ACE Engineering Academy

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ESE- 2019 (Prelims) - Offline Test Series Test-9

ELECTRICAL ENGINEERING

SUBJECT: CIRCUITS & FIELDS AND ELECTRICAL MATERIALS SOLUTIONS

01. Ans: (c)

Sol: $R_1 = \frac{\ell}{\sigma_1 \ell^2} = \frac{1}{\sigma_1 \ell}$

$R_2 = \frac{2\ell}{\sigma_2 4\ell^2} = \frac{1}{2\ell\sigma_2}$

So, $R_1 = R_2 \Rightarrow \frac{1}{\sigma_1 \ell} = \frac{1}{2\ell\sigma_2}$

$\Rightarrow \frac{\sigma_1}{\sigma_2} = \frac{2}{1}$

02. Ans: (b)

Sol: The charge deposited on the object, q = it

$q = 8\text{ k} \times 15\mu = 120\text{ mC}$

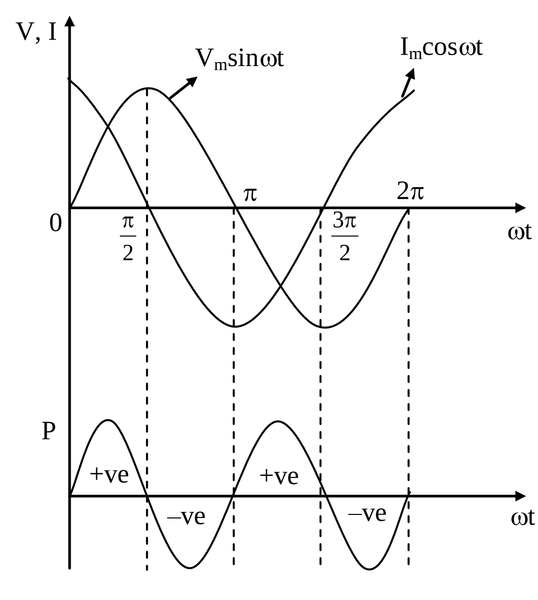
03. Ans: (a)

Sol: In a Pure capacitor

Let applied voltage $V = V_m \sin\omega t$

Current drawn from the supply $I = I_m \cos\omega t$ (as capacitor is pure)

Power drawn from the source will be positive when applied voltage increases but current decreases.



04. Ans: (b)

Sol: The supply voltage =220 V

Initial current $I(0^+) = I(0^-) = 0\text{A}$

Steady state current, $I(\infty) = \frac{220}{100} = 2.2\text{A}$

Time constant, $\tau = \frac{L}{R} = \frac{0.5}{100} = 5\text{mSec}$

The current flowing through Inductor,

$I(t) = I(\infty) + [I(0^+) - I(\infty)]e^{-t/\tau}$

$1 = 2.2\,[1 - e^{-200t}]$

$t \approx 3.03$ msec

05. Ans: (d)

Sol: $\cos\phi = \frac{R}{|Z|} = \frac{10}{\sqrt{100+100}} = \frac{1}{\sqrt{2}}$

$= 0.707$ (lead)

$\because X_C > X_L$

06. Ans: (c)

Sol: Current $i = 2\left[\frac{100\angle 0^o}{\sqrt{64+36}}\right] = 20$ A

07. Ans: (d)

Sol: At parallel resonance the supply current, voltages are in phase.

$\Rightarrow$Input power factor is unity. $\Rightarrow$ Supply voltage (V) and current (I) are in phase

08. Ans: (a)

Sol: $S_1 = P_1 + jQ_1 \Rightarrow S_1 = 20000 + j0$

$S_2 = P_2 + jQ_2 \Rightarrow S_2 = 30000\,(0.8) + j30000\,(0.6)$

$S_3 = P_3 - jQ_3 \Rightarrow S_3 = 35000\,(0.9) - j35000\,(\sqrt{1-0.9^2}\,)$

Total active power, $P_T = P_1 + P_2 + P_3$

$= 20\text{ k} + 24\text{ k} + 31.5\text{ k}$

$= 75.5$ kW

09. Ans: (d)

Sol: Given $V = 3\cos 3t$,

$I = -2\sin(3t + 10°)$

$= 2\cos(3t + 10° + 90°)$

$= 2\cos(3t + 100°)$

I leads V by an angle 100°

10. Ans: (a)

Sol: $Z_1 = 3+j4$, $Z_2 = 10 + j0$

$I_1Z_1 = I_2Z_2$ [$\because$ parallel]

