PB-T1/PHQP/1221/A **14-NOV-2021**

PREBOARD EXAMINATION (2021-22)
TERM I – SET A

Subject: PHYSICS **Max. Marks:3 5**
Grade: XII **Time: 90 Minutes**
Name: **Section:** **Roll No:**

- **General Instructions:**
  1. The Question Paper contains three sections.
  2. Section A has 25 questions. Attempt any 20 questions.
  3. Section B has 24 questions. Attempt any20 questions.
  4. Section C has 6 questions. Attempt any 5 questions.
  5. All questions carry equal marks.
  6. There is no negative marking.

I. SECTION A

This section consists of 25 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

1. Shape of equipotential surface in uniform electric field will be :
- **a.** Spherical normal to electric field
- **b.** Random
- **c.** circular normal to electric field
- **d.** Equidistant Planes normal to electric field

2. The field at a distance r from a long string of charge per unit length λ is
- **a.** $\frac{k\lambda}{r^2}$
- **b.** $\frac{k\lambda}{r}$
- **c.** $\frac{k\lambda}{2r}$
- **d.** $\frac{2k\lambda}{r}$

3. The ratio of electric field due to dipole at equatorial line and axial line is
- **a.** 2:1
- **b.** 1:2
- **c.** 1:1
- **d.** 3:2

4. Capacitance of a parallel plate capacitor can be increased by
- **a.** increasing the distance between the plates
- **b.** decreasing the distance between the plates
- **c.** decreasing the area of plates
- **d.** increasing the thickness of the plates.

5. What is the value of minimum force acting between two charges placed at 1 m apart from each other
- **a.** Ke^2
- **b.** K e
- **c.** $\frac{Ke}{4}$
- **d.** $\frac{Ke^2}{2}$

6. An electric charge q is placed at the centre of a cube of side a. The electric flux on one of its faces will be

a. $\frac{q}{6\varepsilon_0}$ **b.** $\frac{q}{\varepsilon_0 a^2}$

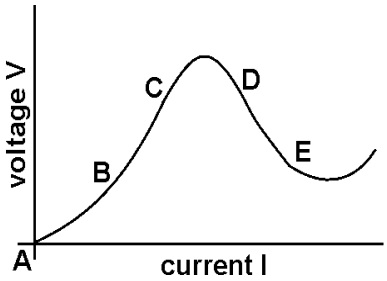
c. $\frac{q}{4\pi\varepsilon_0 a^2}$ **d.** $\frac{q}{\varepsilon_0}$

7. Two large, parallel conducting plates are placed close to each other. The inner surfaces of the two plates have surface charge densities +σ and −σ. The other surfaces are without charge. The electric field has a magnitude of :

a. 2σ/ε0 in the region between the plates **b.** σ/ε0 in the region between the plates

c. σ/ε0 in the region outside the plate **d.** zero in the region between the plates

8. Graph showing the variation of current versus voltage for a material GaAs is shown in the figure. Identify the region of negative resistance.



a. AB **b.** BC

c. CD **d.** DE

9. In a potentiometer of 10 wires, the balance point is obtained on the 7th wire. To shift the balance point to 9th wire, we should

a. Decrease resistance in the main circuit **b.** Increase potential gradient

c. Decrease resistance in series with the cell whose emf is to be measured **d.** Increasing the resistance in series of potentiometer wire

10. In a metre bridge, wires of nichrome, manganin and constantan are used because it has

a. low resistivity and low-temperature coefficient of resistance **b.** high resistivity and low-temperature coefficient of resistance

c. low resistivity and high-temperature coefficient of resistance **d.** high resistivity and high-temperature coefficient of resistance

11. Across a metallic conductor of non – uniform cross section a constant potential difference is applied. The quantity which remains constant along the conductor is

