PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

ELECTROMAGNETIC INDUCTION & ALTERNATING CURRENT

Solved Examples

1. What is magnetic flux linked with a coil or N turns or are cross section A held with its plane parallel to the field?

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2. A square coil of $10^{-2}m^2$ area is placed perpenducular to a uniform magnetic field of $10^3 Wb/m^2$. What is magnetic flux through the coil?

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3. The magnetic flux threading a coil changes from 12×10^{-3} Wb to 6×10^{-3} Wb in 0.01. Calculate the induced e.m.f.

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4. A coil having 500 square loops each of side $10cm$ is placed normal to a magnetic flux which increase at the rate of $1.0\frac{\text{tesla}}{\text{second}}$. The induced r.m.f. in volts is

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5. A wire of length 0.1 m moves with a speed of $10m/s$ perpendicular to a magnetic field of induction Wb/m^2. Calculate induced e.m.f.

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6. A horizontal conducting rod 10 m long extending from east to west is falling with a speed of $5.0m/s$ at right angles to the horizontal component of earth's magnetic field, $0.3 \times 10^{-4} Wb/m^2$. Find the instantaneous value of e.m.f. induced in the rod.

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7. What e.m.f. will be induced in a 10 inductor in which current changes from 10 A to 7 A in $9 \times 10^{-2} s$?

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8. The current passing through a choke coil of 5 hery is decreasing at the rate of $2ampere/\sec$. The e.mf. Devlopeing across the coil is

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9. Three coils of self inductance, 5, 10 and 15 Mh are connected first in series an then in parallel. What is the ration of the net inductance in the two cases?

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10. A current of 10 A in primary of a circuit is reduced to zero at a unifrom rate in 10^{-3}s. If coeff.of mutual inductance is 3 H, what is the induced e.m.f. in the secondary ?

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11. Two circular coils, one of smaller radius r_1 and the other of very large radius r_2 are placed co-axially with centres coinciding. Obtain the mutual inductance of the arrangement.

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12. A 2 m long solenoid with diameter 4 cm and 2000 turns has a secondary of 1000 turns wound closely near its mid point. Calculate the mutual inductance between the two coils.

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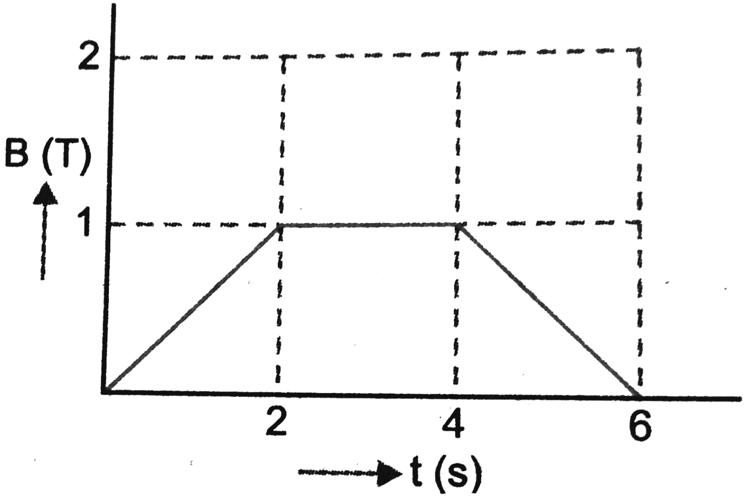
13. The magnetic field through a circular loop of wire 12 cm in radius and 8.5 ohm resistance, changes with time as shown in Fig. The magnetic field is perpendicular to the plane of the loop. Calculate the induced current in the loop and plot is as a function of time.



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14. A rectangular loop of area $20cm \times 30cm$ is held in a magnetic field of 0.3 T with its plane inclined at (i) 30° to the field (ii) parallel to the field. Find magnetic flux linked with the coil in each case.

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15. A 10 ohm resistance coil has 1000 turns and at a time, magnetic flux 5.5×10^{-4} Wb in 0.1 s, find the emf generated in the coil and the change that flows through the coil.

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16. A conducting circular loop is placed is a uniform magnetic field B =0.20 T with its plane perpendicualr to the field . Somehow, the radius of the loop starts shrinking at a constant rate of

$1.0 mms^{-1}$. Find the induced emf in the loop at an instant when the radius is 2 cm.

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17. The magnetic flux through a coil perpendicular to its plane and directed into paper is varying according to the relation $\phi = (5t^2 + 10t + 5)$ milliweber. Calculate the e.m.f. induced in the loop at $t = 5$ s.

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18. A square loop of side 10 cm and resistance 0.70 ohm is placed vertically in the east -west plane. A uniform magnetic field of 0.10 T is set up across the plane in north-east direction. The magnetic field is decreased to zero in 0.7 sec. at a steady rate. Determine the magnitudes of induced e.m.f. and current during this time interval.

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19. A coil having an area $2m^2$ is placed in a magnetic field which changes from $1wb/m_2$ n interval of 2s. The e.m.f. induced in the coil is:

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20. A circular coil of radius 10 cm, 500 turns and resistance 2 Omega is placed with its plane prependicular to the horizontal component of the earth's magnetic field. It is rotated about its vertical diameter through 180° in 0.25 s. Estimate the magnitude of the e.m.f and current induced in the coil. Horizotal component of earth's magnetic field at the place is $3 \times 10^{-5} T$.

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21. A magnetic field of flux density 10 T acts normal to a coil of 50 turns having $20cm^2$ area. Find emf induced if the coil is removed from the magnetic field in 0.1 sec.

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22. The magnetic flux through a coil is varying according to the relation $\phi = (5t^3 + 4t^2 + 2t - 5)$ Wb. Calculate the induced current through the coil at $t = 2$ s if resistiance of coil is 5 ohm.

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23. A railway track running north south has two parrallel rails 1.0 m apart. Calculate the e.m.f. induced between the rails when a train passes at a speed of 90 km h^{-1}. Horizontal component of earth's magnetic field at that plane is $0.3 \times 10^{-4} T$ and angle of dip is 60°.

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24. A wheel with 8 matallic spokes each 50 cm long is rotated with a speed of 120 $rev / \min$ in a plane normal to horizontal component of earth's magnetic field. Earth's magnetic field at the phase is

0.4 G and angle of dip 60°. Calculate the emf induced between the axle and rim of the wheel. How is the emf affected if number of spokes is increased ?

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25. A wheel with 15 metallic spokes each 60 cm long is roated at 360 rpm in a plane normal to the horizontal component of earth's magnetic field. The angle of dip at that place 60°. If the e.m.f. induced between the rim of the wheel and the axle is 400 m mV, calculate horizontal component of earth's magnetic field at the place. How will the induced e.m.f. change. if number of spokes is increased ?

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26. Twelve wires of equal lenghts (each 10 cm) are connected in the form of a skeleton cube. If the cube is moving with a velocity 0.05 Wb/m^2, find the emf induced in each arm of the cube, If the cube. If the moves perpendicular to the field, What will be the induced e.m.f. in each arm ?

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27. An aircraft with a wingspan of 40 m flies a speed of 1080 km hr_1 in the eastward direction at a constant altitude in the northern hemisphere, where the vertical component of earth's magnetic fieldis 1.75×10^{-5} T. Find the e.m.f. that develops between the tips of the wings.

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28. A wheel with 10 metallic spokes each 0.5 m long, is rotated with a speed of 120 rpm. Please of the wheel is normal to earth's magnetic field at that place. If the magnitude of the field is 0.40 G, what is the induced emf between the axle and rim of the wheel?

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29. A metallic rod of 1 m length is rotated with a frequency of 50 rev/s, with on end hinged at the centre and the other end at the circumference of a circular metallic ring of radius 1 m, about an axis passing through the centre and perpendicular at to the plane of the ring. A constant uniform magnetic field of 1 T parallel to the axis is persent eveywhere. what is the e.m.f. between the centre and the metallic ring?

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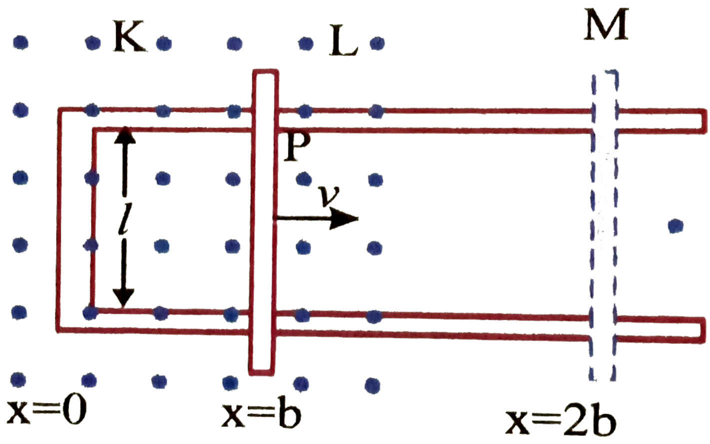
30. The arm PQ of the rectangular conductor is moved from $x = 0$, outwards in the uniform magnetic field which extends from $x = 0$ to $x = b$ and is zero for $x > b$ as shown. Only the arm PQ possess substantial resistance r. Consider the situation when the arm PQ is pulled outwards from $x = 0$ to $x = 2b$, and is then moved back to $x = 0$ with constant speed v. Obtain expression for the flux, the induced emf, the force necessary to pull the arm and the power dissipated as Joule heat. Sketch the variation of these quantities with distance.



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31. A cycle wheel 12 metalli spokes each 0.2 m long. It make 60 revolutions in 1 minute in a phane normal to earth's magnetic field of 0.4×10^{-4} T. Calculate the induced e.m.f. between the axle and rim of the wheel.

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32. An average induced e.m.f. of 0.4 V appears in a coil when current in it is changed from 10 A in one direction to 10 A in opposite direction in 0.40 second. Find the coefficient of self induction of the coil.

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33. A coil has a self inductance of 10 Mh. What is the maximum magnitude of the induced e.m.f. in the coil when a current of I $= 0.1 \sin 200t$ ampere is sent through it ?

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34. A solenoid of length 40 cm area of cross section 20 cm^2 abd total number of turns 800 is connected to a sources that supplies current changing at the rate of 0.2 A/s . What is the emf induced across the solenoid ?

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35. Find the change in current in an inductor of 10 H in which the e.m.f. induced is 300 V in 10^{-2} sec. Also, find the change in magnetic flux.

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36. The self inductance of a coil having 200 turns is 10 mH. Complete the total flux linked with the coil. Also, determine the magnetic flux through the cross section of the coil, corresponding to current of 4 mA.

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37. A solenoid of radius 3 cm and length 1 m has 600 turns per metre. What is its self inductance? Will the value of self inductance change if is would on an iron piece?

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38. magnetic flux of 20 μ Wb is linked with a coil when current of 5 mA is flown through it. What is the self induction of the coil?

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39. Magnetic field of 2×10^{-2} Wb m^2 is acting at right angle to a coil of 1000 cm^2 having 50 turns. The coil is removed from the field in $\frac{1}{10}$ second. Find the magnitude of induced e.m.f.

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40. The average e.m.f. induced in a coil in which the current changes from 2 amperes to 4 amperes in 0.05 seconds is 8 volts. What is the self-inductance of the coil?

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41. If a current of 3.0 amperes flowing in the primary coil is reduced to zero in 0.001 second, then the induced e.m.f. in the secondary coil is 15000volts. The mutual inductance between the two coils is

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42. A large circular coil of radius R and a small circular coil of radius r are put in vicinity of each other. If coefficient of mutual inductance of this pair equals 1 mH, what would be the flux linked with larger coil when a current of 0.5 A flows through the smaller coil? When would current in the smaller coil falls to zero, what would be its effect in the larger coil ?

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43. An e.m.f. of 0.5 V is developed in the secondary coil, when current in primary coiol changes form 5.0 A to 2.0 A in 300 millisec. Calculate the mutal inductance of tow coils.

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44. A solenoid of 2000 turns is wound over a length of 0.3 m. The area aof cross section is $1.3 \times 10^{-3} m^2$. Around its central seciton, a coil of 300 turns is closely wound. If an initial current of 2 A is reversed in 0.25 s, find the e.m.f induced in the coil .

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45. Two coils have mutual inductance of 1.5 henry. If current in primary circuit is raised to 5 ampere in one millisecond after closing the circuit, what is the e.m.f. Induced in the secondary ?

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46. A solenoid of length 50 cm with 20 turns per cm and area of cross section 40 cm^2 comletely surrounds another co-axial solenoid of the same length, area of cross seciton $25cm^2$ with 25 turns per cm. Calculate the mutual inductance of the system.

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47. A conducting wire of 100 turns is wound over and near the centre of a solenoid of 100 cm length and 2 cm radius having 600 turns. Calculate mutual inductance of two coils.

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48. The current through two inductors of self inductance 12 mH and 30 mH is increasing with time at the same rate. Draw graphs showing the variation of the (a) e.m.f. induced with the rate of change of current in each inductor. (b) enargy stored in each inductor with the current flowing through it.

Compare the energy stored in the coils if power dissipated in the coil is same.

49. A toroidal solenoid with an air core has an average radius of 15 cm, area of cross-section $12cm^2$ and 1200 turns. Obtain the self inductance of the toroid. Ignore field variations across the cross-section of the toroid.

(b) A second coil of 300 turns is wound closely on the toroid above. If the current in the primary coil is increased from zero to 2.0 A in 0.05 s, obtain the induced e.m.f. in the second coil.

50. Two co-axial circular coils of radii 50 cm and 5 cm are separated by a distance of 50 cm and carry currents 3 A and 2 A respectively. Calcualte the mutual inductance of the two coils.

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51. A metallic rod held horizontally along east west direction is allowed to fill under gravity. Wil there be an e.m.f induced acroos its ends ?

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52. A bar magnet is moved towards a wire loop suspended as shown in fig .What is the direction of emf. Induced ?

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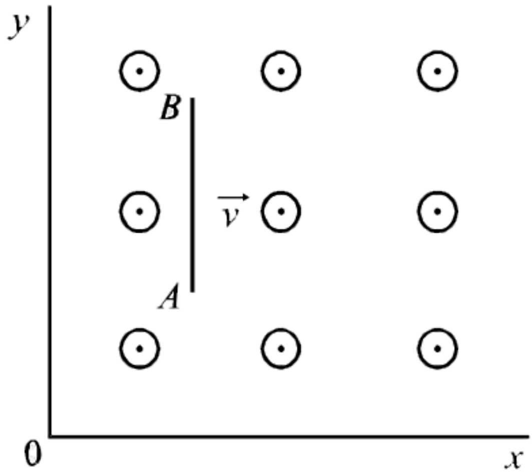
53. A conducting rod AB moves parallel to the x-axis (see Fig.) in a uniform magnetic field pointing in the positive z-direction. The end A of the rod gets positively charged.



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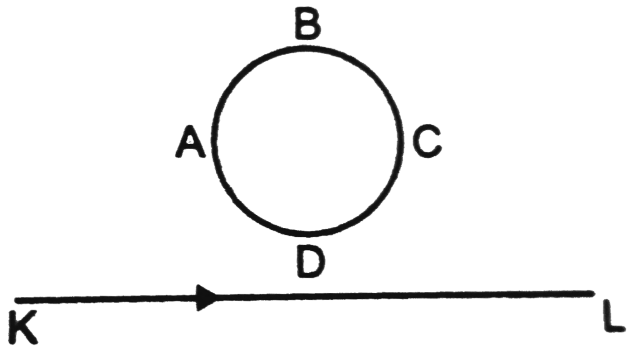
54. What is the magnitude of induced current in the circular loop ABCD or radius r, when a steady current of I ampere is passed through wire KL?



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55. Two spherical bobs, one metallic and other of glass, of the same size are allowed to fall freely from the same height above the ground. Which of the two would reach the ground earlier and why ?

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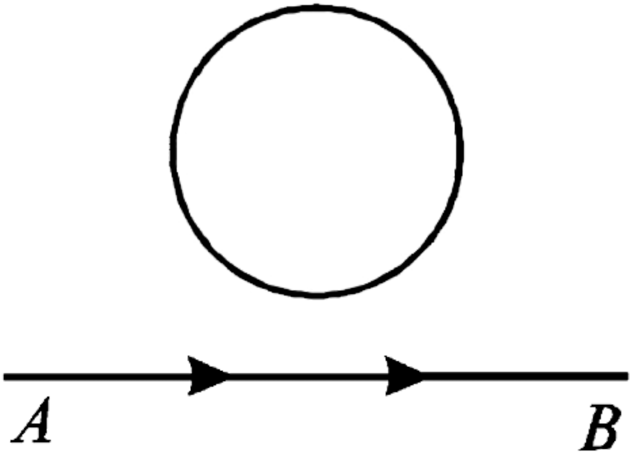
56. A current from A to B is increasing in magnitude. What is the direction of induced current. If any,in the loop as shown in the figure?



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57. A coil is removed from a magnetic field (i) rapidly (ii) slowly. In which case, more work will be done ?

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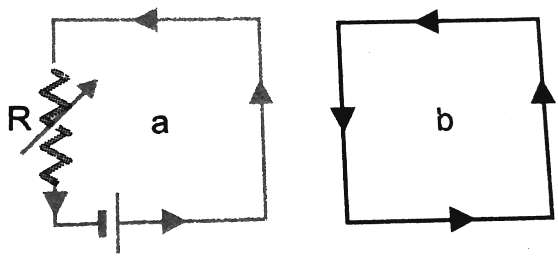
58. If resistance R in circuit 'a' of fig. be decreased, what will be the directionn of induced current in the circuit 'b'



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59. How would you detect the presence of magnetic field on an unknown planet?

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60. A bar magnet falls through a material ring. Will its acceleration be equal to 'g' ?

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61. In the above problem, if the ring is cut somewhere, what would be the answer ?

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62. What are the factors on which the magnitude of induced emf depends?

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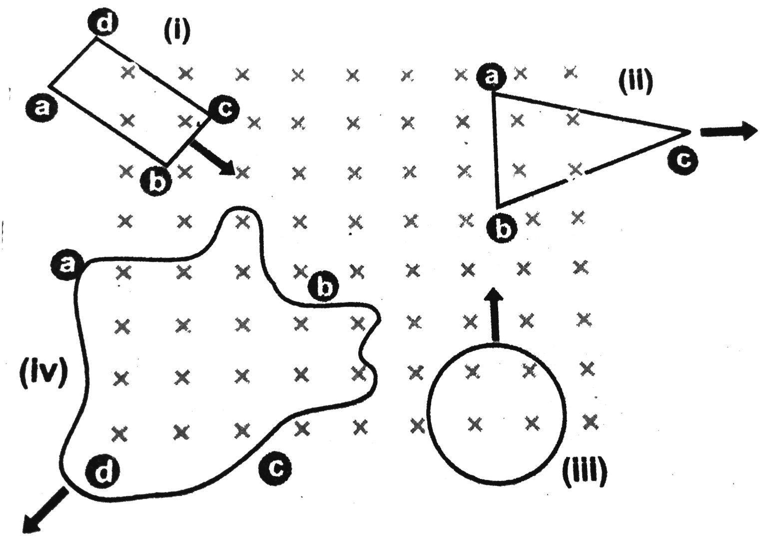
63. Fig. shows planer loops of different shapes moving out of or into a region of magnetic field which is directed normal to the plane of the loops away from the reader. Determine the direction of induced current in each loop using Lenz's law. Check if you would obtain the same answers by considering magnetic force on the charge inside the moving loops.



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64. Answer the following quesitons : (a) A closed conducting loop moves normal to the electric fieldd between the plates of a large capacitor. Is a current induced in the loop when it is (i) wholly inside the capacitor (ii) partially outside the plates of capacitor. Electric field is normal to the plane of the loop.

(b) A rectangular loop and a circular loop are moving out of a uniform magnetic field region to a field free region with a constant velocity, Fig. In which loop do you expact the induced e.m.f. to be constant during the passage out of the field region, the field is normal to the loops ?

(c) Predict the polarity of the capacitor in the situation described by Fig.

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65. A long straight current carrying wire passes normally through the centre of circular loop. If the current through the wire increases, will there be an induced emg in the loop ? Justify.

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66. Calculate the rate at which the flux linked with the generated area changes with time when a rod length l is (a) translated (b) rotated in a uniform field of induction B as shown in fig.

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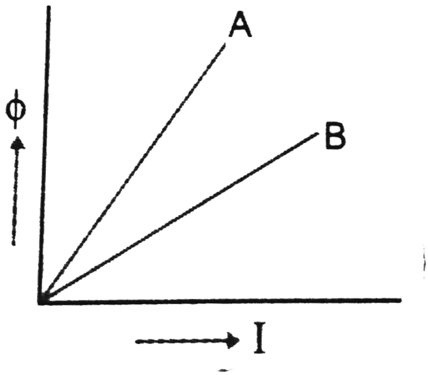
67. A plot of magnetic flux (ϕ) versus current (I) is shown for two inductors A and B. Which of the two has larger value of self inductance ?



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68. Self inductance of an air core inductor increases from 0.01 mH to 10 mH when an iron core is introduced in it. What is the relative permeability of the core ?

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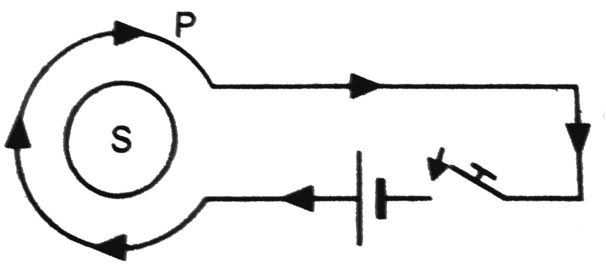
69. In fig. P and S are two coils. What shall be the direction of induced momentary current in S immediately after the switch is closed, (ii) if the switch is opened, after it the been closed for some time,



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70. A lamp in a circuit consisting of a coil of large number of truns and a battery does not ligth upto full brilliance instantly on switching on the circuit ?

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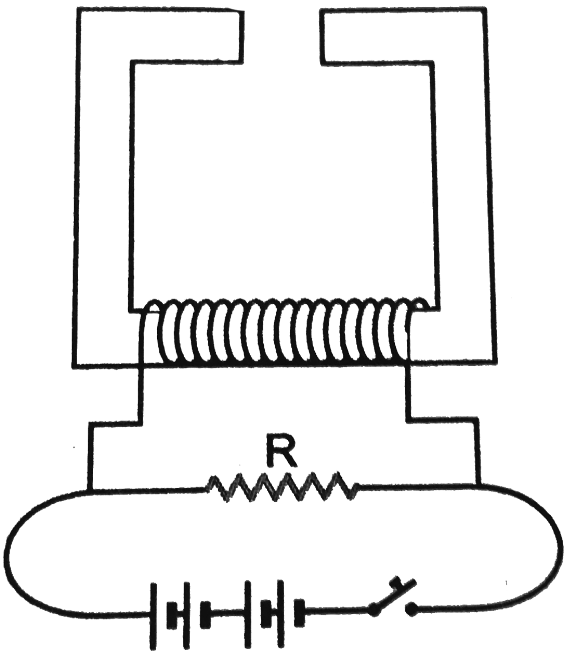
71. A small resistor R (say, a lamp) is usually put in parallel with the current carrying coil of an electromagnet, fig. What prupose does it serve ?



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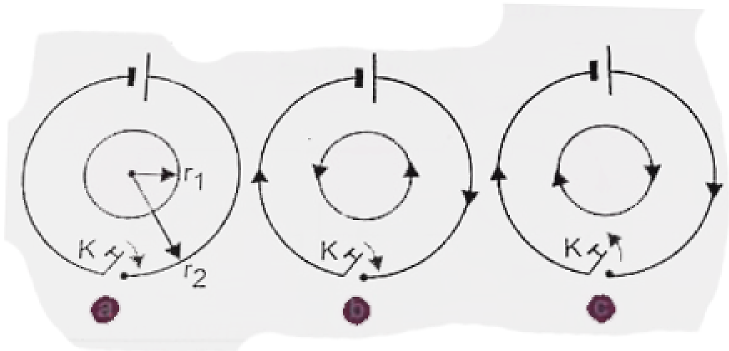
72. In co-axial concentric coils of radius r_1 and r_2 such that $r_1 < < r_2$ Fig. find direction of induced current when K is (i) pressed (ii) released.



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73. How is mutual inductance of a pair of coils affected when (i) separation between the coils in increased, (ii) the number of turns of each coil is increased , (iii) a thin iron sheet is placed between the two coils, other factors ramaining the same ? Explain your answer in each case.

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74. An ideal inductor when connected in a.c. circuit does not produce heating effect though it reduces the current in the circuit. Explain why ?

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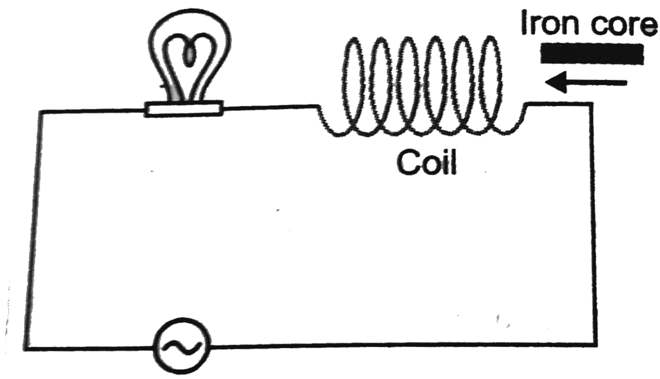
75. A bulb connected in series with a solenoid is lit by a.c. source, Fig. If the soft in core is introduced in the solenoid, will is bulb glow brighter ?



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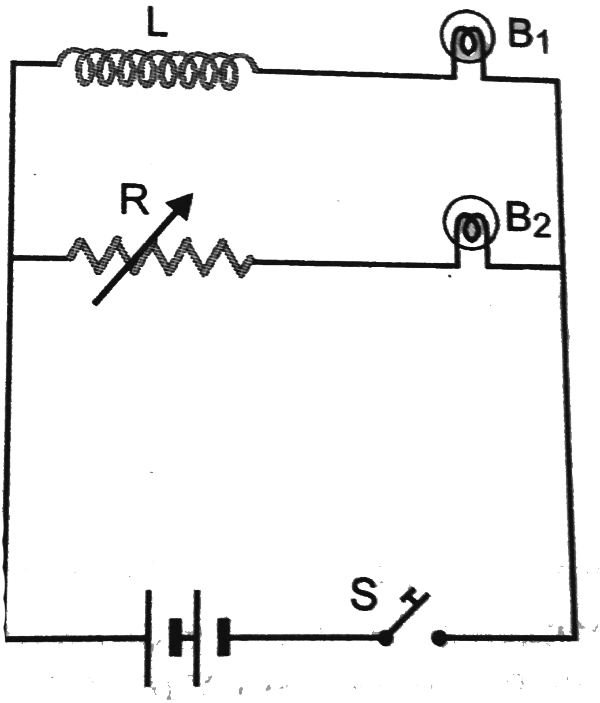
76. Answer the following questions :

Fig shows an inductor L and a resistance R connected in parallel to battery through a switch. The resistance of R is the same as that of the coil that makes L. Two identical bulbs are put in each arm of the circuit. (i) Which of the bulb be equally bright after some time ?



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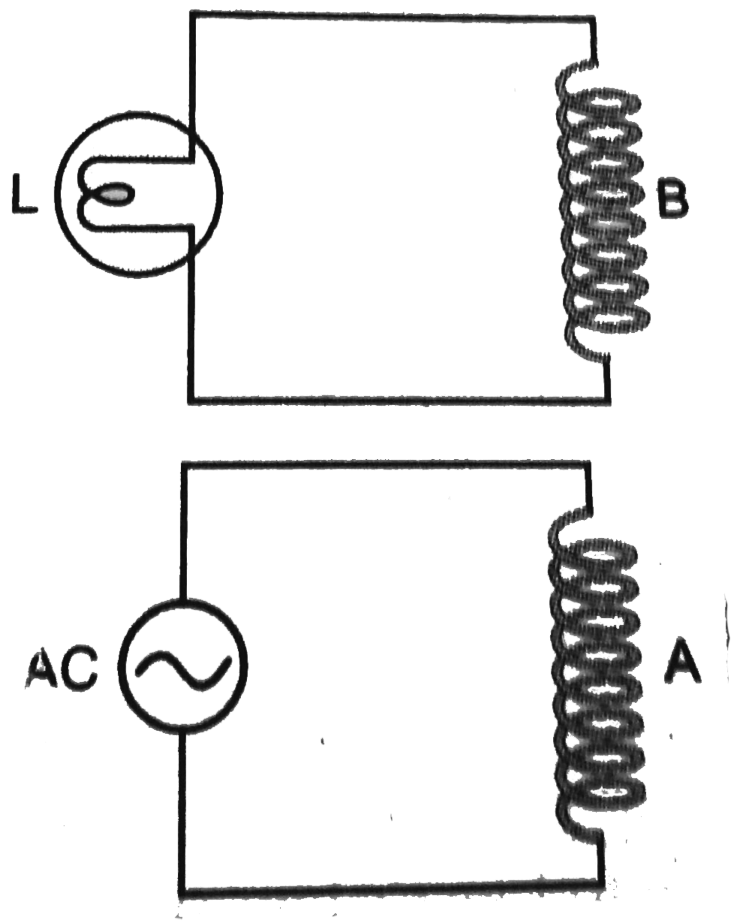
77. In Fig. a coil B is connected to a low voltage bulb L and placed parallel to another coil A, as shown. Explain the following observations : (i) bulb lights

(ii) gets dimmer if the coil B is moved upwards.



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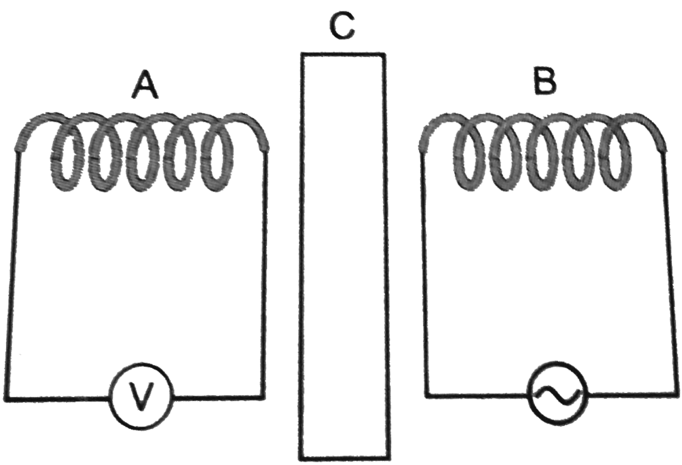
78. A coil A is connected to a voltmeter V and the other coil B to an alterniting current sourecs, Fig. If a large copper sheet is placed between the two coils, how does the induced emf in coil A change due to current in coil B ?



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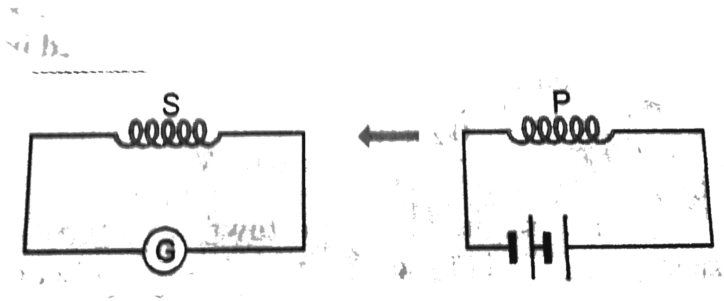
79. When primary coil P is moved towards secondary coil S, Fig. the galvanometer shows memetary deflection in the can be done to have larger deflection in the galvanometer with same battery ? State the related law ?



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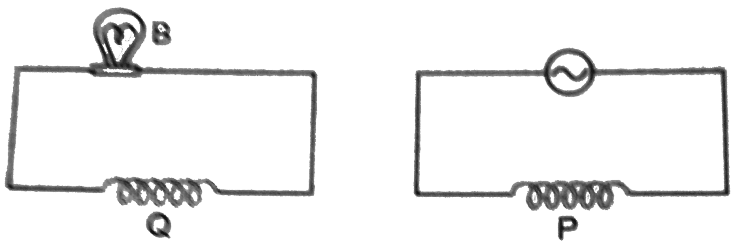
80. A coil Q is connected to low voltage bulb B and placed near another coil P as showns in Fig. Give reasons to explain the following observation : (a) The bulb B lights (b) Bulb gets dimmer if coil Q is moved toward left.



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81. A coil is held in a magnetic field perpendcular to its plane. When will the average e.m.f. induced in the coil be maximum ? (i) magnetic field is strong but it does not change (ii) magnetic field is small, but its rate of change is large (iii) magnetic field is large, but its rate of change is small.

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82. When is the magnetic crossing a given surface area held in a magnetic field maximum ?

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83. The dimensional formula for magnetic flux is

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84. What is the relation between weber and Maxwell ?

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85. A coil intercepts a magnetic flux of 0.2×10^{-2} Wb in 0.1 s. What is the emf induced in the coil ?

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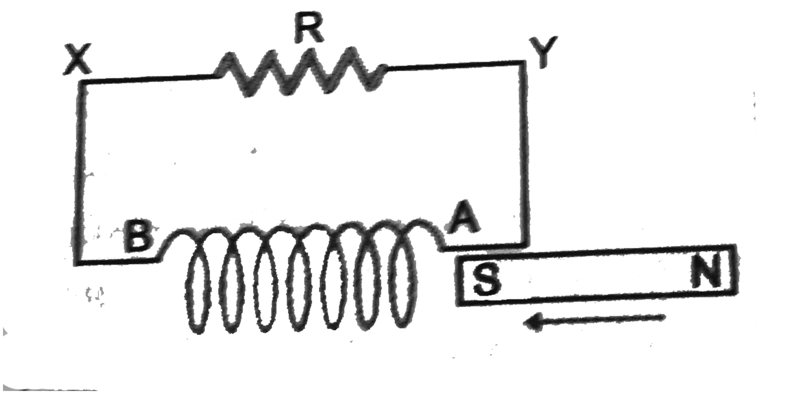
86. A bar magnet is moved towards a solenoid as shown in Fig. What is the direction of induced current in R ?



