In electrostriction, the strain $\epsilon \propto E^2$. In piezoelectric effect, the strain $\epsilon \propto E$.

9. In ferromagnetic materials, the net magnetic moment created due to magnetization by an applied field is:
- (A) Normal to the applied field
 (B) Adds to the applied field
 (C) In line with magneto motive force
 (D) Subtracts from the applied field

Key: (B)

Sol: A ferromagnet contains a large number of domains, with each domain having a large magnetic moment. On the application of magnetic field the domain starts aligning in the direction of magnetic field and hence the field due to the magnetization adds to the applied field.

10. At what temperatures domains lose their ferromagnetic properties?
(A) Above ferromagnetic Curie temperature
(B) Below paramagnetic Curie temperature
(C) Above 4°K
(D) At room temperature

Key: (A)

Sol: The domains get into random orientation and magnetization decreases with increase in temperature. At a particular temperature called the Curie temperature, the ferromagnet transforms to a paramagnet.

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

Key: (C)

Sol: Paramagnetism is due to the presence of one or two unpaired electrons in the outer most orbital. This can occur in the case of rare earth elements with incomplete shell and in transition elements.
Magnesium Oxide cannot be a property of paramagnetic.

12. In a superconducting magnet, wires of superconducting material are embedded in the thick copper matrix, because while the material is in the superconducting state:
(A) The leakage current passes through copper part
(B) Copper part helps in conducting heat away from the superconductor
(C) Copper part helps in overcoming the mechanical stress

- (D) Copper acts as an insulating cover for superconductor

Key: (C)

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

Key: (B)

Sol: An atom is always neutral, a cation is formed by the loss of the electron by one atom and hence positively charged and the anion is formed by accepting that electron and hence negatively charged.

14. Manganin alloy used for making resistors for laboratory instruments contains:
(A) Copper, Aluminium and Manganese
(B) Copper, Nickel and Manganese
(C) Aluminium, Nickel and Manganese
(D) Chromium, Nickel and Manganese

Key: (B)

Sol: Manganin is an alloy of 86% Cu, 2% Ni, 12% Mn.

15. A rolled-paper capacitor of value $0.02\ \mu\text{F}$ is to be constructed using two strips of

aluminium of width 6 cm, and wax impregnated paper of thickness 0.06 mm whose relative permittivity is 3. The length of foil strips should be:

- (A) 0.3765 m (B) 0.4765 m
(C) 0.5765 m (D) 0.7765 m

Key: (A)

Sol: $C = 0.02 \mu\text{F}$; $w = 6 \text{ cm}$

$d = 0.06 \text{ mm}$; $\epsilon_r = 3$

For rolled - paper capacitor

$$2.0 \times 10^{-22} \text{ m}^{-3}$$

$$L \times w = \frac{C \times d}{2 \times 3 \times 8.854 \times 10^{-12}}$$

$$L = \frac{0.02 \times 10^{-6} \times 0.06 \times 10^{-3}}{2 \times 3 \times 8.854 \times 10^{-12} \times 6 \times 10^{-2}}$$

$$L = 0.37964 \text{ m}$$

16. A Ge sample at room temperature has intrinsic carrier concentration, $n_i = 1.5 \times 10^{13} \text{ cm}^{-3}$ and is uniformly doped with acceptor of $3 \times 10^{16} \text{ cm}^{-3}$ and donor of $2.5 \times 10^{15} \text{ cm}^{-3}$. Then, the minority charge carrier concentration is:

- (A) $0.918 \times 10^{10} \text{ cm}^{-3}$ (B) $0.818 \times 10^{10} \text{ cm}^{-3}$
(C) $0.918 \times 10^{12} \text{ cm}^{-3}$ (D) $0.818 \times 10^{12} \text{ cm}^{-3}$

Key: (B)

Sol: For a compensated semiconductor,

$$N_A - N_D = 3 \times 10^{16} - 2.5 \times 10^{15} = 2.75 \times 10^{16}$$

Therefore it is a p-type compensated semiconductor

$$p = \frac{N_A - N_D}{2} + \sqrt{\left(\frac{N_A - N_D}{2}\right)^2 + n_i^2}$$

$$p = 2.75 \times 10^{16} / \text{cm}^3$$

According to law of Mass Action,

$$n_0 = \frac{n_i^2}{p_0}$$

$$n_0 = \frac{(1.5 \times 10^{13})^2}{2.75 \times 10^{16}} = 0.818 \times 10^{10} / \text{cm}^3$$

17. Assume that the values of mobility of holes and that of electrons in an intrinsic semiconductor are equal and the values of conductivity and intrinsic electron density are $2.32 / \Omega\text{m}$ and $2.5 \times 10^{19} / \text{m}^3$ respectively. Then, the mobility of electron/hole is approximately:

- (A) $0.3 \text{ m}^2 / \text{Vs}$ (B) $0.5 \text{ m}^2 / \text{Vs}$
(C) $0.7 \text{ m}^2 / \text{Vs}$ (D) $0.9 \text{ m}^2 / \text{Vs}$

Key: (A)

Sol: It is given that $\mu_p = \mu_n$ &

$$\sigma_i = 2.32 (\Omega - \text{m})^{-1}$$

Intrinsic electron concentration is,

$$n_i = 2.5 \times 10^{19} / \text{cm}^3$$

$$\sigma_i = n_i q (\mu_n + \mu_p) = n_i q (2\mu_n)$$

$$2.32 = 2.5 \times 10^{19} \times 1.6 \times 10^{-19} \times 2 \times \mu_n$$

$$\mu_n = 0.29 \text{ m}^2 / \text{V-sec}$$

$$\mu_n \text{ or } \mu_p = 0.29 \text{ m}^2 / \text{V-sec}$$

18. A silicon sample A is doped with $10^{18} \text{ atom/cm}^3$ of Boron and another silicon sample B of identical dimensions is doped with $10^{18} \text{ atom/cm}^3$ of Phosphorous. If the ratio of electron to hole mobility is 3, then the ratio of conductivity of the sample A to that B is:

- (A) $\frac{3}{2}$ (B) $\frac{2}{3}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$

Key: (C)

The doping concentration are given as,

$$N_A = 10^{18} \text{ atoms/cm}^3 \quad N_D = 10^{18} \text{ atoms/cm}^3$$

$$\sigma_A = N_A q \mu_p \quad \& \quad \sigma_B = N_D q \mu_n$$

$$= \frac{\mu_p}{\mu_n} = \frac{1}{3}$$

$$\frac{\sigma_A}{\sigma_B} = \frac{1}{3}$$

19. The Hall-coefficient of a specimen of doped semiconductor is $3.06 \times 10^{-4} \text{ m}^3 \text{C}^{-1}$ and the

resistivity of the specimen is $6.93 \times 10^{-3} \Omega \text{ m}$.

The majority carrier mobility will be:

- (A) $0.014 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ (B) $0.024 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$
(C) $0.034 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ (D) $0.044 \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$

Key: (D)

Sol: It is given that $R_k = 3.06 \times 10^{-4} \text{ m}^3 / \text{c}$

$$\rho = 6.93 \times 10^{-3} \Omega - \text{m}$$

From hall effect,

$$\mu = \sigma R_H$$

$$\mu = \frac{3.06 \times 10^{-4}}{6.93 \times 10^{-3}} \Rightarrow \mu = 0.04415 \text{ m}^2 / \text{V} - \text{sec}$$

20. Doped silicon has Hall-coefficient of $3.68 \times 10^{-4} \text{ m}^3 \text{ C}^{-1}$ and then its carrier concentration value is

- (A) $2.0 \times 10^{22} \text{ m}^{-3}$ (B) $2.0 \times 10^{22} \text{ m}^{-3}$
(C) $0.2 \times 10^{22} \text{ m}^{-3}$ (D) $0.2 \times 10^{22} \text{ m}^{-3}$

Key: (A)

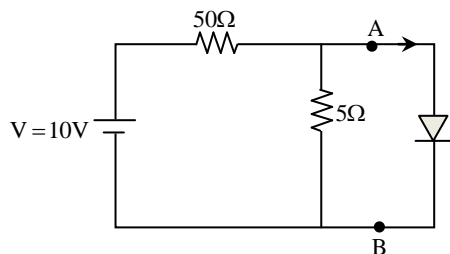
Sol: It is given that $R_H = 3.68 \times 10^{-4} \text{ m}^3 \text{ C}^{-1}$

$$\therefore R_H = \frac{1}{nq}$$

$$\begin{aligned} \text{Carrier concentration} &= \frac{1}{R_H q} \\ &= \frac{1}{3.68 \times 10^{-4} \times 1.6 \times 10^{-19}} \\ &= 1.7 \times 10^{22} \end{aligned}$$

The approximate value is $2 \times 10^{22} \text{ cm}^{-3}$

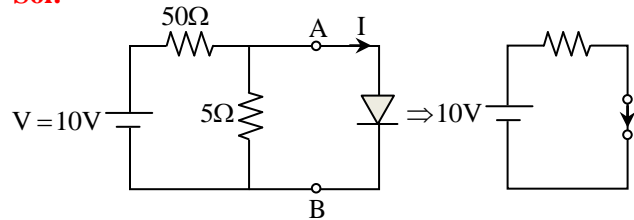
21. What is the value of current I through the ideal diode in the circuit ?



- (A) 100mA (B) 150 mA
(C) 200 mA (D) 250 mA

Key: (C)

Sol:

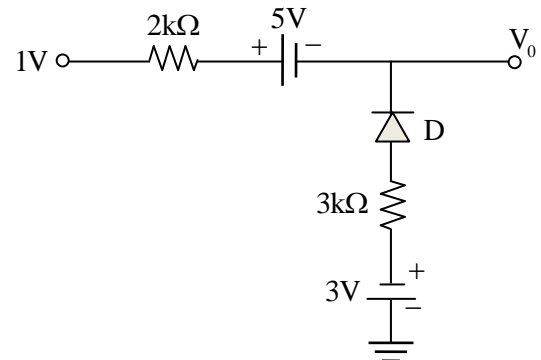


Diode current I

diode \rightarrow Short circuit

$$I = \frac{V}{R} = \frac{10}{50} = 0.2 \text{ amp} = 200 \text{ mA}$$

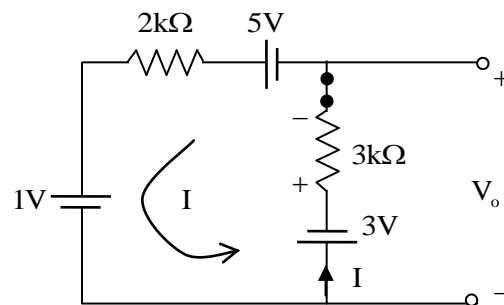
22. What is the output voltage V_0 for the circuit shown below assuming an ideal diode?