$\frac{|I_1|}{|I_2|} = \frac{|Z_2|}{|Z_1|} = \frac{10}{\sqrt{3^2+4^2}} = 2$

$\Rightarrow \quad |I_1| = 2|I_2|$

$\frac{P_1}{P_2} = \frac{|I_1|^2 R_1}{|I_2|^2 R_2} = \frac{[|2I_2|^2].3}{|I_2|^2 .10}$

$\frac{P_1}{P_2} = \frac{12}{10} = \frac{6}{5}$ ………(1)

& $P_1 + P_2 = 1100$ ……...(2)

So, $P_1 = 600$ W, $P_2 = 500$ W

11. Ans: (b)

Sol: $P_{Lost} = (I_{Rms})^2 .R$

$I_{Rms} = \sqrt{\frac{1}{8}[100(2)+16(2)+4(2)]}$

$= \sqrt{\frac{120\times 2}{8}}$

$$= \sqrt{\frac{120}{4}}$$

$$= \sqrt{30}$$

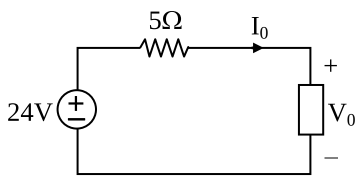
$$P = \left(\sqrt{30}\right)^2(1) = 30\text{ W}$$

12. Ans: (b)

Sol: Apply Thevenin's theorem

$\rightarrow R_{TH} = 2 + [12//4] = 5\ \Omega$

$\rightarrow V_{TH} = 32\left[\frac{12}{16}\right] = 24\text{ V}$



KVL $-24 + 5I_0 + V_0 = 0$

$V_0 = 24 - 5I_0$

13. Ans: (d)

Sol: time constant, $\tau = \frac{L}{R}$

$$= \frac{20}{(10//10)}$$

$= 4$ sec

14. Ans: (c)

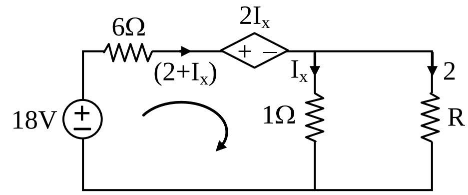
Sol: $I_N = 10\left[\frac{3}{9}\right]$

$$= \frac{10}{3} = 3.33\text{ A}$$

$R_N = 6 + 3 = 9\ \Omega$

15. Ans: (d)

Sol:



KVL $-18 + 6[2 + I_x] + 2[I_x] + I_x = 0$

$9I_x = 18 - 12$

$I_x = \frac{2}{3}\text{ A}$

Voltage across R = $\frac{2}{3}$ V

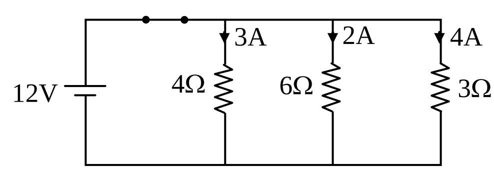
Then $R = \frac{V}{i} = \frac{\frac{2}{3}}{2} = \frac{1}{3}\Omega$

16. Ans: (d)

Sol: $R_A = \frac{12\times12}{36} = 4\ \Omega$

$R_B = \frac{12\times12}{24} = 6\ \Omega$

$R_C = \frac{12\times12}{48} = 3\ \Omega$



$I_T = 3 + 2 + 4 = 9$ A

If another 11 A flows fuse will blow but each bulb A carries 3A.

So, x[3] ≥ 11

$x \geq \frac{11}{3} \approx 3.66 = 4$ bulbs

17. Ans: (d)

Sol: Network nodes (n) =4

Branches (b) =6

Complete graph will have nc_2 branches

$\Rightarrow 4c_2 = 6$, given network graph is complete.

Number of trees $=n^{n-2}$

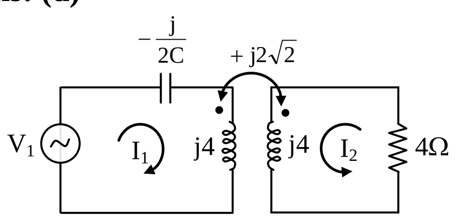
($\because$ as graph is complete)

=16

Number of cut set matrices = Number of tie set matrices =number of trees = 16.