a. Drift velocity **b.** Electric field

c. Current density **d.** Current

12. Two bulbs of 40 W and 60 W are connected to 220 V line, the ratio of resistance will be

a. 4:3 **b.** 3:4

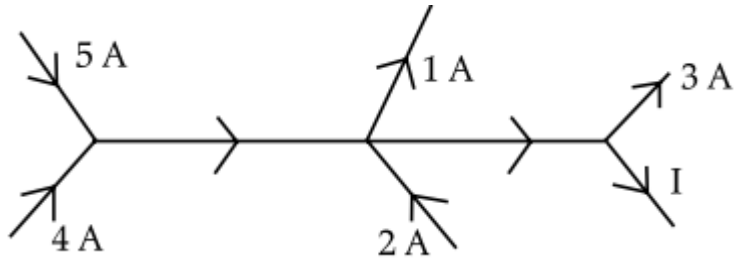
c. 2:3 **d.** 3:2

13. Electric field and current density have relation

a. $E \propto J$ **b.** $E \propto J^2$

c. $E \propto \frac{1}{J^2}$ **d.** $E \propto \frac{1}{J}$

14. Apply Kirchhoff's law to find the current I in the part of the following circuit.



a. 5 A **b.** 3 A
c. 7 A **d.** 1 A

15. Dip is the angle that the total _____ of the earth makes with the surface of the earth.

a. Vertical component of magnetic field **b.** Magnetic field
c. Magnetic declination **d.** Magnetic meridian

16. Which of the following does not resemble the Gauss' law in magnetism?

a. Magnetic poles exist in pair of unlike poles. **b.** Magnetic flux through a closed loop is zero.
c. The number of magnetic field lines entering a closed surface is equal to that leaving the surface. **d.** Single pole exists in nature

17. An infinitely long straight conductor is carrying a steady current i. The magnetic field at a distance r from the wire varies as

a. $\frac{1}{\sqrt{d}}$ **b.** $\frac{1}{d}$
c. $\frac{1}{d^2}$ **d.** $\frac{1}{d^3}$

18. To increase the current sensitivity of a moving coil galvanometer, we should decrease

a. Strength of magnet **b.** Torsional constant of spring
c. Number of turns in coil **d.** Area of coil

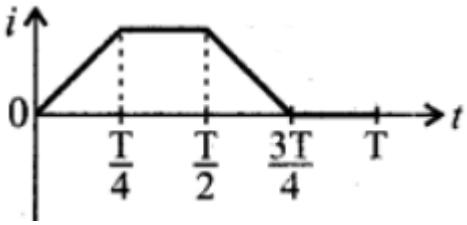
19. At a place in magnetic meridian, magnetic needle bends 30^0 from horizontal. If earth's magnetic field at this place is 2G, then horizontal component of earth's magnetic field is

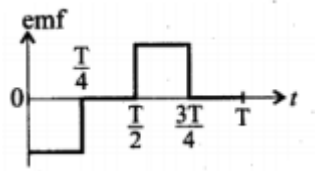
a. $10^{-4}\ T$ **b.** $\sqrt{3}\ \text{x}\ 10^{-4}\ T$
c. $\sqrt{2}\ \text{x}\ 10^{-4}\ T$ **d.** $10^{4}\ T$

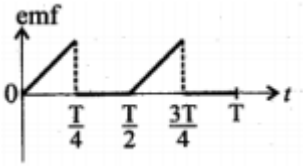
20. Increasing current flows from A to B is as shown in figure. The direction of the induced current in the loop is

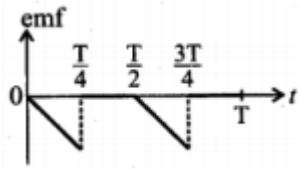
a. Clockwise **b.** Anti – clockwise
c. Straight line **d.** No induced emf produced

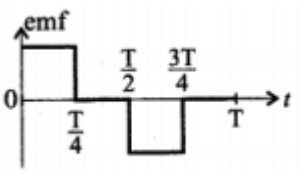
21. The current i in a coil varies with time as shown in the figure. The variation of induced emf with time would be



a.


b.


c.


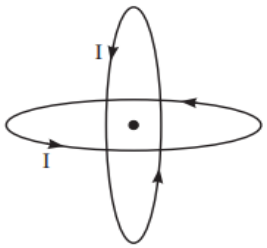
d.


22. The magnetic flux linked with a coil, in Weber, is given by the equations $\Phi = 3t^2+4t+9$. Then the magnitude of induced e.m.f. at t = 2 second will be

a. 2 volt **b.** 4 volt

c. 8 volt **d.** 16 volt

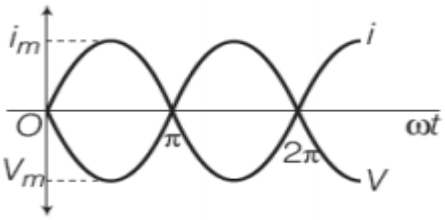
23. Two similar coils are kept mutually perpendicular such that their centres coincide. At the centre , find the ratio of the magnetic field due to one coil and the resultant magnetic field by both coils, if the same current is flown