- (A) $-\frac{18}{5} \text{ V}$ (B) $\frac{18}{5} \text{ V}$
(C) $-\frac{13}{5} \text{ V}$ (D) $\frac{13}{5} \text{ V}$

Key: (A)

Sol: Diode is Ideal then according to current direction it acts as short circuit



$$V_0 = -I(3k) - 3 \dots \dots (1)$$

$$\text{By KVL, } I = \frac{5-3-1}{2k+3k} \Rightarrow I = \frac{1}{5k}$$

$$V_0 = -\frac{3k}{5k} - 3 = -\frac{18}{5} \text{ volts}$$

23. In a semiconductor diode, cut-in voltage is the voltage:

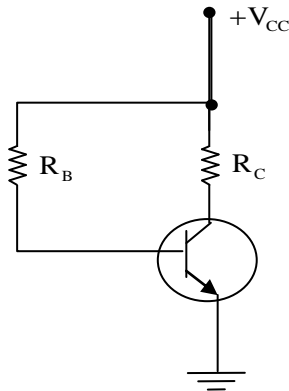
- (A) upto which the current is zero
- (B) upto which the current is very small
- (C) at which the current is 10% of the maximum rated current
- (D) at which depletion layer is formed

Key: (B)

Sol: Cut-in, voltage is the voltage, below which the current is small and after cut -in voltage current increases rapidly.

24. A transistor circuit is shown in the figure.

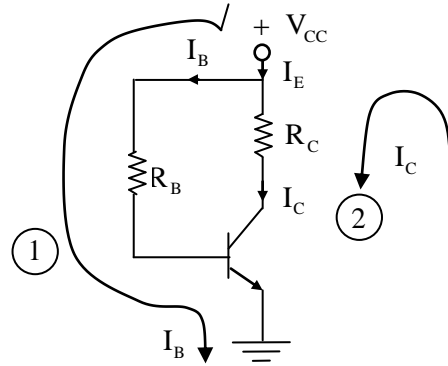
Assume $\beta = 100$, $R_B = 200k\Omega$, $R_C = 1k\Omega$,
 $V_{CC} = 15 \text{ V}$, $V_{BE_{act}} = 0.7\text{V}$, $V_{BE_{sat}} = 0.8\text{V}$,
 $V_{CE_{sat}} = 0.2\text{V}$, $V_{CE_{act}} = 0.2\text{V}$.



The transistor is operating in:

- (A) Saturation
- (B) Cut-off
- (C) Normal active
- (D) Reverse active

Key: (C)



$V_{CC} = 15\text{V}$
 $V_{BE(sat)} = 0.7\text{V}$
 $R_B = 200k\Omega$
 $R_C = 1k\Omega$

Apply KVL to loop - (1)

$$15 - 200 \times 10^3 I_B - 0.7 = 0 \Rightarrow I_B = \frac{14.3}{200 \times 10^3}$$

$$I_B = 71.5 \times 10^{-6} \text{ A} \Rightarrow I_B = 71.5 \mu\text{A}$$

$$I_C = \beta I_B$$

$$I_C = 100 \times 71.5 \times 10^{-6} \Rightarrow I_C = 7.15 \text{ mA}$$

Apply KVL to loop - (2)

$$15 - I_C R_C - V_{CE} = 0$$

$$V_{CE} = 15 - I_C R_C$$

$$= 15 - 7.15 \times 10^{-3} \times 10^3 \Rightarrow 7.85 \text{ V}$$

Since $V_{CE(Active)} > V_{CE(sat)}$

The transistor is in normal active mode only.

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

(A) $\frac{E_C - E_V}{2} + \frac{kT}{2} \ln \frac{N_V}{N_C}$

(B) $\frac{E_C + E_V}{2} - \frac{kT}{2} \ln \frac{N_V}{N_C}$

(C) $\frac{E_C + E_V}{2} + \frac{kT}{2} \ln \frac{N_V}{N_C}$

(D) $\frac{E_C - E_V}{2} - \frac{kT}{2} \ln \frac{N_V}{N_C}$

Key: (C)

Sol: The position of the intrinsic Fermi level of an undoped semiconductor is given by

$$E_{Fi} = \frac{E_C + E_V}{2} - \frac{kT}{2} \ln \frac{N_V}{N_C}$$

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

- (A) $\frac{1+\beta}{1-\beta\left(\frac{dI_B}{dI_C}\right)}$
 (B) $\left(\frac{1+\beta}{1-\beta}\right)\left[1-\frac{dI_B}{dI_C}\right]$
 (C) $(1+\beta)\left[1-\beta\left(\frac{dI_B}{dI_C}\right)\right]$
 (D) $\frac{\beta-1}{\left[1-\beta\left(\frac{dI_B}{dI_C}\right)\right]}$

Key: (A)

Sol: $S = \frac{\partial I_C}{\partial I_{CO}}$ with β and V_{EE} constant

Consider the collector current equation of a BJT in CE configuration:

$$I_C = \beta I_B + (1+\beta)I_{CO} \dots (1)$$

Differentiating equation (1) with respect to I_C

$$1 = \beta \frac{\partial I_B}{\partial I_C} + (1+\beta) \frac{\partial I_{CO}}{\partial I_C}$$

$$\frac{\partial I_{CO}}{\partial I_C} = \frac{1-\beta\left(\frac{\partial I_B}{\partial I_C}\right)}{1+\beta} \Rightarrow \frac{\partial I_C}{\partial I_{CO}} = \frac{1+\beta}{1-\beta\left(\frac{\partial I_B}{\partial I_C}\right)}$$

$$\therefore S = \frac{\partial I_C}{\partial I_{CO}} = \frac{1+\beta}{1-\beta\left(\frac{\partial I_B}{\partial I_C}\right)}$$

27. The leakage current in an NPN transistor is due to the flow of:

- (A) Holes from base to emitter
 (B) Electrons from collector to base
 (C) Holes from collector to base
 (D) Minority carriers from emitter to collector

Key: (C)

Sol: In a BJT, current due to the minority carriers at collector junction is called leakage current. In npn transistor, it is the current due to holes of collector region.

28. In Early effect:

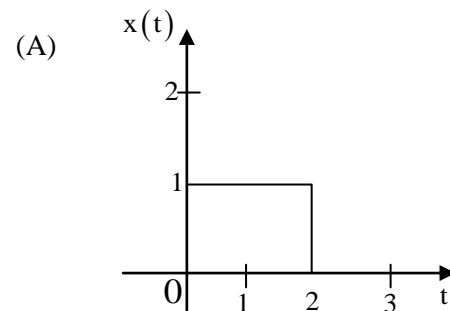
- (A) Increase in magnitude of Collector voltage increases space charge width at the input junction of a BJT
 (B) Increase in magnitude of Emitter-Base voltage increases space charge width of output junction of a BJT
 (C) Increase in magnitude of Collector voltage increases space charge width of output junction of a BJT
 (D) Decrease in magnitude of Emitter-Base voltage increases space charge width of output junction of a BJT

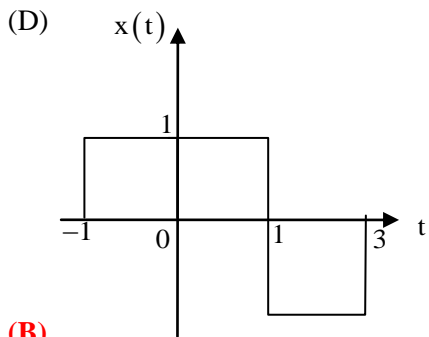
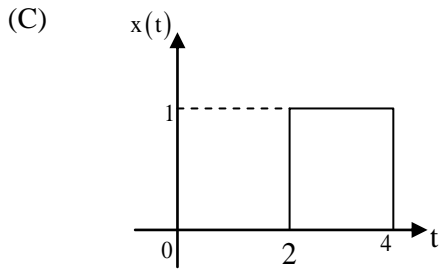
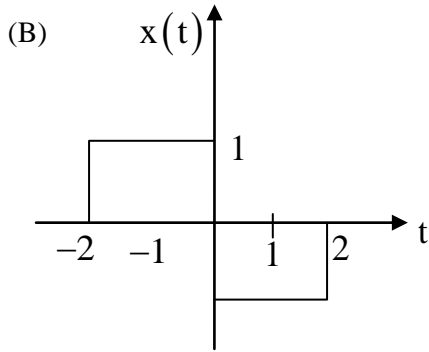
Key: (C)

Sol: Output junction is C-B junction which is always Reverse Bias and by increasing the magnitude of Reverse Bias voltage depletion layer width at Collector – Base junction increases.

When the CB junction is reverse biased, with an increase in reverse bias voltage potential barrier external more into the junction. This is called early effect or base width modulation.

