ETERNAL CAREER CLASSES

SUBJECT : PHYSICS	CLASS : XII	FULL MARKS : 40
NAME :	BOARD TEST : 17	DATE : 23.12.2024

SECTION - A

Single answer type question.   Attempt any Forteen question :-   **Marks : 1** $\times$ 14 = 14

1. In a coil of resistance 100 Wa current is induced by changing the magnetic flux through it. The variation of current with time is as shown in the figure. The magnitude of change in flux through coil is

    (a) 200 Wb   (b) 275 Wb
    (c) 225 Wb   (d)250 Wb

2. The magnetic flux linked with the coil (in Weber) is given by the equation :
    $$\phi = 5t^2 + 3t + 16$$
    The induced EMF in the coil at time, t = 4 will be :
    (a) – 27 V   (b) – 43 V
    (c) – 108 V   (d) 210 V

3.   Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon the :
    (a) rate at which current change in the two coils
    (b) relative position and orientation of the coils
    (c) rate at which voltage induced across two coils
    (d) currents in the two coils

4. The coefficient of mutual inductance between a pair of coils is equal to the induced emf produced in one coil. This is possible in case ,
    (a) The rate of change in current in the second coil is 1 A/s
    (b) The current is the second coil is 1A
    (c) The current in the second coil changes from 1A to 2A in 1 minute
    (d) The current in both the coils is 1 A

5. Two coils are placed close to each other. The mutual inductance of the pair coils depends upon the
    (a) rate at which current change in the two coils
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6.   If both the number of turns and core length of an inductor is doubled keeping other factors constant, then its self – inductance will be
     (a) Unaffected   (b) doubled
    (c) halved   (d) quadrupled

7. A square of side L metars lies in the x – y plane in a region where the magnetic field is given by B = $B_0 \left(2\hat{i} + 3\hat{j} + 4\hat{k} \right)$ Tesla, where B_0 is constant. The a mgnitude of flux passing through the square is
    (a) $2B_0\ L^2$Wb   (b) $2B_0\ L^2$Wb
   (c) $2B_0\ L^2$Wb   (d) $\sqrt{29}\ B_0\ L^2$Wb

8. The self – inductance L of a solenoid of length l and area of cross – section A, with a fixed number of turns N increases as
   (a) l and A increase
   (b) l decreases and A increases
   (c) l increases and A decreases
   (d) both l and A decrease

9. A metal plate is getting heated . it can be because
   (a) a direct current is passing through the plate.
   (b) it is placed in a time varying magnetic field
   (c) it is placed in a space varying magnetic filed, but does not vary with time
   (d) a current (either direct or alternating) is passing through the plate.

10. An e.m.f is produced in a coil, which is not connected to an external voltage source. This can be due to
    (a) the coil being in a time varying magnetic field.
    (b) The coil moving in a time varying magnetic field
    (c) the coil moving in a constant magnetic field
    (d) the coil is stationary in external spatially

11. A very high frequency AC source of peak EMF 200 V is connected across a circuit as shown in the figure. The components of the circuit as shown in the figure. The components of the circuit are L = 1 mH, C = 1 μF, R_1 = 10 ohm, R_2 = 40 ohm, R_3 = 30 ohm. What is the approximate value of the peak current flowing through this circuit ?
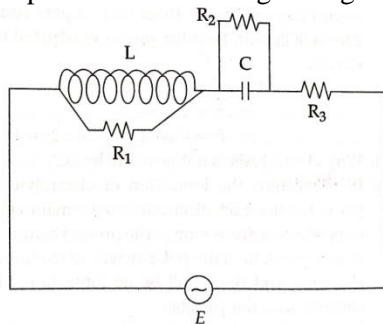
   (a) 0 A   (b) 2.5 A
   (c) 5 A   (d) 6.67 A

12. If the rms current in a 50 Hz AC circuit is 5 A, the value of the current 1/300 s after its value becomes zero is

   (a) $5\sqrt{2}$ A   (b) $5\sqrt{\dfrac{3}{2}}$ A

   (c) $\dfrac{5}{6}$ A   (d) $\dfrac{5}{\sqrt{2}}$ A

13. A capacitor has a dielectric of dielectric constant 6, that completely occupies the space between its plates. If a current I flows through this capacitor when connected to an AC source what will be the current in the circuit when this dielectric is removed ?
   (a) $\dfrac{I}{6}$ (b) I – 6
   (c) I   (d) 6 I

14. An alternating current generator has a internal resistance R_g and an internal reactance X_s, It is used to supply power to a passive load consisting of a resistance R_g and a reactance X_L . For maximum power to be delivered from the generator to the load, the value of X_L is equal to
   (a) zero   (b) X_g
   (c) $-X_g$ (d) R_g

15. The instaneous values of emf and the current in a series ac circuit are – $E = E_o$ sin ωt and I = I_o sin $(\omega t + \pi/3)$ respectively, then it is

(a) Necessarily a RL circuit
(b) Necessarily a RC circuit
(c) Necessarily a LCR circuit
(d) can be RC or LCR circuit