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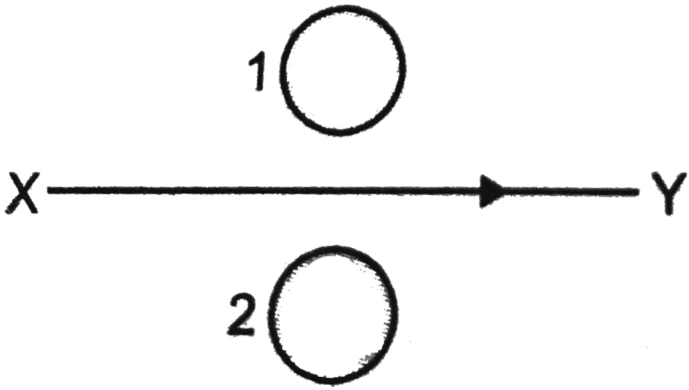
87. Current I in wire XY is increasing steadily. What will be the direction of induced currents in metal rings 1 and 2 ?



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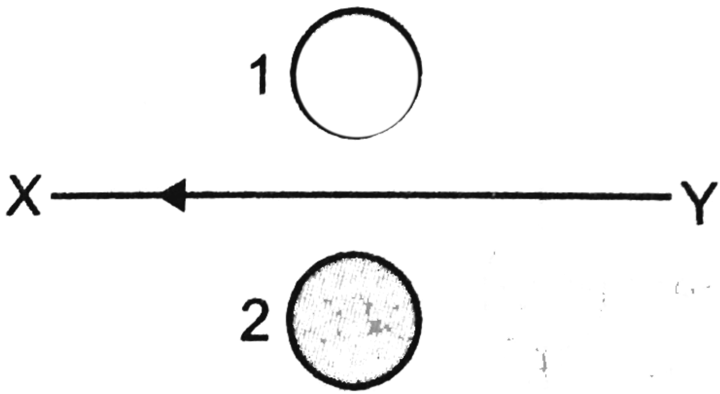
88. Current in wire XY is decreasing steadily. Predict the direction of induced current in metal rings 1 and 2.



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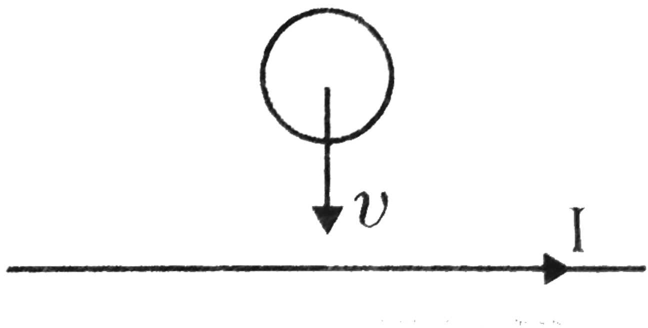
89. A metal ring moves towards a straingt wire carrying current. What is the direction of induced current in the ring ?



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90. Does chanbe in magnetic flux induce e.m.f. or current ?

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91. A vertical matallic pole falls down through the plane of magnetic meridian. Will any e.m.f. be induced between its ends ?

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92. Two straight and parallel wires A and B are being brought towards each other. If current in A be i. what will be the direction of induced current in B? If A and B are being taken away from each other, then ?

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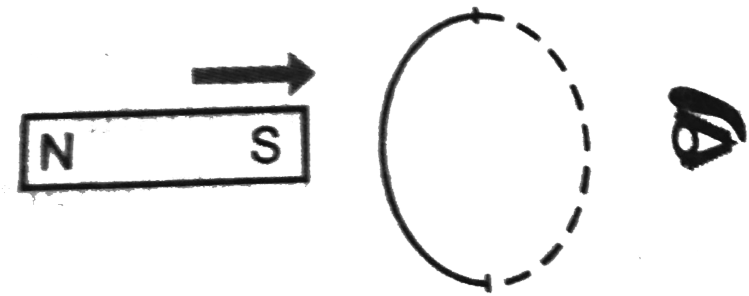
93. The south pole of a magnet is brought near a conducting loop. What is the direction of induced current as seen by a person on the other side of the loop ?



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94. A train is moving with uniform speed from north to south. Will any induced e.m.f. appear across the ends of its axle ? Will the answer be affected if train moves from east to west ?

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95. What are the SI units of magnetic field induction or magnetic flux density?

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96. When is magnetic flux linked with a coil held in a magnetic field zero ?

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97. The induced e.m.f. is sometimes called back e.m.f. Why ?

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98. Why are oscillations of a copper sheet in a magnetic field highly damped ?

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99. What causes sparking in the switchs when light is put off ?

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100. What is the basic cause of induced e.m.f. ?

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101. Does Len'z law violet the principle of energy conservation ?

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102. A cylindrical bar magnet is kept along the axis of coil. Will there be a current induced in the coil. Will there be a current induced in the coil if the magnet is rotaded about its axis ? Give reasons.

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103. Could a current be induced in a coil by rotating a magnet inside the coil ? If so, how ?

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104. Is induced electric field conservative or non conservative ?

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105. A glass rod of length l moves with velocity in a uniform magnetic field B. What is the e.m.f. induced in the rod ?

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106. A wheel with a certain number of spokes is rotated in plane normal to earth's magnetic field so the an e.m.f. is induced between the axle and rim of the wheel. Keeping all other things same, number of spokes is changed. How is the e.m.f. affected ?

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107. Why does a metallic piece become very hot when it surrounded by a carrying high frequency alternaiting current ?

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108. The dimensions of self inductance are

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109. The self induced emf in a coil when current charges in it is given by.

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110. The induced e.m.f. is sometimes called back e.m.f. Why ?

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111. What are the dimensions of mutual inductance ?

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112. The inductance of a coil is 0.25 H. Calculate its inductive reactance in a.c. frequency 50 Hz.

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113. How does self inductance of a solenoid change when number of turns is double keeping othe parameters same ?

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114. What are the factors on which self inductance of a coil depend ?

Watch Video Solution

115. What is the SI unit of mutual inductance of two coils ?

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116. Name the physical quantity which is measured in weber amp^{-1}.

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117. When current in a coil changes with time, how is the back e.m.f. induced in the coil related to it ?

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118. Two inductors L_1 and L_2 are at a sufficient distance apart. Equivalent inductance when they

are connected (i) in series (ii) in parallel are

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119. What is one henry ?

Watch Video Solution

120. Are eddy currents useful or harmful ?

Watch Video Solution

121. Write an expression for self inductance of a long solenoid.

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122. Write an expression for mutual inductance of two co-axial solenoids.

Watch Video Solution

123. An artificial satellite with a metal surface is orbiting the earth around the equator : Will the earth's magnetism induce some current in it ?

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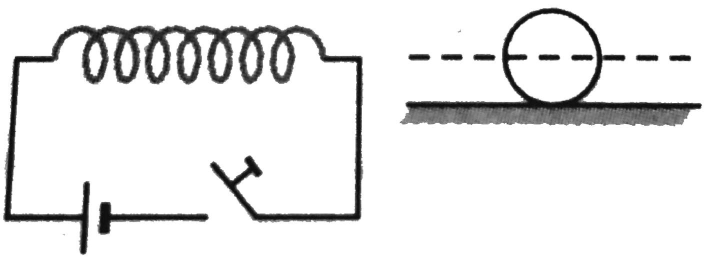
124. A horizontal solenoid is connected to a cell and a switch, Fig. A Copper ring with its axis along the axis of the solenoid is placed on a frictionless track. What happen to the ring, as the switch is closed ?



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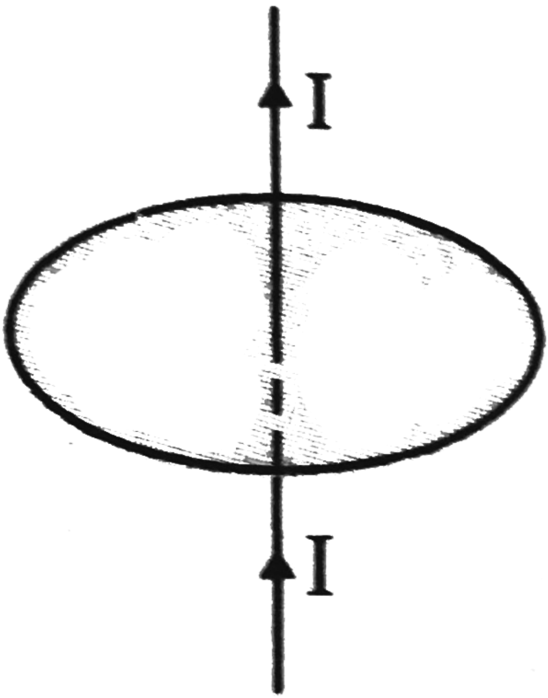
125. Current is passed through a wire passing normally through the centre of a conducting loop, Fig. If currents is increased gradually, what will be the direction fo induced current in the loop ?



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126. An artificial satellite with a metal surface is orbiting the earth around the poles. Will there by any induced current due to earth's magnetic field ?

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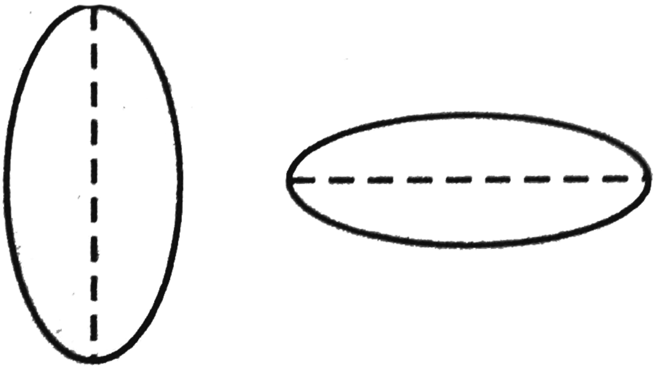
127. The plane of two circular conductors are perpendicular to each othe, as shown in Fig. If current in any one is changed, will there be induced

current in the other ?



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128. State whether the following statement are true of false giving reason in brif :

(a) The dimension of (h/e) is the same as that of magnetic flux ϕ.

(b) The dimensions of electric and magnetic flux are same.

(c) A coil or a metal wire is kept stationary in a non-uniform magnetic field. An e.m.f. is induced in the coil.

(d) An e.m.f. can be induced between the two ends of a straingth copper wire when it is moved through a magnetic field.

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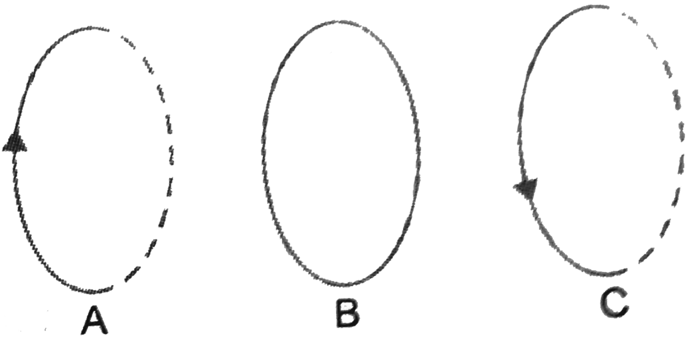
129. Three identical coils A, B and C are placed with their planes parallel to one another. Fig Coils B and C carry currents as shwon. Coils B and C are fixed. The coil A is moved towards B with uniform speed.

Is three any induced current in B



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130. Show that the rate of change of magnetic flux has the same units as induced e.m.f.

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131. A circular brass loop of radius a and resistance R is placed with it plane perpendicular to a magnetic field, which varies with time as $B = B_0 \sin \omega t$. Obtain the expression for the induced current in the loop.

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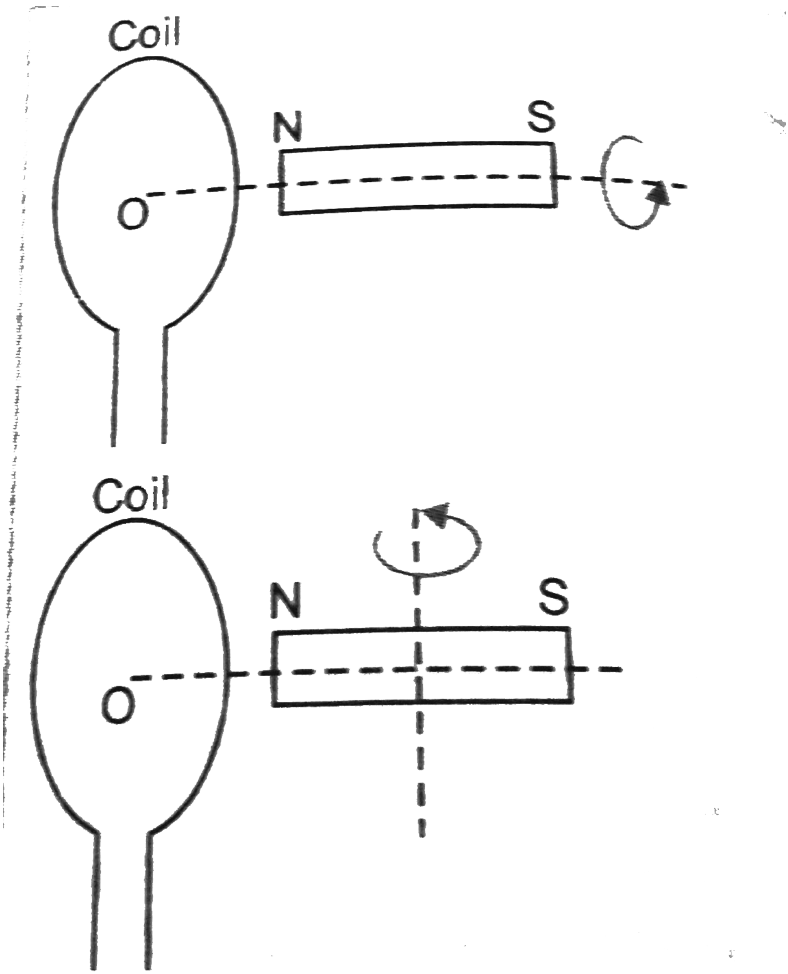
132. A cylindrical bar magnet is kept along the axis of circular coil and near it as shown in Fig. Will there be any induced emf at the terminals of the coil, when magnet is rotated (a) about its own axis (b) about an aixs perpendicular to the length of the magnet ?



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133. Consider Experiment 2, Art. 4(a). 3,

(a) What would you do to obtain a large deflection of the galvanometer ?

(b) How would you demonstrate the presence of an induced current in the absence of a galvanmeter ?

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134. How is mutual inductance of a pair of coils affected when (i) separation between the coils in increased, (ii) the number of turns of each coil is increased , (iii) a thin iron sheet is placed between the two coils, other factors ramaining the same ? Explain your answer in each case.

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135. Can one have an inductance without a resistance ? How about a resistance with an inductance ?

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136. A coil is wound on an iron core and looped back on itself so that the core has two sets of in

opposite senses. How is its self inductance affected ?

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137. Explain why resistance coils are usually double wound.

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138. How is an electric guitar different from an acoustic guitar ?

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139. What is the principle of working of meterbridge?

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140. A cell of $1.5V$ is connected across an inductor of $2mH$ in series with a 2Ω resistor. What is the rate of growth of current immediately after the cell is switched on.

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141. A coil of inductance $300mh$ and resistance 2Ω is connected to a source of voltage $2V$. The current reaches half of its steady state value in

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142. A 0.18μ F capacitor is first charged and then discharged through a high resistance. If it takes 0.5 sec for the chage to reduce to one forth of its initial value, find the value of the resistance. Given $\log_e 4 = 1.386$

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143. The instantaneous current from an a.c. source is $I = 6 \sin 314t$. What is the r.m.s value of the current ?

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144. What will be the instantaneous voltage for a.c. supply of 220 V at 50 hertz ?

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145. A 1000 hertz a.c. is flowing in a 14 mH coil. Find its reactance.

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146. An inductor of 1 H and negligible resistance is used on 220 V a.c. mains of frequency 50 Hz. Calculate the effective current.

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147. On microfarad capaitor is joined to 200 V, 50 hz alternate. Calculate the rms current through capacitor,

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148. 220 V, Hz is connected across a capacitor of $5\mu F$. Calculate the effective current.

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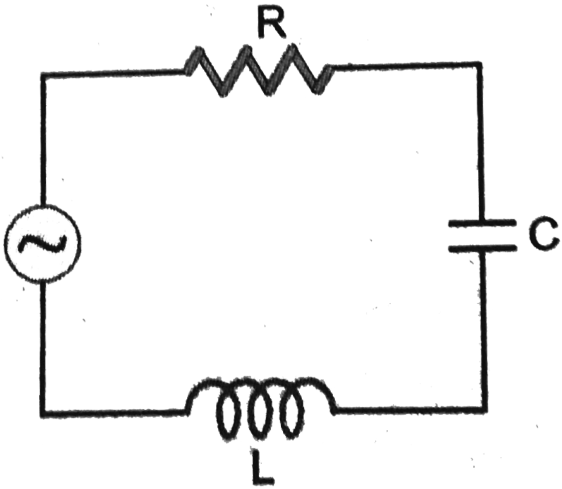
149. Fig. show a series LCR circuit with $L = 0.1H$, $X_C = 14\Omega$ and $R = 12\Omega$ connected to a 50 Hz, 200 V source. Calculate

(i) current in the circuit and

(ii) phase angle between current and voltage.

Take $\pi = 3$



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150. A capacitor of capacitance $100\mu F$ and a coil of resistance 50Ω and inductance $0.5H$ are connected in series with $a110V, 50HzAC$ source. Find the rms value of the current.

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151. A.C. mains of 200 V, 50 Hz is connected to a circuit containing a resistance of 30 ohm and a coil of induction $4/\pi$ henry is series. Calculate the virtual current in the circuit.

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152. A Source of 200 V - 50 Hz a.c. is connected to a resistance of 10 ohm, a capacitor C and an ammeter in series. If reading of ammeter is 2 A, what is the capacity of condenser ?

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153. A 1.5 mH inductor in LC circuit stores a maximum energy of 17μ J. What is the peak current ?

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154. A charged $30\mu F$ capacitor is connected to a 27 mH inductor. What is the frequency of free oscilolations of the circuit ?

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155. A capacitor, a 101.5 mH inductor and a 5 ohm resistor are connected in series with a 50 Hz a.c. source. If current and voltage in the circuit are in phase, what is the capacity of the condenser ?

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156. A 200 ohm electric iron is connected to 220 V, 50 Hz a.c. supply. Calculate the average power delivered to iron.

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157. A coil of 1 H and 100Ω resistance has a peak voltage of $5\sqrt{2}$ volt 50 hz connected across it. Calculate the current through the coil and power absorbed.

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158. The voltage and current in an a.c. circuit are given by $E = 300 \sin(\omega t + \pi/2)$ and $I = 5 \sin \omega t$. What is power factor of the circuit and power dissipated in each cycle ?

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159. A series LCR circuit with $r = 10 ohm$, $L = 2H$ and $C = 25 \mu F$ is connected to a varialbe frequency 200 V a.c. supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transferred to the circuit in one complete cycle ?

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160. Current is switched on in a circuit contaning a resistance of 10Ω and an inductance of 0.8 H. Calculate the time taken by the current to grow to half its maximum value.

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161. When a current of 10 ampere is flowing through a resistance of 20 ohm and inductance of 10 henry, the battery is switched off. Find (i) current after 0.4

sec. (ii) the time the current takes to fall to 60% of its initial value.

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162. A capacitor of capacitance $0.5\mu F$ is discharged through a resistance. Find the value of resistance if half the charge on capacitor escapes in one minute.

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163. A 20 mH coil is connected in series with a $2k\Omega$ resistor and a 12 V battery.

Calcualte

(i) time constant of the circuit,

(ii) time during which current decrys to 10% of its maximum value.

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164. A capacitor of $1.0\mu F$ is connected to series with a resistance of $10^4 ohm$, and a battery of 2.0 V. Find the maximum value of current and current after 0.02 s.

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165. A capacitor of $10\mu F$ is connected to a resistance of $2.2 \times 10^5 ohm$ in series. What is time constant of the circuit? Can oscillations of charge/current be produced in this circuit ?

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166. Find the time required for a $50Hz$ alternating current to change its value from zero to the rms value.

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167. If the effective value of current in 50 Hz a.c. circuit is 5.0 A, What is (i) peak value or current (ii) mean value of current over half a cycle (iii) value of current $1/300$ s after it was zero ?

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168. The instantananeous current from an a.c. is $I = 10 \sin 314t$. What is the frequency of the source and virtual value of current ?

Watch Video Solution

169. What is the root mean square value of current of effective current of an a.c. having a peak value of 5.0 amp? What will be the reading shown for this current by (i) an a.c. ammeter (ii) an ordinary moving coil ammeter ?

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170. In an a.c. circuit, the rms voltage is $100\sqrt{2}V$. Find the peak value of voltage and its means value during a positve half cycle.

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171. The instantaneous current from an a.c source is $I = 5 \sin 100\pi t$ What is the frequency of a.c. ? What is the rms value of current ?

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172. The equation of a.c. in a circuit is $I = 50 \sin 100\pi t$. Find

(i) frequency of a.c.

(ii) mean value of a.c. over positive half cycle

(iii) rms value of current and (iv) value of current $1/600s$ after it was zero.

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173. A alternating voltage given by $V = 140 \sin 314t$ is connected across a pure resistor of 50 ohm. Find the rms current through the resistor.

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174. A 100Ω iron is connected to 220 V, 50 wall plug. What is (i) peak pot. Diff. (ii) average pot.diff. over half cycle (iii) rms current ?

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175. A light bulb is rated at 100 W for a 220 V supply.

Find

(a) the resistance of the bulb.

(b) the peak voltage of the source

(c) the rms current through the bulb.

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176. An alternating voltage given by $V = 140 \sin 314t$ is connected across a pure resistor of 50 ohm. Find (i) the frequency of the source. (ii) the rms current thought the resistor.

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177. An alternating e.m.f. of peak value 350 V is applied across an ammeter of resistance 100 ohm. What will be the reading of ammeter ?

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178. A resistance of 40Ω is connected to an source of 220 v, 50 Hz. Find the (i) rms current (ii) maximum instantaneous current in resistor.

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179. Find the value of current through an inductance of 2.0 H and negligible resistance, when connected to an a.c. source of $150V$, $50Hz$.

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180. Alternating e.m.f. of $E = 220 \sin 100\pi t$ is applied to a circuit containing an inductance of $(1/\pi)$ henry. Write equation for instantaneous current through the circuit. What will be the reading of a.c. galvanometer connected in the circuit ?

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181. Find the maximum value of current when inductance of two henry is connected to 150 volt, 50 cycle supply.

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182. A pure inductor of 25.0 mH is connected to a source of 220 V. Find the inductive reactance and rms current in the circuit if the frequency of the source is 50 Hz.

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183. A coil has an inductane of 1 H. At what frequency will it have a reactance of 3142 ohm ?

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184. A pure inductor of 50 mH is connected to a.c. supply of 220 V, 50 Hz. Find its inductive reactance, impedance, rms current and peak current.

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185. A capactior of $1\mu F$ is connected ot an a.c. source of e.m.f $E = 250\sin 100\pi t$. Write an equation for instantaneous current through the circuit and given reading of a.c. ammeter connected in the circuit.

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186. A $1.5\mu F$ capacitor has a capacitative reactance of 12Ω. What is the frequency of the source ? If frequency of source is double, what will be the capacitative reactance ?

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187. A coil has an inductance of 1 henry. (a) At what frequency will it have a reactance of 3142 ohm? (b) What should be the capacity of a condenser which has the same reactanc at frequency ?

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188. A $15.0\mu F$ capacitor is connected to a 220 V, 50 Hz source. Find the capacitative reactance and the current (rms and peak) in the circuit. If the frequency is doubled. What happens to the capactive reactance and current ?

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189. A capacitor of capacitance $10\mu F$ is connected to an oscillator giving an output voltage $\varepsilon = (10V)\sin\omega t$. Find the peak currents in the circuit for $\omega = 10s^{-1}, 100s^{-1}, 500s^{-1}, 1000s^{-1}$.

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190. A coil when connected across a 10 V d.c. supply draws a current of 2 A. When it is connected across 10 V - 50 hz a.c. supply the same coil draws a current of 1 A. Explain why? Hence determine self inductance of the coil.

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191. A capacitor and a resistor are connected in series with an a.c. source. If the potential difference across C, R are 120 V and 90 V repectively, and if rms value of current is 3 A, calculate impedance and power factor of the circuit.

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192. Following readings were obtained in the experiment to determine self inductance of a coil. If frequency of a.c. is 50 Hz, what is the value of self inductance ?

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193. An electric lamp which runs at 80 volt d.c. and consumes 10 ampere is connected to 100 volt, 50 Hz a.c. mains. Calculate the inductance of the choke required.

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194. A coil of negligible resistance is connected inseries with 90Ω resistor acorss a 120 V -60 Hz line. A voltmeter reads 36 V across the resistance. Find voltage across the coil and inductance of the coil.

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195. A 60 V - 10 W electric lamp is to be run on 100 V - 60 Hz mains. Calculate the inductance of the choke coil required. If a resistor is to be used in place of choke coil to achieve the same result, calculate its value.

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196. When an inductor L and a resistor R are connected across 12 V, 50 Hz a.c. supply, a current of 0.5 A flows through the distance the circuit. What is the value of R if current differs in phase from applied voltage by $\pi/3$ radian?

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197. An a.c. circuit consists of a series combination of circuit elements X and Y. The current is ahead of voltage in phase by $\pi/4$. If element X is a pure resistor of 100 ohm, name the circuit element Y, and calculate the rms value of current if rms voltage is 141 V.

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198. A 20 watt, 50 V lamp is connected in series to a.c. mains of 250 V, 50 Hz. Calculate to value of capacitor to run the lamp.

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199. A resistor of $200\Omega$and a capacitor of $15.0\mu F$ are connected in series to a $220V, 50Hz$ source.

(a) Calculate the current in the circuit .

(b) Calcutalte the voltage (rms) across the resistor and the inductor. Is the algebraic sum of these voltages more than the source voltage? If yes, resolve the paradox.

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200. A 120 V, 60 Hz power source is connected across an 800Ω non inductive resistance and an unkown capacitance in series. The voltage drop across the resistor is 102 V.

(a) What is the voltahe drop acorss the capacitor ?

(b) What is the reactance of the capacitor ?

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201. A circuit consists of a resistance 10 ohm and a capacitance of $0.1\mu F$ If an alternating e.m.f. of 100 V. 50 Hz is applied, calculate the current in the circuit.

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202. A capacitor of unknown capacitance, a resistance of 100 ohm and an inductor of inductance $L = 4/\pi^2$ henry are connected in series across an a.c. source of 200 V, 50 Hz. Calculate the value of capacitance and the current that flows in the circuit, when the current is in phase with the voltage.

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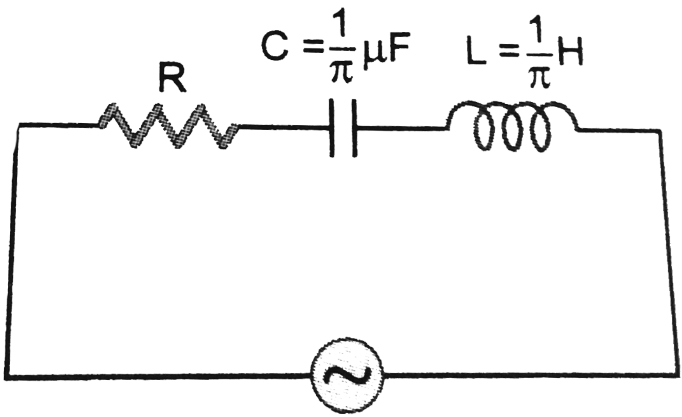
203. In the a.c. circuit shown in fig, the main supply hs constant voltage but variable frequency. For what frequency will the voltage across the resistance R be maximum ?



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204. A series LCR circuit is connected to an a.c. source 200 V, 50 Hz. The voltages acorss the resistor, indcutor and capacitor are respectively 200 V, 250 V and 250 V. (i) The algerbriac sum of the three voltages is greater than the source voltage. How is the paradox resolved ?

(ii) If $R = 40\Omega$, calculate the current in the circuit.

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205. A capacitor of capacitance $100\mu F$ and a coil of resistance 50Ω and inductance $0.5H$ are connected in series with $a 110V, 50 Hz AC$ source. Find the rms value of the current.

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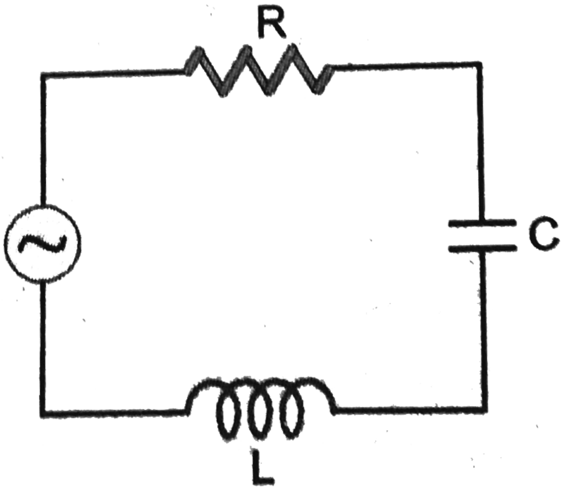
206. Fig. show a series LCR circuit with $L = 0.1H, X_C = 14\Omega$ and $R = 12\Omega$ connected to a 50 Hz, 200 V source. Calculate

(i) current in the circuit and

(ii) phase angle between current and voltage.

Take $\pi = 3$



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207. A resistor of 100Ω, inductance of 1 H and a capacitor of capacitance $10.13 \times 10^{-6} F$ are in series. This combination is conneceted to an A.C.

source of 200 V, 50 Hz. Find the current in the circuit and the P.D. across the resistor.

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208. A resistor of 50 ohm, an inductor of $(20/\pi)$ H and a capacitor of $(5/\pi)\mu F$ are connected in series to an a.c. source 230 V, 50 Hz. Find the current in the circuit.

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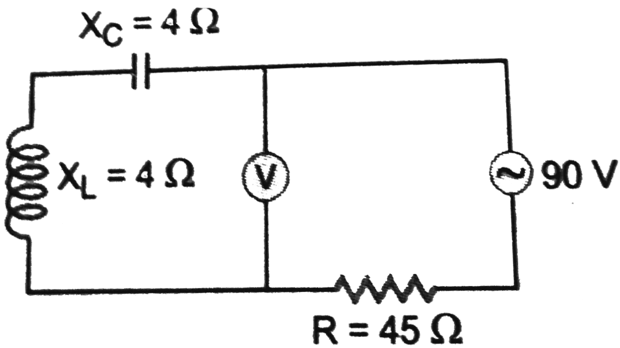
209. What will be the reading in the voltmeter and ammeter of the circuit shown in fig.



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210. An LCR circuit has L = 10 mH, $R = 3\Omega$ and $C = 1\mu F$ and is connected in series to a source of $(20 \sin \omega t)$ volt. Calculate the current amplitude at a frequency 20 % lower than the resonance frequency of the circuit.

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211. A series LCR circuit with $L = 4.0h, C = 100\mu F$ and $R = 60\Omega$ is connected to a varialbe frequency 240 V source. Calcalate

(i) angular frequency of the source which drives the circuit in resonace,

(ii) current at the resonating frequency,

(iii) rms potential drop across the inductro at resonance.

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212. Compute the resonant frequency and the Q factor of a series LCR circuit having $L = 4.0H, C = 36\mu F$ and $R = \frac{10}{3}\Omega$. How can sharpness of resonance of the circuit be improved by a factor of 2 by reducing its full width at half maximum ?

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213. A $2\mu F$ capacitor, 100 ohm resistor and 8 H inductor are connected in series with an a.c. source.

What should be the frequency of soure for which the current drawn in the circuit is maximum? If peak value of emf of the source is 200 V, find the maximum current, inductive reactance, capactive reactance, total impedance, peak value of current in the circuit. What is the phase relation between voltages across inductor and resistor ? Also, give the phase relation between voltages acorss inductor and capacitor.

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214. A series LCR circuit is connected to an a.c. source of 220 V - 50 hz. If the readings of voltmeters acorss resistor, capacitor and inductor are 65 V, 415 V and 204 volt respectively , and $R = 100\Omega$ calculate (i) current in the circuit (ii) value of L (iii) valueo of C and (iv) capacitance required to produce resonance with the given inductor L.

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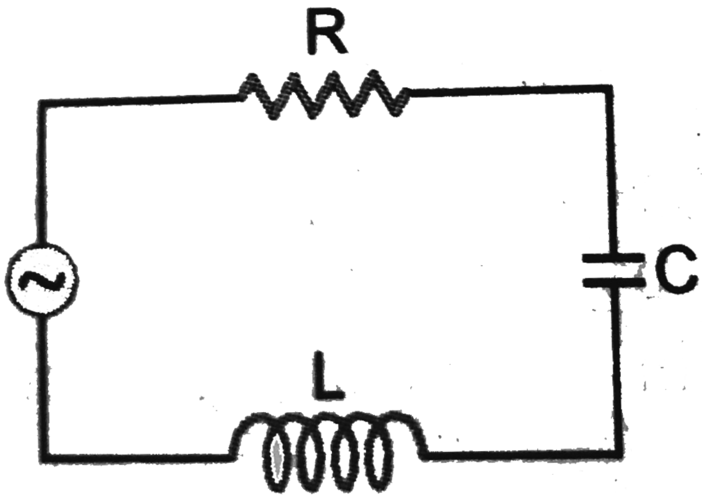
215. Fig. shows series LCR circuit with $L = 5.0H, C = 80\mu F, R = 40\Omega$ connected to a variable frequency 240 V source. Calculate

(i) the angular freuquency of the source which drives the circuit at resonance.

(ii) Current at the resonanting frequency.

(iii) the rms pot. drop across the capacitor at resonance.



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216. A series LCR circuit with $L = 80mH, C = 50\mu F$ and $R = 60ohm$ is

connected to a variable frequency 220 V source. Determine (i) the source frequency which drives the circuitin resonance (iii) the quality factor Q of the circuit.

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217. A series LCR circuit is connected to an a.c. source 200 V, 50 Hz. The voltages acorss the resistor, indcutor and capacitor are respectively 200 V, 250 V and 250 V. (i) The algerbriac sum of the three voltages is greater than the source voltage. How is the paradox resolved ?

(ii) If $R = 40\Omega$, calculate the current in the circuit.