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

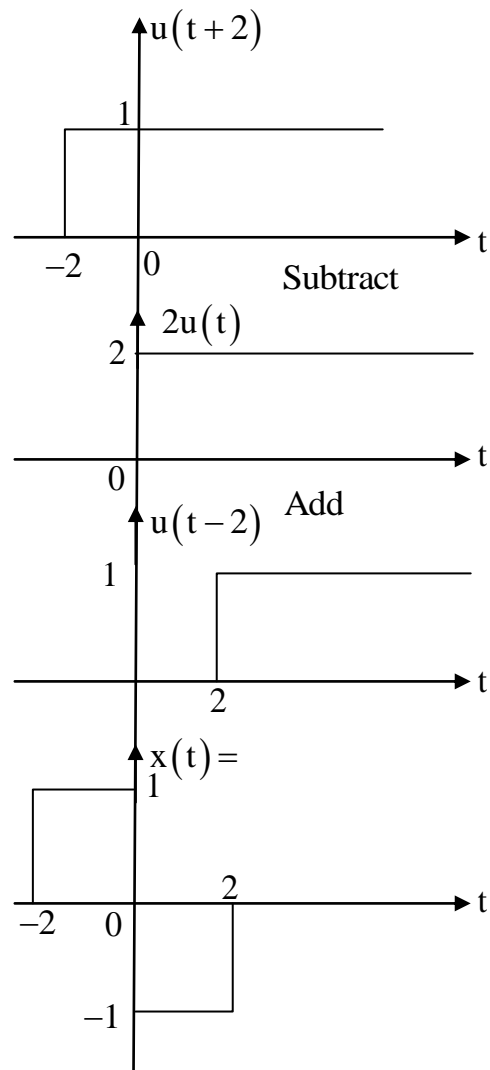




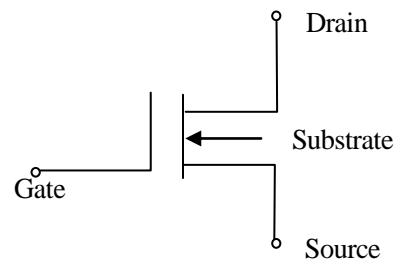
Key: (B)

Sol: Number of step signals in any signal is equal to number of jump discontinuities in it.

$$x(t) = u(t+2) - 2u(t) + u(t-2)$$



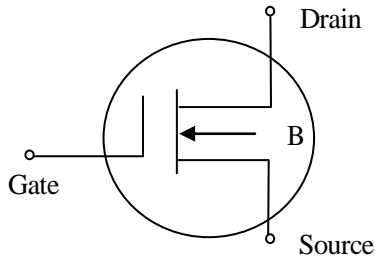
30. The figure shown represent:



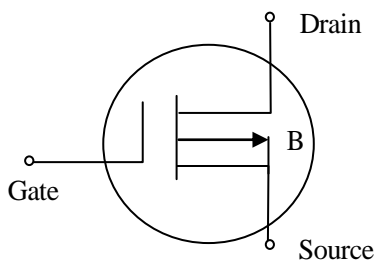
- (A) n-channel MOSFET
- (B) Enhanced-mode E-MOSFET
- (C) p-Channel MOSFET
- (D) J-FET

Key: (A)

Sol: n-Channel MOSFET:

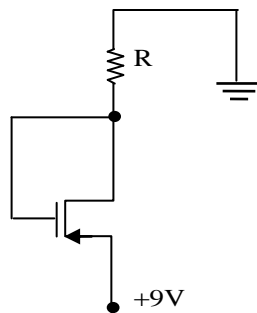


p-Channel MOSFET:



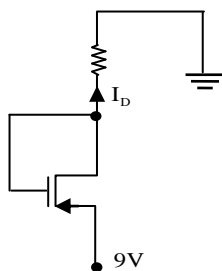
31. The PMOSFET circuit shown in the figure has $V_{TP} = -1.4V$, $K'_p = 25\mu A/V^2$, $L=2\mu m$, $\lambda = 0$. If $I_{DS} = -0.1mA$ and $V_{DS} = -2.4V$ then the width of channel W and R are respectively:

- (A) $16\mu m$ and $66 k\Omega$
- (B) $18 \mu m$ and $33 k\Omega$
- (C) $16\mu m$ and $33 k\Omega$
- (D) $18\mu m$ and $66 k\Omega$



Key: (A)

Sol:



$$I_D = \frac{1}{2} K \frac{W}{L} (V_{GS} - V_T)^2$$

and $V_{GS} = V_{DS} = -2.4V$

$$0.1 \times 10^{-3} = \frac{1}{2} \times 25 \times 10^{-6} \times \frac{W}{2 \times 10^{-6}} (-2.4 - (-1.4))^2$$

$$\Rightarrow W = \frac{0.4 \times 10^{-3}}{25} = 16\mu m$$

On applying KVL,

$$9 + V_{GS} - I_D R = 0$$

$$R = \frac{9 - 2.4}{0.1 \times 10^{-3}} = 66k\Omega$$

32. Maximum energy of electrons liberated photoelectrically is:
- (A) Proportional to light intensity and independent of frequency of the light
 - (B) Independent of light intensity and varies linearly with frequency of the light
 - (C) Proportional to both, light intensity and frequency of the light
 - (D) Independent of light intensity and inversely proportional to frequency of the light

Key: (B)

Sol: The kinetic energy of the emitted photo electron depends directly upon the frequency of the incident light and is independent of the intensity.

33. The response of a Gaussian random process applied to a stable linear system is:
1. A Gaussian random process
 2. Not a Gaussian random process
 3. Completely specified by its mean and auto-covariance functions.
- Which of the above statements is/are correct?

- (A) 1 only
- (B) 2 only
- (C) 2 and 3
- (D) 1 and 3

Key: (D)

Sol: $m_y = m_x H(0)$

34. Consider a system, which computes the ‘MEDIAN’ of signal values in a window of size ‘N’. Such a discrete time system is:
 (A) Linear
 (B) Non-linear
 (C) Sometimes linear
 (D) Sometimes non-linear

Key: (B)

Sol: Median is a non linear operator

35. Consider a discrete time system which satisfies the additivity property, i.e., if the output for $u_1[n]$ is $y_1[n]$ and that for $u_2[n]$ is $y_2[n]$, then output for $u_1[n] + u_2[n]$ is $y_1[n] + y_2[n]$. Such a system is:
 (A) Linear
 (B) Sometimes linear
 (C) Non-linear
 (D) Sometimes non-linear

Key: (B&D)

Sol: The system may not satisfy homogeneity every time. So system may be linear (or) Non-linear.

36. Consider an ideal low pass filter. Such a discrete-time system is:
 (A) always realizable physically
 (B) never realizable physically
 (C) a non linear system
 (D) a linear, causal system

Key: (B)

Sol: Since the frequency response of an ideal low pass filter is non-causal it can't be realized physically.

37. The result of $h(2t) * \delta(t - t_0)$ (“*” denotes convolution and “ $\delta(\cdot)$ ” denotes the Dirac delta function) is:
 (A) $h(2t - 2t_0)$ (B) $h(2t_0 - 2t)$
 (C) $h(-2t - 2t_0)$ (D) $h(2t + 2t_0)$

Key: (A)

Sol: $x(t) * \delta(t) = x(t)$

$$x(t) * \delta(t - t_0) = x(t - t_0)$$

→ Shifting property of convolution

$$h(2t) * \delta(t - t_0) = h(2(t - t_0)) = h(2t - 2t_0)$$

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

(A) $\frac{1}{\sqrt{2}}$ (B) $\frac{3}{\sqrt{2}}$ (C) $\frac{\sqrt{2}}{3}$ (D) $\sqrt{2}$

Key: (C)

Sol: $n = \sqrt{\epsilon_r} = 1.5$

$$\theta_i = \frac{\pi}{4}$$

From snell's law

$$\frac{\sin \theta_i}{\sin \theta_t} = \sqrt{\frac{\epsilon_2}{\epsilon_1}} = \sqrt{\frac{\epsilon_{r_2}}{\epsilon_{r_1}}} = \frac{n_2}{n_1}$$

$$\frac{\sin \pi / 4}{\sin \theta_t} = \frac{1.5}{1}$$

$$\sin \theta_t = \frac{1}{1.5} \sin \pi / 4 = \frac{2}{3} \times \frac{1}{\sqrt{2}}$$

$$\sin \theta_t = \frac{\sqrt{2}}{3}$$

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

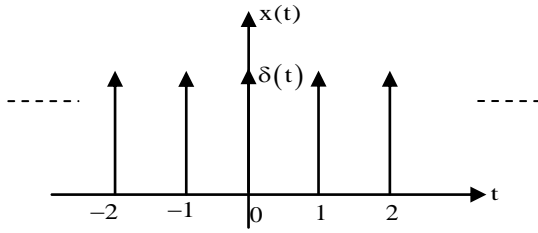
$$x(t) = \sum_{k=-\infty}^{\infty} a_k \cdot e^{j \frac{2\pi}{T_0} kt}$$

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

- (A) $1 - (-k)^k$ (B) $1 + (-1)^k$
 (C) 1 (D) -1

Key: (C)

Sol: $x(t) = \sum_{b=-\infty}^{\infty} \delta(t - b)$



The exponential Fourier Series coefficient is,

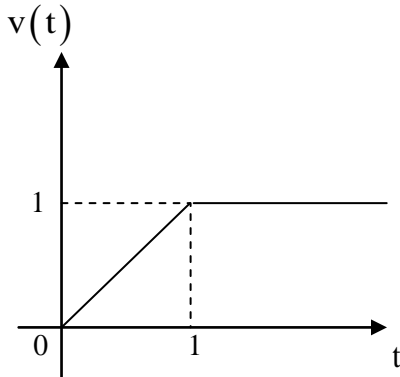
$$a_k = \frac{1}{T_0} \int_{t_a}^{t_a+T_0} x(t) e^{-j\frac{2\pi}{T_0}kt} dt$$

$$a_k = \frac{1}{1} \int_0^1 \delta(t) e^{-j\frac{2\pi}{1}kt} dt$$

(By shifting property of impulse signal)

$$a_k = 1$$

40. Laplace transform of the function $v(t)$ shown in the figure is :

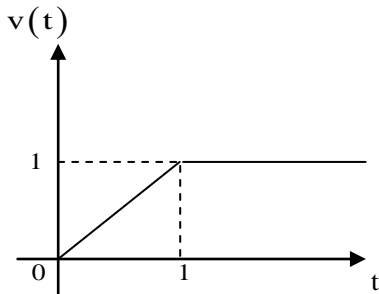


(A) $s^2 [1 - e^{-s}]$ (B) $s^2 [1 - e^{-s}]$

(C) $\frac{1}{s^2} [1 - e^{-s}]$ (D) $\frac{1}{s^2} [1 - e^{-s}]$

Key: (D)

Sol:



$$x(t) = r(t) - r(t-1)$$

$$r(t) \leftrightarrow \frac{1}{s^2}$$

$$r(t-1) \leftrightarrow \frac{e^{-s}}{s^2}$$

$$X(s) = \frac{1}{s^2} [1 - e^{-s}]$$

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

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

2. Non periodic

3. Periodic for some value of period N

Which of the above statements is/are correct?