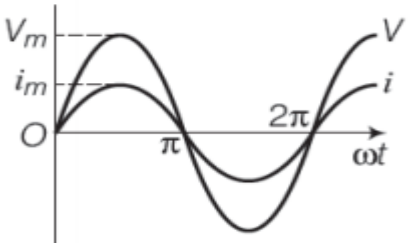


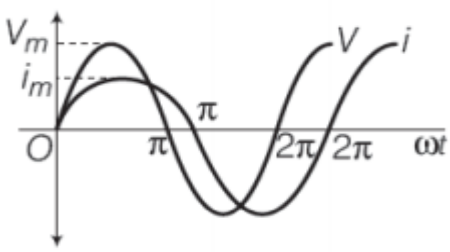
a. $1:\sqrt{2}$ **b.** 1:2

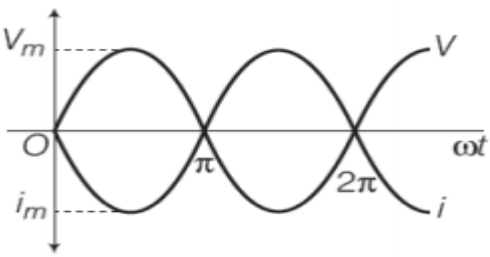
c. 2:1 **d.** $\sqrt{3}:1$

24. Which of the following graphs shows ac current flowing through a pure resistor?

a.


b.


c.


d.


25. A step down transformer is connected to 2400 volts line and 80 amperes of current is found to flow in output load. The ratio of the turns in primary and secondary coil is 20 : 1. If transformer efficiency is 100%, then the current flowing in the primary coil will be

a. 1600 A **b.** 20 A

c. 4 A **d.** 1.5 A

II. **SECTION B**

This section consists of 24 multiple choice questions with overall choice to attempt any 20 questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.

26. When placed in a uniform field, a dipole experience:

a. a net force **b.** a torque

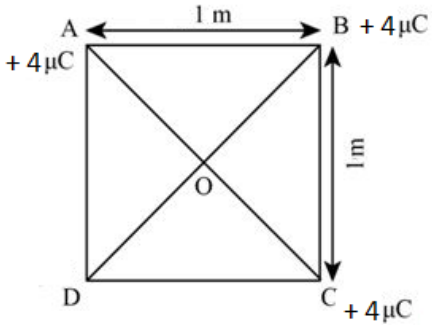
c. both a net force and torque **d.** neither a net force nor a torque

27. Two point charges + 9e and + e are at 16 cm away from each other. Where should another charge q be placed between them so that the system remains in equilibrium

a. 24 cm from + 9e **b.** 12 cm from + 9e

c. 24 cm from + e **d.** 12 cm from +e

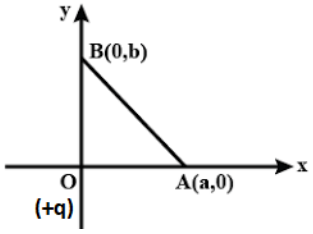
28. Three charges, each of +4μC, are placed at the corners A,B,C of a square of side 1 m. The electric field at the centre O of the square is



a. 7.2 x 10^4 N/C towards D **b.** 7.2 x 10^4 N/C towards B

c. 3.6 x 10^4 N/C towards D **d.** 3.6 x 10^4 N/C towards B

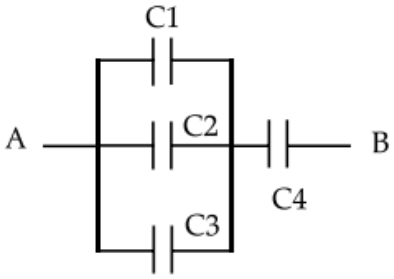
29. A charge +q is placed at the origin O of $xy-$ axis as shown in the figure. The work done in taking a charge Q from A to B along the straight-line AB is



a. $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{a-b}{ab}\right)$ **b.** $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{b-a}{ab}\right)$

c. $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{b}{a^2}-\frac{1}{b}\right)$ **d.** $\frac{qQ}{4\pi\varepsilon_0}\left(\frac{a}{b^2}-\frac{1}{b}\right)$

30. 4 capacitors, each of 2 μF, are connected as shown. What will be the equivalent capacitor across the points A, B?



a. 1/2 Mf **b.** 2/3 μF

c. 3/2 μF **d.** 1/8 μF

31. A plane square loop of side "a" made of thin copper wire has "n" turns and it carries a direct current "I" ampere. This wire loop is placed in a magnetic field of flux density "B" tesla, which is directed perpendicularly in to the plane of the loop. What is the torque acting on the loop?