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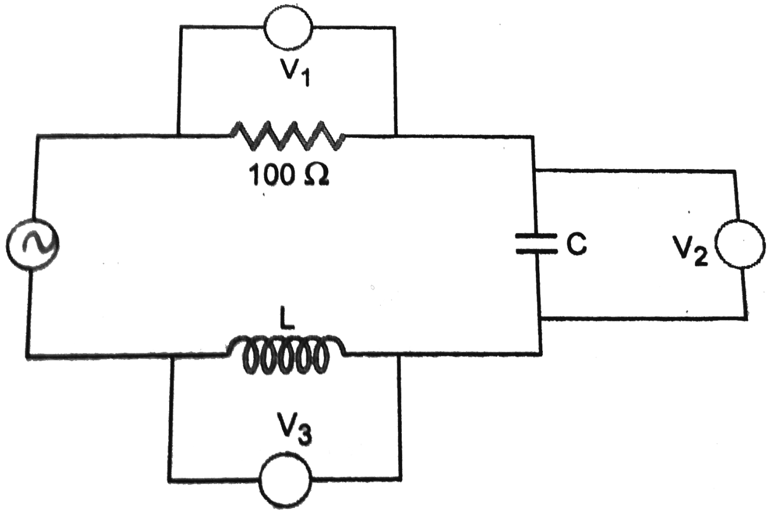
218. A series LCR circuit is connected to an a.c. source 220 V - 50 Hz as shown in fig. If the reading of the three voltemeters V_1, V_2, V_3 are 65 V, 415 V and 204 V respectively. Calculate (i) current in the circuit (ii) value of inductor L (ii) value of capacitor C (iv) value of C for same L required to produce resonance.



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219. A $100\mu F$ capacitor is charged with a 50 V source supply. Then source supply is removed and the capacitor is connected across an inductor, as a result of which 5 A current flows through the inductance. Calculate the value of inductance.

A. 0.01

B. 0.02

C. 0.03

D. 0.04

Answer: A

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220. A 1.5 mH inductor in an LC circuit stores a maximum energy of $30\mu J$. What is the maximum current in the circuit ?

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: B

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221. The current in a coil of self inductance 2.0 henry is increasing according to $i = 2\sin t^2$ ampere. Find the amount of energy spent during the period when the current changes from 0 to 2 apere.

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222. Three series capacitors of capacitances 2.0, 3.0 and $6.0\mu F$ are charged by a 60 V vattery. Find the total energy stored.

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223. A transmitter operates at 1 MHz. The oscillating circuit has a capacitance of 200 pF. What is the inductance and capacitative reactance of the resonant circuit ?

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224. A coil of inductance 0.4 mH is connected to a capacitor of capacitance 400 pF. To what wavelength is this circuit truned ?

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225. Find the natural frequency of oscillation of a circuit containing an inductance of 400 mH and a capacity of $40\mu F$. To which wavelength will its response be maximum ? How long will the oscillations last ?

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226. Find the natural frequency of a circuit jcontaininig inductance of $100\mu H$ and a capacity of $0.1\mu F$. To which wavelength will its respone be maximum? How long will the oscillations last ?`

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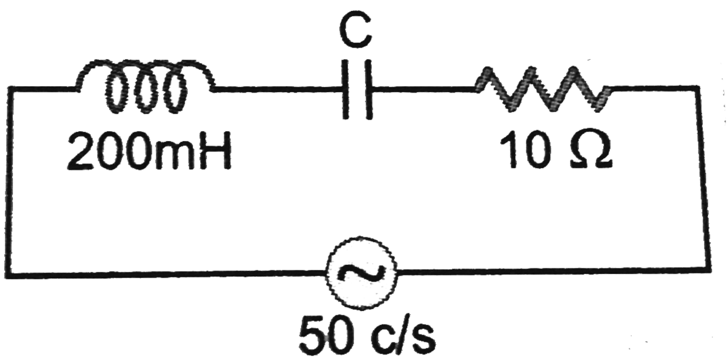
227. In the circuit shown in fin. Calculate the capacitance C of the capacitor, if the power factor of the circuit is unity. Also, calculate Q factor of the circuit.



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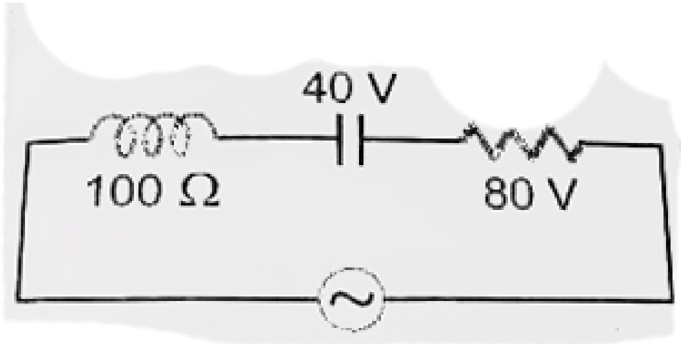
228. In the circuit shown in fig. potential diff. across L, C and and R are given. Find the e.m.f. of the source and calculate power factor of the circuit.



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229. A coil has an inductance of 0.7 H and is joined in series with a resistance of 220 ohm. Find the wattless component of current in the circuit, when an alternating e.m.f. of 220 V at a frequency of 50 Hz is supplied to it.

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230. A group of electric lamps having total power rating of 900 watt is supplied an a.c. voltage $E = 200 \cos(314t + 60^\circ)$. Find rms value of alternating current.

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231. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which $R = 3ohm$, $L = 25.48mH$ and $C = 796\mu F$. Find (a) the impedance of the circuit (b) phase difference between the voltage across the source and current (c) the power dissipated in the circuit and (d) the power factor.

Watch Video Solution

232. Suppose the frequency of the source in the above example can be varied (a) What is the frequency of the source at which resonance occurs

? (b) Calculate the impedeance, the current and power dissipated at the resonant condition.

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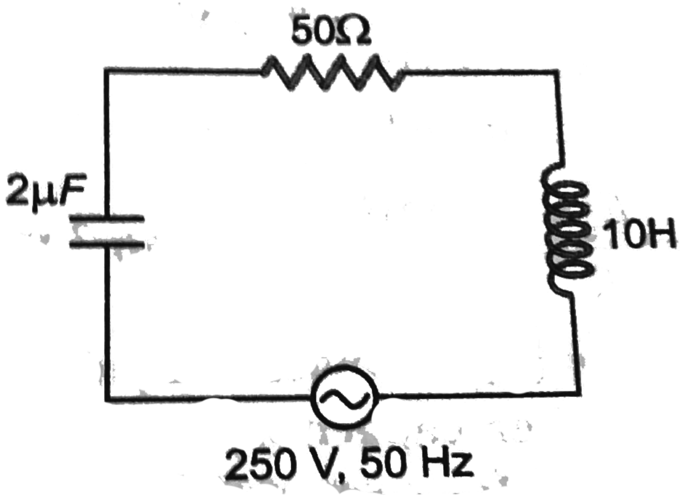
233. In an alternaitng current circuit, resistor, inductor and capacitor are connected in series in diagram shown in Fig. Find the value of current and power foctor of the circuit



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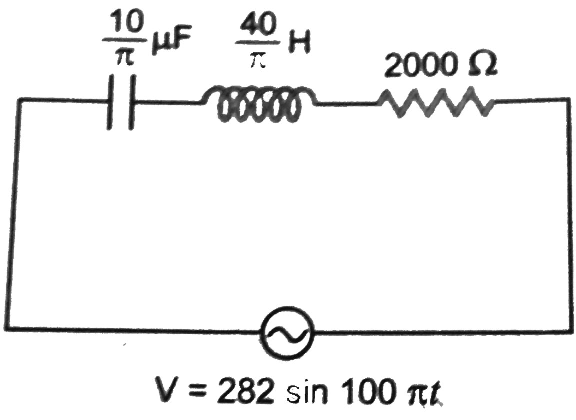
234. A circuit containing an 80 mH inductor and a $250\mu F$ capacitor in series is connected to 240 V, $100 rad / s$ supply. The resistance of the circuit is negligible. (i) Obtain rms value of current. (ii) What is the total average power consumed in the circuit ?

Watch Video Solution

235. A series LCR circuit is made by taking $R = 100\Omega, L = \frac{2}{\pi}$ and $C = \frac{100}{\pi}\mu F$. The series combination is connected across an a.c. source of 220 V, 50 Hz. Calculate impedance of the circuit and peak value of current flowing n the circuit. What is power factor of the circuit ? Compare it with one at resonance frequency.

Watch Video Solution

236. Equation of emf of a generator is $V = 282 \sin 100\pi t$ volt. Internal resistance of generator is 2000Ω. It is connected as shown in Fig. Find the frequency of generator and impedance of circuit.



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237. A circular coil having 20 turns, each of radius 8 cm, is rotating about its vertical diameter with an angular speed of 50 rad/s in a uniform horizontal magnetic field of 30 mT. Obtain the maximum, average and rms value of e.m.f. induced in the coil. If the coil forms a closed loop of resistance 10 ohm, how much power is dissipated as heat

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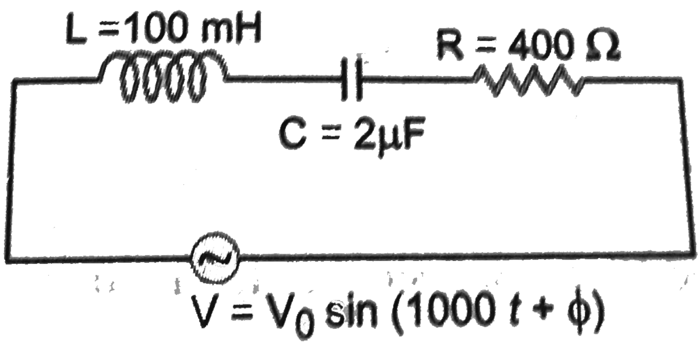
238. Capacitor C_1 of capacitance 1 micro-farad and capacitor C_2 of capacitance 2 microfarad are separately charged fully by a common battery. The two capacitors are then separately allowed to discharged through equal resistors at time t = 0.

Watch Video Solution

239. A solenoid of resistance 50Ω and inductance 80 H is connected to a 200 V battery, How long will it take for the current to reach 50% of its final equlibrium value ? Calculate the maximum enargy stored ?

Watch Video Solution

240. Find the value of phase lag/lead between the current and voltage in the given CLR circuit, fig. Without making any other change, find the value of additional capacitor, such that when joined switably to $C = 2\mu F$, would make the power factor of this circuit unity.



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241. An inductor of 200 mH, capacitor of $400\mu F$ and a resistance of 10 ohm are connected in series to an a.c. source of 50 V of varialbe frequency. Calculate (i) angular frequency at which maximum power dissipation occurs in the circuit and the corresponding value of effective current, and (ii) value of Q factor is the circuit.

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242. What is the significance of high Q-value circuits ?

Watch Video Solution

243. What is the average value of a.c. over a full cycle ?

Watch Video Solution

244. Find the time taken by 60 Hz a.c. to reach its peak value from zero.

Watch Video Solution

245. The time constant of C-R circuit is

Watch Video Solution

246. Show that time constant $(\tau = RC)$ of $R - C$ circuit has the dimensions of time.

Watch Video Solution

247. Can we use 15 Hz ac for lighting purpose?

Watch Video Solution

248. 220 volt a.c. is more dangerous than 220 volt d.c why?

Watch Video Solution

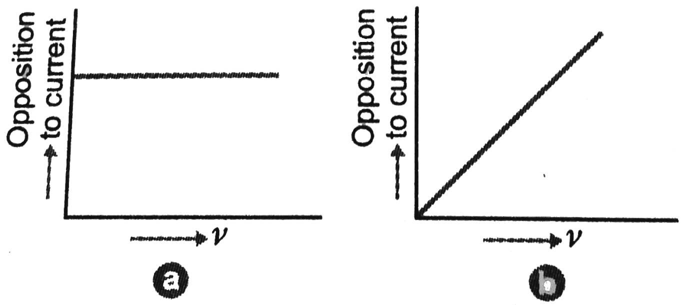
249. The d.c. and a.c. both, can be measured by a hot wire instrument. Why ?

Watch Video Solution

250. Show that the sum of instantaneous currents during growth and decay of current in LR circuit is independent of time.

Watch Video Solution

251. The graphs shown in Fig. represent the variation of opposition offered by the circuit element of the flow of a.c. with frequency of applied e.m.f. Iddntify the circuit element .



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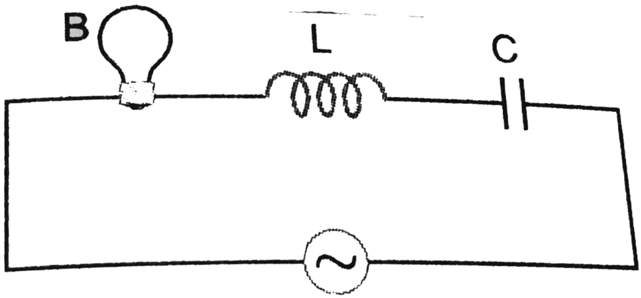
252. In the circuit shown Fig. when frequency of supply is doubled, how should the values of L and C be changed so that glow in the bulb remains unchanged ?



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253. A bulb B a capacitor C are connected in series to an a.c. source. A dielectric slab is now introduced between the plates of the capacitor. How will the brightness of bulb change ?

Watch Video Solution

254. Sketch a graph to show how the reactance of(i) a capacitor (ii) an inductor varies as a function of frequency ?

Watch Video Solution

255. A Capacitor blocks d.c. and allows a.c. Why ?

Watch Video Solution

256. The resistance of a coil for direct current is 10Ω. An alternating current is sent through it. Will its resistance remain the same ?

Watch Video Solution

257. Explain : voltages across L and C in series are 180° out of phase, while for L and C in parallel, current in L and C are 180° out of phase.

Watch Video Solution

258. Does the current in an A.C. circuit lag, lead or remain in phase with the voltages of frequency v applied to the circuit when (i) $v = v_r$ (ii) $v < v_r$ (iii) $v > v_r$ where v_r is the resonance frequency.

Watch Video Solution

259. At an airport, a perosn is made to walk through the door wy of a metal detector, for security reasons. If she/he is carrying anything made of metal, the metal detector emits a sound. On what principle does this detector work ?

Watch Video Solution

260. Can the voltage drop across the inductor or capacitro in a series LCR circuit be greater than the applied voltage of the ac souce?

Justify your answer.

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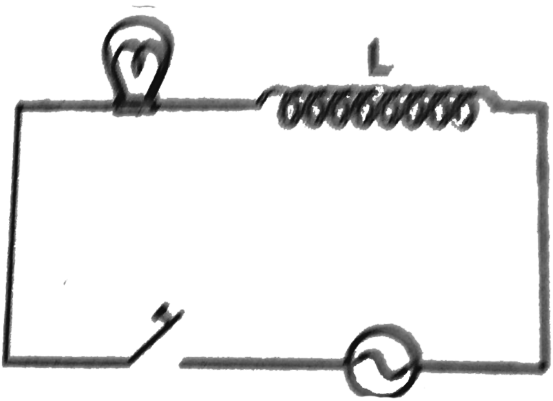
261. A lamp is connected in series with a capacitor. Predict your observations for dc and ac connections. What happens in each case if capacitance of the capacitor is reduced?

Watch Video Solution

262. A light bulb and an open coil inductor are connected to an ac source through a key as shown in Fig. The switch is closed and after sometime, an iron rod is inserted inot the interior of the inductor. The glow of the ligth bulb (a) increases (b) decreases (c) is unchanged as the iron is inserted. Give your answer with reasosns. What will be your answer if ac source is replaced by dc source ?



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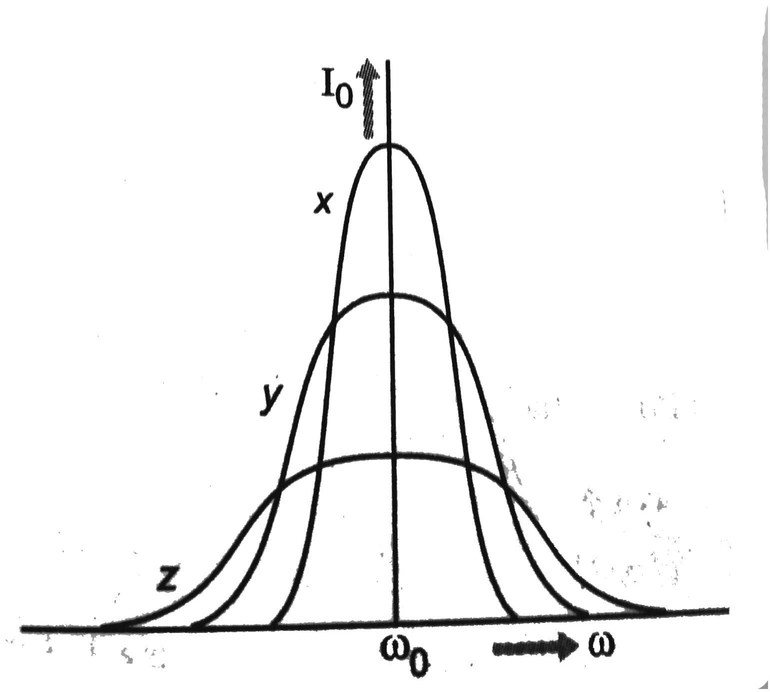
263. A bulb and a capacitor are connected in series to an a.c. source of varialbe frequency. How will the brightness of the bulb change on increasing the frequency of a.c. source ?

Watch Video Solution

264. Sketch a graph showing the variation of impedance of LCR circuit the frequency of applied voltage.

Watch Video Solution

265. Three studends X,Y and Z performed an experiment for studying variation of a.c. with angular frequency in series LCR circuit, and obtained the graphs shown in Fig. They all used a.c. soucre of same rms value and inductance of same value. What can we conclude about (i) Capacitance value (ii) Resistance value used by them? In which case will the quality factor be maximum? What we conclude about nature of impedance of set up at frequency ω_0 ?



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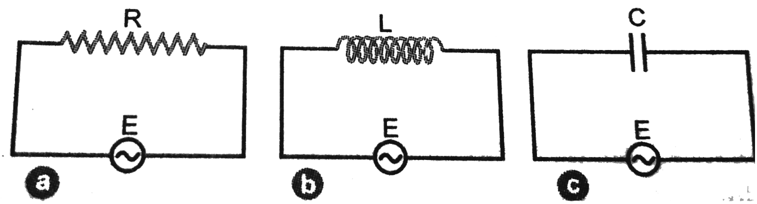
266. Fig. show three alternating circuits with equal currents. If frequency of alt. e.m.f be increased, what will be the effect on currents in the three cases? Explain.



267. The hot wire ammeter A in Fig. shows some deflection, but not in Fig. Why ?

Watch Video Solution

268. When a capacitor is connected in series with series LR circuit, the alternating current in the circuit increases. Why ?

Watch Video Solution

269. State the condition under which resonance occurs in LCR circuit ?

Watch Video Solution

270. What is wattless current ?

Watch Video Solution

271. What is expression for magnetic energy stored in an inductor. Compare it with the electrostatic energy stored in a capacitor.

Watch Video Solution

272. Show that n the free oscillations of an LC circuit, the sum of energies stored in the capacitor and and the inductor is constant in time.

Watch Video Solution

273. (a) For circuits used for transporting electric power, a low power factor implies larger power loss in transmission. Explain.

(b) power factor can oftern be improved by the use of a capacitor of appropraite capacitance in the circuit, Explain.

Watch Video Solution

274. What is the average value of atlernating current, $I = I_0 \sin \omega t$ over time interval $t = \pi / \omega$ to

$t = \pi / \omega$?

Watch Video Solution

275. What is the average value of a.c. over a full cycle ?

Watch Video Solution

276. A 220 V, 50 Hz a.c. source is being used. What is the average e.m.f over a full cycle ? What is the rmx voltage ?

Watch Video Solution

277. Show that $\left(\frac{L}{R}\right)$ has the dimensions of time.

Watch Video Solution

278. Show that time constant $(\tau = RC)$ of $R - C$ circuit has the dimensions of time.

Watch Video Solution

279. We can measure d.c. by an ordinary ammeter, but not a.c. Why ?

Watch Video Solution

280. The peak value of 220 a.c. is

Watch Video Solution

281. Can r.m.s value of current be defined in terms of chemical effect of current ?

Watch Video Solution

282. Give expression for average value of a.c. voltage $V = V_0 \sin \omega t$ over interval $t = 0$ to $t = \frac{\pi}{\omega}$

Watch Video Solution

283. Alternating current through an inductor lags behind the alternating voltage by 90°. What does it imply ?

Watch Video Solution

284. How does ohmic resistance in a circuit affeated when frequecny of a.c. source in the circuit is doubled ?

Watch Video Solution

285. How does inductive reactance vary when frequency of a.c. source in the circuit is halved ?

Watch Video Solution

286. How is capacitative reactance affected when frequency of a.c. supply is tripled ?

Watch Video Solution

287. What are the SI units of reactance and impedance in a.c. circuit ?

Watch Video Solution

288. In a series LCR circuit, the voltages across an inductor, a capacitor and a resistor are 30 V, 30 V, 60 V respectively. What is the phase difference between the applied voltage and the current in the circuit ?

Watch Video Solution

289. In an inductor, current rises to a steady value at a constant rate. Comment.

Watch Video Solution

290. At very high frequency of a.c., a capacitor behaves as a pure conductor. Why ?

Watch Video Solution

291. Does the steady state current in RL circuit depend upon L ?`

Watch Video Solution

292. What is the natural frequency of LC circuit ? What is the reactance of this circuit at this frequency ?

Watch Video Solution

293. What is the dimensional formula of $\sqrt{LC}$?

A. $[M^0L^0T^1]$

B. $[M^0L^1T^1]$

C. $[M^1L^0T^1]$

D. $[M^1L^1T^1]$

Answer: A

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294. How can you improve the quality factor of series resonance circuit ?

Watch Video Solution

295. An electrical element X when connected to an alternating voltage source has current through it leading the voltage by $\pi/2$ radian. Identify X and write an expression for its reactance.

Watch Video Solution

296. Can a capacitor of suitable capacitance be use dto control a.c in place of the choke coil ?

Watch Video Solution

297. At resonance in an a.c. circuit, what is the value of power factor ?

Watch Video Solution

298. Does it imply that power dissipated in an a.c. circuit is zero at resonance ?

Watch Video Solution

299. At parallel resonance frequency, is current zero or maximum ?

Watch Video Solution

300. Why are parallel resonance circuits called rejector circuit/filter circuits/antiresonance circuits

?

Watch Video Solution

301. Where is the power dissipaiton in an alternating current circuit ? In resistance ? In inductance ? In capacitance ?

Watch Video Solution

302. What is wattless current ?

Watch Video Solution

303. In a pure LC circuit, what is the energy stored when peak current is I_0?

Watch Video Solution

304. What is the average power consumed in a circuit consisting of resistanceless inductiance ?

Watch Video Solution

305. What is the minimum value of power factor ? When does it occur ?

Watch Video Solution

306. What is the maximum value of power factor ? When does it occur ?

Watch Video Solution

307. In a series LCR circuit, $V_L = V_C \neq V_R$. What is the value of power factor ?

Watch Video Solution

308. A 110 V d.c source replace an a.c source such that heat produced is same in the two case. What is the rms value of alternting voltage source.

Watch Video Solution

309. Calculate the time taken by 60 Hz a.c source to reach its negative peak value from zero value ?

Watch Video Solution

310. Why connot we use a.c. for electrolysis?

Watch Video Solution

311. For an a.c. can ever:

(a) r.m.s value to equal to peak value ?

(b) average value be equal to peak value ?

(c) r.m.s value be equal to average value

(d) all the three values be equal ?

Watch Video Solution

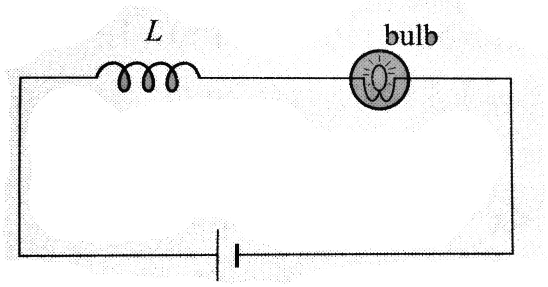
312. Distinguish between alternating current and direct current by giving two points.

Watch Video Solution

313. An inductor is connected in series with a bulb to an a.c source. What happens to brighness of bulb when number of turns in the inductor is reduced ?

Watch Video Solution

314. An iron rod is inserted in the inductor, what will be the effect on the brightness of the bulb?



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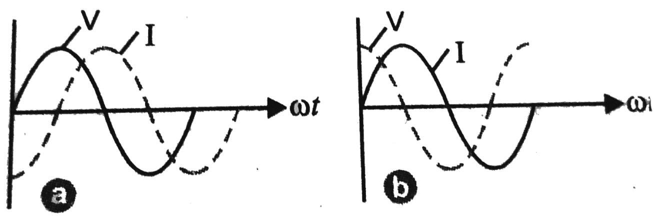
315. For a series LCR circuit, connected to an a.c. source, identify the graph that correspondings to $\omega > \dfrac{1}{\sqrt{LC}}$. Give reason.



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316. Define reactance X and impedance Z. Can these be nagative ? If yes, when and what does it imply ?`

Watch Video Solution

317. An eletric lamp connected in series with a capacitor and an a.c. source is glowing with certain brightness. How does the brighness of the lamp change on reducing the capacitance ?

Watch Video Solution

318. An inductor acts as a conductor for d.c. why ?

Watch Video Solution

319. A capacitor allow a.c. to pass through. Why ?

Watch Video Solution

320. The instantananeous current from an a.c. is $I = 10 \sin 314t$. What is the frequency of the source and virtual value of current ?

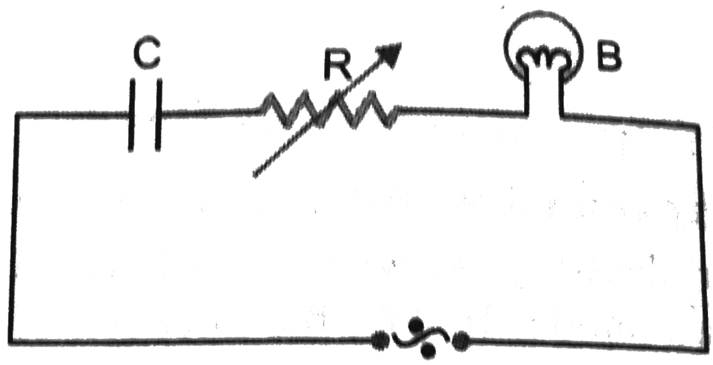
Watch Video Solution

321. An electric lamp having coil of negligible inductance connected in series with a capacitor and an a.c. source is glowing with certain brightness, Fig. How does the brightness of the lamp change on reducing (i) capacitance (ii) frequency

Watch Video Solution

322. An capacitor C, a variable resistor R and a bulb B are connected in series to the ac mains in circuits as shown if Fig. The bulb glows with some brightness. How will the glow of the bulb change if

(i) a dielectric slab is introduced between the plates of the capacitor, keeping resistance T to be the same, (ii) the resistance R to be the same, (ii) the resistance R is increased keeping the same capacitance.



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323. Under what conditions, power factor of an a.c. circuit is maximum ?

Watch Video Solution

324. Altering current through pure, inductor and pure capacitor is wattless

Watch Video Solution

325. What is power dissipation in an a.c. circuit in which $E = 230 \sin(\omega t + \pi / 2), I = 10 \sin \omega t$?

Watch Video Solution

326. In an a.c. circuit, there is no power consumption in an ideal inductor. Explain.

Watch Video Solution

327. An electromagnet has stroed 648 J of magnetic energy, when a current of 9 A exists in its coils. What average e.m.f. is induced if the current is reduced to zero in 0.45

Watch Video Solution

328. Can a.c. source be connected to a circuit and yet deliver no power to it ? If so, under what circumstance ?

Watch Video Solution

329. An a.c generator consists of a coil of 1000 turns each of area $100cm^2$ and rotating at an angular speed of 100 rpm in a uniform magnetic field fo $3.6 \times 10^2 T$. Find the peak and r.m.s value of e.m.f induced in the coil.

Watch Video Solution

330. A circular coil of cross-sectional area $200cm^2$ and 20 turns is rotated about the vertical diameter with angular speed of $50 rad/s$ in a uniform magnetic of $3.0 \times 10^{-2} T$. Calculate the maximum value of current in the coil.

Watch Video Solution

331. A motor having an armature of resistance 2.0 ohm operates on 220 V mains. At its full speed, it develops a back e.m.f. of 210 V. Find the currents in the armature when motor is switched on and when running at full speed. What is the efficiency ot the motor at full speed ?

Watch Video Solution

332. A transformer has an efficiency of 80%. It works at 4 kW, 100 V. If the secondary voltage is 240 V, Calculate the primary and secondary currents.

Watch Video Solution

333. A power tansmission line feeds input input power at 2200 V to a step down transformer with its primary windings having 3000 turns. Find the number of turns in secondary to get the power output at 220 V.

Watch Video Solution

334. A small town with a demand of 1 MW at 220 V is situated 20 km away from an electric plant generating power at 440 V. The resistance of two line wires carrying is 0.5Ω per km. Two step down transformers are available : 4000 V - 220 V and 100000 V - 220 V at a substationin the town for supply of power. Which one will you prefer and why?

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335. An armature coil consists of 20 turns of wire each of area $A = 0.09m^2$ and total resistance 15.0 ohm. It rotates in a magnetic field of 0.5 T at a constant frequency of $\frac{150}{\pi}Hz$.

Calculate the value of (i) maximum and (ii) average induced e.m.f. produced in the coil.

Watch Video Solution

336. An athlete peddles a stationary tricycle whose pedals are atteached to a coil having 100 turns each

of area $0.1m^2$. The coil lying in XY plane is rotated in this plane at the rate of 50 rpm about the Y=axis in a region where a uniform magnetic field $\vec{B} = (0.01)\hat{k}$ tesla is present. Find the (i) max. e.m.f. (ii) average e.m.f. generated in the coil over one complete rotation.

Watch Video Solution

337. A rectangular coil of 200 turns or wire $15 \times 40cm^2$ makes 50 r.p.s. about an axis in its plane parallel to its longer side and perpendicular to a magnetic field of intensity $0.08Wb/m^2$. What are the instantaneous values of induced e.m.f. when the plane of the coil makes an angle with magnetic field of (a) 0° (b) 60° (c) 90° ?

Watch Video Solution

338. Kamla peddles a stationary bicycle, the pedals of which are attached to a 100 turn coil of area $0.10m^2$.The coil rotates at half a revolution in one second and it is placed in a uniform magnetic field of 0.01 T perpendicular to the axis of rotation of the coil. What is the maximum voltage generated in the coil ?

Watch Video Solution

339. A 100 turn coil of area $0.1m^2$ rotates at half a revolution per second. It is placed in a magnetic field of 0.01 T perpendicular to the axis of rotation of the coil. Calculate the maximum voltage generated in the coil.

Watch Video Solution

340. An a.c generator consists of a coil of 50 turns and area $2.5m^2$ rotating at an angular speed of $60rad/s$ in a uniform magnetic field of 0.30 T. The resistance of the circuit is 500 ohm. What is the maximum current drawn from the generator? What is the flux through the coil, when current is zero and when current is maximum ?

Watch Video Solution

341. An electric motor operating on a $50V dc$ supply draws a current of $12A$. If the efficiency of the motor is 30% ,estimate the resistance of the windings of the motor.

Watch Video Solution

342. A small d.c. motor operating at 200 V draws a current of 5.0 amp.at its full speed of 3000 r.p.m. The resistance of the armature of the motor is 8.5Ω. Determine the back e.m.f. of the motor. Obtain the power input, power output and efficiency of motor.

Watch Video Solution

343. (a) Suppose the windings og the armature in the d.c. motor or Example 4 connot tolerate a current of more than 20 amp. WhaT do you think will happen if the armature gets jammed and cannot rotate when the motor is connected to the supply ?

(b) If the supply connection of the d.c. motor in Ex. are removed and the motor is used as a generated by connecting the shaft of its armature to an external mechanical rotor of speed 3000 r.p.m., how much e.m.f. will be generated ?

Watch Video Solution

344. Given the input current 15 A and input voltage of 100 V for a step up transformer having 90% efficiency. Find the output power and voltage in the secondary if output current is 3 A.

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Watch Video Solution

345. A transformer has 500 turns in the primary and 1000 turns in its secondary. The primary voltage is 200 V and load in secondary is 100 ohm. Calculate the current in primary assuming it to ideal transformer.

Watch Video Solution

346. How much current is drawn by the primary coil of a transformer which steps down 220 V to 22 V to operate device with an impedance of 220 ohm.

Watch Video Solution

347. A step down transformer converts transmission line voltage from 2200 V to 220 V. Primary coil is having 5000 turns. Efficiency of transformer is 90% and output power is 8 kW. Evaluate number of turns in secondary coil and input power.

Watch Video Solution

348. Calculate current drawn by primary coil of a transformer, Which steps down 200 V to 20 V to operate a device of 20 ohm resistance. Assume efficiency of transformer 80 %.

Watch Video Solution

349. A 66 % efficient transformer is working on 110 V and 2.2 kW power.If current in secondary coil is 6.0 A, calculate (i) current in primary coil and (ii) voltage across secondary coil.

Watch Video Solution

350. A transformer has an efficiency of 80%. It works at 4 kW, 100 V. If the secondary voltage is 240 V, Calculate the primary and secondary currents.

Watch Video Solution

351. A transformer has an efficiency of 80%. It delivers 2kW output power at 100 V primary and 240 V secondary voltages. Calculate primary and secondary currents

Watch Video Solution

352. A town situated 20 kW away from a power plant generating power at 440 V requires 600 KW of electric power at 200 V. The resistance of two wire lines carrying poweris 0.4Ω per km. The town gets power from the line through a 3000-220 V step down transformer at a substation in the town. Find line power losses in the form of heat. How much power must the plant supply assuming that there is negligilbe power loss due to leakage ?

Watch Video Solution

353. The number of turns in the primary and secondary coils of an ideal transformer are 2000 and 50 respectively. The primary coil is conneted to a main supply of 120 V and socondary to a night bulb of 0.6Ω. Calculate

(i) Voltage acorss the secondary. (ii) Current in the bulb, (iii) Current in primarya coil, (iv) Power in primary and secondary coils, (iv) Power in primary and secondary coils.