- (A) 1 only (B) 2 only
(C) 3 only (D) 1 and 3

Key: (B)

Sol: $\omega_0 = 1$

A discrete time complex exponential is periodic if $\frac{\omega_0}{2\pi}$ is a rational number. But

given $\omega_0 = 1$

$$\frac{\omega_0}{2\pi} = \frac{1}{2\pi}$$

is a irrational number, so non periodic

42. Consider the following transforms:

1. Fourier transform

2. Laplace transform

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

- (A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (C)

Sol: Both Fourier transform and Laplace transform is used. Fourier transform is used to find the spectrum, Laplace transform is used for positive going exponentials.

43. The varactor diode has a voltage-dependent:

1. Resistance
2. Capacitance
3. Inductance

Which of the above is/are correct?

- (A) 1 only (B) 2 only
(C) 3 only (D) 1 and 3

Key: (B)

Sol: A varactor diode is a reverse biased junction diode whose capacitance can be changed with the applied reverse bias voltage.

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

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

- (A) 0 for $0 \leq n \leq 3$ and 0.24 otherwise
(B) 0.24 for $0 \leq n \leq 3$ and 0 otherwise
(C) 0.24 for $n = 0$ to $n = \infty$
(D) 0 for $n = 0$ to $n = \infty$

Key: (B)

Sol: $y(n) = 0.24 (x[n]+x[n-1]+x[n-2]+x[n-3])$

Applying Z-Transform

$$Y(z) = 0.24 [X(z) + z^{-1}X(z) + z^{-2}X(z) + z^{-3}X(z)]$$

$$H(z) = 0.24 [1 + z^{-1} + z^{-2} + z^{-3}] = \frac{Y(z)}{X(z)}$$

By using Inverse Z-Transform

$$h(n) = 0.24 \delta(n) + 0.24 \delta(n-1) + 0.24 \delta(n-2) + 0.24\delta(n-3)$$

$$h(n) = [0.24, 0.24, 0.24, 0.24]$$

$$h(n) = 0.24 \quad ; 0 \leq n \leq 3$$

$$0 \quad ; \text{otherwise}$$

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

- (A) Small signal current gain
(B) High frequency current gain
(C) Power loss in the BJT
(D) Large-signal current gain

Key: (D)

Sol: For a BJT,

$$\alpha = \beta^* \gamma$$

Where α is large signal current gain.

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

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

Which of the above is/are correct?

- (A) 1 only (B) 2 only
(C) 3 only (D) 1 and 3

Key: (C)

Sol: For a two sided signal ROC is a ring which is bounded by poles (or) it may not exist. Thus only statement 3 is to be considered.

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

- (A) $f(n) = 0$ for $n < 0$
(B) $f(n) < 0$ for $n > 0$
(C) $f(n) = 0$ for $n > n_0$
(D) $f(n) = \infty$ for $n < n_0$
($n_0 \rightarrow$ Positive or negative integer)

Key: (C)

Sol: If a sequence is defined as zero for all positive values of time including zero with same (or) all negative time sequences then it is left sided.

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

1. Transient behavior
2. Steady-state behavior

Which of the above behaviours is/are correct?

- (A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (C)

Sol: Solving constant coefficient difference equations with initial conditions using z-

transform gives transient response as well as steady state response.

49. The response of a linear, time-invariant discrete-time system to a unit step input $u[n]$ is $\delta[n]$. The system response to a ramp input $n u[n]$ would be:
- (A) $\delta[n-1]$ (B) $u[n-1]$
(C) $n \delta[n-1]$ (D) $n u[n-1]$

Key: (B)

Sol: It is given that

$$x(n) = u(n), y(n) = \delta(n)$$

By first difference,

$$u(n) - u(n-1) = \delta(n)$$

$$y(n) = x(n) - x(n-1)$$

$$\text{Now } x(n) = nu(n)$$

$$y(n) = nu(n) - (n-1)u(n-1)$$

$$y(n) = nu(n) - nu(n-1) + u(n-1)$$

$$y(n) = n\delta(n) + u(n-1) = 0 + u(n-1)$$

$$y(n) = u(n-1)$$

50. Consider a discrete-random variable z assuming finitely many values. The cumulative distribution function, $F_z(z)$ has the following properties:
- $\int_{-\infty}^{+\infty} F_z(z) dz = 1$
 - $F_z(z)$ is non-decreasing with finitely many jump-discontinuities
 - $F_z(z)$ is negative and non-decreasing

Which of the above properties is/are correct?

- (A) 1 only (B) 2 only
(C) 3 only (D) 2 and 3

Key: (B)

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

- (A) Gaussian
(B) Rayleigh
(C) Rician
(D) Uniform in $[-A, A]$

Key: (A)

Sol: The envelope of Gaussian random variable is Rayleigh and phase is uniform.

52. Poisson's equation is derived with the following assumption about the medium. The medium is:
- (A) Non-homogeneous and isotropic
(B) Non-homogeneous and non-isotropic
(C) Homogeneous and non-isotropic
(D) Homogeneous and isotropic

Key: (D)

Sol: From Gauss law we know

$$\nabla \cdot \bar{D} = \rho_v$$

$$D = \epsilon \bar{E}$$

$$\nabla \cdot (\epsilon \bar{E}) = \rho_v$$

If the medium is homogeneous and isotropic then only E can be taken out.

$$\nabla \cdot \bar{E} = \frac{\rho_v}{\epsilon}$$

$$E = -\nabla V$$

$$\nabla \cdot (-\nabla V) = \frac{\rho_v}{\epsilon}$$

$$\nabla^2 V = -\frac{\rho_v}{\epsilon}$$

53. The state space representation of a linear time invariant system is:

$$\dot{X}(t) = AX(t) + Bu(t)$$

$$Y(t) = CX(t)$$

What is the transfer function $H(s)$ of the system?

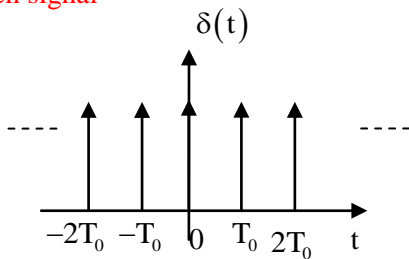
- (A) $C(sI - A)^{-1}B$
(B) $B(sI - A)^{-1}C$
(C) $C(sI - A)B$
(D) $B(sI - A)C$

Key: (A)

54. $x(t) = \frac{1}{T_0} + \sum_{k=1}^N \frac{2}{T_0} \cos k\omega_0 t$, is the combined trigonometric form of Fourier series for:
 (A) Half rectified wave
 (B) Saw-tooth wave
 (C) Rectangular wave
 (D) Impulse train

Key: (D)

Sol: As sine terms are missing in Trigonometric Fourier series expansions it should be an even signal



$$a_0 = \frac{1}{T_0} \int_{t_a}^{t_a+T_0} x(t) dt = \frac{1}{T_0} \int_{t_a}^{t_a+T_0} \delta(t) dt = \frac{1}{T_0}$$

$$a_n = \frac{2}{T_0} \int_{t_a}^{t_a+T_0} x(t) \cdot \cos(k\omega_0 t) dt$$

$$= \frac{2}{T_0} \int_{t_a}^{t_a+T_0} \delta(t) \cdot \cos(k\omega_0 t) dt = \frac{2}{T_0}$$

$$b_n = \frac{2}{T_0} \int_{t_a}^{t_a+T_0} x(t) \cdot \sin(k\omega_0 t) dt$$

$$= \frac{2}{T_0} \int_{t_a}^{t_a+T_0} \delta(t) \cdot \sin(k\omega_0 t) dt = 0$$

55. A signal x_n is given by $x_0 = 3, x_1 = 2, x_2 = 5, x_3 = 1, x_4 = 0, x_5 = 1, x_6 = 2, x_7 = 2, x_8 = 4$, where the subscript 'n' denotes time. The peak value of the auto correlation of $x[2n-11]$ is:
 (A) 0 (B) 10 (C) 54 (D) 64

Key: (B)

Sol: $x(n) = [3, 2, 5, 1, 0, 1, 2, 2, 4]$
 ↑

$$x(n-11) = [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 2, 5, 1, 0, 1, 2, 2, 4]$$

↑

$$y(n) = x(2n-11) = [0, 0, 0, 0, 0, 0, 0, 2, 1, 1, 2]$$

↑

$$y(n) \text{ correlation } y(n) = y(n) * y(-n)$$

$$y(-n) = [2, 1, 1, 2, 0, 0, 0, 0, 0, 0]$$

↑

	2	1	1	2	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
2	4	2	2	4	0	0	0	0	0	0
1	2	1	1	2	0	0	0	0	0	0
1	2	1	1	2	0	0	0	0	0	0
2	4	2	2	4	0	0	0	0	0	0

$$y(n) * y(n) = [0, 0, 0, 0, 0, 0, 4, 4, 5, 10, 5, 4, 4, 0, 0, 0, 0, 0]$$

Highest value is '10'

56. A system has impulse response $h[n] = \cos(n)u[n]$. The system is:
 (A) Causal and stable
 (B) Non causal and stable
 (C) Non causal and not stable
 (D) Causal and not stable

Key: (D)

Sol: $h(n) = \cos(n) \cdot u(n)$

If any signal is multiplied with $u[n]$ it is causal

$$\sum_{n=-\infty}^{\infty} |h(n)| = \sum_{n=0}^{\infty} |\cos(n)| = \infty, \text{ not stable}$$

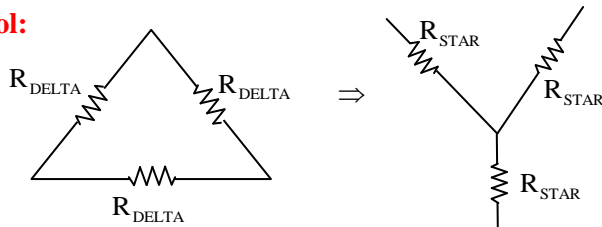
Since the absolute summation of $h[n]$ infinite. It is unstable.