18. Ans: (d)

Sol:



KVL-1: $V_1 = -j\frac{I_1}{2C} + j4I_1 + j\,2\sqrt{2}\,I_2$ ....(1)

KVL-2: $0 = (4 + j4)I_2 + j\,2\sqrt{2}\,I_1$ ....(2)

$$\Rightarrow I_2 = \frac{-j\sqrt{2}\,I_1}{2[1+j]}$$

Now, $\frac{V_1}{I_1} = \frac{-j}{2C} + j4 + \frac{2}{1+j}$

$$\frac{V_1}{I_1} = \frac{-j + j8C + 2C - j2C}{2C}$$

$$Z_{in} = \frac{V_1}{I_1} = \frac{-j + j8C + 2C - j2C}{2C}$$

Under Resonance,

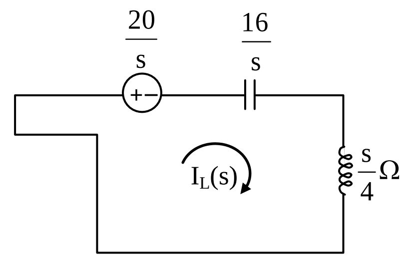
$I_m(z_{in}) = 0 \Rightarrow -j + j8C - j2C = 0$

$6C = 1$

$$C = \frac{1}{6}F$$

19. Ans: (a)

Sol: $V_c(0^-) = 20$ V, $i_L(0^-) = 0$



$$I(s)\left[\frac{16}{s} + \frac{s}{4}\right] = -\frac{20}{s}$$

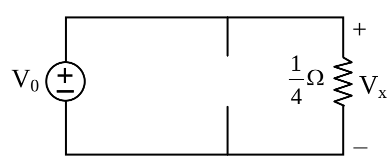
$$I(s)\left[\frac{64 + s^2}{4s}\right] = -\frac{20}{s}$$

$$I(s) = \frac{-80}{s^2 + 8^2} = -10\left[\frac{8}{s^2 + 8^2}\right]$$

$i(t) = -10\sin 8t$ A

20. Ans: (b)

Sol: Circuit at $t = 0^+$



$V_x(0^+) = V_0 = 2$V only

21. Ans: (d)

Sol: The h-parameters

$$V_1 = h_{11}I_1 + h_{12}V_2$$

$$I_2 = h_{21}I_1 + h_{22}V_2$$

When $I_1 = 0$

$$V_1 = 20\ I_2$$

$$V_2 = 20\ I_2$$

$$h_{12} = \frac{V_1}{V_2} = 1$$

$$h_{22} = \frac{I_2}{V_2} = \frac{1}{20} = 0.05$$

When $V_2 = 0$,

$$V_1 = 10I_1$$

$$I_1 = -I_2$$

$$h_{11} = \frac{V_1}{I_1} = \frac{10}{1} = 10$$

$$h_{21} = \frac{I_2}{I_1} = -1$$

22. Ans: (a)

Sol: $\frac{F(s)}{s} = \frac{1}{s} - \frac{1}{(s+\alpha)}$

$$F(s) = 1 - \frac{s}{s+\alpha}$$

$$= 1 - \left[\frac{s+\alpha-\alpha}{s+\alpha}\right]$$

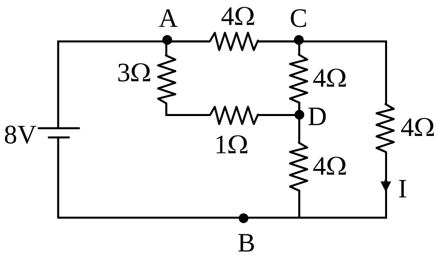
$$= 1 - \left[1 - \frac{\alpha}{s+\alpha}\right]$$

$$= \frac{\alpha}{s+\alpha}$$

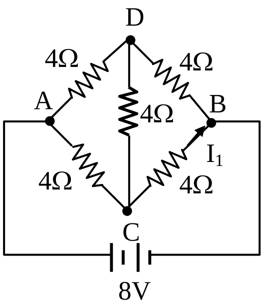
Impulse response is, $\alpha e^{-\alpha t}$

23. Ans: (b)

Sol: What is the current I in the given below



Redrawn the circuit



As the bridge is balanced the current flowing through in the branch CD is zero.

So $I_1 = \frac{8V}{8\Omega} = 1A$

24. Ans: (c)

Sol: Tree is a connected sub graph, which connects all the nodes without any closed loop.