Watch Video Solution

354. A step-up transfomer operates on a 220 volt line and supplies to load, a current of 2A. The ratio of primary and secondary winding is 1 : 25. Calculate secondary voltage, primary current and power output, if efficiency is 80%`

Watch Video Solution

355. 11 kW of electric power can be transmitted to a distant station at (i) 220 V (ii) 22000 V. Which of the two transmission modes be preferred and why ? Support your answer with calculations.

Watch Video Solution

356. Is there any device by which direct current can be controlled without any loss of energy ? Can a choke coil do so?

Watch Video Solution

357. The word generator is a misnomer.Why ?

Watch Video Solution

358. Why do we prefer a choke coil to a rhestat in controlling a.c.?

Watch Video Solution

359. Can a capacitor of suitable capacitance be use dto control a.c in place of the choke coil ?

Watch Video Solution

360. Iron cored chokes are used for reducing low frequency a.c., why ?

Watch Video Solution

361. Air cored chokes are used for reducing high frequency a.c., why?

Watch Video Solution

362. You are given a fixed length of wire to design a generator. For a given magnetic field strength and given frequency of rotation, will you use one turn or two turn square coil to generate maximum peak e.m.f. ?

Watch Video Solution

363. Which generator do you prefer to install , a.c. or d.c. and why?

Watch Video Solution

364. What is meant by back e.m.f.in a motor?

Watch Video Solution

365. What is the use of a motor starter ?

Watch Video Solution

366. An a.c. generator having a constant magnetic field is conneted to a resistive load. What will be the effect of doulbling the speed of rotation on: (i) frequency of a.c. (ii) generated e.m.f. (iii) mechanical power required to rotate the generator ?

Watch Video Solution

367. A radio frequency choke is air-cored whereas an audio frequency choke is iron cored. Why ?

Watch Video Solution

368. Out of two arrangements of primary and secondary windings in a transfomers, which will have higher efficiency and why ?

Watch Video Solution

369. The core of a transformer is made of a material having norrow hysterisis loop. Why ?

Watch Video Solution

370. The core of a transformer is made of magnetic material of high permeanbility. Why ?

Watch Video Solution

371. The number of turns in the secondary coil of a transformer is 20 times that in primary. What value of power will be obtained in secondary, if power fed to primary is 100 watt ?

Watch Video Solution

372. When a current flows in the coil of a transformer, then why does its core become hot ?

Watch Video Solution

373. A transformer is used to step down a.c.voltage. What appliance do you use to step down d.c. voltage ?

Watch Video Solution

374. 11 kW of electric power can be transmitted to a distant station at (i) 220 V (ii) 22000 V. Which of the two transmission modes be preferred and why ? Support your answer with calculations.

Watch Video Solution

375. The core of a transformer is made of magnetic material of high permeanbility. Why ?

Watch Video Solution

376. In a.c generator, which rule determines the direction of induced e.m.f.

Watch Video Solution

377. In d.c. motor, is the supplied voltage alternating ?

Watch Video Solution

378. In d.c. motor, which rule is applied detemine the direction of rotation of coil ?

Watch Video Solution

379. Name the main component which changes an a.c. generator into d.c. generator.

Watch Video Solution

380. Which is the best method of reducing a.c. n a ciruit ?

Watch Video Solution

381. Is a motor starter a variable R or L or C ?

Watch Video Solution

382. A small d.c. motor operates at 110 V d.c. what is back e.m.f. when its effieincy is maximum ?

Watch Video Solution

383. Why cannot a transformer be used to step up d.c. voltage ?

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384. Does a step up transformer violate the principle of conservation of energy ?

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385. Name any appliance that can step down d.c. voltage.

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386. For transporting elecrtic power, what is required at the generating station ?

Watch Video Solution

387. What is iron in a transformer ?

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388. The number of turns in secondary coil of a transformer is 100 times the number of turns in primary coil. What is the transformer ratio ?

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389. In a transformer with transformation ratio 0.1, 220 volt a.c. is fed to primary. What voltage is obtained acorss the secondary ?

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390. A transfomer steps down 220 volt to 11 volt. What is the transformation ratio ?

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391. Can a transformer work on d.c. ?

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392. The primary and secondary coils of a transformer do not have any electrical contact. How is then electrical energy transferred from primary to secondary ?

Watch Video Solution

393. The one of a transformer is laminated, why ?

Watch Video Solution

394. Which of the primary and secondary of a step down transformer has a larger number of turns ?

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395. Does a transformer change the frequency of a.c. ?

Watch Video Solution

396. What is the function of oil in a transformer ?

Watch Video Solution

397. Why is choke coil needed in the use fluoresent tube with ac mains ?

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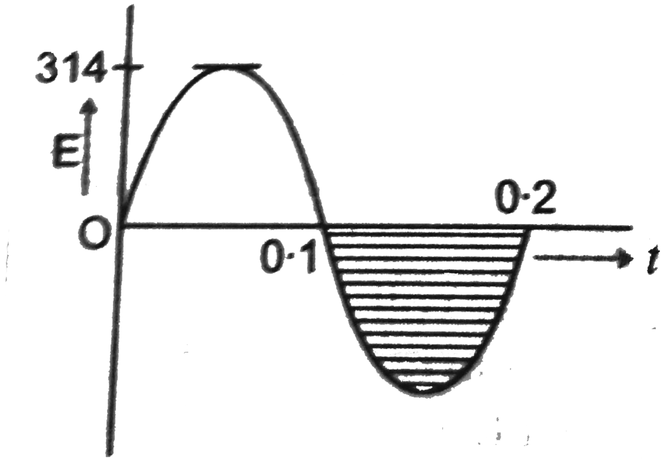
398. What is the average value of shaded portion of the graph of E vs t ?



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399. In the preceding question, what will be the reading of a.c. voltmeter ?

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400. What is the basic difference in the design of an a.c. generator and d.c. generator ?

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401. A.d.c. motor acts as generator too. Is it ture ?

Watch Video Solution

402. What are the advantage of three phase a.c. ?

Watch Video Solution

403. What is meant by form factor of an a.c. generator ?

Watch Video Solution

404. What are phasa lines and neutral line in respect of a generator ?

Watch Video Solution

405. In a d.c. motor, do we use slip ring or split ring arrangement and why?

Watch Video Solution

406. Which rule do you for direction of forces in d.c. motor ?

Watch Video Solution

407. The one of a transformer is laminated, why ?

Watch Video Solution

408. What causes the core of a transfomer to get heated under operation ?

Watch Video Solution

409. A solenoid with an iron core and a bulb are connected to a d.c. source. How does the brightness of the bulb change when iron core is removed from the solenoid ?

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410. In India, domestic power suppy is at 220 V, 50 hz, while in U.S.A, its 110 V, 60 hz. Give one advantage and one disadvantage of 220 V supply over 110 V supply.

Watch Video Solution

411. Explain the concept fo magnetic flux. Discuss its units and dimensions.

Watch Video Solution

412. Describe two simple experiments to show that currents are induced by currents

Watch Video Solution

413. State and Explain Faraday's laws of electromagneticf induction.

Watch Video Solution

414. Describe a smiple experiment (or activity) to show that the polarity of emf induced in a coil is always such that it tends to prduce a current which oppose the change of magnetic flux that produce it

Watch Video Solution

415. What are eddy currents ? Discuss briefly any two applications of eddy currents.

Watch Video Solution

416. Distinguish between self induciton and Self induction. Give two factors on which self inductance of an air cored coil depends ?

Watch Video Solution

417. Define self inductance. Find the relation for self inductance of two coils (i) in series (ii) in parallel.

Watch Video Solution

418. The current flowing through inductor of self inductance L is continously increasing. Plot a graph showing the variation of

(i) Magnetic flux versus the current

(ii) Induced emf versus dI/dt

(iii) Magnetic potential energy stored versus the current.

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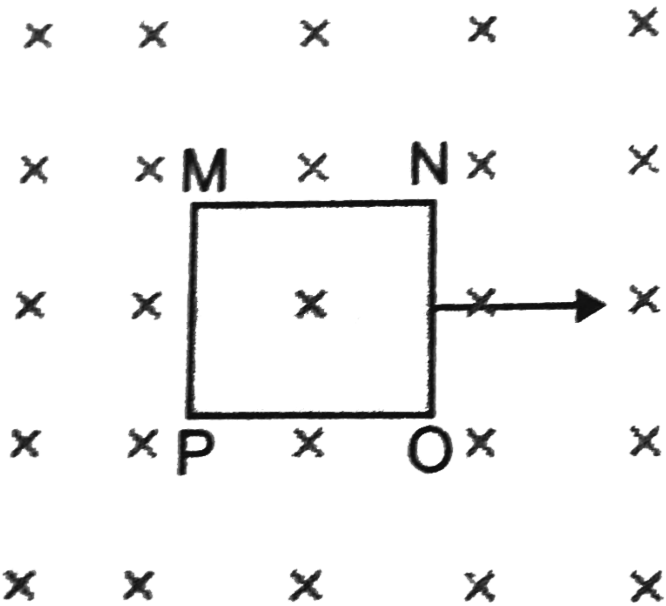
419. A square loop MNOP of side 20 cm is placed horizontally in a uniform magnetic field acting vertically downwards as shown in Fig. The loop is pulled with a constant velocity of $20 cm / s$ till it goes out of the field.



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420. State and explain Lenz's law. Give one exmple to illustrate the law. How will you verify it experimentally ? Does it obey the principle of energy consevartion ?

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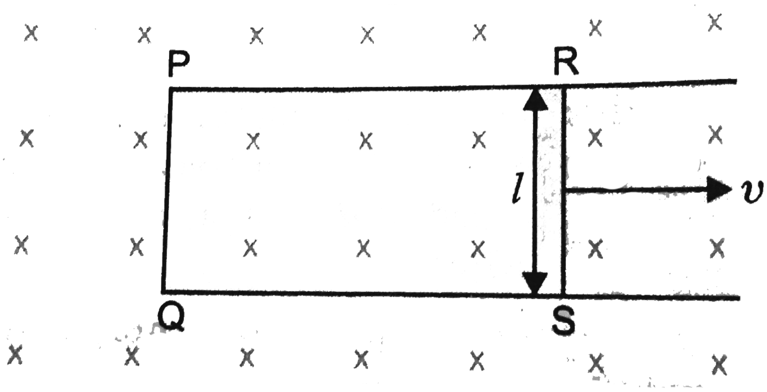
421. Fig. shows a rectangular conducting loop PQSR in which arm RS of length l is movalbe. The loop is kept in a uniform magnetic field B directed downwards perpendicular to the plane of the loop. The arem RS is moved with a uniform speed v. Deduce an expression for

(i) the emf induced across the are RS.

(ii) the external force required to move the arm, and

(iii) the power dissipated as heat.



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422. What are eddy currents ? Give some applications of eddy currents. How can the eddy currents be minimised ?

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423. What do you understand by motional electromotive force ? Find the relation for induced emf and induced current when a conducting rod is moved through a constant magnetic field. Also, find out the relation for mechanical energy dissipated per second.

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424. In what situations, is it preferable to use an a.c. source rather than a.d.c. source ? What is d.c. perferred to a.c. ?

Watch Video Solution

425. What is meant by rms value of a.c. ?Derive an expression for altenating emf ?

Watch Video Solution

426. What is a phasor diagram ? Draw a phasor diagram when a pure resistor is conneted acorss an a.c. supply and show that current and voltage are in the same phase.

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427. What do you understand by peak value and rms value of alternating current ? Derive a relation between them.

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428. An voltage, $E = E_0 \sin \omega t$ is applied acorss an inductor L. Obtain an expression for the current.

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429. Discuss the phase relationship between current and emf in an circuit containing a capacitance only.

Watch Video Solution

430. What is the impedance triangle ? Discuss its use.

Watch Video Solution

431. Obtain an experssion for the frequency of oscillations when a capacitor discharges itself through an inductor.

Watch Video Solution

432. Define quality factor in electrical resonance circuit. Find quality factor of series resonance circuit.

Watch Video Solution

433. What is wattless current ? Show mathematically that an ideal inductor does not consume any power in an a.c. circuit.

Watch Video Solution

434. Discuss charging and discharging of a condensor through resistor.

Watch Video Solution

435. Find in an alternating LR circuit, (i) resultant voltage (ii) impedance of circuit, (iii) Phase difference, (iv) average power.

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436. Calculate the frequency of series resonance circuit. Define Q factor of this circuit. Explain briefly how the phenomenon of resonance in the circuit can be used in the tuning mechanism of a radio or TV set.

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437. Define the quality factor in an a.c. circuit. Why should the quality factor have high value in receiving circuits ? Name the factors on which it depends.

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438. Calcualte energy stored in an inductor in an a.c. circuit. Show that average power consumed per cycle in an a.c. circuit containing pure indcutor is zero

Watch Video Solution

439. Derive an experssion for the average power in LCR circuit connected to a.c. supply. Hence define power factor. Show that average power cousumed per cycle in an a.c. circuit conataining an ideal capacitor is zero.

Watch Video Solution

440. Prove that an ideal capacitor in an a.c. circuit does not dissipate power.

Watch Video Solution

441. A choke coil is preferred to a resistance for reducing current in an ac circuit because .

Watch Video Solution

442. The efficiency of d.c. motor is given by $\eta =$

Watch Video Solution

443. Mention two charateristic properties of the material suitable for making core of a transformer.

Watch Video Solution

444. What is the basic difference in the design of an a.c. generator and d.c. generator ?

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445. A circuit containing resistance R_1 inductance L_1 and capacitance C_1 connected in series gives resonance at the same frequency v as a second similar combination of R_2, L_2 and C_2. If the two circuits are connected in series, shown that the whole circuit will resonate with the same frequency.

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446. A copper rod of length $0.19m$ is moving with uniform velocity $10ms^{-1}$ parallel to a long straight wire carrying a current of $5.0A$. The rod is perpendicular to the wire with its ends at distances

0.01 and $0.2m$ from it. Calculate the emf induced in the rod.

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447. The impedance of a series LCR circuit is 8 ohm when $v = 60Hz$ at resonance. At $v = 80Hz$, the impedance is 10 ohm. Calculate the values of inductance L and capacitance C.

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448. A uniform wound solenoid coil of self inductance $1.8 \times 10^{-4} H$ and resistance ohm is broken into two identical coils. These indentical coils are connected in parallel across a 12 V battery of negligible resistance. Calculate the steady state current through the battery and time constant of the circuit.

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449. An a.c. source of angular frequency ω is fed across a resistor R and a capacitor C in series. The current registered is I. If you the frequency of source is changed to $\omega/3$, maintaining the same voltage, current in the circuits is found to be halved. Caculate the ratio of reactance to resistance at the original frequency ω.

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450. A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At centre of the solenoid is 100 turns coil of radius 0.01 m placed with its axis coinciding with solenoid axis. The current in the solenoid is decreased at a constant rate form + 2 A to - 2 A in 0.05 s. Find the e.m.f. induced in the coil. Also, find the total charge flowing through the coil during this time, when the resistance of the coil is $10\pi^2 ohm$.

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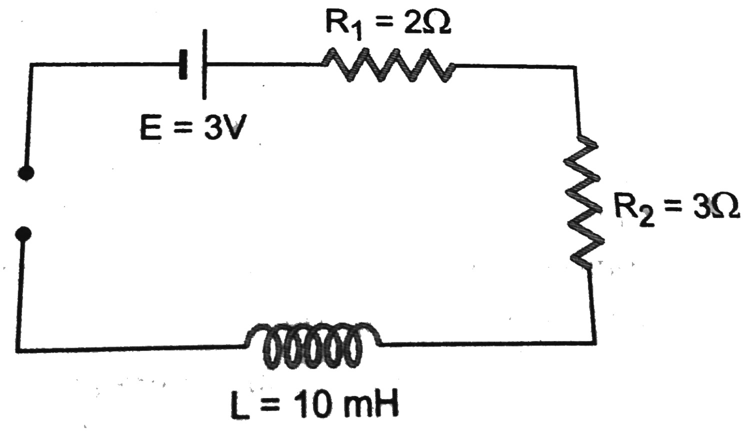
451. The circuit shown in Fig. is switched on at t = 0. Calculate the time at which current in R_2 becomes half the steady value of current. Also, calculate the energy stored in the inductor at that time.



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452. A 200 km long telegraph wire has capacity of $0.14\mu F / km$. If it carries an alternating current of $50kc / s$, what should be the value of inductance required to be connected in series so that impedance is minimum ?

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453. The capacitor of an oscillatory circuit of negligible resistance is enclosed in a container. When the container is evacuated, the frequency of the circuit is $150kc / s$ and when the container is filled with a gas, the frequency changes by $100C / s$. Find the dielectric constant of the gas.

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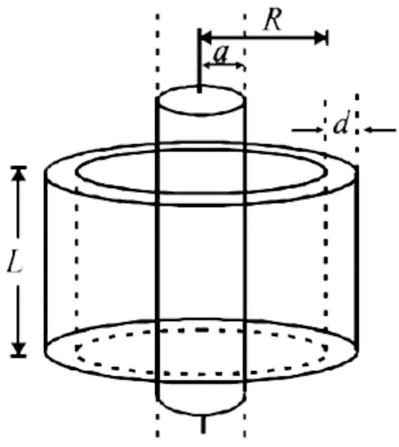
454. A long solenoid of radius a and number of turns per unit length n is enclosed by cylindrical shell of radius R. Thickness d(dltltR) and length L. A variable current $i = i_0 \sin \omega t$ flows through the coil. If the resistivity of the material of cylindrical shell is (ρ), find the induced current in the shell.



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455. An a.c. generator is connected to a sealed box through a pair of terminals. The box may cantain R,L,C or series combination of any two of the three elements. Measurements made outside the box show that $E=(75\sin\omega t)$ volt and $I=1.2\sin(\omega t+\pi/5)A$

(i) Name the circuit elements

(ii) What is the power factor of the circuit

(iii) What is the rat at which energy is delivered by the generator to the circuit ?

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456. A 20 V, 750 Hz source us connected to a series combination of $R = 100\Omega, C = 10\mu F$ and $L = 0.1803H$. Calculate the time in which resistance will get heated by $10^\circ C$, if thermal capacity of the material $= 2J/.^\circ C$

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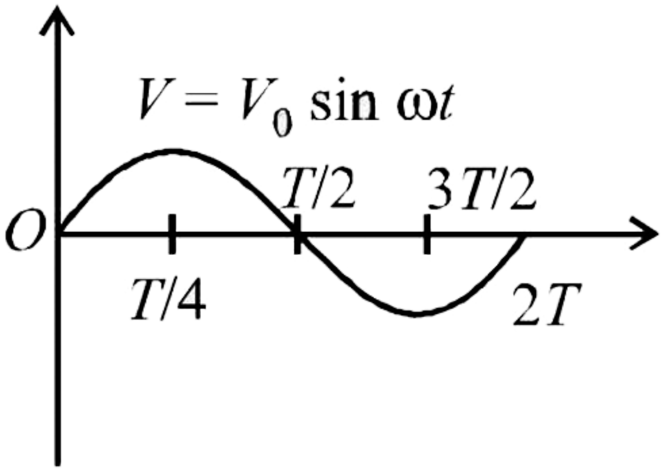
457. In a series L-R circuit $(L = 35mH \text{ and } R = 11\Omega)$, a variable emf source $(V = V_0 \sin \omega t)$ of $V_{rms} = 220V$ and frequency 50 Hz is applied. Find the current amplitude in the circuit and phase of current with respect to voltage.

Draw current-time graph on given graph $\left(\pi = \frac{22}{7}\right)$.



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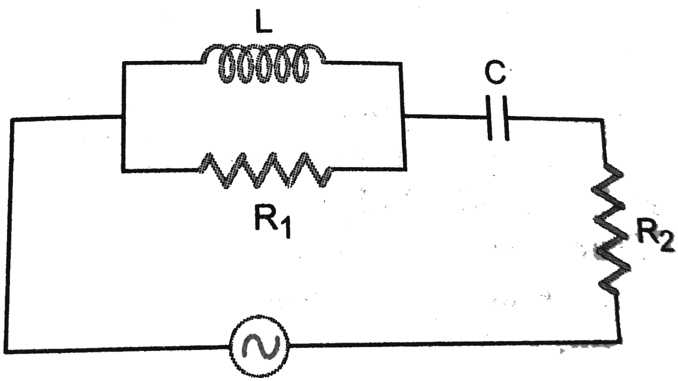
458. In the circuit shown in Fig. (i) find the phase difference between the currents through L and R_1

(ii) find the phase difference between potential differece across C and R_2



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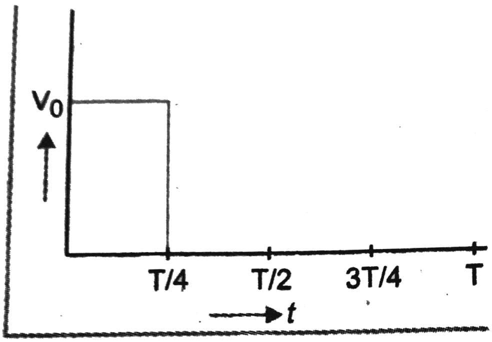
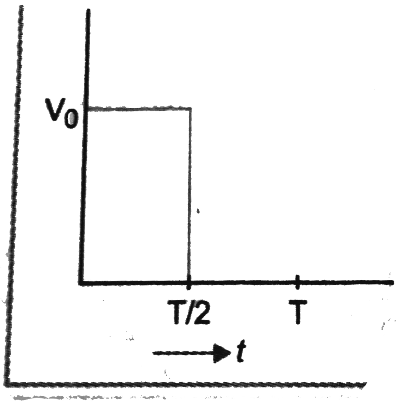
459. Find rms value of voltage given in Fig.





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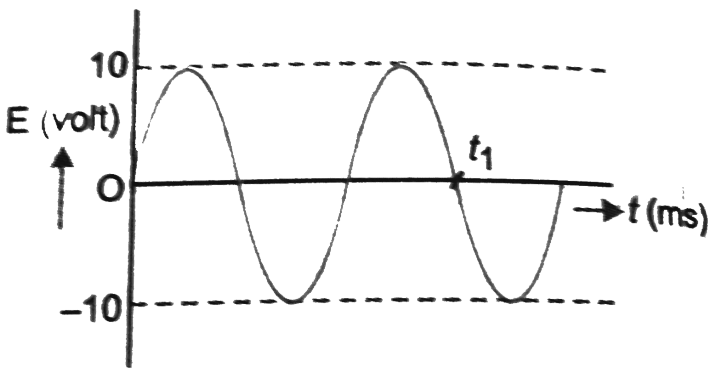
460. The output E of an alternating voltage supply of frequency 50 Hz is shown in Fig. From this Fig, state

(i) value of time t_1

(ii) peak voltage E_0 (iii) root mean square voltage E_v

(iv) mean supply is connected in series with a resistance of 2.4Ω, calculate the mean power dissipated in the resistor.



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461. An a.c. voltage source of $E = 150 \sin 100t$ is used to run device, which offers a resistance of 20 ohm and restricts the flow of current in one direction only. Calcualte the average and rms value of current in the circuit.

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462. The current in a coil self inductance 2.0 H is increasing according to $i = 2 \sin t^2$ amp. Find the amount of energy spent during the period when current changes from to 2 A.

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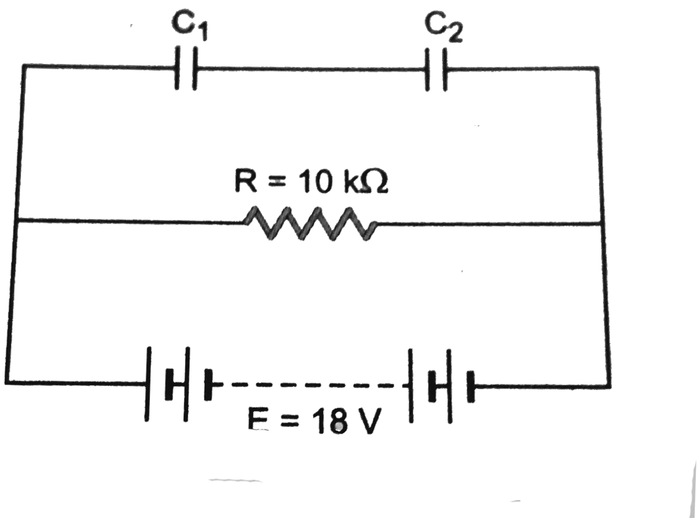
463. Two capacitors $4\mu F$ and $6\mu F$ in series are connected through a resistor of $10k\Omega$ to a 18 V battery of negligible internal resistance. Ater a time of about 10 s, the battery is disconneted and capacitors are allowed to discharge through the resistance. Determine the voltage across each capacitor after a time lapse of 48 millisecond.



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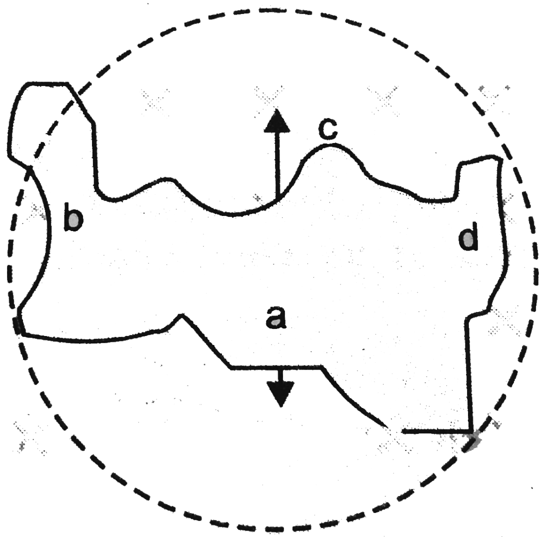
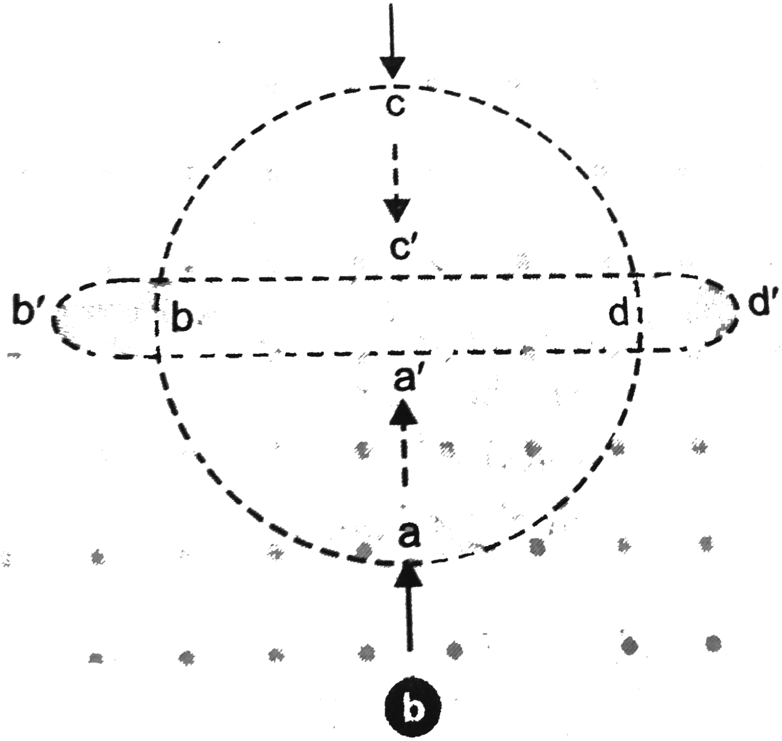
464. Use Lenz's law to determine the direction of induced current in the situation described by Fig.

(a) a wire irregular shape turning into a circular shape (b) a circular loop being deformed into a narrow straight wire. The across indicate the magnetic field into the paper and the dots indicate magnetic field out of the paper.



a



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465. A long solenoid with 15 turns per cm has small loop of area $2.0 cm^2$ placed inside, normal to the axis of the soleniod. If current carried by the solenoid changes steadily from 2 A to 4 A in 0.1 s, what is the induced voltage in the loop, while the current is changing ?

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466. A rectangular loop of sides 8 cm and 2 cm with a small cut is moving out of a region of uniform megnetic field of magnitude 0.3 tesla directed normal to the loop. What is the voltage developed acorss the cut if velocity of the loop is $1cms^{-1}$ in a direction normal to the (i) longer side (ii) shorter side of the loop ? For how long does the induced voltage last in each case?

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467. A 1m long calculating rod rotates with an angular frequency of 400 rad s^{-1} an axis normal to the rod passing through its one one end. The other end of the rod is contact with a circular metallic ring. A constant magnetic field of 0.5 T parallel to the axis everywhere. Calculate the e.m.f. developed between the centre and the ring.

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468. A circular coil of radius 8.0 cm and 20 turns rotates about its vertical diameter with an angular speed of 50 s^{-1} in a uniform horizontal magnetic field of magnitude $3 \times 10^{-2} T$. Obtain the maximum and average e.m.f. induced in the coil . If the coil forms a closed loop of resistance 10Ω, calculate the maximum value of current in the coil. Calculate the average power loss due to Joule heating. Where does this power come from ?

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469. A horizontal straight wire 10 m long extending from east to west is falling with a speed of $5.0ms^{-1}$ at right angle to the horizontal component of the Earth's magnetic field $0.3 \times 10^{-4} Wbm^{2}$.

(a) What is the instantaneous value of the emf induced in the wire?

(b) What is the direction of the emf?

(c) Which end of the wire is at the higher electrical potential?

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470. Current in a circuit falls form 0.5 A to 0.0 A in 0.1 s. If an average e.m.f. of 200 V is induced, give an estimate of the self inductance of the circuit ?

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471. A pair of adjacent coils has a mutual inductance of 1.5. H. If the current in one coil changes from 0 to 20 A in 0.5 s, what is the change in flux linkage with the other coil?

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472. A jet plane is travelling west at the speed of 1800 $km..h.$ What is the voltage difference developed between the ends of the wing 25 m long, if the earth's magnetic field at the location has a magnitude of 5.0×10^{-4} T and the dip angle is 30°

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473. Suppose the loop in Q.4 is stationary, but the current feeding the electromagnet the produces the magnetic field is gradually reduced so that the field decreases form its initial value of 0.3 T at the rate of 0.2 $T/\sec$. If the cut is joined and loop has a resistance of 1.6Ω, how much power is dissipated by the loop as heat ? What is the source of this power ?

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474. A square loop of side $12cm$ with its sides parallel to x and y- axes is moved with a velocity $8cm/s$ along positive x-direction in an environment containing magnetic field along $+ve$ z-direction. The field has a gradient of $10^{-3}\text{tesla}/\text{em}$ along $-ve$ x-direction (increasing along $-ve$ x-axis) and also decreases with time at the rate of 10^{-3}tesla$/s$. The emf induced in the loop is

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475. It is desired to measure the magnitude of field between the poles of a powerful loud speaker magnet. A small flat search coil of area $2cm^2$ with 25 closely wound turns is positioned normal to the field direction and then quickly snatched out of the field region (Equivalently, one can give it a quick 90° turn to bring its plane parallel to the field direction). The total charge flowing in the coil (mesured by a ballistic galbanometer connected to the coil) is 7.5 mC. The resistance of the coil and galvanometer is 0.5Ω. Estimate the field strength of the magnet.

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476. Fig. shows a metal rod PQ resting on the rails A, B and positoned between the poles of a permanent magnet. The rails, the rod and the magnetic field are in three mutually perperdicular directions. A galvanometer connects the rails through a switch K. Length of the rod = 15 cm, B = 0.50 T, resistance of closed loop containing the rod $= 9.0 m\Omega$ Answer the following questions.

(a) Suppose K is open and the rod moves with a speed of $12cm/s$ in the direction shown, Give the polarity and magnitude of induced e.m.f

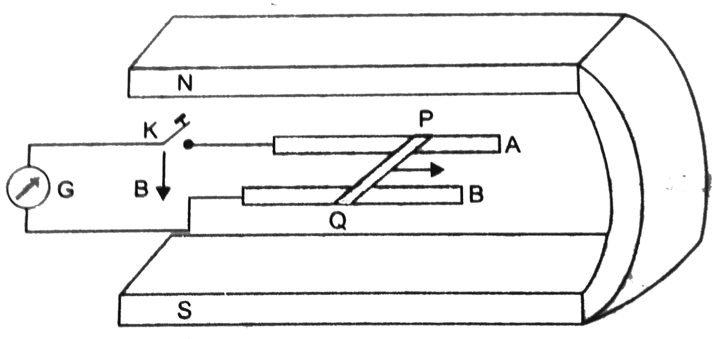
(b) Is there on excess charge built up at the ends of rods when K is open ? What if K is closed ?

(c) With K open and the rod moving uniformly, there is no net force on the electron in the rod PQ even though they do experience magnetic froce due to the motion of the rod Explain.

(d) What is the retarding force on the rod when K is closed?

(e) How much powe s required (by an external agent) to keep the rod moving at the same speed $(=12cm/s)$ when K is closed. (f) How much power is dissipated as heat in the closed circuit ? What is the source of this power?

(g) What is the induced e.m.f. in the following in the moving rod when the permanent magnet is rotated to a vertical position so that the field is parallel to the rails instead of being perpendicular ?



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477. An air cored solenoid with length 30 cm, area of cross-section $25 cm^2$ and number of turns 500 carries a current of $2.5 A$. The current is suddenly switched off in a brief time of 10^{-3} s. How much is the average back e.m.f. induced across the ends of the open switch in the circuit ? Ignore the variation in magnetic field near the ends of the solenoid.

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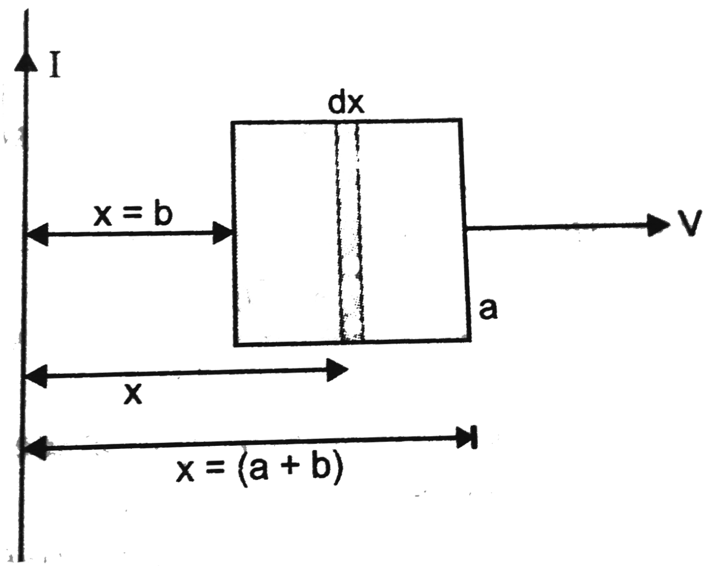
478. (a) Obtain an expression for the mutual inductance between a long straight wire and a square loop of side a as shown in Fig.