57. If the three resistors in a delta network are all equal in values i.e. R_{DELTA} , then the value of the resultant resistors in each branch of the equivalent star network i.e. R_{STAR} will be equal to: ($R_D \rightarrow R_{\text{DELTA}}; R_S \rightarrow R_{\text{STAR}}$)

- (A) $\frac{R_{\text{DELTA}}}{3}$ (B) $\frac{R_{\text{DELTA}}}{2}$
(C) $2R_{\text{DELTA}}$ (D) R_{DELTA}

Key: (A)

Sol:



$$R_{\text{STAR}} = \frac{R_{\text{DELTA}} \times R_{\text{DELTA}}}{R_{\text{DELTA}} + R_{\text{DELTA}} + R_{\text{DELTA}}} = \frac{R_{\text{DELTA}}}{3}$$

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

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

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

Which of the above relations are correct ?

- (A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (A)

- Sol:** 1. $Z_{ij} = Z_{ji}, i, j = 1, 2, 3$
2. $Z_{ii} > 0, i = 1, 2, 3$

When it is passive network it is reciprocal

$$Z_{ij} = Z_{ji}$$

and Z_{ii} should be greater than 0

ΔZ value should be greater than zero

59. A function $c(t)$ satisfies the differential equation $\dot{c}(t) + c(t) = \delta(t)$ For zero initial condition $c(0)$ can be represented by:

- (A) e^{-t} (B) e^t (C) $e^t u(t)$ (D) $e^{-t} u(t)$

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

Key: (D)

Sol: $\dot{c}(t) + c(t) = \delta(t)$

Apply time differentiation property of ULT,

$$sC(s) - c(0) + C(s) = 1$$

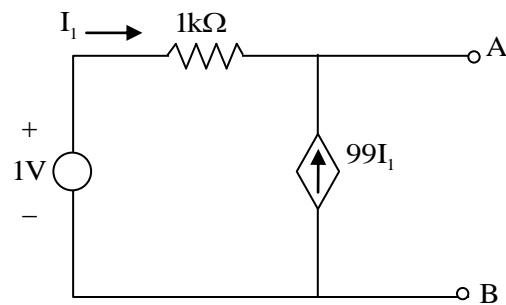
$$c(0) = 0$$

$$C(s) = \frac{1}{s+1}$$

By using inverse laplace transform

$$c(t) = e^{-t} \cdot u(t)$$

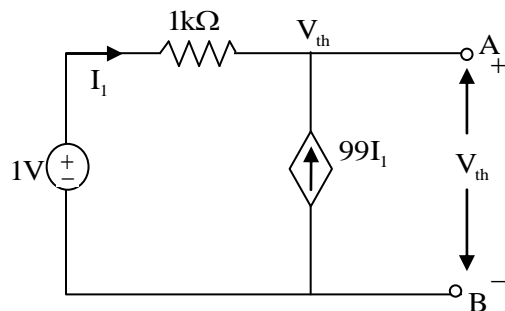
60. For the network shown, Thevenin's equivalent voltage source and resistance are, respectively:



- (A) 1mV and 10Ω (B) 1V and 1kΩ
(C) 1mV and 1kΩ (D) 1V and 10Ω

Key: (D)

Sol: For V_{th}



By KCL

$$\frac{(V_{\text{th}} - 1)}{1 \times 10^3} - 99I_1 = 0;$$

$$\therefore I_1 + 99I_1 = 0 \Rightarrow I_1 = 0$$

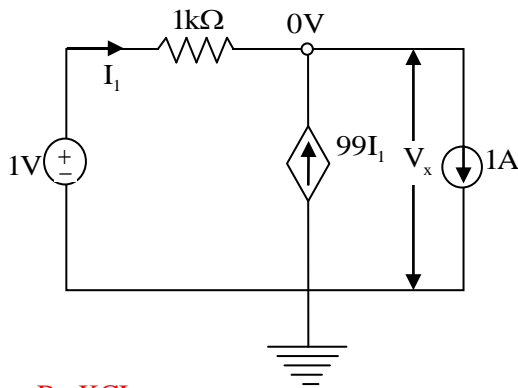
$$\frac{(V_{th} - 1)}{1 \times 10^3} = 0 \Rightarrow V_{th} = 1V$$

For R_{th}

$$R_{th} = \frac{V_x}{1}$$

$$99I_1 + I_1 = -1$$

$$I_1 = -0.01A$$



By KCL

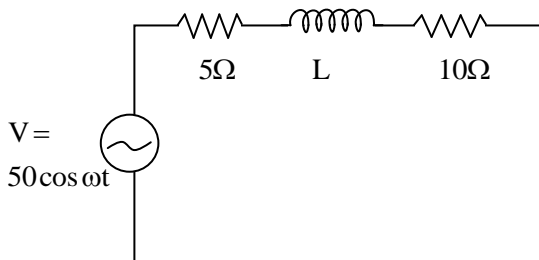
$$\frac{V_x}{1 \times 10^3} - 99I_1 - 1 = 0$$

$$\frac{V_x}{1 \times 10^3} + 0.99 - 1 = 0$$

$$V_x = 10V; R_{th} = \frac{V_x}{1}$$

$$R_{th} = 10\Omega$$

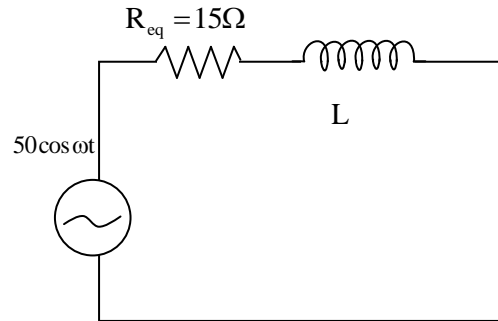
61. In the circuit shown, if the power consumed by the 5Ω resistor is $10W$, then the power factor of the circuit is:



- (A) 0.8 (B) 0.6 (C) 0.4 (D) 0.2

Key: (B)

Sol:



Given

$$P_{5\Omega} = 10W$$

$$P_{5\Omega} = I^2 \times 5$$

$$10 = I^2 \times 5$$

$$I = \sqrt{2}$$

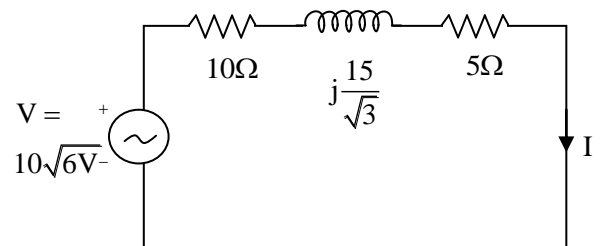
$$\text{Power factor} = \frac{V_{req}}{V}$$

$$V_{Req} = IR_{eq} = 15\sqrt{2} \text{ V}$$

$$V = V_{rms} = \frac{50}{\sqrt{2}} \text{ V}$$

$$\text{power factor} = \frac{V_{Req}}{V} = \frac{15\sqrt{2}}{50/\sqrt{2}} = \frac{30}{50} = 0.6 \text{ lags}$$

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



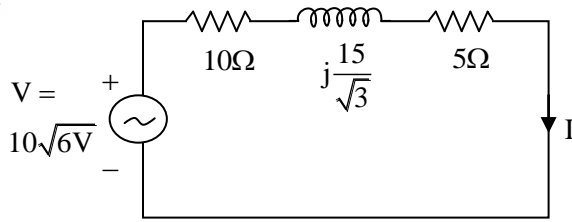
1. $|I| = \sqrt{2}A$
2. Total impedance = 5Ω
3. Power factor = 0.866

Which of the above are correct ?

- (A) 1 and 3 only (B) 1 and 2 only
(C) 2 and 3 only (D) 1, 2 and 3

Key: (A)

Sol:



1. Power consumed by 5Ω is 10 W

$$I^2 5 = 10 \Rightarrow I = \sqrt{2}\text{Amps}$$

2. Total impedance $Z = \left(10 + 5 + j\frac{15}{\sqrt{3}}\right)\Omega$

$$Z = \left(15 + j\frac{15}{\sqrt{3}}\right)\Omega$$

$$Z = \frac{30}{\sqrt{3}} = 10\sqrt{3}\Omega$$

3. Power factor $\cos \phi = \frac{V_{R_{eq}}}{V} = \frac{IR_{eq}}{V}$

$$\cos \phi = \frac{\sqrt{2}(10+5)}{10\sqrt{6}} = \frac{15\sqrt{2}}{10\sqrt{6}} = \frac{\sqrt{3}}{2} = 0.866$$

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

1. Branch currents
2. Link voltages

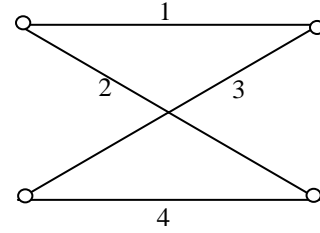
Which of the above is/are correct?

- (A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (D)

Sol: Branch voltages are related independent of cut set. Link currents are related independent of Tieset.

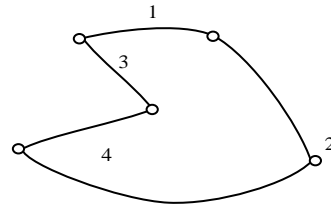
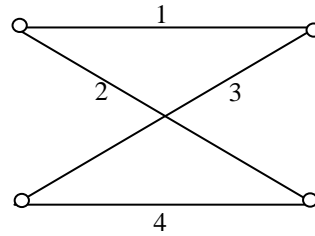
64. For the network graph, the number of trees (P) and the number of cut-sets (Q) are respectively:



- (A) 4 and 2 (B) 6 and 2
(C) 4 and 6 (D) 2 and 6

Key: (C)

Sol: The given graph



→ The no. of trees : 4 No. of cutsets = 6

As the total number of branches in the given graph 4, there only 4 possibilities with 3 branches.

→ From the given graph it can be observed that any 2 branches out of the total 4 branches from a cut-set. As 6 such combination are possible the number of cut-set $Q = 6$.

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

- (A) Velocity (B) Humidity
(C) Displacement
(D) Percent of CO_2 in air

Key: (A)

66. According to network graphs, the network with:

1. Only two odd vertices is traversable
2. No odd vertices is traversable
3. Two or more than two odd vertices are traversable

Which of the above statements is/are correct?