Tree branches are called twigs

The number of tree branches of any graph = (n-1)

The rank of tree is n-1

25. Ans: (c)

Sol: **damped frequency,** $\omega_d = \omega_0\sqrt{1-\delta^2}$

$$\sqrt{15} = \omega_0\sqrt{1-\delta^2}$$

Bandwidth, BW $= \dfrac{\omega_0}{Q}$, $Q = \dfrac{1}{2\delta}$

$BW = 2\delta\omega_0$,

$2 = 2\delta\omega_0$,

$\delta\omega_0 = 1$

$\omega_0^2(1-\delta^2) = 15$

$\omega_0^2 - \omega_0^2\delta^2 = 15$

$\omega_0^2 = 15 + 1 = 16$,

Resonant frequency = 4 rad/sec

26. Ans: (c)

Sol: In 3-ϕ star-connected system

$V_L = \sqrt{3}V_{phase}$

$I_L = I_{ph}$

Line voltages are 30° ahead of the corresponding phase voltage

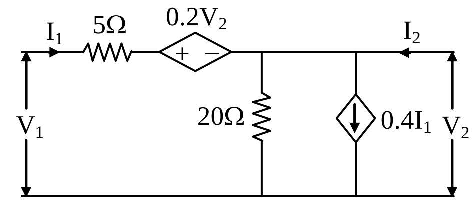
Output power = 3 $V_{ph}I_{ph}\cos\phi$

$$= \sqrt{3}V_L I_L \cos\phi$$

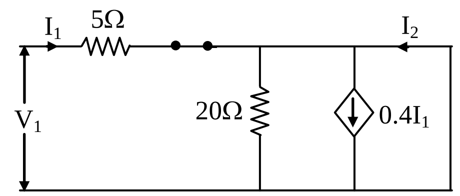
Where ϕ angle between phase voltage and phase current

27. Ans: (c)

Sol:



$$Y_{21} = \left.\frac{I_2}{V_1}\right|_{V_2=0}$$



$V_1 = 5I_1$

$I_1 + I_2 = 0.4\ I_1$

$\Rightarrow I_2 = -0.6I_1$

$= -0.6 \times \dfrac{V_1}{5}$

$\dfrac{I_2}{V_1} = -0.12$

28. Ans: (b)

Sol: Resistance of blub, $R = \dfrac{V^2}{P}$

$$= \frac{(120)(120)}{60}$$

$= 240\ \Omega$

29. Ans: (b)

30. Ans: (c)

Sol: $I_1 = 4\,V_1 + V_2$

$I_2 = 2\,V_1 + 3\,V_2$

$$Z_{22} = \left.\frac{V_2}{I_2}\right|_{I_1=0}$$

$I_1 = 0$, $V_2 = -4\,V_1$, $I_2 = -10\,V_1$,

$$Z_{22} = 0.4\Omega$$

31. Ans: (b)

32. Ans: (a)

Sol: $$L\frac{di}{dt} + Ri + \frac{1}{C}\int i\,dt = v_s(t)$$

Characteristic equation:

$$\frac{d^2 i}{dt^2} + \frac{R}{L}\frac{di}{dt} + \frac{1}{LC}\,i(t) = 0$$

For critical damping:

$$\left(\frac{R}{L}\right)^2 = \left(\frac{4}{LC}\right),\ R^2 = 4\,\frac{L}{C},\ \ R = 2\sqrt{\frac{L}{C}}$$

$$R = 2\sqrt{\frac{1}{4}} = 1\Omega$$

33. Ans: (a)

Sol: Ionic compounds are very strong in nature. They require a lot of energy to break them. Therefore they have high melting and boiling points.

34. Ans: (d)

Sol: In tungsten, atoms are arranged in all eight corners and has an additional atom in the centre satisfying the body centered cubic lattice condition.

35. Ans: (b)

Sol: When a large value of a.c. current is applied to a super conducting material it induces some magnetic field in the material and because of this magnetic field, the superconducting property of the material is destroyed.

36. Ans: (a)

Sol: Magnetic lines of force are defined as the continuous curve in a magnetic field. The tangent drawn at any point on the curve gives the direction of resultant magnetic field at that point.

37. Ans: (a)

Sol: Nano particles are produced by generating plasma using Radio frequency heating coils in plasma arching method. It consists of an evacuated chamber, wounded by high voltage RF coils.