16. An alternating voltage source of variable angular frequency ω and fixed amplitude V is connected in series with a capacitance C and 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 the circuit remains unchanged
(d) Total impedance of the circuit increases

17. An iron cored coil is connected in series with an electric bulb with an AC source as shown in figure. When iron piece is taken out of the coil, the brightness of the bulb will
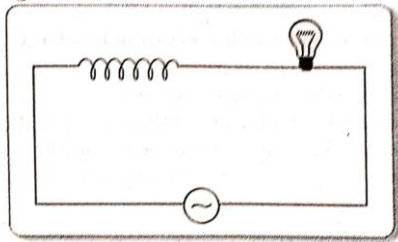
(a) decrease
(b) remain unaffected
(c) increase
(d) fluctuate

18. If the reading of the voltmeter V_1 is 40 V, then the reading of voltmeter V_2 is
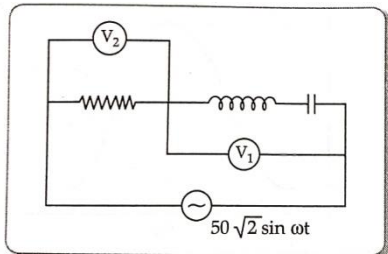
(a) 30 V   (b)58 V
(c) 29 V   (d)15 V

19. A 20 volt AC is applied to a circuit consisting of a resistance and a coil with negligible resistance if the voltage across the resistance is 12 volt, the voltage across the coil is :
(a) 16 V   (b)10 V
(c) 8 V   (d) 6 V

20. The large scale transmission of electrical energy over long distances is done with the use of transformer. The voltage output of the generator is stepped – up because of
(a) reduction of current
(b) reduction of current and voltage both
(c) power loss is cut down
(d) a and c both

SECTION - B

Short answer type question. Attempt any four question :-   **Marks : $2 \times 3 = 6$**

21. **(a)** Define mutual inductance an write its SI unit.
    (b) Two circular loops, one of small radius r and other of larger radius R, such that R $>$ $>$ r, are placed coaxially with centres coinciding . Obtain the mutual inductance of the arrangement.

22. **(a)** Define the term self – inductance' and write its S.I. unit
    (b) Obtain the expression for the mutual inductance of two long co - axial solenoids S_1 and S_2 wound one over the other, each of length L and radii r_1 and r_2 and n_1 and n_2 number of turns per unit length, when a current I is set up in the outer solenoid S_2 .

23. A 100 W, 100 V bulb is to be connected to AC mains supply of 200 V, 50 Hz. Suggest a suitable capacitor that should be connected in series with the bulb so that the bulb lights up without burning out .

24. A source ac voltage V = V_0 sin ωt is connected to a series combination of a resistor R and a capacitor C. Draw the phasor diagram and use it to obtain the expression for (impedance of the circuit and (ii) Phase angle .

Long answer type question. Attempt any four question :-   **Marks : $4 \times 5 = 20$**

25. A rectangular coil of area A, having number of turns N is rotated at f revolutions per second in a uniform magnetic field B, the field being perpendicular to the coil.
    Prove that the maximum emf induced in the coil is 2πfNBA

26. (a) A conductor of length 'l' is rotated about one of its ends at a constant angular speed 'ω' in a plane perpendicular to a uniform magnetic field B. Plot graphs to show variations of the emf induced across the IP variations of the emf induced across the ends of the conductor with (i) angular speed ω and (ii) length of the conductor l .
    (b) Two concentric circular loops of radii 1 cm and 20 cm are placed coaxially .
    (i) Find mutual inductance of the arrangement.
    (ii) if the current passed through the outer loop is changed at a rate of 5 A/ms, find the emf induced in the inner loop. Assume the magnetic field on the inner loop to be uniform .

27. State Faraday's law of electromagnetic induction. Figure shown rectangular conductor PQRS in which the conductor PQ is free to move in a uniform magnetic field B perpendicular to the plane of the paper. The field extends from x = 0 the arm PQ possesses resistance r. When the arm is then moved backward to x = 0 to x = 2b and is then moved backward to x = 0 with constant speed v, obtain the expressions for the flux and the induced emf .
    Sketch the variation of these quantities with distance 0 ≤ x ≤ 2 b

28. (a) series LCR circuit is connected to an ac source. Using the phasor diagram, derive the expression for the impedance of the circuit
    (b) Plot a graph to show the variation of current with frequency of the ac source, explaining the nature of its variation for two different resistances R_1 and R_2 ($R_1 < R_2$) at resonance .

29. (a) Derive the expression for the current flowing in an ideal capacitor and its reactance when connected to an ac source of voltage V = V_0 sin ωt
    (b) Draw its phasor diagram
    (c) If resistance is added in series to capacitor what changes will occur in the current flowing in the circuit and phase angle between voltage and current .

30. (a) State the principle of ac generator :
    (b) Explain with the help of a well labelled diagram , its working and obtain the expression for the emf generated in the coil
    Its working and obtain the expression for the emf generated in the coil
    (c) is it possible to generate emf without rotating the coil ? explain .