a. nIaB **b.** Zero

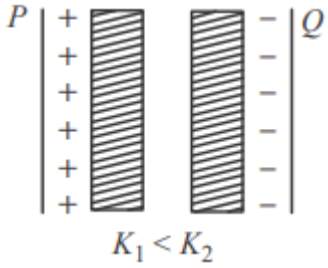
c. IaB **d.** nIa2B

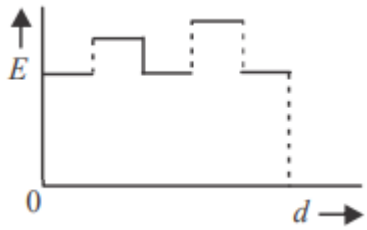
32. The output of a step – down transformer is measured to be 24 V when connected to a 12 W light bulb. The value of the peak current is

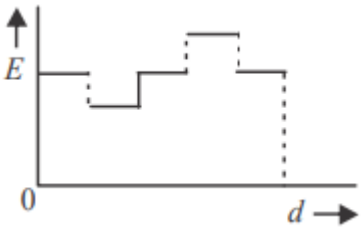
a. $\frac{1}{\sqrt{2}}\ A$ **b.** $\sqrt{2}\ A$

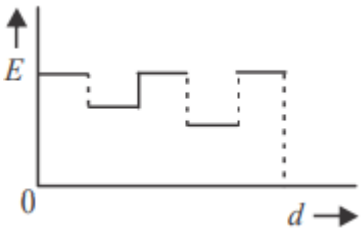
c. $2\ A$ **d.** $2\sqrt{2}\ A$

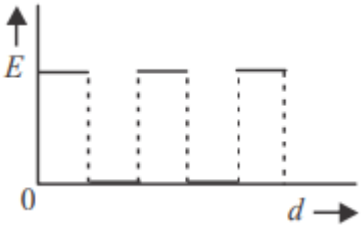
33. The thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field E between the plates with distance d as measured from plate P is correctly shown by



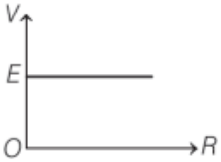
a.


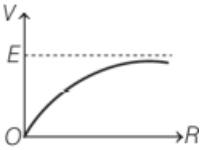
b.


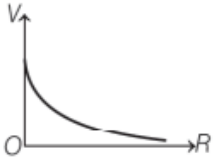
c.


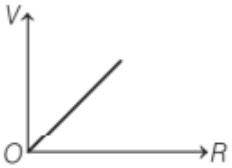
d.


34. A cell of emf E and internal resistance r is connected across a variable external resistance R. The graph of terminal potential difference V as a function of R is

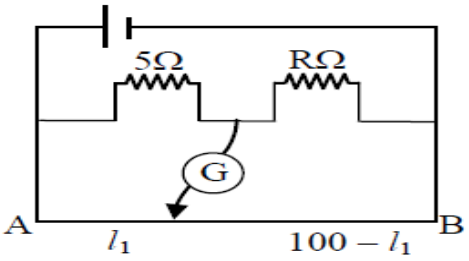
a.


b.


c.


d.


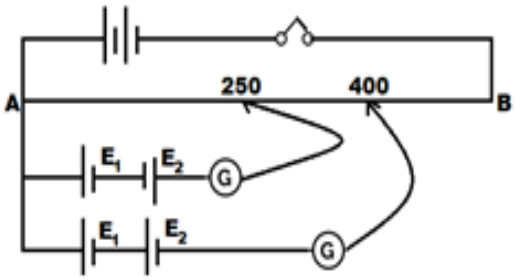
35. In a metre bridge, the balancing length from the left end is found to be 20 cm. The value of the unknown resistance is



a. 5 Ω **b.** 10 Ω

c. 15 Ω **d.** 20 Ω

36. Two primary cells of emf E_1 and E_2 ($E_1 > E_2$) are connected to the potentiometer wire AB as shown in figure. If the balancing lengths for the two combinations of the cells are 250 cm and 400 cm, find the ratio of E_1 and E_2.