38. Ans: (b)

Sol: When alkali halides are heated in an atmosphere of the constituent metal, halide ions diffuse to the surface to react with the vapour particles. These results in excess of cations over anions.

39. Ans: (c)

Sol: Ceramics, which mainly consist of oxides, carbides and nitrides, can withstand very high temperatures; furnaces are generally lined with such ceramics.

40. Ans: (d)

Sol: Maglev trains which can reach very high velocity

→ MRI scan machine (medical science, brain imaging)

→ energy storage

→ The Large Hadron Collider (LHC) for generating high velocity particles travelling at speed of high.

41. Ans: (b)

Sol: $\sqrt{2}\,a = 4R$

$$a = \frac{4R}{\sqrt{2}}$$

$$= \frac{4(0.175)}{\sqrt{2}}$$

$$= 0.494 \text{ nm}$$

42. Ans: (a)

Sol: Given data:

$V = 10$

$d = 2 \times 10^{-3}$ m

$\varepsilon_r = 6$

$\varepsilon_0 = 8.85 \times 10^{-12}$ F/m

Dielectric displacement $D = \varepsilon_0 \varepsilon_r E$

$$\therefore\ E = \frac{V}{d} = \frac{10}{2\times10^{-3}\,\text{V/m}}$$

$$D = 6 \times 8.85 \times 10^{-12} \times 5 \times 10^{3}$$

$$= 265.5 \times 10^{-9}\ \text{C/m}^2$$

43. Ans: (d)

Sol: In an intrinsic semiconductor the probability of finding an electron at the edge of the conduction band is equal to that of finding a hole at the edge of valence band at all temperatures.

Hence the Fermi level lies in the middle of the band gap always at all temperatures.

44. Ans: (d)

Sol: AX_2 materials are: SiO_2, CaF_2, PuO_3, ThO_2.

45. Ans: (c)

Sol: Dielectric constant depends on a frequency and temperature.

46. Ans: (b)

Sol: The residual polarization can be eliminated by

→ Applying field in opposite direction

→ Heating material above curie temperature

47. Ans: (b)

Sol: Statement 3 is incorrect, only some of piezo electric materials are ferro electric materials.

48. Ans: (c)

Sol: The material for use as permanent magnets should have the following:

→ Low permeability

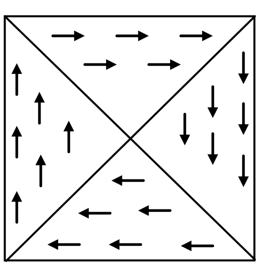
→ High coercive force

→ Appreciable remnant flux density

→ High curie temperature, to minimize easy demagnetization.

49. Ans: (c)

Sol: As per wiess-Domain theory, atomic dipole moment is individual domain is parallel



H = 0

50. Ans: (b)

Sol: Ferrites for permanent magnets → Hard ferrites

Ferrites for transformers and inductors→ Soft ferrites

Data storage → rectangular loop ferrites

Microwave isolators → Ferrites and Garnets

51. Ans: (d)

Sol: Ceramics are good electrical and thermal insulators because of no free electrons ceramics are brittle in nature due to high porosity and hence low facture toughness.

52. Ans: (a)

Sol: → In rock salt structure, number of cations =4 and number of anions = 4

→ Coordination number is 6

→MgO, FeO are rock salt structure materials.

→ Automatic packing factor = 0.793

53. Ans: (c)

Sol: → Magnetic susceptibility equal to –1

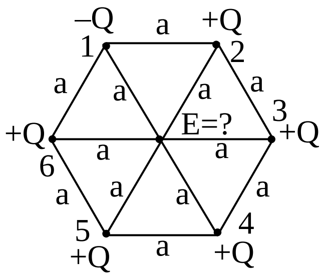
→ Magnetic flux density of super conductor is not zero.

→ Super conductors are used in maglev trains.

→ With increasing temperature of a super conductor required magnetic field to destroy super conductor is decreases.