(b) Evaluate the induced emf in loop if the wire carries a current of 50 A and the loop has an instantaneous velocity $v = 10ms^{-1}$ at the location x = 0.2 m, as shown. Take a = 0.1m and assume that the loop has a large resistance.



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479. A 100Ω resistor is connected to a 220 V, 50 Hz ac supply.

(a) What is the rms value of current in the circuit?

(b) What is the net power consumed over a full cycle?

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480. (a) The peak voltag3e of an a.c. supply is 300 V. What is its r.m.s voltages?

(b) The r.m.s value of current in an ac circuit is 10 A. What is the peak current ?

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481. A 44 m H inductor is conneted to 220 V, 50 Hz a.c. supply. Determine the r.m.s. value of currents in the circuit.

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482. A $60\mu F$ capacitor is connected to a 110 V, 60 Hz a.c. supply Determine the r.m.s value of current in the circuit.

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483. Obtain the resonant frequency (ω_r) of a series LCR circuit withL = 2.0 H, C = 32 μF and R = 10 ohm. What is the Q value of this circuit ?

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484. A charged 30 μF capacitor is connected to a 27 mH inductor. What is the angular frequency of free oscillations of the circuit ?

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485. Suppose the initial charge on the capactor in the above question is 6 mC. What is the total energy stored in the capactor intially ? What is the total energy at later time ?

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486. A series LCR circuit with $R = 20\Omega$, $L = 1.5H$ and $C = 35\mu F$ is connected to a variable frequency $200V$ ac supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power in kW transferred to the circuit in one complete cycle?

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487. A radio can tune over the frequency range of a portion of MW broadcast band (800 kHz to 1200 kHz). If its LC circuit has an effective inductance of $200\mu H$, what must be the range of its varialbe capacitor ?

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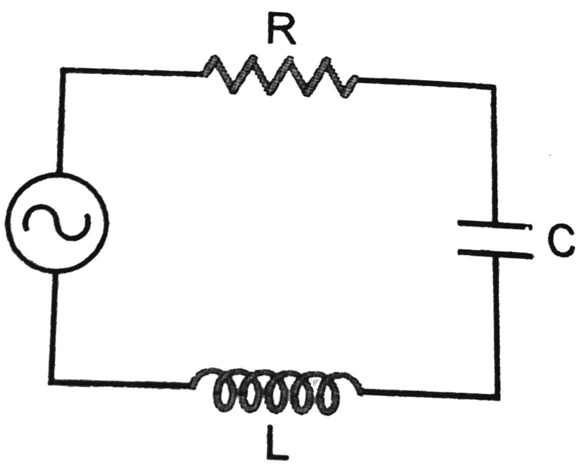
488. A series LCR circuit connected to a variable frequency 230 V source has L = 5.0 H, $C = 80\mu F$, $R = 40\Omega$, Fig.

(a) Determine the source frequency which drives the circuit in resonance.

(b) Obtain the impedance of the circuit and amplitude of current at at resonating frequency.

(c) Determine the r.m.s. potential drops acorss the three elements the circuits. Show that the potential drop acorss the LC combination is zero at the resonating frequecny.



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489. An LC circuit contains a 20 mH inductor and a $50 \mu F$ capacitor with an initial charge of 10 mC. The resistance of the circuit is negligible. Let the instant the circuit is closed be t = 0.

(a) What is the total energy stored initially ? Is it conserved during the oscillalions?

(b) What is the natural frequency of the circuit?

(c) At what time is the energy stored? (i) Completely electrical ? (ii) Completely magnetic ?

(d) At what time is the total energy shared equally between the inductor and the capacitor ?

(e) If a resistor is inserted in the circuit, how much energy is eventually dissipated as heat ?

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490. A coil of inductance $0.50H$ and resistance 100Ω is connected to a $240V, 50Hz$ ac supply. What are the maximum current in the coil and the time lag between voltage maximum and current maximum?

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491. Obtain the answers to (a) and (b) Q.13, if the circuit is connected to a high frequency supply (240 V , 10 kHz). Hence explain statement that at very high frequency. Inductor in circuit nearly amount to open circuit. How does an indcutor behave in a d.c. circuit after the steady state ?

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492. A $10\mu F$ capacitor in series with a 40Ω resistance is connected to a 110 V, 60Hz supply. (a) What is the maximum current in the circuit ? (b)

What is the time lag between current maximum and voltage maximum ?

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493. Obtain the answers to (a) and (b) in Q .15, if the circuit is connected to 110 V, 12 kHz supply. Hence explain the statement that a capacitor is a conductor at very high frequencies. Compare this behaviour with that of a capacitor in d.c. after the steady state.

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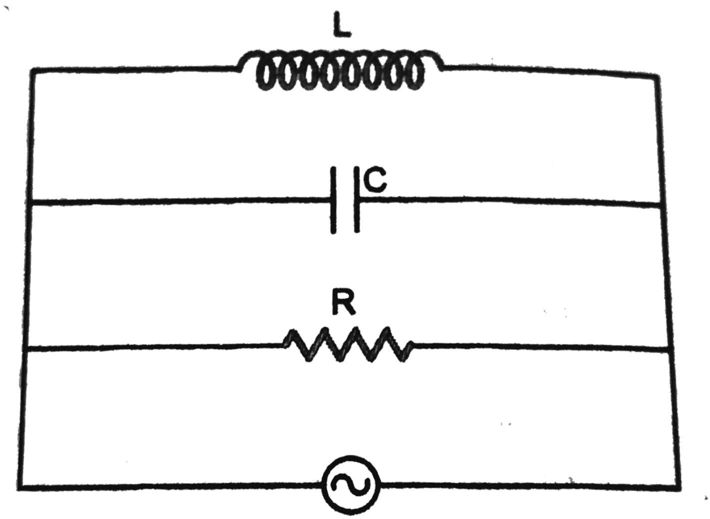
494. Keeping the source of frequency equal to the resonating frequency of the series LCR circuit, if the three elements L, C and R in are arranged in parallel , show that the total current in the parallel LCR circuit is a minimum at this frequency. Obtain the r.m.s. value of current in each brach of the circuit for the elements and source specified in for this frequency.



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495. A circuit containing an $80mH$ inductor and a $60\mu F$ capacitor in series is connected to a $230V - 50Hz$ Supply. The resistance in the circuit is negligible .

(a) Obtain the current amplitude and rms currents.

(b) Obtain the rms values of voltage across inductor and capacitor.

(c) What is the average power transferred to the inductor and to the capacitor?

(d) What is the total power absorbed by the circuit?

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496. A series LCR circuit with $L = 0.12H, C = 480nF,$ and $R = 23\Omega$ is connected to a $230V$ variable frequency supply.

(a) What is the source frequency for which current amplitude is maximum? Find this maximum value.

(b) What is the source frequency for which average power absorbed by the circuit is maximum? Obtain the value of maximum power.

(c) For which frequencies of the source is the power transferred to the circuit half the power at resonant frequency?

(d) What is the Q-factor of the circuit?

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497. Obtain the resonant frequency and Q-factor of a series LCR circuit with $L = 3.0H, C = 27\mu F$, and $R = 7.4\Omega$. How will you improve the sharpness of resonance of the circuit by a factor of 2 by reducing its full width at half maximum?

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498. Answer the following questions :

(a) In any a.c. circuit, is the applied instantaneous voltage equal to the algebraic sum of the instantaneous voltages acorss the series elements of the circuit ? Is the same true for r.m.s. voltage?

(b) A capacitor is used in the primary circuit of an induction coil.

(c) An applied voltage signal consists of a superposition of a d.c. voltage and an a.c. voltage of high frequency. The circuit consists of an inductor and a capacitor in series. Show that the d.c. signal will appear across C and the a.c. signal will appear across L.

(d) A choke coil in series with a lamp is connected to a d.c. line. The lamp is seen to shine brightly. Insertion of an iron core in the choke causes no change in the lamp's brightness. Predict the corresponding observation if the connection is to an a.c. line.

(e) Why is choke coil needed in use of fluorescent tubes with ac mains ? Why can we not use an ordinary resistor instead of choke coil?

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499. A power transmission line feeds input power at 2300 V to a step down trnasformer with it primary windings having 4000 turns. What should be the number of turns in the seconday windings in order to get output power at 230 V?

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500. At a hydroelectric power plant, the water pressure head is at a height of 300 m and the water flow available is $100 m^3 s^{-1}$. If the turbine generator efficiency is 60%, estimate the electric power available from the plant $(g = 9.8ms^{-2})$.

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501. A small town with a demand of 800 kW of electric power at 220 V is situated 15 km away from an electric plant generating power at 440 V. The resistance of the two line wires carrying power is 0.5Ω per km. The town gets power from the lines through a 4000-220 V step down transformer at a substation in the town.

Estimate the line power loss in the form of heat.

(b) How much power must the plant supply.

assuming there is negligible power loss due to leakage?

(c) Characterize the step up transformer at the plant.

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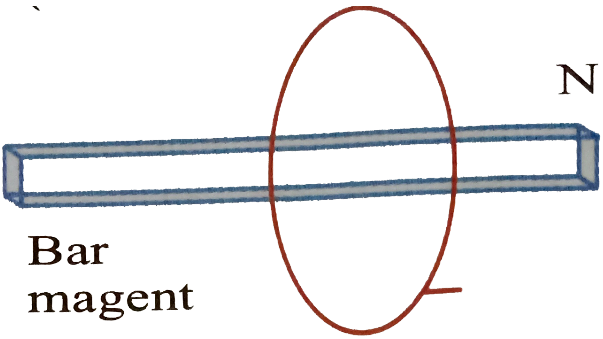
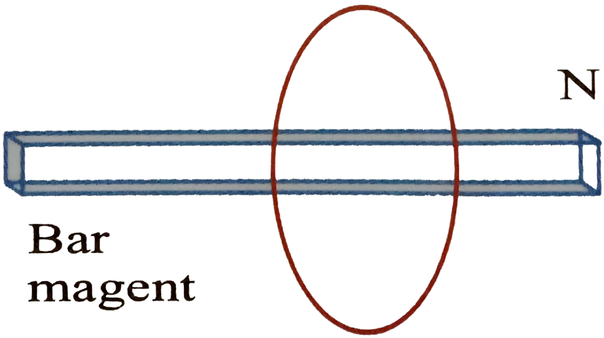
502. Consider a magnet surround by a wire with an on $/$ of switch S (figure) if the switch is thrown from the off position (open circuit) to the on position the (closed circuit).



Circuit open



Circuit closed

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503. A wire in the form of a tightly would solenoid is connected to a DC source, and carries a current. If the coil is stretched so that there are gaps between successive elements of the spiral coil, then

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504. A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, then

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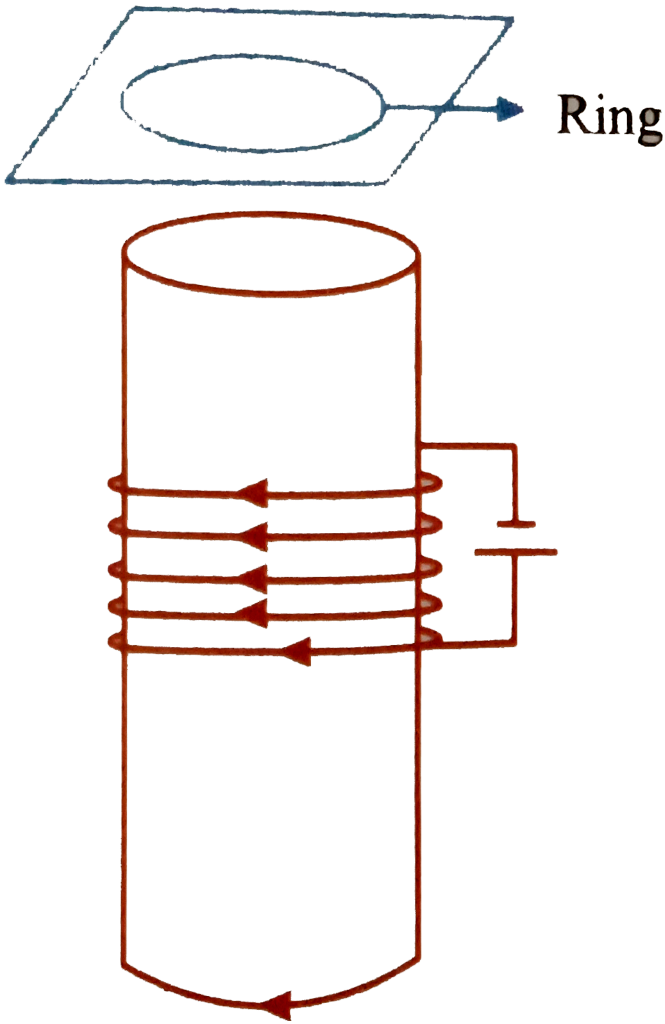
505. Consider a metal ring kept on top of a fixed solenoid (say on a carboard) The centre of the ring coincides with the axis of the solenoid. If the current is suddenly switched on then



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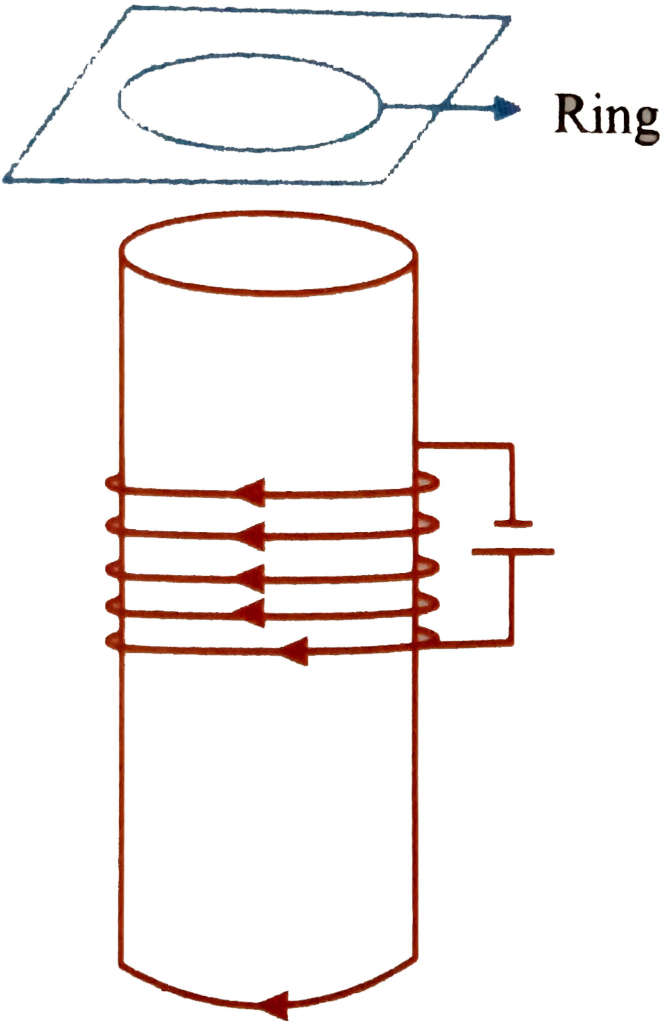
506. Consider a metal ring kept on top of a fixed solenoid (say on a carboard) The centre of the ring coincides with the axis of the solenoid. If the current is suddenly switched on then



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507. Consider a metallic pipe with an inner radius of 1 cm. If a cylindrical bar magnet of radius 0.8 cm is dropped through the pipe, it takes more time to come down than it takes for a similar unmagnetised cylindrical iron bar dropped through the metallic pipe. Explain.

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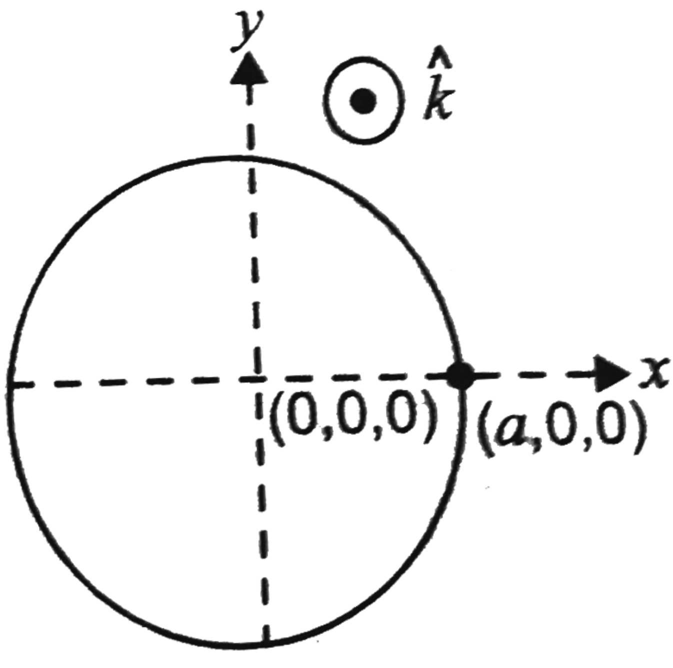
508. A magnetic field in a certain region is given by $B = B_0 \cos(\omega t) \hat{k}$ and a coil of radius a with resistance R is placed in the x-y plane with its centre at the origin in the magnetic field, Fig. Find the magnitude and the direction of the current at (a,0,0) $att = \pi / 2\omega, t = \pi / \omega$ and $t = 3\pi / 2\omega.$



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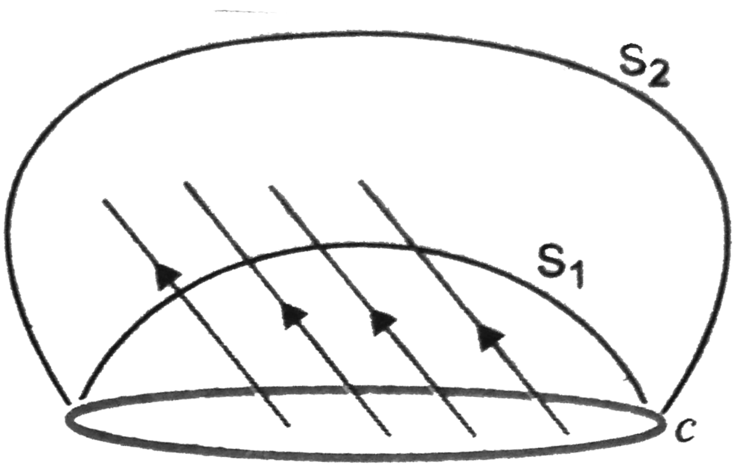
509. Consider a closed loop C in a magnetic field, Fig. The flux passing through the loop is defined by choosing a surface whose edge coincides with the loop and using the formula $\phi = B_1 . dA_1 + B_2 . Da_2 + $ ....Now if we chose two different surfaces S_1 and S_2 having C as their edge, would we get the same answer for flux. Justify your answer.



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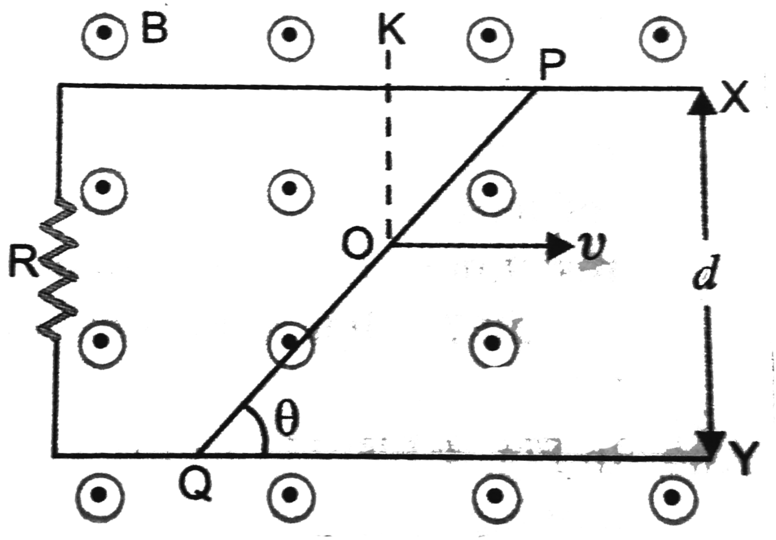
510. Find the current in the wire PQ for the configuration shown in Fig. Wire PQ has negligible resistance. B, the magnetic field is coming out of the paper. θ is a fixed angle made by PQ travelling smoothly over two conducting parallel wires seperated by a distance d.



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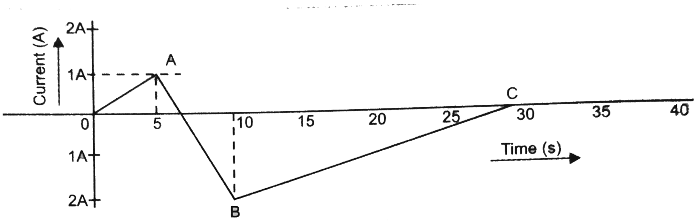
511. A (current vs time) graph of the current passing through a solenoid is shown in Fig. For which time is the back electromotive force (u) a maximum? If the back emf t = 3 s is e, find the back emf at t = 7 s, 15 s and 40 s OA, AB and BC are straight line segments.



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512. There are two coils A and B seperated by some distance. If a current of 2 A flows through A, a magnetic flux of 10^{-2} Wb passes through B (no current through B). If no current passes through A and a current 1 A passes through B, what is the flux through A?

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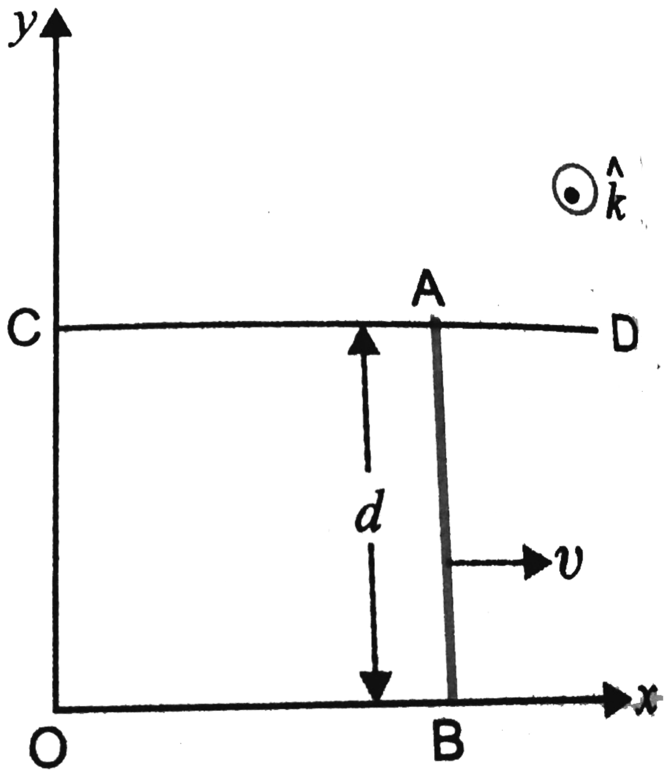
513. A magnetic field $B = B_0 \sin(\omega t)\hat{k}$ covers a large region where a wire AB slides smoothly over two parallel conductors separated by a distance d, Fig. The wires are in the x-y plane. The wire AB (of length d) has resistance R and parallel wires have negligible resistance. If AB is moving with velocity v, what is the current in the circuit ? What is the force needed to keep the wire moving at constant velocity ?



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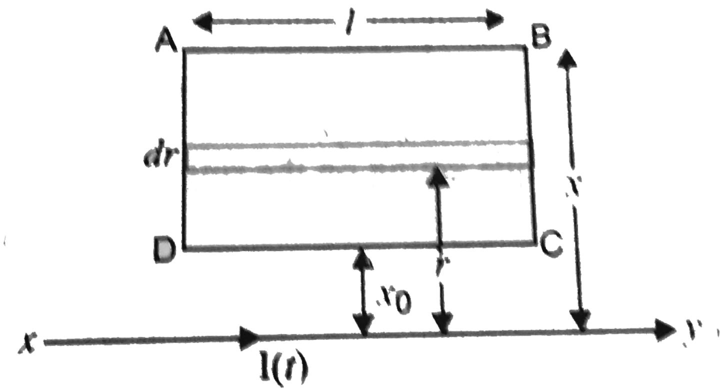
514. Consider an infinitely long wire carrying a current I (t),

With $\frac{dI}{dt} = \lambda$ = constant . Find the current produced in the rectangular loop of wire ABCD if its resistance is R, Fig



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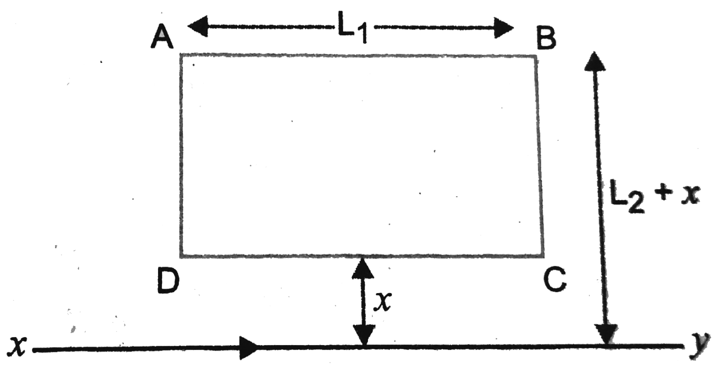
515. A rectangular loop of wire ABCD is kept close to an infinitely long wire carring a current I (t) $= I_0(1 = t/T)$ for $0 \leq t \leq$ and I (0) for t gt T, Fig. Find the total charges passing through a given point in the loop, in time T. resistance of the loop is R



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516. A magnetic field B is confined to a region $r \leq$ a and points out of the paper (the z-axis), r = 0 being the centre of the cicular region. A charged ring (charge = Q) of radius b,$b > a$ and mass m lie in the x-y plane with its centre at origin. The ring is free to rotate and is at rest. The magnetic field is brought to zero in time Δt. Find the angular velocity ω of the ring after the field vanishes.

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517. A rod of mass m and resistance R slides smoothly over two parallel perfectly conducting wires kept sloping at an angle θ with respect to the horiaontal, Fig. The circuit is closed through a perfert conductor at the top. There is a constant magnetic field B along the vertical direction. If the rod is initially at rest, find the velocity of the rod as a function of time.

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518. Find the current in the sliding rod AB (resistance = R) for the arrangement shown in Fig. B is constant and is out of the paper. Parallel wires have no resistance. v is constant. Switch is closed at time t = 0.

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519. A metallic ring of field. If z is the radius l (ring being horizontal is falling under gravity in a region haivng a magnetic field. If z is the vertical direction, the z-component of magnetic field is $B_z = B_0(1 + \lambda z)$. If R the resistance of the ring and if the ring falls with a velocity v, find the energy lost in the resistance If the ring has reached a constant velocity, use the conservation of energy to determine v in terms of m, B, λ and acceleration due to gravity g.

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520. A long solenoid 'S' has 'n' turns per meter, with diameter 'a'. At the centre of this coil, we place a smallar coil of 'N' tunrs and diameter 'b' (where b lt a). If the current in the solenoid increase linearly with time, what is the induced emf apperaing in the smaller coil. Plot graph showing nature of variation in emf, if current varies as a function of $mt^2 + C$.

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521. If a LC circuit is considered analogous to a harmonically osicallting spring block system, which energy of the LC circuit would be analogous to potential energy and which one analogous to kinetic energy ?

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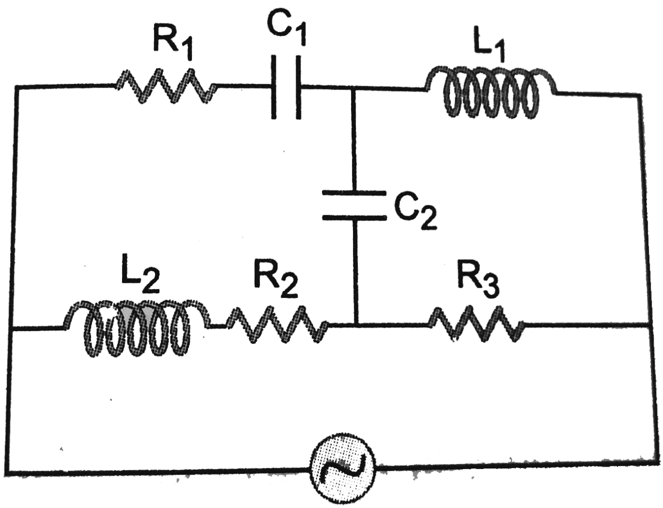
522. Draw the effective equivalent circuit of the circuit show in Fig. at very high frequencies and find the effective impedance.



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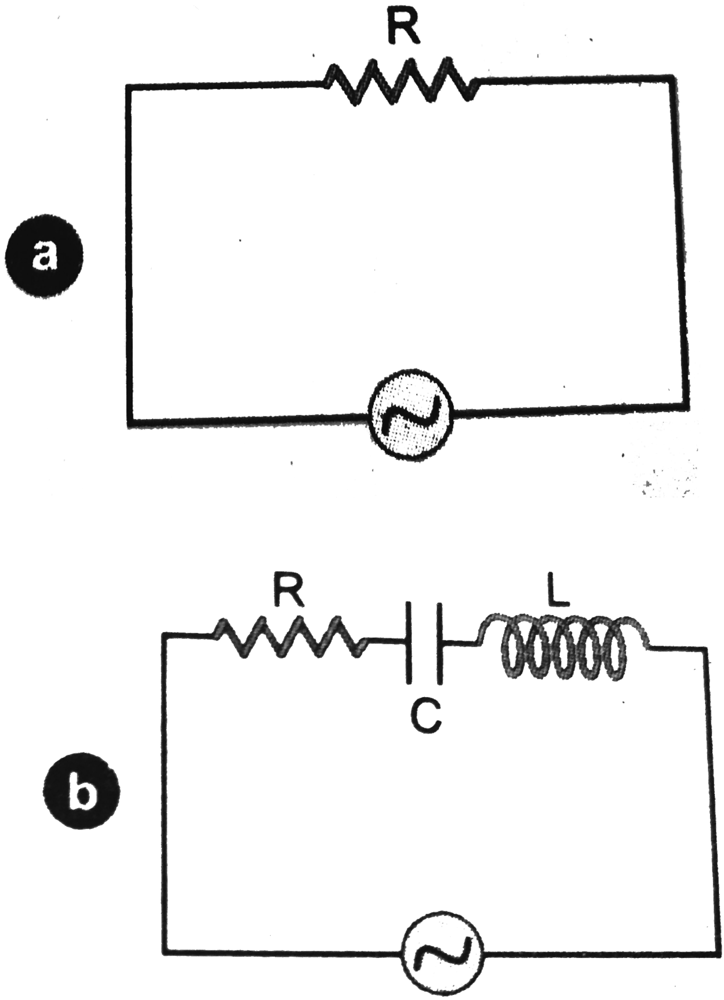
523. Study the circuit (a) and (b) shown in Fig. and answer the following questions.

(a) Under which conditions would the rms currents in the two circuits be the same ?

Can the rms curent in circuit (b) be larger than that in (a) ?



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524. Can the instantaneous power output of an ac source ever be negative ? Can the average power output be negative ?

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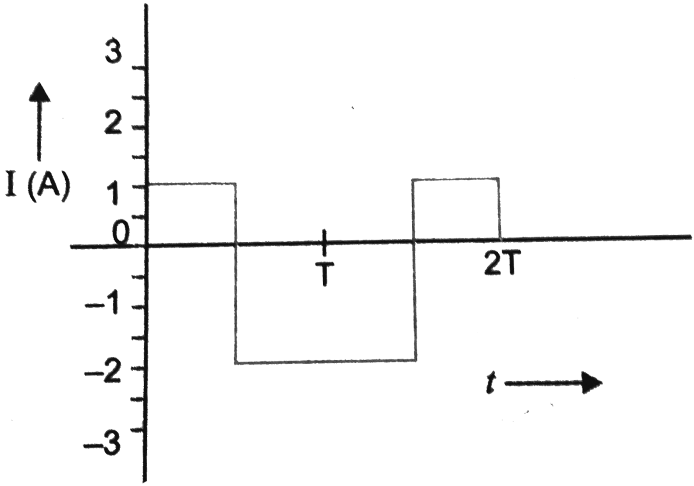
525. The alternating current in a cuicuit in a cuicuit is described by the graph shown in Fig. Show rms current in this graph.



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526. How does the sign of the phase angle ϕ, by which the supply voltage leads the current in an LCR serices circuit, change as the supply frequency is gradually increased from very low to very high values ?

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527. Both alternating current and direct are measured in ampers. But how is the ampere defined for an alternating current ?

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528. A coil of 0.01 henry inductance and 1 ohm resistance is connected to 200 volt, 50 Hz ac supply.

Find the impedance of the circuit and time lag between max. alternating voltage and current.

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529. A 60 W load is connected to the secondary of a transformer whose primary draws line voltage. If a current of 0.54 A flows in the load, what is the current in the primary coil? Comment on the types of transformer being used.

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530. Explain why the reactance provided by a capacitor to an alternating current decreases with increasing frequency.

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531. Explain why the reactance offered by an inductor increases with increasing frequency of an alternaitng voltage.

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532. An electrical device draws 2 kW power form AC mains [voltage 223 V (rms) $= \sqrt{50,000V}$]. The current differs (lags) in phase by $\phi\left(\tan = \frac{-3}{4}\right)$ as compared to voltage. Find (i) R, (ii) $X_C - X_L$, and (iii) I_M. Another device has twice the values for R, X_C and X_L. How are the answers affected ?

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533. 1 MW power is to be delivered from a power station to a town 10 km away. One uses a pair of Cu wires of radius 0.5 cm for this purpose. Calculate the fraction of ohmic losses to power transimitted if (i) power is transformer is used to boost the voltage to 11000 V, power transmitted, then a step down transformer is used to bring voltages to 220 V. $\left(\rho_{Cu} = 1.7 \times 10^{-8} SI\text{unit}\right)$

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534. For an LCR circuit driven at frequency ω, the equation reads $L\frac{di}{dt} + Ri + \frac{q}{C} = v_i = v_m \sin \omega t$

(i) Multiply the equation by I and simplify where possible. (ii) Interpret each term physically.