a. 3/13 **b.** 13/3

c. 400/250 **d.** 250/400

37. A metal wire is subjected to a constant potential difference. When the temperature of the metal wire increases, then the drift velocity of the electron in it

a. Increases and thermal velocity of the electron decreases

b. Decreases and thermal velocity of the electron decreases

c. Increases and thermal velocity of the electron increases

d. Decreases and thermal velocity of the electron increases

38. A proton and an alpha – particle, accelerated through same potential difference, enter in a region of uniform magnetic field with their velocities perpendicular to the magnetic field. The ratio of radii of circular paths followed by proton and alpha – particle is

a. $1:\sqrt{2}$ **b.** $1:2\sqrt{2}$

c. 1:2 **d.** 1:4

39. In a toroid the number of turns per unit length is 1000 and current through it is 1/4π ampere. The magnetic field produced inside will be

a. 1×10^{-2} T **b.** 1×10^{-3} T

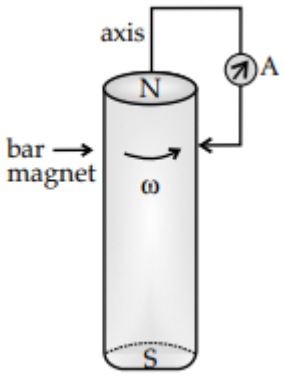
c. 1×10^{-4} T **d.** 1×10^{-7} T

40. A proton enters a magnetic field of flux density 1.5 Wbm^{-2} with a velocity 2×10^7 m/s at an angle of 30^0 with the field. The force on the proton will be

a. 2.4×10^{-12} N **b.** 0.24×10^{-12} N

c. 24×10^{-12} N **d.** 0.024×10^{-12} N

41. A cylindrical bar magnet is rotated about its axis in the figure. A wire is connected from the axis and is made to touch the cylindrical surface through a contact. Then



a. A direct current flows in the ammeter A.
b. No current flows through the ammeter A
c. An alternating sinusoidal current flows through the ammeter A with a time period $\frac{2\pi}{\omega}$
d. A time varying non – sinusoidal current flows through the ammeter A

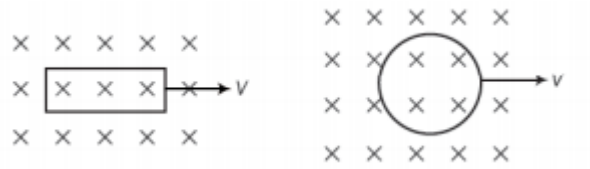
42. An AC voltage source of variable angular frequency ω and fixed amplitude V connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased

a. The bulb glows dimmer
b. The bulb glows brighter
c. Net impedance of circuit is unchanged
d. Total impedance of the circuit increases

43. If a medium of relative permeability μ_r had been present instead of air, the mutual inductance would be

a. $M = \mu_r \mu_0 n_1 n_2 \pi r_1 l$
b. $M = \mu_r \mu_0 n_1 n_2 r_1 l$
c. $M = \mu_r \mu_0 n_1 n_2 r_1^2 l$
d. $M = \mu_r \mu_0 n_1 n_2 \pi r_1^2 l$

44. A rectangular loop and a circular loop are moving out of a uniform magnetic field region in the given figure to a field free region with a constant velocity v. In which loop do you expect the induced emf to be constant during the passage out of the field region?



a. Rectangular loop
b. Circular loop
c. Both (a) and (b)
d. Neither (a) nor (b)

For question numbers 45-49 two statements are given- one labeled Assertion (A) and the other labeled Reason (R).

Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

a) Both A and R are true, and R is correct explanation of the assertion.

b) Both A and R are true, but R is not the correct explanation of the assertion.

c) A is true, but R is false.

d) A is false, but R is true.

45. **Assertion (A)** : Galvanometer to ammeter conversion takes place by connecting a low value resistance in parallel with it.

Reason(R) : The low value resistance increases the effective resistance and protects the galvanometer.

46. **Assertion (A):** Work done in moving a charge between any two points in a uniform electric field is independent of the path followed by the charge between these two points.

Reason (R): Electrostatic forces are nonconservative.

47. **Assertion (A)**: If a compass needle be kept at magnetic north pole of Earth, the compass needle may

stay in any direction.

Reason (R): Dip needle will stay vertical at the north pole of Earth.

48. **Assertion (A):** Kirchhoff's junction rule is applicable for any number of lines meeting at a point in an electrical circuit.

Reason (R): When there is a flow of steady current, then there is no accumulation of charge at the junction.

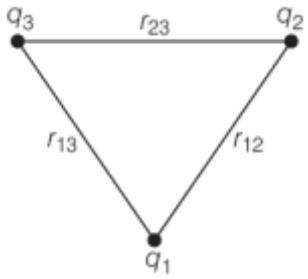
49. **Assertion :** Only a change in magnetic flux will maintain an induced current in the coil.