54. Ans: (c)

Sol:



As in the resultant field, electric field intensities due to two pairs at vertices 3 & 6, 2 & 5 are cancelled and hence the resultant field is due to pair at vertices 1 & 4 only.

i.e $E = \frac{Q}{4\pi\varepsilon_0 a^2} + \frac{Q}{4\pi\varepsilon_0 a^2}$

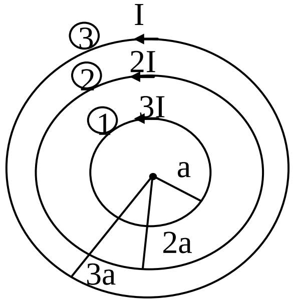
$$E = \frac{2Q}{4\pi\varepsilon_0 a^2}$$

∴ magnitude of electric field intensity at the centre of hexagon is

$$E = \frac{Q}{2\pi\varepsilon_0 a^2}$$

55. Ans: (b)

Sol:



Figure

Magnetic flux density at the centre of circular current loop of radius 'r', carrying current I Amp is $B = \frac{\mu I}{2r}$

As three loops are carrying currents in same direction and hence the resultant magnetic flux density is sum of the flux densities due to individual loops.

$B = B_1 + B_2 + B_3$

$$= \frac{\mu_0(3I)}{2(a)} + \frac{\mu_0(2I)}{2(2a)} + \frac{\mu_0 I}{2(3a)}$$

$$B = \frac{\mu_0 I}{2a}\left[3 + 1 + \frac{1}{3}\right]$$

$$\therefore B = \frac{13\mu_0 I}{6a} \text{ Tesla}$$

56. Ans: (c)

Sol: Magnitude of force per unit length is given by

$$F = \frac{\mu_0 I_1 I_2}{2\pi d}$$

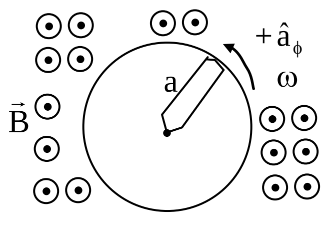
Given: $I_1 = I_2 = I$

Spacing $d = b$

$$\therefore F = \frac{\mu_0 I^2}{2\pi b} \text{ N/m}$$

57. Ans: (a)

Sol:



Blade length $a = \frac{1}{\sqrt{\pi}}$ m

f = 5cycles/sec

$\vec{B} = 10\hat{a}_z$ Tesla

$\vec{v} = r\omega\hat{a}_\phi$

Potential at the centre with respective to end of blade is given by

$$V_{oa} = \int_a^0 (\vec{v}\times\vec{B}).d\vec{\ell}$$

$$= \int_a^0 (r\omega\hat{a}_\phi \times 10\hat{a}_z).dr\hat{a}_r$$

$$= 10\omega\int_a^0 r.dr = \frac{-10\omega a^2}{2}$$

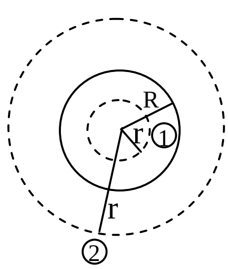
$$= \frac{-10\times 2\pi\times 5\times\left(\frac{1}{\sqrt{\pi}}\right)^2}{2}$$

$\therefore V_{oa} = -50$ volt

58. Ans: (c)

Sol: Consider a sphere of radius 'R' centered at the origin, contains volume charge distribution $+\rho_V\ C/m^3$.

From Gauss's law electric field intensity inside and outside the sphere is given by



$$\vec{E} = \frac{\rho_V r}{3\varepsilon}\hat{a}_r;\quad 0 < r < R$$

$$\vec{E} = \frac{\rho_V R^3}{3\varepsilon r^2}\hat{a}_r;\quad r > R$$

$E_{in} \propto r$ and

$E_{out} \propto \frac{1}{r^2}$

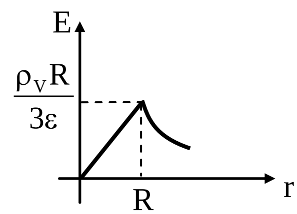


Figure: A plot of variation of E against distance 'r'

59. Ans: (d)

Sol: If a point charge of 'Q' is located at the center of sphere then the electric field intensity at any point on the surface of sphere is given by

$$\vec{E} = \frac{Q}{4\pi\varepsilon r^2}\hat{a}_r\ \text{V/m}$$

And electric potential, V is given by

$$V = \frac{Q}{4\pi\varepsilon r}\ \text{Volt}$$

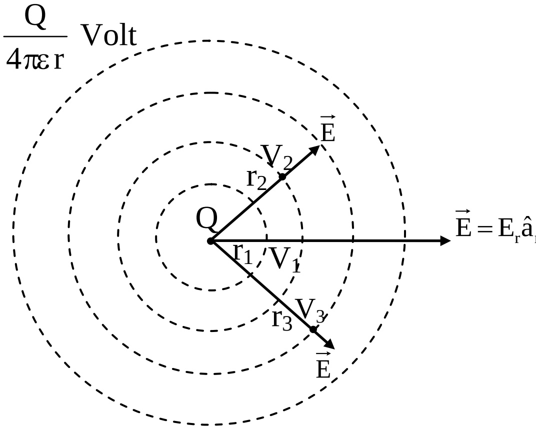


Figure: A point charge is located at 'Q' the centre of sphere.