(iii) Cast the equation in the form of a conservation of energy statement.

(iv) Intergrate the equation over one cycle to find that the phase difference between v and i must be acute.

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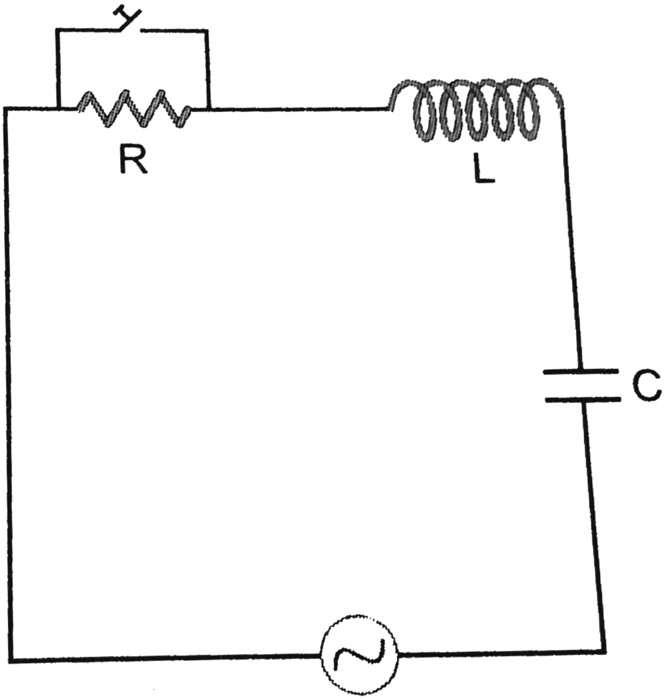
535. In the LCR circuit shown in Fig., the ac driving voltage is $v = v_m \sin \omega t$.

(i) Write down the equation of motion for q (t).

(ii) At $t = t_0$, the source stops and R is short circuited.

Now write down how much energy is stored in each of L and C.

(iii) Describe subsequent motion of charges.



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536. A 100 mH inductor and a $50\mu F$ capacitor in series are connected to a 200 V, 50 Hz supply. Calcualte rms value of current and potential drops across each element. What is the average power transferred to the inductor and also to the capacitor and the total average power absorbed ?

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537. When a circuit element X is conneted across a.c. source, a current $\sqrt{2}A$ flows through it and this current is in phase with applied voltage. When another element Y is connected across same a.c.

source, the same current flows in the circuit, but it leads the voltages by $\pi/2$. Name the circuit elements X and Y. Find current that flows in the circuit when series combination of X and Y is connected acorss same a.c. voltage. Plot a graph showing variation of net impedance of series combination of X and Y as a function of angular frequency of applied voltage.

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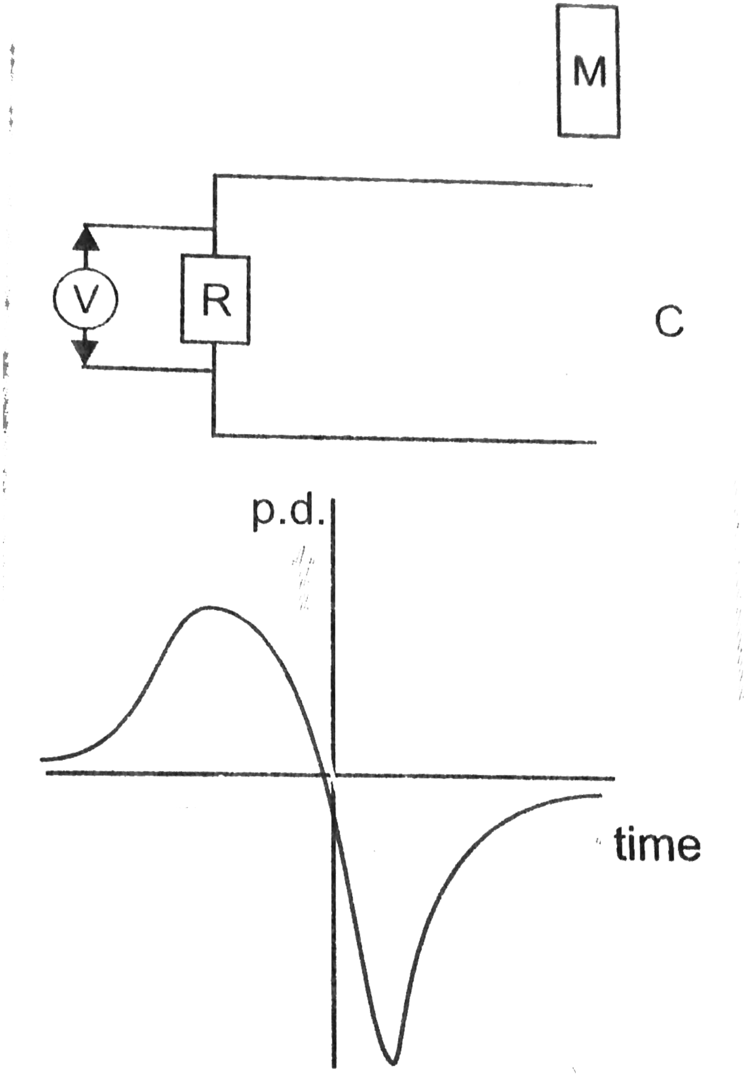
538. A bar magnet M is dropped so that if falls vertically through the coil C. The graph obtained for voltage produced acorss the coil vs time is shown in

Fig.

(i) Explain the shape of the graph

(ii) Why is the negative peak longer than the positive peak?



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539. How much charge will flow through a 200Ω galvanometer connected to a 400Ω circular coil of 1000 turns wound on a wooden stick 20 mm in diameter, if a magnetic field b = 0.0113 T parallel to the axis of the stick is decreased suddenly to zero.

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540. The brush potential of a separately excited generator, when it is delivering 5 A is 125 V. When the generator dilivers 15 A, the potential difference across the brushes fall to 122 V. What are the induced e.m.f. and the resistance of armature ?

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541. An a.c. generator consists of a coil of 50 turns and area $2.5m^2$ rotating at an angular speed of 60 $rads^{-1}$, in a uniform magnetic field B = 0.30 T between two fixed pole pieces. The resistance of the circuit including that of coil is 500Ω.

(a) What is the max. current drawn from the generator?

(b) What is the flux through the coil when the current is zero ? What is the flux when the current is max. ?

(c) Would the generator work if the coil were stationary and instead pole pieces rotated together with the same speed as above ?

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542. A horizontal telephone wire 1 km long is lying along east-west in earth's magnetic field. If falls freely to the ground from a height of 10 m. Calculate the e.m.f. induced in the wire on striking the ground. Given horizontal component of earth's field is 0.32 gauss.

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543. A 20 V, 750 Hz source us connected to a series combination of $R = 100\Omega, C = 10\mu F$ and $L = 0.1803H$. Calculate the time in which resistance will get heated by $10^{\circ} C$, if thermal capacity of the material $= 2J / .^{\circ} C$

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544. An LCR circuit has L = 10 mH, $R = 3\Omega$ and $C = 1\mu F$ connected in series to a source of 15 copy $\cos \omega t$.volt. Calculate the current ampliuted and the average power dissipated per cycle at a frequency 10% lower than the resonance frequency.

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545. A Choke coil is needed to operate an arc lamp at $160V$ (rms) and $50Hz$. The lamp has an effective resistnce of 5Ω when running at $10A(\mathrm{rms})$. Calculate the inductance of the choke coil. If the same arc lamp is to be operated on $160V(DC)$, what additional resistance is required ? Compare the power loses in both cases.

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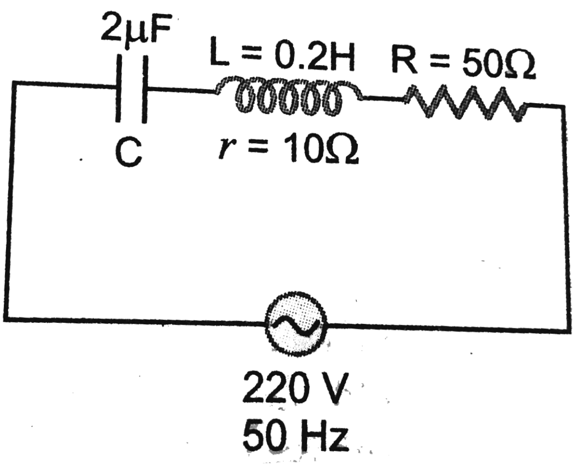
546. In the circuit shown in Fig. calculate

(i) current in the circuit

(ii) Potential difference across each element.



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547. The phenomenon of generating current/e.m.f. in a circuit by changing magnetic field linked with the circuit is called electromagnetic induction (EMI). In our daily lives, we use (EMI) in many ways without even realiaing it.

Read the above passage and answer the following question :

(i) What is the most universal application of EMI ?

(ii) How is the phenomenon being used to enhance the safety of all our important establishments ?

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548. Faraday's second law of EMI says that the magnitude of e.m.f. induced in a cuicuit is directly proportional to the rate of change of magnetic flux linked with circuit, i.e., $e \propto \frac{d\phi}{dt}$. It means if the magnetic flux linked with a circuit changes at a faster rate, the induced e.m.f. is larger and vice-versa.

Read the above passage and answer the following question :

(i) Coil A is held in a very strong magnetic field and coil B is held in a weak magnetic field. In which coil do you expect larger induced e.m.f. ?

(ii) A coil is moved in a uniform magnetic field.

When do you expect induced e.m.f. in the coil ?

(iii) What values of life do you learn from Faraday's second law of EMI ?

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549. Self induction is the property of a coil by virture of which the coil oppose any change in the strenght of current flowing through it by inducting an e.m.f. in itself.

Self induction represents electric inertia which is measured in terms of coefficient of self inductance

We can show that $L = \frac{\phi}{I} = \frac{-e}{dI/dt}$

Read the above passage and answer the following questions :

An e.m.f. of 150 microvolt is induced in a coil when current in it changes from 5A ot 1 A in 0.2 sec. what is self inductance of the coil ?

(ii) How does self indcution of a coil represent its electric inertia ?

(iii) What is them implication of this property in our daily life ?

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550. Faraday established that an e.m.f. can be induced in a coil by changing the amount of magnetic flux (ϕ) linked with the coi. As $\phi = Ba\cos\theta$, therefore, three methods of inducting e.m.f. are by changing magnetic field B or by changing area A or by changing relative orientation θ of the coil w.r.t. the magnetic field.

Read the above passage and answer the following question :

(i) Have you heard of a battery less flashlight ? How does it work?

(ii) Can you operate a typical cell phone from the hip movements of the person?

Whant do you know about gas-elcetric hybrid autos ?

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551. Ajit had a high tension tower erected on his farm land. He kept complaninng to the authorities to remove it as it was occupying a large portion of his land. His uncle who was a teacher, explained to him the need for erecting these toward for efficient transmission of power. As Ajit realized its significance, he stopped complaining.

Read the above passage and answer the following questions :

(i) Why is necessary to transport power at high voltage ?

(ii) A low power factor implies larger power loss.

Explain.

(iii) Write two values each, displayed by Ajit and his uncle.

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552. Ram is a student of class X in a village school. His uncle gifted him a bicycle with a dynomo ditted in it. He was very excited to get it. While cyciling during night, he could light the bulb and see the object on the teacher considered it an opportunity to explain the working to the whole class.

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Solved Examples (b)

1. (a) Obtain the expression for the magnetic energy stored in a solenoid in terms of magnetic field B, area A and length l of the solenoid. (b) How does this magnetic energy compare with the electrostatic energy stored in a capacitor?

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Long Answer Questions

1. (a) A metallic rod of length l is moved perpendicular to its length with velocity v in a magnetic field $\vec{B}$ acting perpendicular to the plane in which rod moves. Derive the expression for the inducced emf.

(b) A wheel with 15 metallic spokes each 60 cm long, is rotated at 360 rev/min in a plane normal to the horizontal component of earth's magnetic field. The angle of dip at that place is 60°. If the emf induced between rim of the wheel and the axle is 400 mV, calculate the horizontal component of earth's magnetic field at the place.

How will the induced emf change, if the number of spokes is increased ?

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2. Questions based on L.R. Circuit | Growth and decay of current In L-R Circuit

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3. Explain the term 'inductive reactance'.Show graphically the variation of inductive reactance with frequency of the applied alternating voltage.

An $a.c.$ voltage $E = E_0 \sin \omega t$ is applied across a pure inductor L.Show mathematically that the current flowing through it lags behind the applied voltage by a phase angle of $\pi/2$.

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4. Explain the term 'capacitive reactance'.Show graphically the variation of capacitive reactance with frequency of the applied alternating voltage.

An $a.c.$ voltage $E = E_0 \sin \omega t$ is applied a across a pure capacitor C.Show mathematically that the current flowing through it leads the applied voltage by a phase angle of $\pi/2$

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5. Describe the principle, construction and working of a DC generator.

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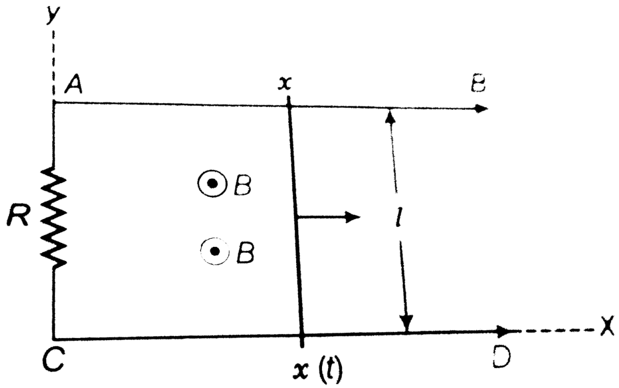
6. A conducting wire XY of mass M and negligible resistance slides smothly on two parallel conducting wires as shown in figure. The closed circuit has a resistance R due to AC. AB and CD are perfect conductors. There is a magnetic field

$B = B(t)\hat{k}$



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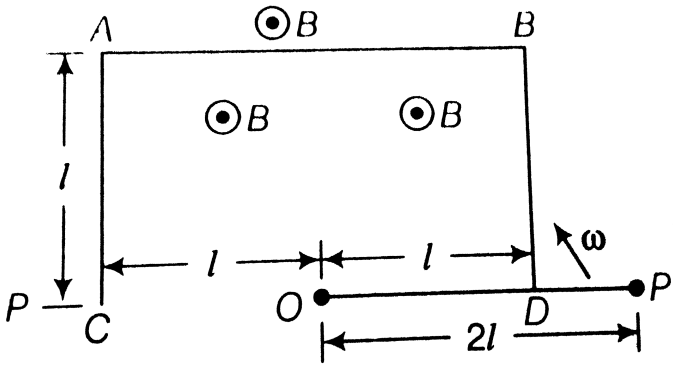
7. ODBAC is a fixed rectangular conductor of negligible resistance (CO is not connected) and OP is a conductor which clockwise with an angular velocity ω (figure). The entire system is in a uniform magnetic field B whose direction is along the normal to the surface of the rectangular conductor

ABDC. The conductor OP is in electirc contact with ABDC. The rotaating conductor has a resistance of λ per unit length. Find the current in the rotating conductor, as it rotates by 180°.



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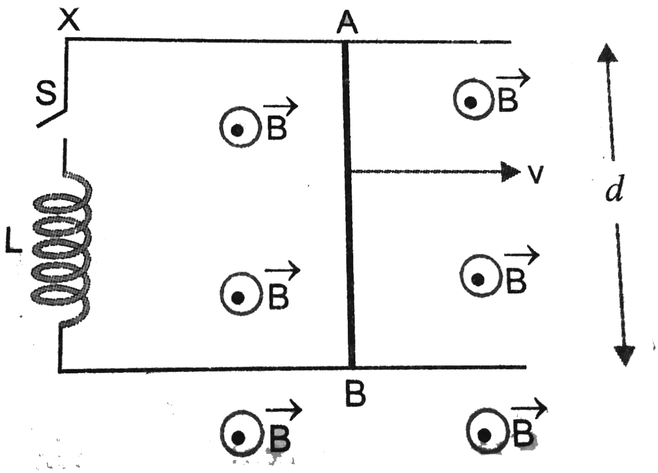
8. Find the current in the sliding rod AB (resistance = R) for the arranged shown in Fig. B is constant and is out of the paper. Paralllel wires have no resistance. v is constant. Switch is closed at time t = 0.



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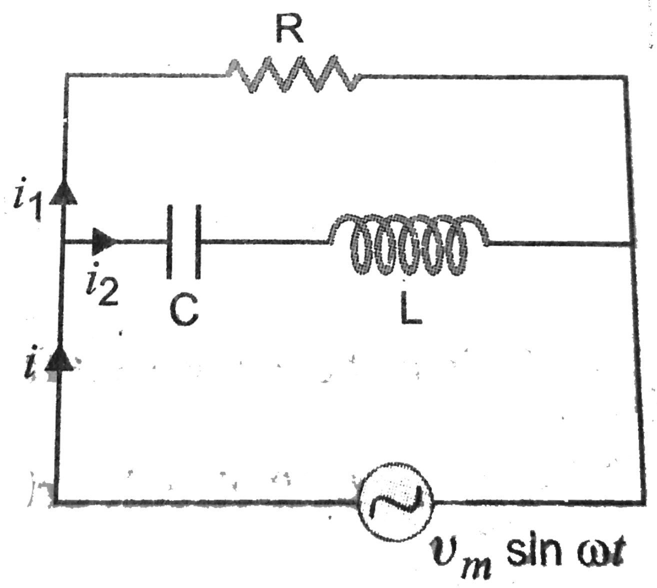
9. Consider the LCR circuit shown in Fig. Find the net current I and the phase of i. show that $i = \frac{v}{Z}$.

Find the impedence Z for this circuit.



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Short Answer Qusetions

1. Explain the use of transformer for distribution of power over long distances.

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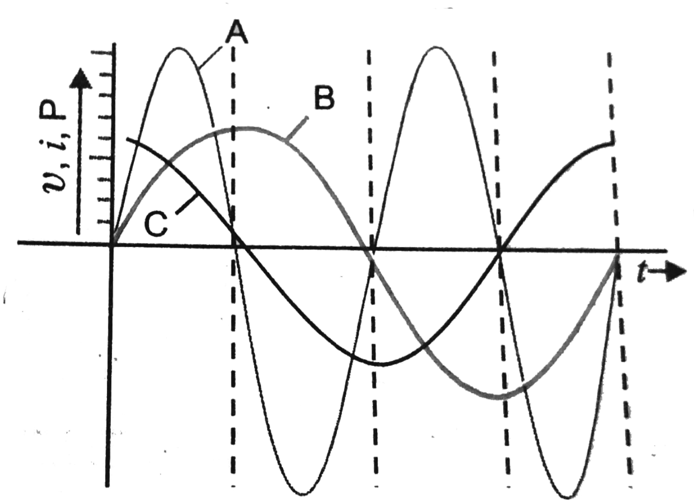
2. A device 'X' is connected to an a.c. source. The variation of voltage, current and power in one complete cycle is shown in Fig.

(a) Which curve shows power consumption over a full cycle?

(b) What is the average power consuption over a cycle ?

(c) Identify the device 'X'.



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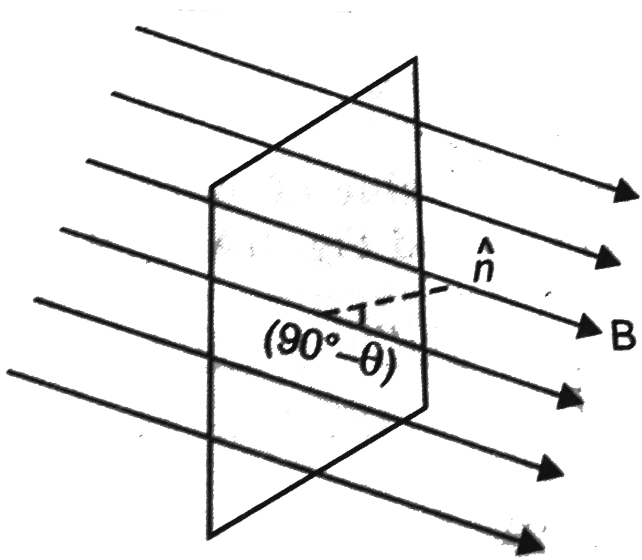
Advance Problems For Competitions

1. A flat coil consists of N turns of wire and has area A. The coil is placed so that its plane is at an angle θ to a uniform magnetic field of flux density B. Obtain an expression for magnetic flux linked with the coil. The magnetic flux density B in the coil is now made to vary with time t as shown in Fig. Sketch the variation with time t of the e.m.f. induced in the coil.



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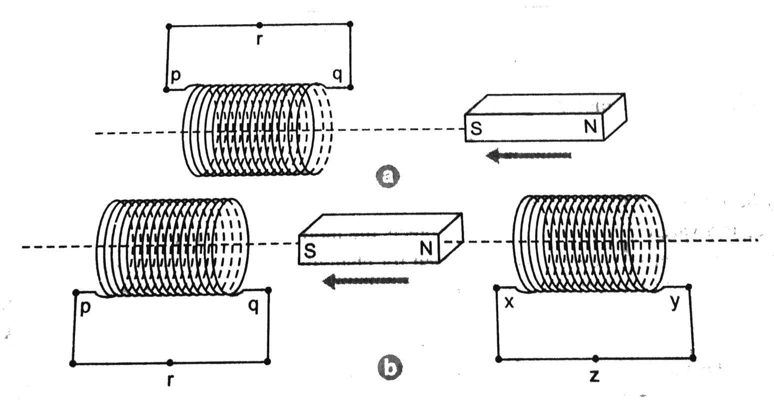
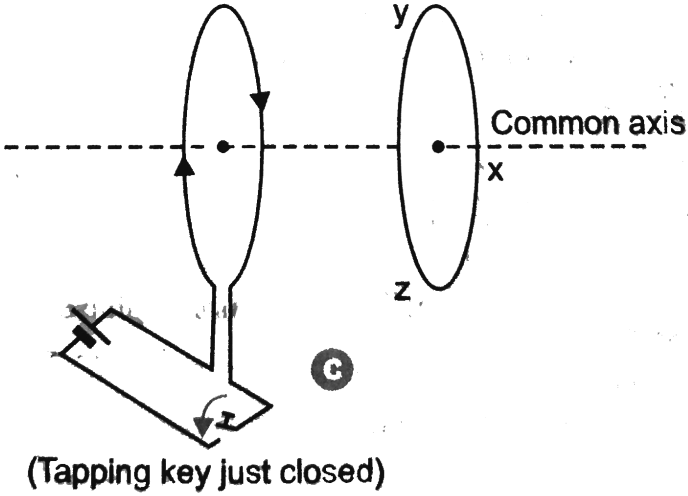
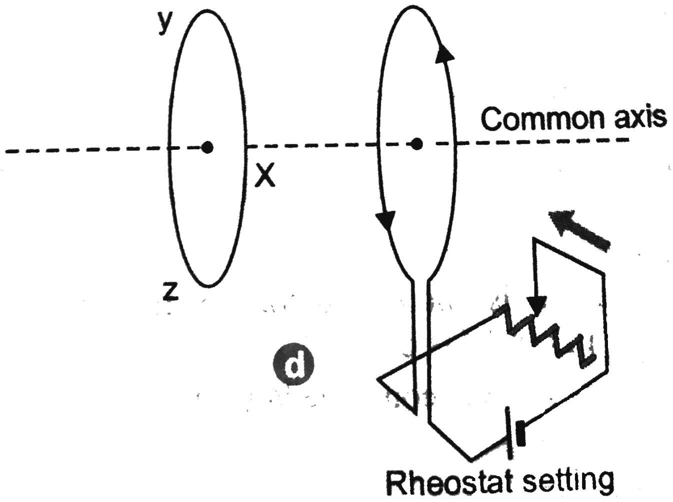
NCERT Question

1. Predict the direction of indcued current in the situation described by the following Fig.

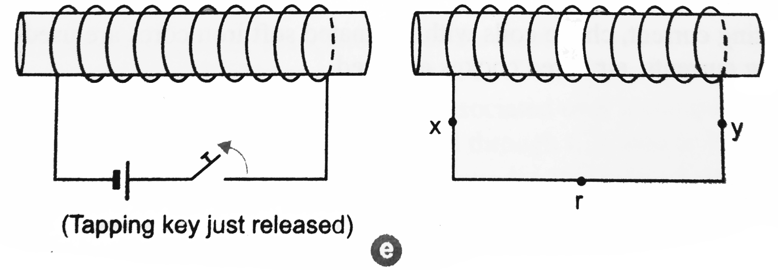


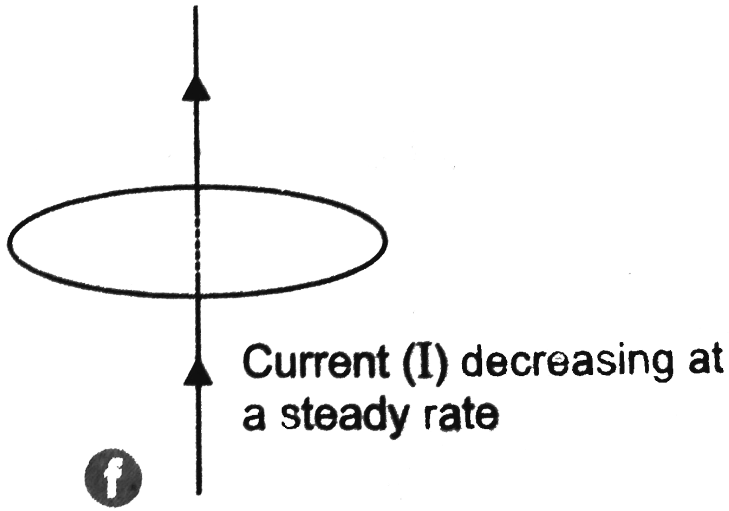

y
Common axis
x
z
(Tapping key just closed)

c


y
Common axis
X
z
Rheostat setting
being changed

d





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2. What is the net power absorbed by each circuit over a complete cycle. Explain your answer.

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3. Suppose the circuit in has a resistance of 15 ohm. Obtain the average power transferred to each element of the circuit, and the total power absorbed.

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4. Do the same exercise as above with the replacement of the earlier transformer by a 40,000-220 V step-down transformer (Neglect, as before, leakage losses though this may not be a good assumption any longer because of the very high voltage transmission involved). Hence, explain why high voltage transmission is preferred?

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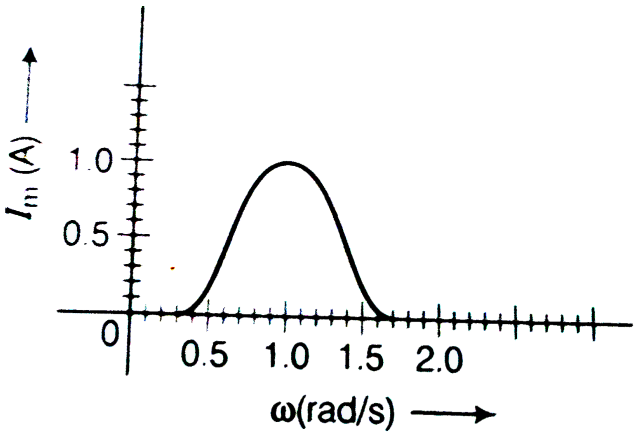
Very Short Answer Qusetions

1. In series LCR circuit, the plot of $I_{\max}$ versus ω is shown in figure. Find the bandwidth and mark in the figure.



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Value Based Questions

1. Lenz's law gives us the direction of current induced in a circuit. According to this law, the polarity of induced e.m.f is always such that is opposes the change in magnetic flux responsible for its production. It means if e.m.f. is induced due to increase in magnetic flux, the direction of e.m.f. induced is such as to oppose the increase in magnetic flux. The reverse is also true.

Read the above passage and answer the following questions :

(i) Does Lenz's law violate the principle of conservation of energy ?

(ii) Name any other rule for finding the direction of induced current.

(iii) What does Lenz's law imply in day to day life?

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2. A transformer is an electrial device which is used for changing the a.c. voltages. It is based on the principle of mutual induction, i.e., whenever the amount of magnetic flux linked with a coil changes, an e.m.f. is induced in the neighbouring coil. For an ideal transformer, $\frac{E_s}{E_P} = \frac{I_P}{I_s} = \frac{n_s}{n_P}$ where the symbols have their usual meaning

Read the above passage adn answer the following question :

(i) A transformer has 20 turns in primary and 200 turns in seconday. If the primary is connected to 220 V d.c. supply, what will be the voltage across secondary ?

(ii) The output voltage of an ideal tansformer connected to 240 V a.c. mains is 24 V. When this transformer is used to light a bulb with rating 24 V, 24 W, what is thr primary current ?

(iii) What values of life do you learn from the theory of transformer ?

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Exercise

1. In the relation $\phi = BA\cos\theta$, θ is angle

A. which normal to surface area makes with the direction of magnetic field

B. which magnetic field makes with the surface

C. which is never constant

D. none of the above

Answer: A

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2. SI unit of magnetic flux is

A. henry

B. weber

C. coulomb

D. volt

Answer: B

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3. The cause of induced e.m.f is

A. magnetic flux

B. magnetic field

C. area

D. change in magnetic flux

Answer: D

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4. Choose the wrong statement :

A. Whenever the amount of magnetic flux linked wita circuit, an e.m.f. induced in the circuit.

B. The induced e.m.f. lasts so long as the change in magnetic flux continues.

C. Larger the amount of magnetic flux linked with a circuit, greater is the e.m.f. induced in it.

D. The direction of induced e.m.f. is given by Lenz's Law.

Answer: C

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5. Amount of charge inuduced in a circuit of resistance R is given by

A. $dQ = (d\phi) \times R$

B. $dQ = \frac{d\phi}{R}$

C. $dQ = R^2 d\phi$

D. $dQ = \frac{d\phi}{R^2}$

Answer: B

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6. In which of the following devices, the eddy current effect is not used ?

A. Magnetic breaks

B. speedometers

C. Induction furnace

D. Transformers

Answer: D

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7. Out of the following choose the correct relation

A. 1 henry $= \dfrac{1\text{volt}}{1\text{ampere}}$

B. 1 henry $= \dfrac{1\text{amp}}{1\text{volt}}$

C. 1 henry $= \dfrac{1\text{volt}}{1amp/\sec}$

D. 1 henry $= \frac{1\text{volt}}{1amp.\ \text{sec}}$

Answer: C

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8. When number of turns of a solenoid is doulbed, its self inductance becomes k time, where k =

A. 2

B. 1

C. 8

D. 4

Answer: D

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9. The magnetic flux linked with a coil is $\phi = (3t^2 - 2t + 1)$ milliweber. The e.m.f. induced in the coil at t = 1 sec is

A. 4 V

B. $4 \times 10^{-3} V$

C. 6 V

D. $4 \times 10^3 V$

Answer: B

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10. A wire of length 2 m moves with a speed of $5m/s$ perdendicular to a magnetic field of induction 0.1 W/bm^2. The e.m.f. induced in the wire is

A. 1 V

B. 10 V

C. 5 V

D. 2 V

Answer: A

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11. One weber is the amount of ....over an area of .... Held normal to a uniform

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12. An e.m.f. is induced in a coil when .... Linked with the coil .... With ....

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13. The magnetic of ....in a circuit is ....to the......................linked with the circuit.

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14. According to ....law, the polarity of ....is such that it.................... responsible for..................

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15. Lenz's law is consequence of the law of conservation of

A. Conservation of energy

B. Conservation of mass

C. Conservation of charge

D. Conservation of momentum

Answer: A

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16. Eddy curents are the current ....when ....changes.

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17. If ω is angular frequency of a.c., then the reactance offered by inductance L and capacitance C are X_L..........................and X_C...............

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18. Self induction of a coil is said to be................. When a current change.............................through the coil induces....................in the coil.

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19. Self inductance of a solenoid varies........................as the ....of the number of turns in the solenoid.

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20. Coefficient of mutual inductance of two coil is numerically ....linked with one coil when ....flows through......................

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21. A coil with an average diameter of 0.02 m is placed perpendicular to a magnetic field of 6000 T. If the induced e.m.f. is 11 V when magnetic field is changed to 1000 T in 4 s, what is the number of turns in the coil ?

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22. An air cored solenoid of length 50 cm and area of cross section $20m^2$ has 200 turns and carries a current of 5.0 A. On switching off, the current decreases to across the ends of the solenoid.

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23. A magnetic field of flux density 1.0 Wbm^{-2} acts normal to a 80 turns coil of m^2 area. Find the e.m.f. induced in it, if this coil is removed from the field in 0.1 second.

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24. A square copper coil of each side 8 cm consists of 100 turns. The coil is initially in vertical plane, such that the plane of the coil is normal to uniform magnetic field of induction 0.4 Wbm^{-2}. The coil is turned throuugh 180° about a horzontal axis in 0.2 s. Find the induced e.m.f.

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25. The area of a coil of 25 turns is $1.6cm^2$. This coil is inserted in 0.3 sec in a magnetic field of 1.8 Wb/m^2 such that its plane is perpendicular to the flux lines of the field. Calculate the e.m.f. induced in the coil. Also, calculate the total charge that passes through the wire, if its resistance is 10Ω

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26. A uniform magnetic field B exists in a direction perpendicular to the plane of a square frame made of copper wire. The wire has a diameter of 2 mm and a total length of 40cm. The magntic field changes with time at a steady rate $\frac{dB}{dt} = 0.02Ts^{-1}$. Find the current induced in the frame. Resistivity of copper $= 1.7X10^{-8}Wm.$

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27. A wire 88 cm long bent into a circular loop is placed perpendicular to the magnetic field of flux density $2.5 Wbm^{-2}$. Whitin 0.5 sec, the loop is changed into a square of each side 22 am and flux density is increased to $3.0 Wbm^{-2}$. Calculate the value of e.m.f.induced.

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28. A closely wound rectangular coil of 200 turns and size 0.30×0.05 m is placed perpedicular to a megnetic field of induction $0.20 Wbm^{-2}$ Calculate the induced e.m.f. in the coil, when megnetic induction drop to 0.5 Wbm^{-2} in 0.02 s.

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29. A coil of 100 loops is pulled in 0.01 s between the pole of a magnet, where is area intercepts the flux of 300μ Wb, to a place where it intercepts the flux of 100μ Wb. Caluculate the e.m.f. induced in the coil.