- (A) 1 only (B) 2 only
(C) 3 only (D) 1 and 2

Key: (D)

- 67.** For any lumped network, for any cut sets and at any instant of time the algebraic sum of all branch currents traversing the cut-set branches is always:
- (A) One (B) Zero
(C) Infinity
(D) Greater than zero, but less than one

Key: (B)

- 68.** Which one of the following statements concerning Tellegen's theorem is correct?
- (A) It is useful in determining the effects in all parts of a linear four-terminal network
- (B) It is applicable for any lumped network having elements which are linear or nonlinear, active or passive, time varying or time-invariant, and may contain independent or dependent sources
- (C) It can be applied to a branch, which is not coupled to other branches in a network
- (D) It states that the sum of powers taken by all elements of a circuit within constraints imposed by KCL and KVL is non-zero

Key: (B)



- 69.** The open circuit input impedance of a 2-port network is

- (A) $\frac{A}{C}\Omega$ (B) $\frac{B}{D}\Omega$ (C) $\frac{D}{C}\Omega$ (D) $\frac{A}{B}\Omega$

Key: (A)

Sol: For T-parameter

$$V_1 = AV_2 - BI_2$$

$$I_1 = CV_2 - DI_2$$

$$Z_{11} = \left. \frac{V_1}{I_1} \right|_{I_2=0}$$

$$Z_{11} = \frac{AV_2}{CV_2} = \frac{A}{C}$$

- 70.** Consider the following statements:

1. Two identical 2nd order Butterworth LP filters when connected in cascade will make a 4th order Butterworth LP filter.
2. A high 2nd order filter will exhibit a peak if Q exceeds certain value.
3. A band pass filter cannot be of order one.
4. A network consists of an amplifier of real gain A and a β network in cascade with each other. The network will generate sinusoidal oscillations if the β network is a first order LP filter.

Which of the above statements are correct?

- (A) 1 and 2 (B) 2 and 3
(C) 3 and 4 (D) 1 and 4

Key: (B)

- 71.** The lowest and the highest critical frequencies of RC driving point admittance are, respectively:
- (A) a zero and a pole
(B) a pole and a zero
(C) a zero and a zero
(D) a pole and a pole

Key: (A)

Sol: The lowest & highest critical frequencies of RC driving point impedance
→ For RL impedance and RC Admittance function the critical frequency nearest to the

origin or at the origin must be a zero. Whereas the critical frequency nearest to infinity or at infinity must be a pole.

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

- (A) $2.5e^{-3t}$ (B) $7.5e^{-3t}$
(C) $2.5e^{+3t}$ (D) $7.5e^{+3t}$

Key: (B)

$$V(s) = \frac{5(s-0)}{(s+1)(s+3)} = \frac{5s}{(s+1)(s+3)}$$

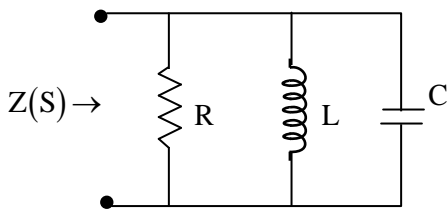
$$= \frac{-5/2}{s+1} + \frac{15/2}{s+3}$$

$$V(t) = -\frac{5}{2}e^{-t} \cdot u(t) + \frac{15}{2}e^{-3t} \cdot u(t)$$

The contribution of the pole at -3 to $v(t)$ is $7.5e^{-3t} u(t)$

73. The driving point impedance of the circuit shown is given by

$$Z(s) = \frac{0.2s}{s^2 + 0.1s + 2}$$



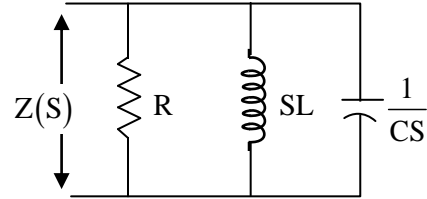
The component values R, L and C are respectively:

- (A) 0.5Ω , 1H and 0.1 F
(B) 2Ω , 5 H and 5 F
(C) 0.5Ω , 0.1 H and 0.1 F
(D) 2Ω , 0.1 H and 5 F

Key: (D)

Sol: The driving point impedance of the circuit

$$Z(s) = \frac{0.2s}{s^2 + 0.1s + 2}$$



$$Y(s) = \left(\frac{1}{R} + \frac{1}{sL} + Cs \right)$$

$$\frac{1}{Z(s)} = \frac{1}{R} + \frac{1}{sL} + Cs$$

$$\frac{s^2 + 0.1s + 2}{0.2s} = \frac{1}{R} + \frac{1}{sL} + Cs$$

$$\frac{s}{0.2} + \frac{1}{2} + \frac{1}{0.1s} = \frac{1}{R} + \frac{1}{sL} + Cs$$

$$R = 2, L = 0.1H, C = 5F$$

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

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

Which of the above is/are realizable?

- (A) 1 only
(B) 2 only
(C) Both 1 and 2
(D) Neither 1 nor 2

Key: (D)

Sol: For driving point impedance function of passive circuit (RL, RC and LC). The poles and zeros are alternate then only it is realizable

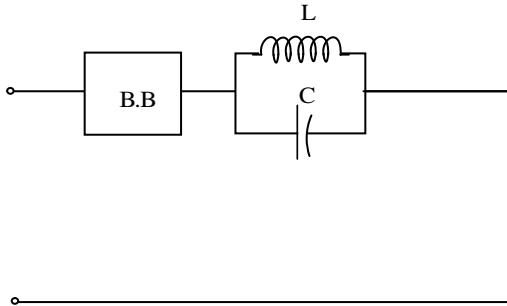
1. $\frac{s+3}{s^2(s+5)}$ 2. $\frac{s^2+3}{s^2(s^2+5)}$



Poles are repeating poles are repeating
(OR)

Both cannot be realized as the difference between highest degree of numerator and denominator polynomial is greater than one.

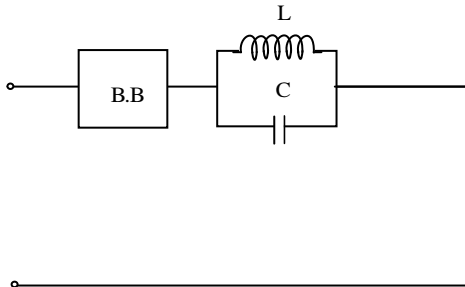
75. A reactance function in the first Foster form has poles at $\omega = 0$ and $\omega = \infty$. The black-box (B.B) in the network contains:



- (A) An inductor
(B) A capacitor
(C) A parallel L – C circuit
(D) A series L – C circuit

Key: (B)

Sol: A reactance function in the first Foster form has poles at $\omega = 0$ and $\omega = \infty$



pole at origin \rightarrow It is capacitor in series.
Black Box should contains only capacitor.

76. Consider the following statements:
- The magnetic field at the centre of a circular coil of a wire carrying current is inversely proportional to the radius of the coil
 - Lifting power of a magnet is proportional to square of magnetic flux density

- A static electric field is conservative (irrotational).
- If the divergence of a vector 'A' is zero, then vector 'A' can be expressed as Curl of a vector F

Which of the above statements are correct?

- (A) 1, 2 and 3 only (B) 3 and 4 only
(C) 1, 2 and 4 only (D) 1, 2, 3 and 4

Key: (D)

Sol: 1. The magnetic field at the centre at circular coil is given by

$$H = \frac{1}{2a}$$

$a \rightarrow$ radius

2. Lifting force $F = \frac{B^2 s}{2\mu}$

$$F \propto B^2$$

3. $\nabla \times E = 0$

$E \rightarrow$ Static electric field

Static electric field is irrotational

4. $\nabla \cdot A = 0$

$$A = \nabla \times F$$

Any solenoidal vector can be expressed as curl of some other vector.

77. Consider the following:

- Electric current flowing in a conducting wire
- A moving charged belt
- An electron beam in a cathode ray tube
- Electron movement in a vacuum tube

Which of the above are examples of convection current?

- (A) 2, 3 and 4 only
(B) 1, 2 and 4 only
(C) 1 and 3 only
(D) 1, 2, 3 and 4

Key: (A)

78. Consider the following sources:

- A permanent magnet

2. A charged disc rotating at uniform speed
3. An accelerated charge
4. An electric field which changes linearly with time

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

- (A) 1, 2 and 3 only
- (B) 3 and 4 only
- (C) 1, 2 and 4 only
- (D) 1, 2, 3 and 4

Key: (C)

Sol: Sources of steady magnetic field are

1. permanent magnet
2. a charged disc rotating at uniform speed
4. an electric field which changes linearly with time but change with acceleration provides time varying magnetic field.

79. A charge Q is enclosed by a Gaussian spherical surface of radius R. If R is doubled then the outward flux is
- (A) Doubled
 - (B) Increased four times
 - (C) Reduced to a quarter
 - (D) Remains unaltered

Key: (D)

Sol: Flux does not changes with radius. Since the amount of charge enclosed does not change with respect to radius.

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

- (A) $\frac{1}{\rho} \frac{\partial}{\partial \rho} (\rho D_\rho) + \frac{1}{\rho} \frac{\partial D_\phi}{\partial \phi} + \frac{\partial D_z}{\partial z}$
- (B) $\frac{1}{\rho} \frac{\partial}{\partial \rho} (\rho D_\rho) + \frac{1}{\rho} \frac{\partial (\phi D_\phi)}{\partial \phi} + \frac{1}{z} \frac{\partial (z D_z)}{\partial z}$
- (C) $\frac{1}{\rho} \frac{\partial}{\partial \rho} (\rho D_\rho) + \frac{1}{\rho} \frac{\partial D_\phi}{\partial \phi} + \frac{\partial D_z}{\partial z}$
- (D) $\frac{\partial D_\rho}{\partial \rho} + \frac{\partial D_\phi}{\partial \phi} + \frac{\partial D_z}{\partial z}$

Key: (C)

Sol: $\nabla \cdot \mathbf{D} = \frac{1}{\rho} \frac{\partial}{\partial \rho} (\rho D_\rho) + \frac{1}{\rho} \frac{\partial D_\phi}{\partial \phi} + \frac{\partial D_z}{\partial z}$

It is a standard formula.