→ In the above figure dotted concentric spheres represents equipotential surfaces with the potentials V_1, V_2, V_3, …. And solid lines are representing electric field intensity which is radially outward from point charge.

→ These equipotential lines and electric field intensity are always orthogonal. Therefore concentric spheres centered at the charge are equipotential surfaces.

60. Ans: (c)

Sol: Capacitance of parallel plate capacitor is given by

$$C \equiv \frac{Q}{V} = \frac{\varepsilon A}{d} C/V\,(\text{or})\,\text{Farad}$$

Capacitance of any configuration is independent of charge and potential applied

For parallel plate capacitor:

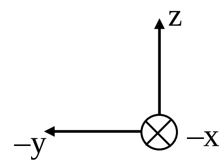
$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

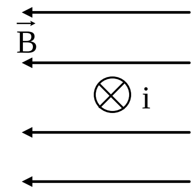
'C' is dependent on permittivity of material (or) medium, proportional to the area of metal plates. and inversely proportional to plate separation.

Therefore statement 1, 3 & 4 are correct.

61. Ans: (a)

Sol:





Figure

Let $\vec{B} = B_0(-\hat{a}_y)$ & current element: $i\ell(-\hat{a}_x)$

Magnetic force on current element due to magnetic field $\vec{B}$ is given by

$$\vec{F} = I\vec{\ell} \times \vec{B} = i\ell(-\hat{a}_x) \times B_0(-\hat{a}_y) = i\ell(\hat{a}_z)$$

Therefore the magnetic force on the wire is acting towards +z direction (or) top of the page

(or)

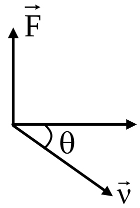
By using Fleming's left hand rule also we can inspect motion of conductor.

If our left hand forefinger is pointed along direction of magnetic field (left hand side) and centre finger is into the page (along direction of current) then left hand thumb points toward +z (or) top of the page results thrust (or) motion of conductor.

62. Ans: (a)

Sol: If a moving charge 'Q'C is present in a magnetic field $\vec{B}$ then the magnetic force on charge is given by

$$\vec{F} = Q\vec{v} \times \vec{B}$$



Magnitude of force is given by

$F = Qv B \sin\theta$ (N)

Magnitude of force is:

→ Proportional to magnitude of charge

→ Proportional to velocity, ν

→ Proportional to magnetic flux density

→ and dependent on 'θ'

Therefore statements (1) & (4) are correct.

63. Ans: (b)

Sol: If two long parallel wires are separated by a distance 'd' and carrying currents I_1 & I_2, then the magnetic force per unit length is given by

$$F = \frac{\mu I_1 I_2}{2\pi d} \text{ N/m}$$

→ If $I_1 = I_2 = I$, then $F = \frac{\mu I^2}{2\pi d}$ N/m

$F \propto \frac{1}{d}$ and $F \propto I^2$

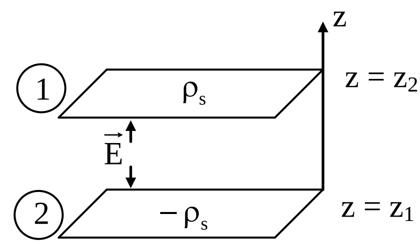
→ If two wires are carrying currents in the same direction, then magnetic force is attractive

→ If two wires are carrying currents in the opposite direction, then magnetic force is repulsive

∴ Statements are 1, 2 and 4 are correct

64. Ans: (d)

Sol:



Electric field intensity between the plates is given by

$$\vec{E} = \vec{E}_1 + \vec{E}_2$$

$$= \frac{\rho_s}{2\varepsilon}(-\hat{a}_z) + \frac{-\rho_s}{2\varepsilon}(\hat{a}_z)$$

$$= \frac{2\rho_s}{2\varepsilon}(-\hat{a}_z)$$

$$\therefore E = 2\left(\frac{\rho_s}{2\varepsilon}\right) \text{V/m}$$

∴ Magnitude of electric field is twice of the field due to one plate.