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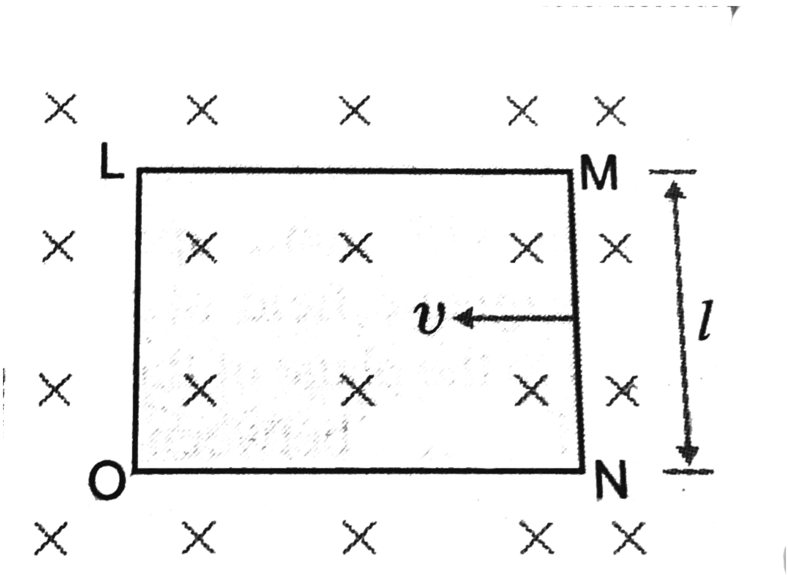
30. A rectangular conductor LMNO is place in a uniform magnetic field of 0.5 T Fig. The field is directed perpendicular to the plane to the conductor. When the arm MN of length 20 cm is moved with a velocity of 10 m/s calculate the emf induced in the arm. Find the value of induced current if resistance of arm MN is 5 Omega arms have negligible resistance.



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31. A circular copper disc of 10 cm radius rotates at $20\pi \ radian/\sec$ about an axis through its centre and perdendicular to the disc. A uniform magnetic field of 0.2 T acts perpendicular to the disc.

Calculate the potential difference developed between axis of the disc and the rim. What is the induced current if resistance of disc is 2 ohm ?

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32. A metre gauge train is running due north with a constant speed of $90 kmh^{-1}$ on a horizontal track. If the vertical component of earth's magnetic field is $3 \times 10^{-5} Wbm^{-2}$, calculate the e.m.f. induced across the axle of the train of length 1.25 m

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33. A metal disc of radius 200 cm is rotated at a constant angular speed of $rads^{-1}$ in a plane at right angles to an external field of magnetic induction $0.05Wbm^{-2}$. Find the e.m.f. induced between the centre and a point on the rim.

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34. The distance between the edges of the wings of an aeroplane is 30 metre. It is landing down with a velocity of 300 km/hr. If while landing, the wings of the aeroplane be east-west, find out the potentail difference between the edges of the wings. What will happen if the wings are along north south. Take $H = 0.4$ gauss.

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35. A jet plane is travelling west at 450 m/s. If the horizontal component of earth's magnetic field at the place is $4 \times 10^{-4}T$ and the angle of dip is 30°, find the e.m.f. induced between the ends of wings having a spam fo 30 m.

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36. A circular disc of radius 20 cm is rotating with a constant angular speed of $2.0 rad/s$ in a uniform magnetic field of 0.2 T. Find the e.m.f. induced between the centre and rim of the disc. Given magnetic field is along the axis of rotation of disc.

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37. An aeroplane is travelling west at the speed of $500 m/s$. What is the voltage difference between the ends of the wings 25 m long. If the earth's magnetic field dip angle is 30°.

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38. When a wheel with metal spokes 1.2 m long rotates in a magnetic field of flux density 5×10^{-5} T normal to the plane of the wheel, an e.m.f. of 10^{-2} V is induced between the rim and the axle. Find the rate of rotation of the wheel.

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39. What is the self inductance of a coil, in which magnetic flux of 40 milliweber is produced when 2 A current flows through it?

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40. An inductor of 5 H inductance carries a steady current of 2 A. How can a 50 V self induced e.m.f. be made to appear in the inductor ?

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41. The current is a solenoid of 240 turns, having a length of 12 cm and a radius of 2 cm, changes at a rate of $0.8As^{-}$. Find the emf indcued in it.

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42. Magnetic flux of 5 microweber is linked with a coil when a current of 1 mA flows through it. What is self inductance of the coil ?

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43. The self inductance of an inductance coil having 100 turns is 20 mH. Calculate the magnetic flux through the cross section of the coil corresponding to a current of 4 milliampere. Also, find the total flux

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44. If self induction of an air core solenoid increases from 0.04 mH to 16 mH on introducing an iron core into it, what is relative magnetic permeability of the core ?

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45. A coil has a self inductance of 10 mH. What is the maximum magnitude of the induced e.m.f. in the coil when a current of $I = 0.1 \sin 200t$ ampere is sent through it ?

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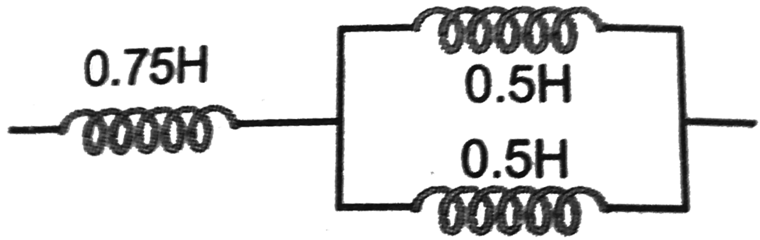
46. Three inductances are connected as shown in figure. Calculate the resultant inductance.



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47. a. What is the magnetic flux through one turn of a solenoid of self inductance $8.0 \times 10^{-5} H$ when a current of $3.0 A$ flows throgh it? Assume that the solenoid has 1000 turns are wound from wire of diameter $1.0mm$.

b. What is the cross sectional area of the solenoid?

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48. A small piece of metal wire is dragged across the gap between the pole pieces of a magnet in 10 s. The magnetic flux between the pole pieces is 8×10^{-4} Wb. Find the magnitude of induced e.m.f.

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49. A carspark coil developes an induced e.m.f. of 40000 V in the secondary when when current in primary changes form 4 A to zero in $10\mu s$. What is the mutual inductance of the coil ?

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50. Over a solenoid of 50 cm length and 2 cm radius having 500 turns. Is wound another wire of 50 turns near the centre. Calculate mutual inductance of the two coils. If currents in primary changes From 0 to 5 a in 0.02 s, what is the emf induced in secondary coil ?

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51. An air cored solenoid is of length 0.3 m, area of cross section $1.2 \times 10^{-3} m^2$ and has 2500 turns. Around the solenoid and the coil are electrically insulated from each other. Calculate the e.m.f. induced in the coil if the initial current of 3 A in the solenoid is reversed in 0.25 s.

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52. Find the mutual inductance between the two coils if a current of 10 ampere in primary coil changes the flux by 500 Wb per turn in the secondary coil of 200 turns. Also, find the induced e.m.f. acorss the ends of the secondary coil if this change occurs in 0.5 sec.

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53. Two solenoids A and B spaced close to each other and sharing the same cylindrical axis have 400 and 700 turns, respectively. A current of $3.50A$ in coil A produced an average flux of $300\mu T - m^2$ through each turn of A and a flux of $90.0mT - m^2$ through each turn of B.

a. Calculate the mutual inductance of the two solenoids.

b.What is the self inductance of A?

c. What emf is induced in B when the current in A increases at the rate of $0.5A/s$?

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54. Compute the mutual inductance for a given pair of coils if increase in current from 2 A to 6 A in 0.1 s in one coil causes an induced e.m.f. of 1 V in the order coil.

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55. A rectangular loop of sides 8 cm and 2 cm with a small cut is stationary in a uniform magnetic field directed normal to the loop. The magneic field is reduced form its initial value of 0.3 T at the rate of 0.2 T s^{-1}. If the cut is joined and the loop has a resistance of 1.6Ω, how much power is dissipated by the loop as heat ?

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56. A conducting circular loop is placed is a uniform magnetic field B =0.20 T with its plane perpendicualr to the field . Somehow, the radius of the loop starts shrinking at a constant rate of $1.0 mm s^{-1}$. Find the induced emf in the loop at an instant when the radius is 2 cm.

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57. Magadh express takes 16 hours to cover the distance of 960km between patna and Gaziabad. The rails are separated by 130 cm and the vertical component of the earth's magnetic field is 4.0×10^{-5} T.

(a) Find the average emf induced across the witdh of the train.

(b) If the leakage resistance between the rails is 100

Omega, find the retarding force on the train due to magnetic field.

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58. A metallic wire bent in the form of a semi-circle of radius 0.1 m is moved in a direction parallel to its plane, but perperdicular to a magnetic field $B = 20mTwithavel. Of 10$m//s`. Find the e.m.f. induced in the wire.

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59. The magnetic flux linked with the loop of a wire of area vector $\left(30\hat{i}+16\hat{j}+23\hat{k}\right)cm^2$ is 5μ Wb. Calculate the magnetic field acting at right angle to the plane of the loop of the wire.

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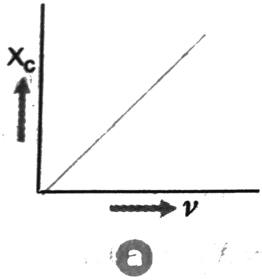
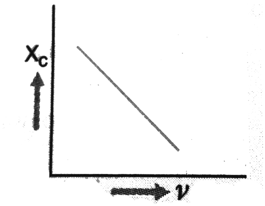
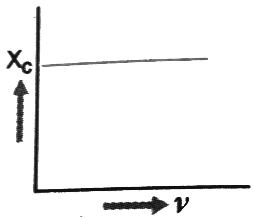
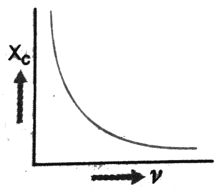
60. Identify the graph which correctly reperesents the variation of capacitive reactance X_C with frequency

A. 

B. 

C. 

D. 

Answer: D

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61. Choose the quantity whose SI is not ohm.

A. Resistance

B. Reactance

C. Capacitance

D. Impedance

Answer: C

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62. Which of the following does not have the dimensions of time ?

A. RC

B. $\frac{L}{R}$

C. $\frac{R}{L}$

D. $\sqrt{LC}$

Answer: C

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63. The peak value of 220 a.c. is

A. 220 V

B. $\frac{220}{\sqrt{2}}V$

C. 440 V

D. $220\sqrt{2}V$

Answer: D

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64. Phase difference between voltages across L and C in series is

A. 0°

B. 90°

C. 180°

D. 360°

Answer: C

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65. The resistance of a coil for direct current is 10 ohm. When a.c. is sent through the same coil, its resistance would be

A. 10Ω

B. $> 10 ohm$

C. $< 10 ohm$

D. cannot say

Answer: B

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66. The average value of a.c. voltge $E = E_0 \sin \omega t$ over the time interval t = 0 to t = π / ω is

A. $-2E_0 / \pi$

B. E_0 / π

C. $\frac{2E_0}{\pi}$

D. zero

Answer: C

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67. The alternating current from a source is represented by $I = 0.5 \sin 314t$. The frequecy of a.c. is

A. 314 Hz

B. 100 Hz

C. 50 Hz

D. zero

Answer: C

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68. Q factor of resonance is given by

A. $\frac{1}{R}\sqrt{\frac{L}{C}}$

B. $\frac{1}{R}\sqrt{\frac{C}{L}}$

C. $\frac{1}{L}\sqrt{\frac{R}{C}}$

D. $\frac{1}{C}\sqrt{\frac{L}{R}}$

Answer: A

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69. The power factor of an a.c. circuit is givne by

$\cos\phi =$

A. $\frac{R}{Z}$

B. $\frac{Z}{R}$

C. $\frac{R}{X_L}$

D. $\frac{R}{X_C}$

Answer: A

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70. The............... of alternating current varies .... With time and its.....................is reversed

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71. Ordinary d.c. ammerter and d.c. votmeter, when used in ....record.........................reading

Watch Video Solution

72. The r.m.s. value or.........................value or ....value of a.c. is ....the peak value of a.c.

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73. 220 V a.c. means...................... and an a.c. of 1 A means........................

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74. In an a.c. circuit containing R only.....................
and......................are in ....phase.

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75. In an a.c. circuit containing L only, alternating current......................alternating voltage by a phase angle of...................

Watch Video Solution

76. The dimensions of inductvie..........................and ....are the same as those of ....

Watch Video Solution

77. A consdenser ....a.c. to pass through but.........................d.c.

Watch Video Solution

78. Ohmic resistance R can reduce ....but indcutor L can reduce...................only.

Watch Video Solution

79. A series resonance circuit is called an ....and a........................is called ....

Watch Video Solution

80. A capacitor is $5 \mu F$ is conneted to 20 V supply through a resistance R. What should be the value of resistance so that condenser acquires 63.2% of its final charge in 10 millisecond ?

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81. A coil of resistance 20Ω and inductance $0.5H$ is switched to $DC 200V$ supply. Calculate the rate of increase of current

a. at the instant of closing the switch and

b. after one time constant.

c. Find the steady state current in the circuit.

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82. An inductor $(L = 20mH)$, a resistor $(R = 100\Omega)$ and a battery$(\varepsilon = 10V)$ are connected in series. Find (a) the time constant, (b) the maximum current and (c) the time elapsed before the current reaches 99% of the maximum value.

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83. A capacitor charged to 10 V is being discharged through a resistance R. At the end of 1 s, the voltage across the capacitor is $5V$. What will be the voltage after 2 s?

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84. If a circuit having a resistor of $2 \times 10^6 \Omega$ in series with a capacitor of $1\mu F$ is placed in series with a cell of e.m.f. V, to what limit will the condenser be charged after 4 s ?

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85. A capacitor of $2\mu F$ is conneted to 10 V supply through 1 mega ohm resistance. How long will it take the capacitor to charge upto 63.2% of its final charge ? Also, calculate the maximum value of charge.

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86. A coil of induction 50 H is connected to a battery of emf 2 V through a resistance of 10 ohm. What is the time constant of the circuit and maximum value of current in the circuit ?

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87. A capacitor of $1 \mu F$ is placed in series with a resistor of 2 mega-ohm and a battery of emf 2 V. Calculate the time after which the charge will grow to 86.74% of its max value.

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88. The equation of a.c.in a circuit is $I = 50 \sin 100\pi t$. Find (i) frequency of a.c.

(ii) mean value of a.c over positive half cycle

(iii) value of current $\frac{1}{300}s$ after it was zero.

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89. The instantaneous value of alterninig voltage is given by E = 140 sin 300 t. what is rms value of voltage and frequency of supply ?

Take $\pi = 3$ and $\sqrt{2} = 1.4$.

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90. If the effective current in a 50 cycles a.c. cuicuit is 5 A, what is the peak value of current ? What is the current $1/600$ sec. after it was zero ?

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91. The electric mains in a house are marked 220V-50Hz. Write down the equation for instantaneous voltage.

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92. The peak value of an a.c. of frequency 50 hertz is 14.14 ampere. Find the r.m.s. value of current. How much time will the current take in reaching from zero to maximum value ?

Watch Video Solution

93. The effective value of current in a 50 cycle a.c. circuit is 5.0 A. What is the value of current $(1/300)$ s after it is zero ?

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94. The electric current in a circuit is given by $I = i_0\left(\frac{t}{\tau}\right)$ for some time. Calculate the rms current for the period $t = 0$ to $t = (\tau)$.

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95. The equation of alternating of alternating current for a cuicuit is given by $I = 50\cos 100\pi t$. Calculate

(i) frequency of a.c. applied,

(ii) virtual value of current,

(iii) value of current $1/600$ s after it was maximum

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96. A resistance of 40Ω is connected to an source of 220 v, 50 Hz. Find the (i) rms current (ii) maximum instantaneous current in resistor.

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97. An alternating voltage given by $E = 280 \sin 50\pi t$ is connected across a pure resistor of 40 ohm. Find frequency of source and rms current through the bulb.

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98. A light bulb is rated 200 W for 220 V supply at 50 Hz. Calculate resistance of the bulb and rms current through the bulb.

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99. An alternating e.m.f. of peak value 350 V is applied across an ammeter of resistance 100 ohm. What will be the reading of ammeter ?

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100. A resistance of 20Ω is connected to a source of alternating current rated $110V, 50Hz$. Find (a) the rms current, (b) the maxium instantaneous current in the resistor and the time taken by the current to change from its maximum value to the rms value.

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101. A 100 ohm iron is connected to a 110 V - 60 hertz wall plug. What is (1) peak pot. Diff. (ii) average potential diff. over a half cycle and (iii) rms current ?

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102. A Sinusoidal voltage V = 200 sin 314 t r is applied to a resistor of 10 ohm. Calculate (i) rms value of voltage (ii) rms current (iii) power dissipated as heat.

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103. An a.c. circuit consists of only an inductance of2 H. If the current is represent by a sine wave of amplitude 0.25 A and frequency 60 Hz. Calculate of effective potential across the inductor.

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104. An inductor $(L = 200mH)$ is connected to an AC source of peak emf $210V$ and frequency $50Hz$. Calculate the peak current. What is the instantaneous voltage of the source when the current is at its peak value?

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105. A pure inductor of self inductance 1 H is connected across in alternating voltage of 115 V and frequency 60 Hz. Calculate the (i) inductive reactance (ii) effective current (iii) peak current (iv) average power consumed.

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106. How much inductance should be connected to 200 V, 50 c/s supply so that a maximum current of 0.5 A flows through it ?

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107. Alternating e.m.f. of $E = 220 \sin 100\pi t$ is applied to a circuit containing an inductance of

$(1/\pi)$ henry. Write equation for instantaneous current through the circuit. What will be the reading of a.c. galvanometer connected in the circuit ?

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108. An inductance of negligible resistance, whose reactance is 22 ohm at 200 Hz is connected to a 220 V V, 50 Hz power line. What is the value of inductance and reactance ?

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109. A capacitor has a reactance of 100Ω at 50 Hz

Whatt will be its reactance at 125 Hz ?

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110. A capacitor of capacitance $10\mu F$ is connected to an oscillator giving an output voltage $\varepsilon = (10V)\sin\omega t$. Find the peak currents in the circuit for $\omega = 10s^{-1}, 100s^{-1}, 500s^{-1}, 1000s^{-1}$.

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111. A $10\mu F$ capacitor is conneted with 1 henry inductance in series with a 50 hertz source of a.c. Calculate the impedance of the combination.

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112. A $3\mu F$ capacitor is connected to a 220 V, 50 Hz a.c. source. Calculate the rms value of current through the circuit. Also, find the peak value of voltage across the capacitor.

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113. A capacitor of $10\mu F$ is connected to an a.c. source of e.m.f. $E = 220 \sin 100\pi t$. Write the equaiton of instananeous current through the circuit. What will be the reading of a.c. ammeter connected in the circuit ?

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114. A current of 30 mA is taken by a $4\mu F$ capacitor connected acorss an alternating current line having frequency of 500 Hz. Calculate reactance of the capacitor and voltage across the capacitor.

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115. A $30\mu F$ capacitor is conneted to a 220 V, 50 Hz. Source. Find its capactive reactance, rms current, peak current and impendance of the circuit.

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116. A $9/(100\pi)H$ inductor and a 12Ω resistance are connected in series to a $225V, 50Hz$ ac source. Calculate the current in the circuit and the phase angle between the current and the source voltage.

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117. An e.m.f. $E = 200 \sin 377t$ volt is applied across an inductance L having a resistance of 1.0 ohm. The maximum current is found to be 10 A. Find the value of L.

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118. The impedance of a coil is 141.4 ohm at 50 hertz and its resistance is 100 ohm. What will be its inductance ?

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119. A coil takes a current of 2.0 ampere and 200 watt power from an alternating current source of 220 volt, 50 hertz. Calculate resistance and inductance of the coil.

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120. When 100 V dc is applied across a coil, a current of 1A flows through it and when 100 V ac of 50 Hz is applied to the same coil, only 0.5 flows

The inductance of coil is

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121. When a series combination of inductance and resistance are conneted with a 10 V, 50 Hz a.c. source, a current of 1 A flows in the circuit. The voltage leads the current by a phase angle of $\pi/3$ radian. Calculate the values of resistance and inductance.

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122. A 80 V - 800 W heater is to be operated on a 100 V - 50 Hz a.c. supply. Calculate the inductance of the choke required.

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123. The inductance of a resistance coil is 0.5. henry. How much potential difference will be develpod across it on passing an alternating current of 0.2 amp.if the frequency of current be 50 hertz ? What will be the phase difference between the potential difference and current in the coil ?

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124. An a.c. voltage of 100 V, 50 Hz is connected across a 20 ohm resistor and 2 mH inductor in series. Calculate ltbr gt (i) impedance of the circuit, (ii) rms current in the circuit.

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125. A coil of inductance $0.50H$ and resistance 100Ω is connected to a $240V, 50Hz$ ac supply. What are the maximum current in the coil and the time lag between voltage maximum and current maximum?

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126. In a series RC circuit, R = 30 ohm, $C = 0.25 \mu F$, $V = 100V, \omega = 10000 rad / s$. Find the current in the circuit and calculate the voltage across the resistor and capacitor. Is the algebraic sum of these voltages more than the source voltage ? If yes, resolve the paradox.

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127. A $1 \mu F$ capacitor is connected to a 220 V, 50 Hz a.c. source. Find the virtual value of current through the circuit if a resistor of 100Ω is connected in series with the capacitor.

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128. When an electric device X is connected to a 220 volt, 50 hertz a.c. supply, the current is 0.5 amp, and is in same phase as the applied voltage. When another device Y is connected to the same supply, the electric current is again 0.5amp, but it leads the potential difference by $\pi / 2$ (i) What are the devices X and Y ? (ii) When X and Y are connected in serices across the same source, what will be the current ?

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129. Find the capacity of a condenser to run a 30 Volt, 10 watt lamp when connected in series with an alternating e.m.f. of 220 volt and frequency $50c/s$

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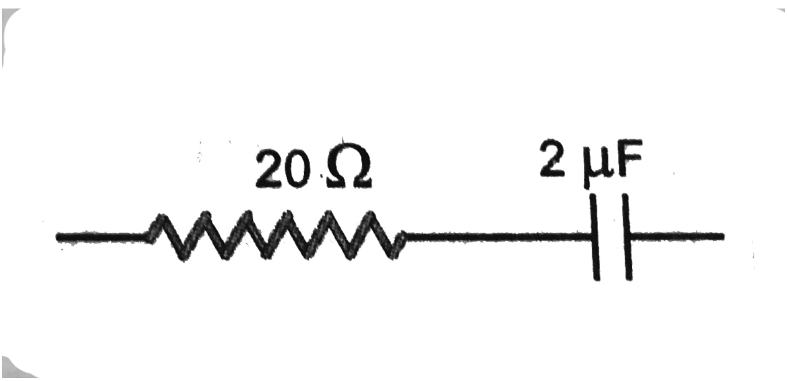
130. What will be the impedance of the adjoining circuit, Fig. (i) current source,(1)D.C (ii) an a.c. source of frequency $25/\pi$ kilohertz ?



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131. A circuit consists of a $2\mu F$ capacitor and a resistor of $1k\Omega$. An a.c. source of 12 V, 50 hz is connected across the circuit. Calculate (i) current flowing (ii) voltage across capacitor (iii) phase angle between voltage and current (iv) average power supplied.

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132. An inductor L, capacitor of $20\mu F$ and a resistor of 10Ω are connected in series with 220 V, 50 Hz a.c.

supply. If current is in phase with the voltage, calculate the inductance. What is the value of current in the circuit ?

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133. When a circuit element X is connected across on a.c. source of e.m.f. $220\sqrt{2}$ volt, current of $\sqrt{2}$ A flows through it in phase with the voltage. When another element Y is connected across the same a.c. source, the same current flows through the circuit, but it leads the voltage by $\pi/2$ radian. Name the circuit element X and Y.

Find the current that flows in the circuit when series combination of X and Y is connected across the same source.

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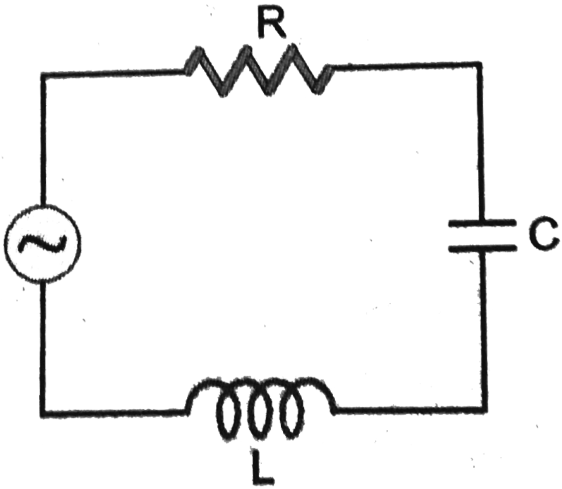
134. Fig. show a series LCR circuit with $L = 0.1 Hl, X_C = 14\Omega$ and $R = 12\Omega$ connected to a 50 Hz, 200 V source. Calculate

(i) current in the circuit and

(ii) phase angle between current and voltage.

Take $\pi = 3$



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135. A $50\mu F$ capacitor, 0.05 H inductor and 48Ω resistor are connected in series with an a.c. source of e.m.f. $E = 310 \sin 314t$. Calculate reactance of the circuit. What is its nature ?

What is phase angle between current and applied e.m.f. ?

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136. A $25\mu F$ capacitor, a $0.1H$ inductor and a 25Ω resistor are connected in series with an ac source of emf $E = 310\sin 314t$. Find

(a) the frequency of the emf

(b) The reactance of the circuit

(c) the impedance of the circuit

(d) the current in the circuit.

(e) the phase angle

(f) the effective voltages across the capacitor, inductor and resistor.

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137. A 40 ohm resistor, 3 mH inductor and $2\mu F$ capacitor are connected in series to a 110 V, 5000 Hz a.c. source. Calculate the value of current in the circuit.

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138. A series LCR circuit having $L = 10mH$, $C = (400/\pi^2)\mu F$ and R = 55 ohm is connected to 220 v variable frequency a.c. supply.

(i) Find frequency of source, for which average power absorbed by the circuit is maximum

(ii) Calculate the amplitude of current.

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139. A variable frequency 230 V alternating voltage source is connected across a series combination of $L = 5.0H, C = 80\mu F$ and $R = 40\Omega$

(i) Calculate the angular frequency fo the source which drives the circuit in resonance.

(ii) Obtain r.m.s. the impedance of the circuit and amplitude of current at resonance frequency

(iii) Obtain r.m.s. potential drop across the three elements of the circuit at resonating frequency.

(iv) How do you explain the observation that the algerbraic sum of voltages across the three elements obtained is greater than the supplied voltage.

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140. An inductor of inductance $100mH$ is connected in series with a resistance, a variable capacitance and an AC source of frequency $2.0kHz$. What should be the value of the capacitance so that maximum current may be drawn into the circuit?

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141. An inductance of $2.0H$, a capacitance of $18\mu F$ and a resistance of $10k\Omega$ are connected to an AC source of $20V$ with adjustable frequency. (a) What frequency should be chosen to maximise the current in the circuit? (b) What is the value of this maximum current?

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142. A series LER circuit with $C = 80\mu F$, L = 5.0 H and $R = 40\Omega$ is connected to a variable frequency 240 V a.c. source Calculate

(i) angular frequency of the source which drives the circuit in resonanace.

(ii) current at the resonating frequency.

(iii) rms pot. drop across the capacitor.

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143. In a series LCR circuit, the resonance frequency is 800 Hz. The half power points are obtained at frequencies 745 and 855 Hz. Calcualte the Q factor of the circuit and the band width.

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144. A capacitor, a resistor and a 40 mH inductor are connected in series to an a.c. source of frequency 60 Hz. Calculate the capacitance of the capacitor,if current is in phase with the voltage.

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145. A coil of inductance 150 mH is connected in series with a variable capacitor of capacitance 20 pF to 500 pF. Calculte the frequency range to which the circuit can be tuned.

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146. A capacitor of $50\mu F$, a resistor of 10 ohm and an inductor L are in series with an a.c. source of frequency 50 Hz. Calculate the value of L if phase angle between current and voltage is zero.

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147. A transmitter transmits at a wavelength of $300m$. A condenser of capacitance $2.4\mu F$ is being used. The value of the inductance for the resonant circuit is approximately

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148. A resistor of resistance 400 ohm and a capacitor of reactance 200 ohm are connected in series ot a 200 V, 50 Hz source. If the current in the circuit is 0.49 A, find the voltage across the resistor and capacitor. What is the value of inductance required so that ane current are in phase ?

149. A capacitor of unknown capacitance, a resistance of 100 ohm and an inductor of inductance $L = 4/\pi^2$ henry are connected in series across an a.c. source of 200 V, 50 Hz. Calculate the value of capactance and the current that flows in the circuit, when the current is in phase with the voltage.

150. Obtain the resonant frequency and Q factor of a series LCR circuit with L = 3.0 H, $C = 27\mu F$ and R = 7.4 ohm.

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151. A $10\mu F$ capacitor is charged to a potential of 25 V. The battery is then disconnected and a pure 100 mH coil is connected across the capacitor so that LC oscillations are set-up. What is the maximum current in the coil ?

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152. An emf $E = 100 \sin 314tV$ is applied across a pure capacitor of $637 \mu F$. Find

(a) the instantaneous current I

(b) the instantaneous power P

(c) the frequency of power

(d) the maximum energy stored in the capacitor.

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153. Find the natural frequency of a circuit containing inductance of 100μ H and a capacity of 0.01 mu F`. To which wavlength, its response will be maxmum ? For how long will the oscillations continue ?

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154. A $100\mu F$ capacitor is charged to a potentail of 50 V. The battery is then disconnected to it. Calculate maximum current in the coil and frequency of LC oscillations

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155. A capacitor of capacitance $54\mu F$ is charged ot a potential of 25 V and then connected to a 15 mH inductor to produce oscillations. What was the energy stored in the capacitor initially and to what wavelength will the circuit respond ?

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156. A series LCR circuit is made by taking $R = 100\Omega, L = \frac{2}{\pi}$ and $C = \frac{100}{\pi}\mu F$. The series combination is connected across an a.c. source of 220 V, 50 Hz. Calculate impedance of the circuit and peak value of current flowing n the circuit. What is power factor of the circuit ?

Compare it with one at resonance frequency.

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157. A resistro R and an element X are connected in series to a.c. source of voltage. The voltage is found to lead the current in phase by $\pi/4$. If X is replaced by another element Y, the voltage lags behind the current by $\pi/4$. Identify elements X and Y. when both X and Y are connected in series with R, to the same, will the power dissipated in the circuit be maximum of minimum ? Justify you answer.

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158. An inductor of unknown value, a capacitor of $100 \mu F$ and a resistor of 10 ohm are conneted in series to a 200 V, 50 Hz a.c. source It is found that power factor of the circuit is unity. Calculate inductance of the inductor and current amplitude.

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159. You are given three circuits X, Y and Z when the element X is connected across an a.c. source of a given voltage, the current and voltage are in same

phase. When element Y is connected in series with X across the source, voltage is ahead of voltage by $\pi/4$. But the current is ahead of voltage by $\pi/4$, when Z is connected series with X, across the source. Identify the circuit elements X, Y and Z.

When all the three elements are connected in series across the same source, determine the impedance of the circuit . Draw a plot of current versus the frequency of applied source and mention the significance of this plot.

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160. A circuit containing an $80mH$ inductor and a $60\mu F$ capacitor in series is connected to a $230V - 50Hz$ Supply. The resistance in the circuit is negligible .

(a) Obtain the current amplitude and rms currents.

(b) Obtain the rms values of voltage across inductor and capacitor.

(c) What is the average power transferred to the inductor and to the capacitor?

(d) What is the total power absorbed by the circuit?

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161. A group of electric bulbs have a power rating of 300 watt. An a.c. voltage V - 314 sin $(314t + \pi/3)$ is applied to the group. Calculate the effective current.

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162. A 60 cycle AC circuit has a resistance of 200Ω and inductance of 10 mH. What is the power fortor? What capacitance placed in the circuit will make the power factor unity?

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163. Find the capacity of a capacitor, which when put in series with a 10 ohm resistor, makes the power factor equal to 0.5. Assume an 80 V - 100 Hz a.c. supply.

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164. An $L-C-R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular frequency $300rad/s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°.

Calculate the current and the power dissipated in the $L - C - R$ circuit

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165. A capacitor and a resistor are connected in series with an a.c. source. If the potential difference across C, R are 120 V and 90 V repectively, and if rms value of current is 3 A, calculate impedance and power factor of the circuit.

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166. A 200 V varialbe frequency a.c. source is connected to a series combination the angular $C = 80\mu F$ and $R = 40\Omega$. Calculate the angular frequency of the soucre to get maximum current in the cicuit, the current amplitude at resonance and power dissipated in the circuit.

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167. An inductor 200 mH, capactior $500\mu F$, resistor 10 ohm are connected in series with a 100 V, varialbe frequency a.c. source. Calculate (i) frequency at which power factor of the circuit is unity (ii) current amplitude at this frequency (iii) Q factor.

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168. A coil having resistance 15Ω and inductance $10H$ is connected across a 90 Volt dc supply. Determine the value of current after $2\sec$, What is the energy stored in the magnetic field at that instant.

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169. An inductor coil stores 32 J of magnetic field energy and dissiopates energy as heat at the rate of 320 W when a current of 4 A is passed through it. Find the time constant of the circuit when this coil is joined across on ideal battery.

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170. A resistor of resistance 100Ω is connected to an AC source $\varepsilon = (12V)\sin(250\pi s^{-1})t$. Find the energy dissipated as heat during $t = 0$ to $t = 1.0ms$.

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171. A $1.5\mu F$ capacitor is charged to 57 volt.The charging battery is then disconnected and a 12 mH coil is connected across the capacitor so that is zero, what is the maximum value of current in the coil ?

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172. An alternating current of 1.5 mA and angular frequency $\omega = 300 \quad radian / \sec$ flows through $10k\Omega$ resistor and a $0.50\mu F$ capacitor in series. Find the r.m.s. voltages across the capacitor and impedance of the circuit.

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173. A coil of inductance 1.0 H and resistance 100 Omega is connected to a battery of emf 12 V. Find the energy stored in the magnetic field associated with the coil at an instant 10 ms after the circuit is switched on.