Reason : The presence of large magnetic flux through a coil maintains a current in the coil if the circuit is continuous.

III SECTION C

This section consists of 6 multiple choice questions with an overall choice to attempt any 5. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.

50. The total potential energy of a system of three charges q_1, q_2 and q_3 located at r_1, r_2 and r_3 respectively is that



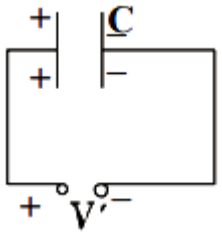
a. $\frac{1}{4\pi\varepsilon_0}\left(\frac{q_1q_2}{r_{12}}+\frac{q_1q_3}{r_{13}}+\frac{q_2q_3}{r_{23}}\right)$

b. $\frac{1}{4\pi\varepsilon_0}\left(\frac{q_1q_2}{r_{12}}-\frac{q_1q_3}{r_{13}}+\frac{q_2q_3}{r_{13}}\right)$

c. $\frac{1}{4\pi\varepsilon_0}\left(\frac{q_1q_2}{r_{12}}+\frac{q_1q_3}{r_{13}}-\frac{q_2q_3}{r_{23}}\right)$

d. $\frac{1}{4\pi\varepsilon_0}\left(\frac{q_1q_2}{r_{12}}-\frac{q_1q_3}{r_{13}}-\frac{q_2q_3}{r_{13}}\right)$

51. Two plates of a capacitor are charged by a battery with 'V' volts. After charging battery is disconnected and a dielectric slab with dielectric constant 'K' is inserted between its plates, the potential across the plates of a capacitor will become



a. Zero

b. V/2

c. V/K

d. KV

Case study : Read the following paragraph and answers the questions:

Electrical Resonance

Electrical resonance is said to take place in a series LCR circuit when the circuit allows maximum current for a given frequency of the source of alternating supply for which capacitive reactance becomes equal to the inductive reactance. Impedance of this LCR circuit is minimum and hence current is maximum.

Resonant circuits are used to respond selectively to signals of a given frequency while discriminating against signals of different frequencies. If the response of the circuit is more narrowly peaked around the chosen frequency, we say that the circuit has higher "selectivity or sharpness". This sharpness is measure with the help of Q – factor.

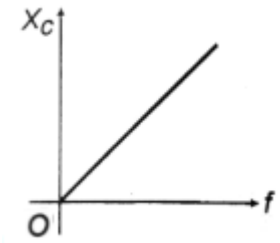
52. In an LCR series AC circuit, if ω_0 is the resonant angular frequency, then the quality factor (Q – factor) is given by

a. $\frac{\omega_0 L}{C}$ **b.** $\frac{\omega_0 L}{R}$

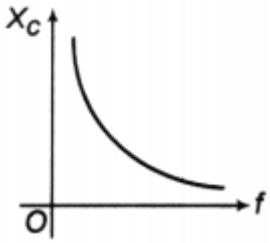
c. $\frac{\omega_0 C}{R}$ **d.** $\frac{\omega_0 C}{L}$

53. The correct variation of capacitive reactance of a capacitor with frequency is

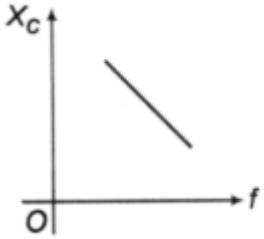
a.



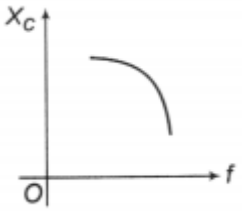
b.



c.



d.

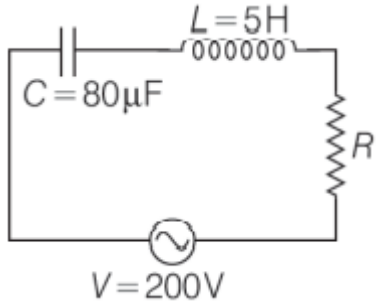


54. If an LCR series circuit is connected to an ac source, then at resonance the voltage across

a. R is zero **b.** R equals the applied voltage

c. C is zero **d.** L equals the applied voltage

55. Figure shows a series LCR circuit, connected to a variable frequency 200 V source. C = 80 μF and R = 40 Ω. The source frequency which drives the circuit at resonance is



a. 25 Hz **b.** 25/π Hz

c. 50 Hz **d.** 50/π Hz

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