65. Ans: (b)

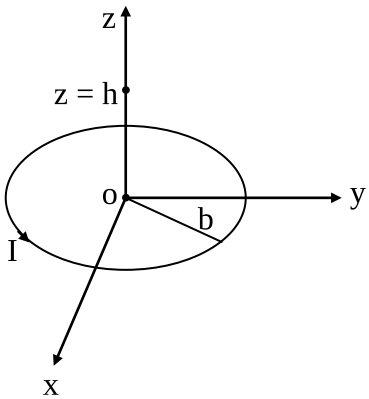
Sol: From Gauss's law

$$\psi_{net} = Q_{enc} = \oint_S \vec{D}.d\vec{S} = \int_S D_n dS$$

∴ The net electric flux (or) displacement flux through the surface is the integral of normal component of displacement flux density.

66. Ans: (c)

Sol:



Magnetic field intensity on the axis of the loop at z = h is given by

$$\vec{H} = \frac{Ib^2}{2(b^2+h^2)^{3/2}}(\hat{a}_z)$$

Direction of magnetic field is along +z

At the centre:

i.e at h = 0

$$\vec{H} = \frac{I}{2b}(\hat{a}_z)$$

Magnetic field is proportional to current 'I' and inversely proportional to radius of the loop.

∴ Statements 1, 2 and 4 are correct.

67. Ans: (a)

Sol: Consider a perfect conductor with conductivity $\sigma = \infty$

Electric field within a perfect conductor is zero

i.e $\vec{E} = 0$

$\vec{E} = -\nabla V$

$\Rightarrow \nabla V = 0$

V = constant (equipotential surface)

This indicates a perfect conductor is an equipotential body.

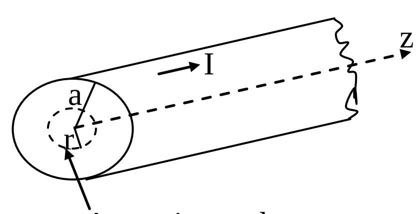
Therefore statement (I) & (II) are individually true and statement II is the correct explanation of statement (I).

68. Ans: (b)

Sol: Ampere's law states that the line integral of magnetic field intensity around any closed path is equal to direct current enclosed by that path.

i.e $\oint_L \vec{H}.d\vec{\ell} = I_{enc}$

Consider a long cylindrical conductor of radius 'a' carrying current ,I amp. The magnetic field intensity inside a conductor at a distance r(r < a) is



$\vec{H} = \frac{Ir}{2\pi a^2}\hat{a}_\phi$

$H \propto r$

Magnetic field is linearly increases with radial distance ‘r’.

Therefore statement-I & II are individually true but statement-II is not the correct explanation of statement-I.

69. Ans: (b)

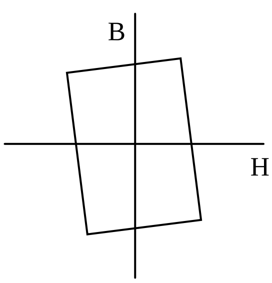
Sol: Both statement (I) and statement (II) are individually true but statement (II) is not the correct explanation of statement (I)

70. Ans: (a)

Sol: Ferrox cube in also known as rectangular ferrite with rectangle hysteresis loop.

Eg: Mn-Mg Fe_2O_4

Zn-MnFe_2O_4



71. Ans: (c)

Sol: Fine grain materials are produced by fast cooling rate and possess more grain boundaries with small grain and these materials require more applied field to magnetize.

72. Ans: (c)

Sol: Statement (II) is incorrect, quantum dot is a zero dimensional material produced by reducing size of bulk material in all dimensions.

73. Ans: (c)

Sol: In frequency domain, the response obtained after solution contain both steady state response as well as transient response. So statement –II is wrong.

74. Ans: (c)

Sol: Cross section of A is less than B $\Rightarrow$ for same length the resistance experienced by A will be more than B.

Section near to A will be more heated compared to section near B $\Rightarrow$Statement I is correct

Current per area section near A will be more than B $\Rightarrow$ Statement II is incorrect.

75. Ans: (a)

Sol: In resonance the current in series RLC circuit is maximum and the voltage across the capacitor is quality factor times the input voltage.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