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

- (A) 180 μJ
- (B) 180 nJ
- (C) 18 μJ
- (D) 18 nJ

Key: (A)

Sol: $W = Q_1 V \Rightarrow V = \frac{1}{4\pi\epsilon} \frac{Q_2}{r}$

$$W = \frac{1}{4\pi\epsilon} \frac{Q_1 Q_2}{r} = \frac{9 \times 10^9 \times 8 \times 10^{-9} \times 5 \times 10^{-6}}{2}$$

$W = 180 \mu\text{J}$

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

- (A) More apart and dielectric constant of the medium between them decreases
- (B) Less apart and dielectric constant of the medium between them decreases
- (C) More apart and dielectric constant of the medium between them increases
- (D) Less apart and dielectric constant of the medium between them increases

Key: (B)

Sol: $F = \frac{1}{4\pi\epsilon} \frac{Q_1 Q_2}{R^2}$

$F \propto \frac{Q_1 Q_2}{\epsilon R^2}$

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

- (A) -1080πā_yN
- (B) -108πā_yN
- (C) -10.8πā_yN
- (D) -1.08πā_yN

Key: (D)

Sol: Since force is inversely proportional to E, R, so, when E, R decreases F increases.

Plane $y = 2$

$$E = \frac{\rho_s \bar{a}_n}{2\epsilon} = \frac{6 \times 10^{-9}}{2 \times \frac{1}{36\pi} \times 10^{-9}} (-\bar{a}_y)$$

$$E = 108\pi \bar{a}_y$$

$$F = QE$$

$$= -10 \times 10^{-3} \times 108\pi \bar{a}_y$$

$$= -1080\pi \bar{a}_y \times 10^{-3}$$

$$F = -1.80\pi \bar{a}_y \text{ N}$$

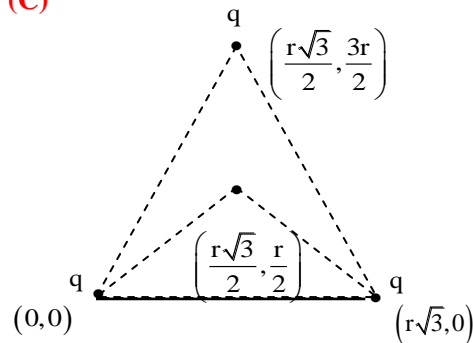
84. The potential at the centroid of an equilateral triangle of side $r\sqrt{3}$ due to three equal positive point charges each of value q and placed at the vertices of the triangle would be

(A) $\frac{q}{2\pi \epsilon_0 r}$ (B) $\frac{\sqrt{3}q}{8\pi \epsilon_0 r}$

(C) $\frac{3q}{4\pi \epsilon_0 r}$ (D) zero

Key: (C)

Sol:



$$V = V_1 + V_2 + V_3$$

$$= \frac{1}{4\pi\epsilon} \frac{q}{r} + \frac{1}{4\pi\epsilon} \frac{q}{r} + \frac{1}{4\pi\epsilon} \frac{q}{r}$$

$$v = \frac{3q}{4\pi\epsilon r}$$

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

(A) $\nabla \times A = J + \frac{\partial D}{\partial t}$ (B) $A = \int \frac{\mu_0 J}{4\pi \epsilon R} dv$

(C) $\nabla^2 A = -\mu_0 J$ (D) $\frac{\partial A}{\partial t} = -\frac{J}{\sigma}$

Key: (C)

Sol: $\nabla^2 A = -\mu_0 J$

Poisson's equation in the magnetic field

86. In the region $Z < 0$, $\epsilon_{r1} = 2$,

$$\bar{E}_1 = -3\bar{a}_x + 4\bar{a}_y - 2\bar{a}_z \text{ V/m.}$$

For region $Z > 0$, where $\epsilon_{r2} = 6.5$, \bar{E}_2 is:

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

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

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

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

Key: (D)

Sol: $E_1 = -3\bar{a}_x + 4\bar{a}_y - 2\bar{a}_z$

$$E_{1t} = 3\bar{a}_x + 4\bar{a}_y$$

$$E_{1n} = -2\bar{a}_z$$

$$E_2 = -3\bar{a}_x + 4\bar{a}_y + \frac{\epsilon_1}{\epsilon_2} (E_{1n})$$

$$E_2 = -3\bar{a}_x + 4\bar{a}_y - \frac{4}{6.5} \bar{a}_z$$

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

1. No charge and no electric field can exist at any point within the interior of a conductor
2. Charge may appear on the surface of a conductor

Which of the above statements are correct?

- (A) 1 only (B) 2 only
(C) Both 1 and 2 (D) Neither 1 nor 2

Key: (C)

Sol: Inside Conductor

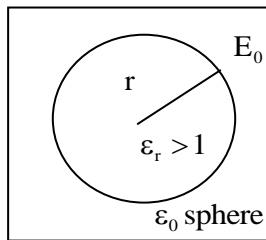
$$\begin{matrix} E = 0 \\ \rho_v = 0 \end{matrix}$$

Because of repulsive force between electrons, they exist on surface.

88. A sphere of homogeneous linear dielectric material of dielectric constant ≥ 1 is placed in a uniform electric field E_0 , then the electric field E that exists inside the sphere is
- (A) Uniform and $E \leq E_0$
 (B) Uniform and $E \geq E_0$
 (C) Varies but $E < E_0$ always
 (D) Varies but $E > E_0$ always

Key: (C)

Sol:



$$E_0 \propto \frac{1}{\epsilon_0} \Rightarrow E \propto \frac{1}{\epsilon} \Rightarrow E \propto \frac{1}{\epsilon_0 \epsilon_r}$$

Electric field inside the sphere,

$$E = \frac{\rho_v}{3\epsilon}$$

$$\epsilon_r > 1; E < E_0$$

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

(A) $\nabla \cdot E = \frac{\rho}{\epsilon_0}$ (B) $\nabla \cdot B = 0$

(C) $\nabla \times E = -\frac{\partial B}{\partial t}$

(D) $\nabla \times B = \mu_0 J + \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$

Key: (D)

Sol: $\nabla \times H = J + \frac{\partial D}{\partial t}$

$$\nabla \times \frac{B}{\mu} = J + \epsilon \frac{\partial E}{\partial t}$$

$$\nabla \times B = \mu J + \mu \epsilon \frac{\partial E}{\partial t}$$

90. Precision is composed of two characteristics, one is the number of significant figures to which a measurement may be made, the other is
- (A) Conformity (B) Meter error
 (C) Inertia effects (D) Noise

Key: (A)

91. If Phasors $P_1 = 3 + j4$ and $P_2 = 6 - j8$, then

$|P_1 - P_2|$ is

- (A) 5 (B) $\sqrt{53}$ (C) $\sqrt{73}$ (D) $\sqrt{153}$

Key: (D)

Sol: If phasors $P_1 = 3 + j4$ & $P_2 = (6 - j8)$

Then

$$|P_1 - P_2| = |(3 + j4) - (6 - j8)| = |-3 + j12|$$

$$|P_1 - P_2| = \sqrt{9 + 144} = \sqrt{153}$$

92. A plane wave in free space has a magnetic field intensity of 0.2 A/m in the Y-direction. The wave is propagating in the Z-direction with a frequency of 3 GHz. The wavelength and amplitude of the electric field intensity are, respectively
- (A) 0.05 m, and 75 V/m
 (B) 0.10 m and 75 V/m
 (C) 0.05 m and 150 V/m
 (D) 0.10 m and 150 V/m

Key: (B)

Sol: $H_0 = 0.2$

$$f = 3\text{GHz}$$

$$\lambda = \frac{V}{f} = \frac{3 \times 10^8}{3 \times 10^9} \Rightarrow \lambda = 0.1$$

$$\frac{E_0}{H_0} = 120\pi$$

$$E_0 = (0.2)(377)$$

$$E_0 = 75.4$$

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

(A) $\sqrt{LC}\Omega$ (B) $\sqrt{\frac{L}{C}}\Omega$
 (C) $\sqrt{\frac{C}{L}}\Omega$ (D) $\sqrt{\frac{R + j\omega L}{G - j\omega L}}\Omega$

Key: (B)

Sol: $Z_0 = \sqrt{\frac{L}{C}}$

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

(A) $40\ \Omega$ (B) $100\ \Omega$
 (C) $400\ \Omega$ (D) $1000\ \Omega$

Key: (B)

Sol: $Z_{QWT} = \sqrt{Z_L Z_0} = \sqrt{(200)(50)} = 100$

95. For a lossless transmission line $L = 0.35\ \mu\text{H/m}$, $C = 90\ \text{pF/m}$ and frequency = $500\ \text{MHz}$. Then the magnitude of propagation constant is

(A) 14.48 (B) 17.63 (C) 19.59 (D) 21.20

Key: (B)

Sol: For lossless transmission line

$$\beta = \omega\sqrt{LC}$$

$$= 2\pi(500 \times 10^6) \sqrt{90 + 10^{-12} \times 0.35 \times 10^{-6}}$$

$$\beta = 17.63$$

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

(A) 90.6 (B) 102.5
 (C) 205 (D) 226

Key: (A)

Sol: If a major lobe and any minor lobes of very low intensity (minor lobes are ignore) are present then the directivity is approximately equal to

$$D_0 \approx \frac{41253}{\theta_{HP}\phi_{HP}} \approx \frac{41253}{400}$$

$$\therefore D \approx 103.13$$

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

(A) Skin-effect
 (B) Inductive effect
 (C) Loading effect
 (D) Lorenz effect

Key: (C)

98. The characteristic impedance η_0 of a free space is

(A) $\frac{\mu_0}{\epsilon_0}$ (B) $\sqrt{\frac{\mu_0}{\epsilon_0}}$ (C) $\sqrt{\mu_0\epsilon_0}$ (D) $\mu_0\epsilon_0$

Key: (B)

Sol: $\eta_0 = \sqrt{\frac{\mu_0}{\epsilon_0}}$

99. A $3\frac{1}{2}$ digit voltmeter has an accuracy specification of $\pm 0.5\%$ of reading \pm one digit. What is the possible error in volts when the instrument displays 2.00V on the $10\ \text{V}$ scale?

(A) $0.03\ \text{V}$ (B) $0.02\ \text{V}$
 (C) $0.01\ \text{V}$ (D) $0.005\ \text{V}$

Key: (B)

$$\begin{aligned} \text{Sol: error} &= \pm \left[\frac{0.5}{100} \times 2V + I_{\text{count}} \right] \\ &= \pm [0.01V + 0.01V] \\ &= \pm [0.01V + 0.01V] = \pm 0.02V \end{aligned}$$

100. A megger is an instrument used for measuring

- (A) Very high voltages
- (B) Very low voltages
- (C) Very high resistances
- (D) Very low resistances

Key: (C)

101. The values of capacitance and inductance used in the series LCR circuit are 160 pF and 160 μH with the inherent tolerance – 10% in each. Then, the resonance frequency of the circuit is in the range of

- (A) 0.8 MHz to 1.2 MHz
- (B) 0.9 MHz to 1.0 MHz
- (C) 0.8 MHz to 1.0 MHz
- (D) 0.9 MHz to 1.2 MHz

Key: (B)

102. Dynamic characteristics of instruments leading to variations during measurement are

1. Speed of response
2. Fidelity
3. Dynamic error

Which of the above are correct?

- (A) 1 and 2 only
- (B) 1 and 3 only
- (C) 2 and 3 only
- (D) 1, 2 and 3

Key: (A)

103. The reliability of an instrument refers to

- (A) Degree to which repeatability continues to remain within specified limits
- (B) The extent to which the characteristics remain linear
- (C) Accuracy of the instrument
- (D) Sensitivity of the instrument

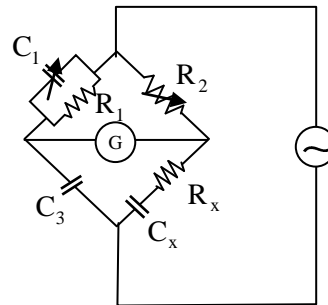
Key: (A)

104. AC Voltmeters use diodes with

- (A) High forward current and low reverse current ratings
- (B) Low forward current and low reverse current rating
- (C) Low forward current and high reverse current ratings
- (D) High forward currents and high reverse current ratings

Key: (A)

105. The bridge circuit shown can be used to measure unknown lossy capacitor C_x with resistance R_x . At balance.



(A) $R_x = \frac{C_1}{C_3} R_2$ and $C_x = \frac{R_1}{R_2} C_3$

(B) $R_x = \frac{C_3}{C_1} R_2$ and $C_x = \frac{R_2}{R_1} C_3$

(C) $R_x = \frac{R_1}{C_2} R_2$ and $C_x = \frac{C_1}{R_1} R_2$

(D) $R_x = R_2$ and $C_x = C_3$

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

Key: (A)

Sol: $Z_1 = R_1 \parallel \frac{-j}{\omega C_1}$; $Z_2 = R_2$; $Z_3 = \frac{-j}{\omega C_3}$;

$$Z_4 = R_x - j \frac{1}{\omega C_x}$$

$$Z_1 = \frac{R_1 \left(\frac{-j}{\omega C_1} \right)}{R_1 - j \left(\frac{1}{\omega C_1} \right)} = \frac{-jR_1}{\omega R_1 C_1 - j}$$

On rationalising, we get

$$Z_1 = \frac{-jR_1}{(\omega R_1 C_1 - j)} \times \frac{(\omega R_1 C_1 + j)}{(\omega R_1 C_1 + j)}$$

$$= \frac{R_1 - j\omega R_1^2 C_1}{\omega^2 R_1^2 C_1^2 + 1}$$

Bridge balance condition, $Z_1 Z_4 = Z_2 Z_3$

$$\therefore Z_4 = \frac{Z_2 Z_3}{Z_1} = \frac{R_2 \left(\frac{-j}{\omega C_3} \right)}{\frac{R_1 - j\omega R_1^2 C_1}{\omega^2 R_1^2 C_1^2 + 1}}$$

$$= \frac{(1 + \omega^2 R_1^2 C_1^2) \cdot R_2 \left(\frac{-j}{\omega C_3} \right)}{R_1 - j\omega R_1^2 C_1}$$

On rationalising, we get

$$Z_4 = R_2 (1 + \omega^2 R_1^2 C_1^2)$$

$$\left\{ \frac{\left(\frac{-j}{\omega C_3} \right) (R_1 + j\omega R_1^2 C_1)}{R_1^2 + \omega^2 R_1^4 C_1^2} \right\}$$

$$R_x - j \frac{1}{\omega C_x} = \frac{R_2 (1 + \omega^2 R_1^2 C_1^2)}{R_1^2 (1 + \omega^2 R_1^2 C_1^2)}$$

$$\left\{ \frac{R_1^2 C_1}{C_3} - j \frac{R_1}{\omega C_3} \right\}$$

$$\therefore R_x = \frac{R_2 C_1}{C_3}$$

$$-j \frac{1}{\omega C_x} = -j \frac{R_2}{R_1^2} \times \frac{R_1}{\omega C_3}$$

$$= -j \left[\frac{1}{\frac{R_1}{R_2} \cdot \omega C_3} \right]$$

$$R_x = \frac{R_2}{R_1^2} \times \frac{R_1^2 C_1}{C_3}$$

$$\omega C_x = \frac{R_1}{R_2} \cdot \omega C_3$$

$$C_x = \frac{R_1}{R_2} \cdot C_3$$

- 106.** Inductance of a coil having Q value in the range of ($1 < Q < 10$), can be measured by using
- (A) Hay's bridge
(B) De Sauty's bridge
(C) Maxwell's bridge
(D) Carry Foster's bridge

Key: (C)

- 107.** The instrument servomechanism is actually an instrument system made of components, which are
- (A) Exclusively passive transducers
(B) Exclusively active transducers
(C) Combination of passive transducers and active transducers
(D) Exclusively primary sensing elements

Key: (C)

- 108.** The scale of an electrodyamometer usually reads the
- (A) Average value of the ac
(B) Mean value of the ac
(C) Effective value of the ac
(D) Squared value of the ac

Key: (B)

109. The resolution of an indicating instrument can be defined as

1. Variation in the meter reading for the same applied input
2. Detectable change in the deflection due to smallest change in the applied input
3. Detectable change in the output due to drifting of pointer

Which of the above statements are correct?

- (A) 1 only (B) 2 only
(C) 3 only (D) 1 and 3

Key: (B)

110. The expected voltage across a resistor is 100 V. However, the voltmeter reads a value of 97 V. The relative error is

- (A) 0.97 (B) 0.03 (C) 0.07 (D) 3.00

Key: (B)

Sol: The relative error ϵ_r

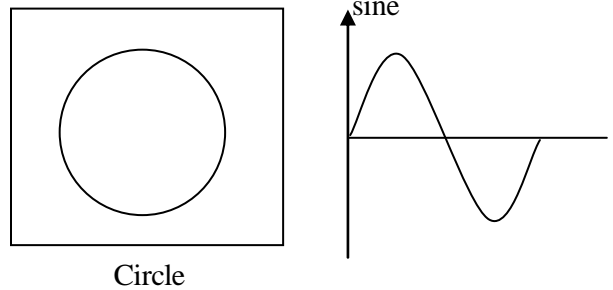
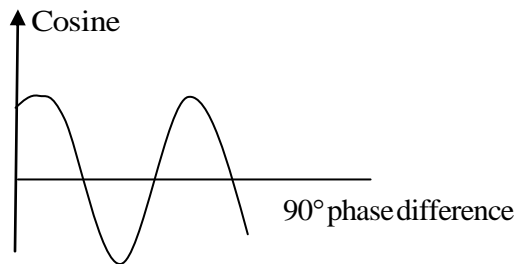
$$\epsilon_r = \frac{A_m - A_t}{A_t} = \frac{97 - 100}{100} = -0.03$$

111. While measuring the phase difference between the signals $v_1(t) = 10 \sin \omega t$ and $v_2(t) = 10 \sin(\omega t + \phi)$, the Lissajous pattern observed on CRO is a circle. The value of ϕ is

- (A) 2π (B) π (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{4}$

Key: (C)

Sol:



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

- (A) 3.18A and 5A
(B) 5 A and 3.18 A
(C) 3.18 A and 5 mA
(D) 5 A and 3.18 mA

Key: (B)

Sol: Hot wire instrument measures RMS value

$$I = \frac{150}{15} = 10A$$

$$I_{rms} = \frac{10}{2} = 5A$$

PMMC measures average value

$$I_{avg} = \frac{10}{\pi} = 3.18A$$

113. A tachometer encoder can be used for measurement of speed

- (A) of false pulses because of electrical noise
(B) in forward and reverse directions
(C) in one direction only
(D) for single revolution in a multiple track

Key: (C)

114. A rotameter works on the principle of variable
 (A) Pressure (B) Length
 (C) Area (D) Resistance

Key: (C)

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

Key: (C)

Sol:
$$D = \frac{\ell LV_d}{2dV_a}$$

$$V_d = \frac{D \times 2 \times d \times V_a}{\ell \times L} = 100V$$

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

Key: (A)

Sol: A transducer can be anything which converts one form of energy to another. Piezoelectric material is one kind. We apply force or pressure on this material it converts voltage and this voltage is function of force or pressure applied to it. The electric voltage produced by piezoelectric transducer can be easily measured by voltage measuring instruments, which can be used to measure stress or forces. The physical quantity like mechanical stress or force cannot be measured directly. Therefore piezoelectric transducer can be used.

117. Which of the following transducers measure the pressure by producing emf as a function of its deformation?
 (A) Photoelectric transducer
 (B) Capacitive transducer
 (C) Inductive transducer
 (D) Piezoelectric transducer

Key: (D)

118. Maxwell's bridge measure an unknown inductance in terms of
 (A) Known inductance
 (B) Known capacitance
 (C) Known resistance
 (D) Q of the coil

Key: (B)

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

Key: (C)

120. The advantages of an LVDT is/are
 1. Linearity
 2. Infinite resolution
 3. Low Hysteresis
 Which of the above advantages is/are correct?
 (A) 1 only (B) 2 only
 (C) 3 only (D) 1, 2 and 3

Key: (D)