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174. The dielectric strength of air is $3.0 \times 10^6 \frac{V}{m}$. A parallel-plate air-capacitor has area $20cm^2$ and plate separation $0.10mm$.Find the maximum rms voltage of an AC source which can be safely connected to this capacitor.

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175. A choke of 0.5 H, a capacitor of $15\mu F$ and resistance of 100 ohm are connected in series across 200 V, 50 Hz main. Find current in the circuit and power factor of the circuit.

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176. Calculate the value of inductance, which should be connected in series with a capacitance of $5\mu F$ and resistance of 10 ohm with a.c. source of 50 Hz, so that power factor of the circuit is unity.

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177. The peak value of alternating e.m.f. in a generator is given by $e_0 =$

A. NAB

B. $NAB\omega$

C. NAB v

D. none of these

Answer: B

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178. The frequency of a.c. generated depend on

A. speed of rotation of coil

B. amplitude of a.c

C. size of coil

D. all the above

Answer: A

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179. The from factor of an a.c. generator is given by

A. $\frac{I_{av}}{I_0}$

B. $\frac{I_0}{I_{av}}$

C. $\frac{I_{av}}{I_v}$

D. $\frac{I_v}{I_{av}}$

Answer: D

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180. State Fleming's left-hand rule.

A. a.c. generator

B. d.c. generator

C. choke coil

D. Transformers

Answer: D

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181. What is the role of the split-ring in an electric motor?

A. a.c. generator

B. d.c. generator

C. choke coil

D. Transformers

Answer: B

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182. The efficiency of d.c. motor is given by $\eta =$

A. $\frac{\text{back e.m.f.}}{\text{applied e.m.f.}}$

B. $\frac{\text{applied e.m.f.}}{\text{back e.m.f.}}$

C. back e.m.f. $\times$ applied e.m.f.

D. none of the above

Answer: A

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183. A transformer is an electrical device used for

A. producing direct current

B. producing alternating current

C. changing d.c. into a.c. inot a.c.

D. changing a.c. voltages

Answer: D

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184. The relation $\frac{E_s}{E_P} = \frac{n_s}{n_P}$ is applicable only be

A. a.c. generator

B. d.c. generator

C. induction coil

D. stepup/down transformer

Answer: D

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185. A battery of 12 V is connected to primary of a transformer with turns $n_s / n_P = 10$. Voltage across secondary would be

A. 120 V

B. 1.2 V

C. 12 V

D. Zero

Answer: D

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186. Out of the following , choose the wrong statement :

A. A transformer cannot work on d.c.

B. A transformer connot change the frequency of a.c.

C. A tranformer can produce a.c. power

D. In a transformer, when a.c. voltage is raised n times, the alternating current reduces to $1/n$ time.

Answer: C

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187. An a.c. generator is a machine that produces...............from.................

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188. An a.c generator is based on the phenomenon of.................................

Watch Video Solution

189. In hydroelectric power station,..................of falling water is converted into ....

Watch Video Solution

190. A d.c. generator produces..................... from.....................

Watch Video Solution

191. In d.c. generator,.........................generator of a.c. generator is replaced by....................

Watch Video Solution

192. A d.c. motor converts ....into ....

Watch Video Solution

193. When a coil carrying current s ....it experincences ....which.....................the coil. This is the principle of............................

Watch Video Solution

194. In a.c. generator, we use.......................... to determine the direction of.......................

Watch Video Solution

195. In d.c. motor, we use.........................to determine the direction of........................

Watch Video Solution

196. A transformer is an electrical device that is used for .... It ....work on ....

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197. An a.c. generator consists of a coil of 100 turns and cross sectional area of $3m^2$, rotating at a constant angular speed of $60 rad/\sec$ in a uniform magnetic field of 0.04 T. The resistance of the coil is 500Ω. Calculate (i) maximum current drawn from the generator and (ii) max. power dissipation in the coil.

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198. An a.c. generator consists of a coil of 2000 turns each of area $80cm^2$ and rotating at an angular speed of 200 rpm in a uniform magnetic field of $4.8 \times 10^{-2} T$. Calculate the peak and rms value of emf. Induced in the coil

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199. A flat coil of 500 turns each of area $50 cm^2$ rotates in a uniform magnetic field of $0.14 Wb/m^2$ at an angular speed of $150 rad/\sec$. The coil has a resistance of 5Ω. The induced e.m.f. is applied to an external resistance of 10 ohm. Calculate the peak current through the resistance.

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200. A coil has 50 turns and its area is $500cm^2$. It is rotating at the rate of 50 r.p.s. at right angles to a magnetic field of $0.5Wb/m^2$. Calculate the maximum value of electromotive force developed across the ends of the coil.

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201. A generator develops an e.m.f. of 120 V and has a terminal potential difference of 115 V, when the amature current is 25 A. What is the resistance of the armature ?

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202. An a.c. generator consists of a coil of 50 turns and area $2.5m^2$ rotating att an angular speed of $60rads^{-1}$ in a uniform magnetic field B = 0.3 T between two fixed pole pieces. The resistance of the circuit including that of coil is 500Ω. Find (i) the max. current drawn from the generator.

(ii) What will be the orientaiton of the coil w.r.t. the magnetic field to have (a) maximum (b) zero magnetic flux ?

(iii) Would the generator work if the coil were stationary and instead, the pole pieces rotated together with the same speed as above ?

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203. A circular coil having 20 turns, each of radius 8 cm, is rotating about its vertical diameter with an angular speed of 50 rad/s in a uniform horizontal magnetic field of 30 mT. Obtain the maximum, average and rms value of e.m.f. induced in the coil. If the coil forms a closed loop of resistance 10 ohm, how much power is dissipated as heat

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204. The resistance of the armature of an electric motor is 55 ohm. The motor draw a current of 2 A when running at 220 V. What is the back e.m.f ?

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205. A motor has an armature resistance of 4 ohm. On a 240 V supply and a light load, the motor speed is 200 rpm and the armature current is 5 A Calculate the motor speed at a full load. When armature current is 20 A.

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206. A motor runs at 20 V. The resistance of the armature is 11 ohm. If the back emf produced is 198 V, when at full speed, then calculate the current through armature, when (i) motor is just switched on and (ii) motor is at full speed.

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207. In an ideal transformer, number of turns in primary and secondary are 200 and 1000 respectively. If the power input to the primary is 10 kW at 200 V, calculate (i) output voltage (ii) primary current.

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208. The primary of a transformer has 200 turns and secondary has 1000 turns. The power output from secondary at 1000 V is 9 kW. Calculate primary voltage and heat loss in primary. Take resistance of primary coil 0.2Ω and efficiency of transformer = 90%.

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209. A transformer has 200 primary turns and 150 secondary turns. If the operating voltage for the load connected to the secondary is measured to be 300 V, what is the voltage supplied to the primary ?

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210. The output voltage of an ideal transformer, connected to a 240 V a.c. mains is 24 V. when this transformer is used to light a bulb with rating 24 V, 24 W, calculate the current in the primary coil of the circuit.

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211. Calculate the current drawn by the primary of a tarnsformer which steps down 200 V to 20 V to operate a device of resistance 20 ohm. Assume the efficiency of transformer to be 80 %

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212. The ratio of the number of turns in primary and secondary coil of a step up transformer is 1:200. It is connected to a.c. mains of 220 volt. Calcualte the voltage developed in the secondary. Determine the maximum current in secondary coil, when a current of ampere flows through the primary.

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213. The primary coil of an ideal stepup transformer has 100 turns and the transformer ratio is also 100. The input voltage and power are 220 V and 1100 W. Calculate (i) number of turns in secondary (ii) current in primary (iii) voltage across secondary (iv) current in secondary (v) power in secondary.

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214. A step down transformer is used at 220 V to provide a current of 0.5 A to a 15 W bulb. If the secondary has 20 turns, find the number of turns in primary coil has current that flows in primary coil.

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215. A transformer whose efficiency is 90%, draws 5 A when 200 V is applied to its primary coil. If output is drawn at 300 V, what is the current in secondary coil ? If number of turns in primary coil is 500, what is the number of turns in secondary coil?

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216. A 10 kW transformer has 20 turns in primary and 100 turns in secondary circuit. A.C. voltage $E_1 = 600 \sin 314t$ is applied to the primary. Find max. value of flux and max. value of secondary voltage.

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217. An a.c. source of internal resistance 9000Ω is to supply current to a load resistor of 10 ohm. How should the source be matched to the load and what is the ratio of the currents passing through the load and the source ?

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218. A transformer with efficiency 80% works at $4kW$ and $100V$. If the secondary voltage is $200V$, then the primary and secondary currents are respectively

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219. An a.c. voltage of 200 V is applied to the primary of a transformer and voltage of 2000 V is obtained from the secondary . Calculate the ratio of currents through primary and secondary coils.

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220. A step down transformer converts a voltage of 2000 V inot 200 V in the transmission line. Number of turns in primary coil is 5000, efficiency of transformer is 80% and output power is 8 kW. Calculate input power and number of turns in secondary coil.

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221. A square of side L meters lies in the x-y plane in a region, where the magnetic field is give by

$B = B_0\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$T, where B_0 is constant. The magnitude of flux passing through the square is

A. $2B_0L^2Wb$

B. $3B_0L^2Wb$

C. $4B_0L^2Wb$

D. $\sqrt{29}B_0L^2Wb$

Answer: C

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222. A loop made of straight edegs has six corners at $A(0,0,0)$, $B(L,O,0) C(L,L,0)$, $D(0,L,0) E(0,L,L)$ and $F(0,0,L)$. Where L is in meter. A magnetic field $B = B_0\left(\hat{i}+\hat{k}\right) T$ is present in the region. The flux passing through the loop $ABCDEFA$ (in that order) is

A. $B_0 L^2 Wb$

B. $2B_0 L^2 Wb$

C. $\sqrt{2} B_0 L^2 Wb$

D. $4B_0 L^2 Wb$

Answer: B

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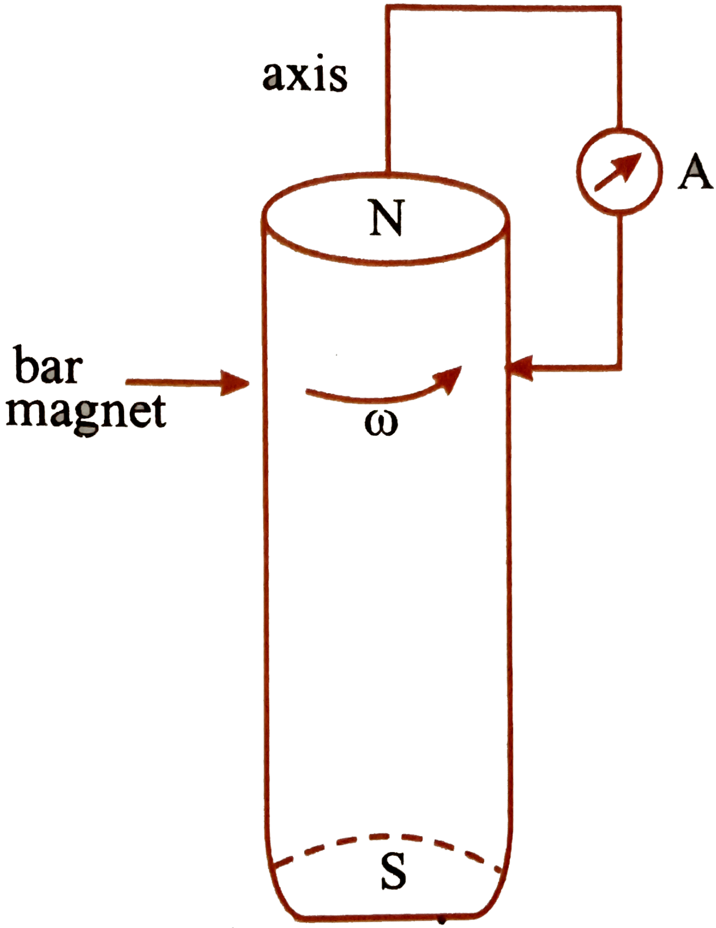
223. A cylindrical bar magnet is rotated about its axis (Figure). A wire is connect from the axis and is made to touch the cylindrical surface through a contact. Then



A. a direct current is flows in the ammeter A

B. no current flows through the ammeter A

C. an alternating sunusoidal current flows through the ammeter A with a time period $T = 2\pi / \omega$

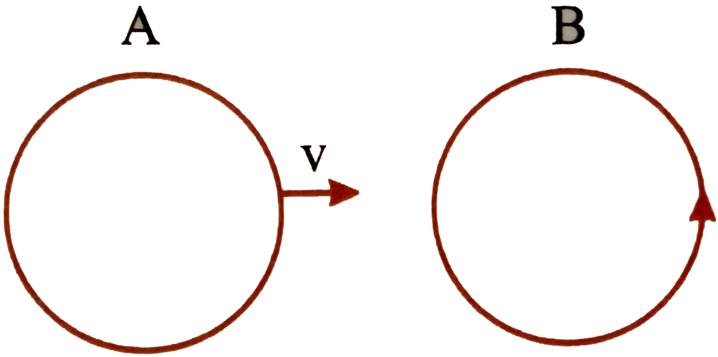
D. a time varying non-sinosoidal current flows through the ammeter A

Answer: B

Watch Video Solution

224. There are two coils A and B as shown in Figure. A current starts flowing in B as shown, when A is moved towards B and stops when A

stops moving. The current in A is counterclockwise. B is kept stationary when A moves. We can infer that



A. there is a constant current in the clockwise direction in A

B. there is a varying current in A

C. there is no current in A

D. there is a constant current in the counterclockwise direction in A

Answer: D

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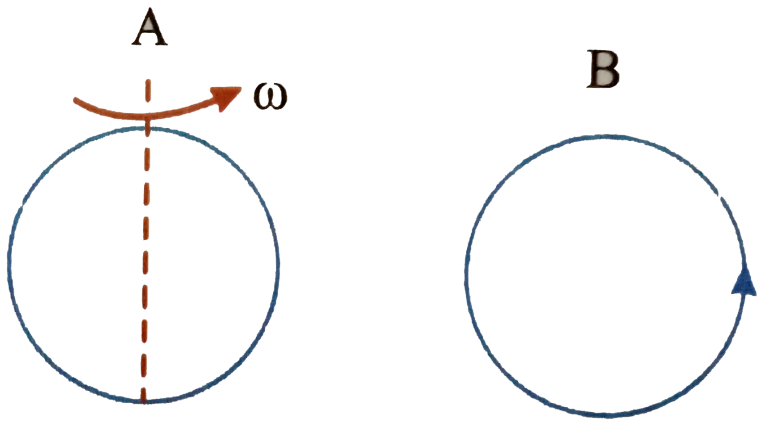
225. Same as problem 4 except the coil A is made to rotate about a vertical axis in the plane of the coil (Figure). No currents flows in B if A is at rest. The current in coil A, when the current in B (at $t = 0$) is counterclockwise and the coil A is as shown at this instant, $t = 0$, is



A. constant current clockwise

B. varying current clockwise

C. varying current counterclockwise

D. constant current counterclockwise

Answer: A

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226. 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 increase

B. l decreases and A increases

C. A increases and A decreases

D. both l and A decrease

Answer: B

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227. A metal plate is getting. 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 field, but does not vary with time

D. a current (either direct or alternating) is passing through the plate

Answer: A::B::D

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228. An e.m.f. is produced in a coil, which is not connected to an exteranl voltage source. This can be due to

A. the coil being in time varying magnetic field

B. the coil moving in a time varying magnetic field

C. the coil moving in constant magnetic field

D. the coil is stationary in external spatially varying magnetic field, which does not change with time

Answer: A::B::C

229. The mutual inductance M_{12} of coil 1 with respect to coil 2

A. increases when they are brought nearer

B. depends on the current passing through the coils

C. increases when one of them is rotated about an axis

D. is the same as M_{21} coil 2 with respect to coil 1

Answer: A::D

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230. A circular coil expands radially in a region of magnetic field and no electromotive force is produced in the coil. This can be because

A. the magnetic field is constant

B. the magnetic field is in the same plance as the circular coil and it may or may not vary

C. the magnetic field has a perpendicular whose magnitude is decreasing suitably

D. there is a constant magnetic field in the perpendicular (to the plane of the coil) direction

Answer: B::C

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231. If the rms current in a 50 Hz ac circuit is 5 A, the value of the current $1/300$ second after its value becomes zero is

A. $5\sqrt{2}A$

B. $5\sqrt{3/2}A$

C. $5/6A$

D. $5/\sqrt{2}A$

Answer: B

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232. An alternating current generator has an internal resistance R_g and an internal reactance X_g. It is used to supply power to a passive load consisting of a resistance R_g and a rectance 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

Answer: C

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233. When a voltage measuring device is connected to a.c. mains the meter shows the steady input voltage of $220V$. This means

A. input voltage can not be AC voltage, but a DC voltage

B. maximum input voltage is 220 V

C. the meter reads no v but $< v^2 >$ and is calibrated to read $\sqrt{< v^2 >}$

D. the pointer of meter is stuck by some mechanical defect

Answer: C

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234. To reduce the resonant frequency in an LCR series circuit with a generator

A. the generator frequency should be reduced

B. another capactior should be added in paralle to the first

C. the iron core of the inductor should be removed

D. dielectric in the capacitor should be removed

Answer: B

Watch Video Solution

235. Which of the following combinations should be selected for better turning of an LCR circuit used for communication ?

A. $R = 20\Omega, L = 1.5H, C = 35\mu F$

B. $R = 25\Omega, L = 2.5H, C = 45\mu F$

C. $R = 15\Omega, L = 3.5H, C = 30\mu F$

D. $R = 25\Omega, L = 1.5H, C = 45\mu F$

Answer: C

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236. A inductor of reactance 1Ω and a resistor of 2Ω are connected in series to the terminals of a 6 V (rms) a.c. source. The power dissipated in the circuit is

A. 8 W

B. 12 w

C. 14.4 W

D. 18 W

Answer: C

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237. The output of a step-down transformer is measured to be $24V$ when connected to a 12 watt light bulb. The value of the peak current is

A. $1\sqrt{2}A$

B. $\sqrt{2}A$

C. $2A$

D. $2\sqrt{2}A$

Answer: A

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238. As the frequency of an ac circuit increases, the current first increases and then decreases. What combination of circuit elements is most likely to comprise the circuit ?

A. Inductor and capacitor

B. Resistor and inductor

C. Resistor and capacitor

D. Resistor, inductor and capacitor.

Answer: A::D

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239. In an alternating current circuit consisting of elements in series, the current increases on increasing the frequency of supply. Which of the following elements are likely to consitute the circuit ?

A. Only resistor

B. Resistor and an inductor

C. Resistor and a capacitor

D. Only a capacitor.

Answer: C::D

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240. Electrical energy is transmitted over large distances at high alternating voltages. Which of the following statements is (are) correct?

A. For given powe level, there is a lower current

B. Lower current implies less power loss

C. Transmission lines can be made thinner

D. It is easy to reduce the voltage at the receiving end using step-down transformers

Answer: A::B::C::D

Watch Video Solution

241. For an LCR circuit, the power transferred from the driving source to the driven oscillator is $P = I^2 Z \cos \phi$.

A. Here, the power factor $\cos\phi \geq 0, P \geq 0$

B. The driving force can give no energy to the oscillator (P = 0) in some cases

C. The driving force can not syphon out $(p < 0)$ the energy out of oscillator

D. The driving force can take away eneryg out of the oscillator

Answer: A::B::C

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242. When an AC voltage of 220 V is applied to the capacitor C

A. the maximum voltage between plates is 220 V

B. the current is in phase with the applied voltage

C. the charge on the plates is in phase with the applied voltage

D. power delivered to the capacitor is zero

Answer: C::D

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243. The line the draws power supply to your house from street has

A. zero average current

B. 220 V average voltage

C. voltage and current out of phasea by 90°

D. voltage and current possibly differing in phase ϕ such that $|\phi| < \frac{\pi}{2}$

Answer: A::D

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244. In a uniform magneitc field of induced B a wire in the form of a semicircle of radius r rotates about the diameter of hte circle with an angular frequency ω. The axis of rotation is perpendicular to hte field. If the total resistance of hte circuit is R, the mean power generated per period of rotation is

A. $\frac{B\pi^2\omega}{2R}$

B. $\frac{\left(B\pi^2\omega\right)^2}{8R}$

C. $\frac{\left(B\pi^2\omega\right)^2}{8R}$

D. $\frac{\left(B\pi^2\omega\right)^2}{8R}$

Answer: D

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245. A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At centre of the solenoid is 100 turns coil of radius 0.01 m placed with its axis coinciding with solenoid axis. The current in the solenoid reduce at a constant rate to 0A from 4 a in 0.05 s . If the resistance of the coil is $10\pi^2\Omega$, the total charge flowing through the coil during this time is

A. $32\pi\mu C$

B. $16\mu C$

C. $32\mu C$

D. $16\pi\mu C$

Answer: C

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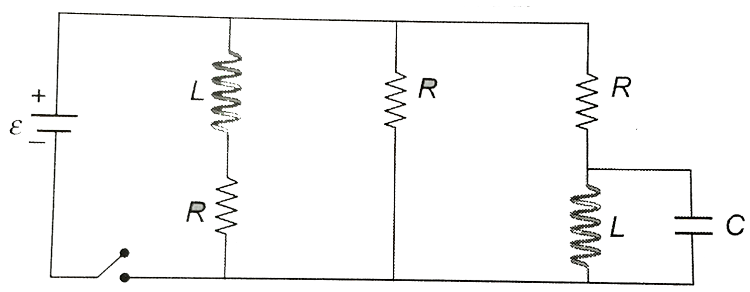
246. Figure shows a circuit that contains three identical resistors with resistance $R = 0.9\Omega$ each, two identical inductors with inductance $L = 2.0mH$ each, and an ideal battery with emf $\varepsilon = 18V$. The current i through the battery just after the switch closed is.......:



A. 2 mA

B. 0.2 A

C. `2 A

D. 0 ampere

Answer: C

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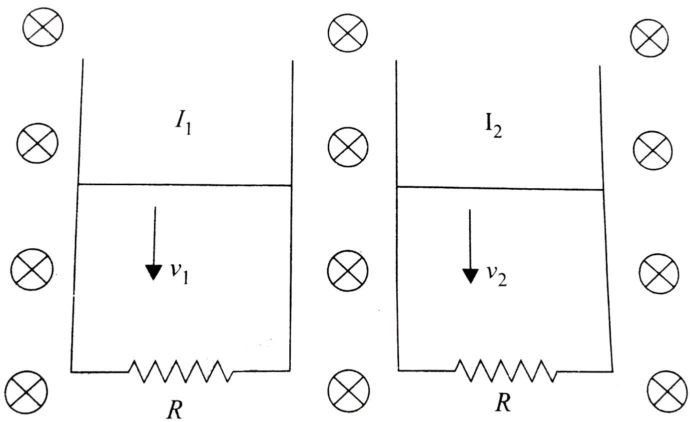
247. In a magnetic field as shown, in Fig. two horizontal wires of same mass and length l_1 and l_2 are free to slide on different vertical rails with velocities v_1 and v_2 respectively. If the resistance of two circuits are same and a_1 and a_2 are acceleration of two horizontal wires respectively, the condition for $a_1 > a_2$ is



A. $\frac{l_1}{l_2} = \frac{v_2}{v_1}$

B. $\frac{l_1}{l_2} = \left(\frac{v_2}{v_1}\right)^{1/2}$

C. $\frac{l_1}{l_2} > \left(\frac{v_2}{v_1}\right)^{1/2}$

D. $\frac{l_1}{l_2} > \left(\frac{v_2}{v_1}\right)$

Answer: B

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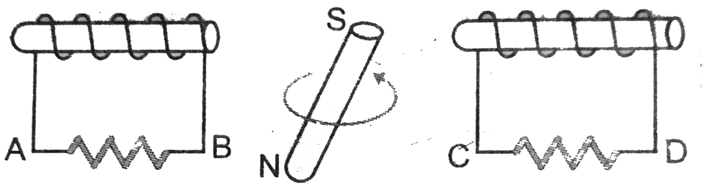
248. The magnet in fig. rotates as shown on a pivot through its center. At the instant shown, the directions of the induced currents are:



A. A to B and C to D

B. B to A and C to D

C. A to B and D to C

D. B to A and D to C

Answer: B

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249. A conducing circular loop is placed in a uniform magnetic field of indution B tesla with its plane normal to the field. Now, radius of the loop starts shrinking at the rate (dr / dt). Then the induced e.m.f. at the instant when the radius is r is:

A. $\pi r B\left(\frac{dr}{dt}\right)$

B. $2\pi r B\left(\frac{dr}{dt}\right)$

C. $\pi r^2\left(\frac{dr}{dt}\right)$

D. $\left(\frac{\pi r^2}{2}\right)^2\left(\frac{dt}{dt}\right)$

Answer: B

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250. A 50 Hz a.c. current of crest value 1A flows through the primary of a transformer. If the mutual inductance between the primary and secondary will be $1.5H$, the crest voltage induced in secondary is-

A. 75 V

B. 150 V

C. 100 V

D. none of these

Answer: C

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251. A coil having n turns and resistance $R \Omega$ is connected with a galvanometer of resistance $4R\Omega$. This combination is moved in time t seconds from a magnetic field W_1 weber to W_2 weber. The induced current in the circuit is

A. $\dfrac{\phi_2 - \phi_1}{5Rnt}$

B. $\dfrac{-n(\phi_2 - \phi_1)}{5Rnt}$

C. $\dfrac{-(\phi_2 - \phi_1)}{Rnt}$

D. $\dfrac{-n(\phi_2 - \phi_1)}{5Rt}$

Answer: B

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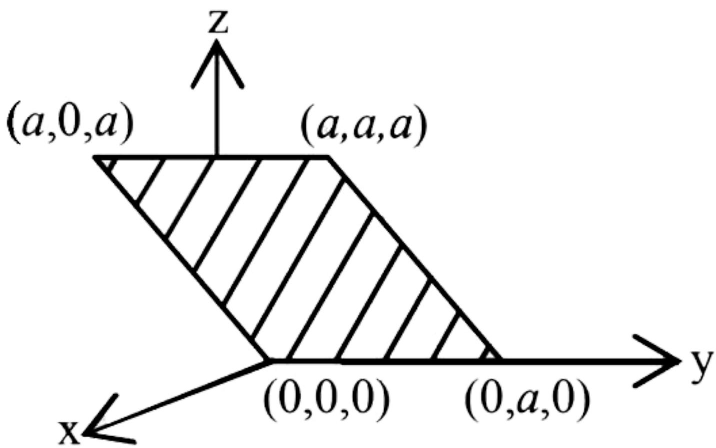
252. Conisder an electric field $\overrightarrow{E} = E_0\hat{x}$ where E_0 is a constant .

The flux through the shaded area (as shown in the figure) due to this field is



A. $2E_0a^2$

B. $\sqrt{2}E_0a^2$

C. E_0a^2

D. $\dfrac{E_0a^2}{\sqrt{2}}$

Answer: C

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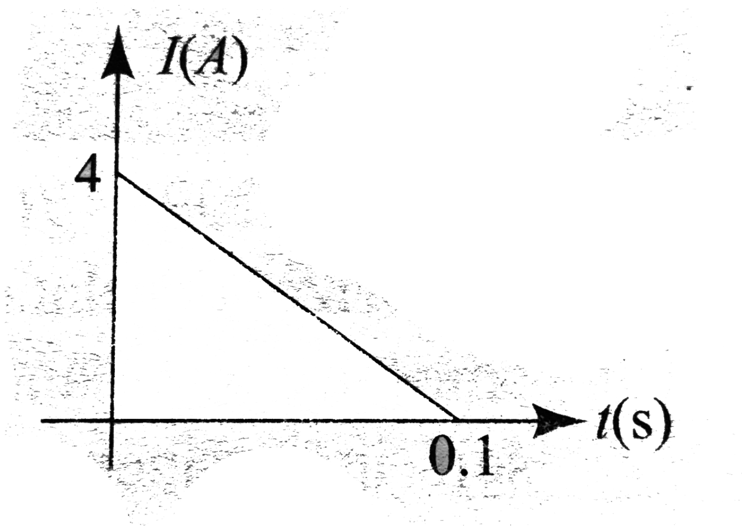
253. Some magnetic flux is changed from a coil of resistance 10Ω. As a result, an induced current is developed it, which varies with time as shown in Fig. Find the magnitude of the change in flux through the coil in weber.



A. 2

B. 4

C. 6

D. none of these

Answer: A

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254. A Pair of coils of turns n_1 and n_2 are kept close together. Current passing through the first is reduced at r, and emf 3 mV is developed across the other coil. If the second coil carries current which is then reduced at the rate 2 r, the emf produced across the first coil will be

A. $\frac{6n_1}{n_2}mV$

B. $\frac{6n_2}{n_1}mV$

C. 6 mV

D. $3/2mV$

Answer: C

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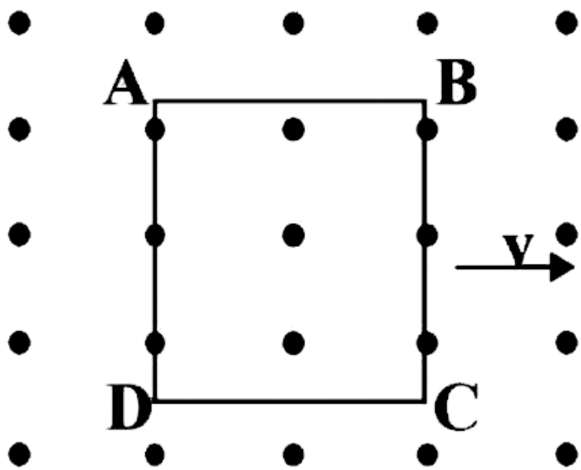
255. A metallic square loop ABCD is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in the figure. An electric field is induced



A. in AD, but not in BC

B. in BC, but not in AD

C. neither in AD nor in BC

D. in both AD and BC

Answer: D

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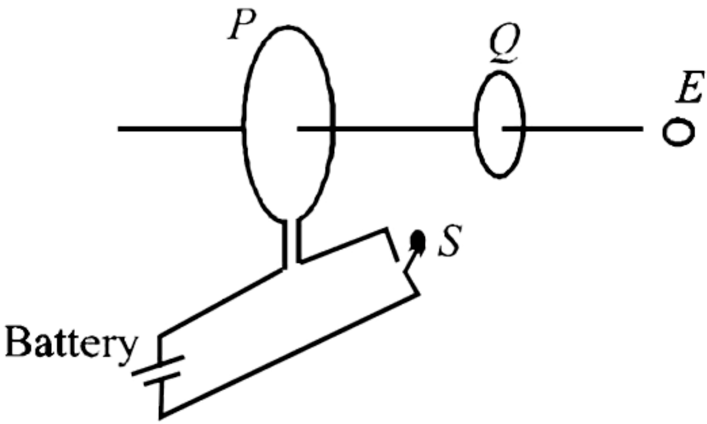
256. As shown in the figure, P and Q are two coaxial conducting loops separated by some distance. When the switch S is closed, a clockwise current I_P (as seen by E) and an induced current I_{Q1} flows in

Q. The switch remains closed for a long time. when S is opened, a current I_{Q2} flows in Q. Then the direction IQ_1 and IQ_2 (as seen by E) are



A. respectively clockwise and anticlockwise

B. both clockwise

C. both anticlockwise

D. respectively anticlockwise and clockwise

Answer: D

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257. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be

A. halved

B. the same

C. doubled

D. quadrupled

Answer: D

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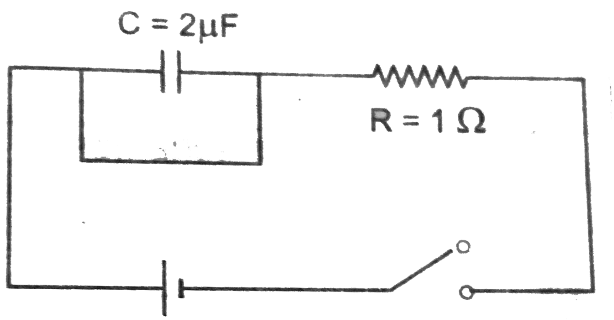
258. The capacitive time constant of the RC circuit shown in the figure.



A. zero

B. infinity

C. 2 s

D. $2\mu s$

Answer: B

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259. A closed coil consists of 500 turns has area $4cm^2$ and a resistance of 50Ω. The coil is kept with its plane perpendicular to a uniform magnetic field of $0.2W\frac{b}{m^2}$. Calculate the amount of charge flowing through the coil if it is rotated through 180°

A. $1.67 \times 10^{-2} C$

B. $1.67 \times 10^{-3} C$

C. $1.67 \times 10^{-4} C$

D. $1.76 \times 10^{-3} C$

Answer: D

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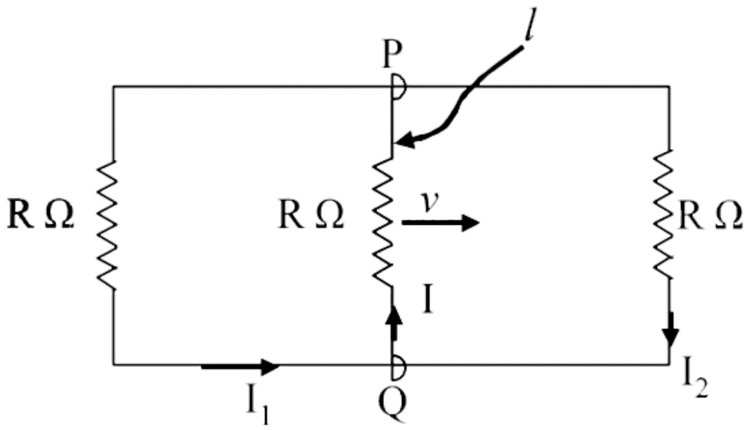
260. A rectangular loop has a sliding connector PQ of length l and resistance $R(\Omega)$ and it is moving with a speed v as shown. The set-up is placed in a uniform magnetic field going into the plane of the paper. The three currents I_1, I_2 and I are



A. $I_1 = I_2 = \dfrac{Blv}{3R}, I = \dfrac{2Blv}{3R}$

B. $I_1 = I_2 = I = \dfrac{Blv}{R}$

C. $I_1 = I_2 = \frac{Blv}{6R}, I = \frac{Blv}{3R}$

D. $I_1 = I_2 = \frac{Blv}{R}, I = \frac{2Blv}{R}$

Answer: A

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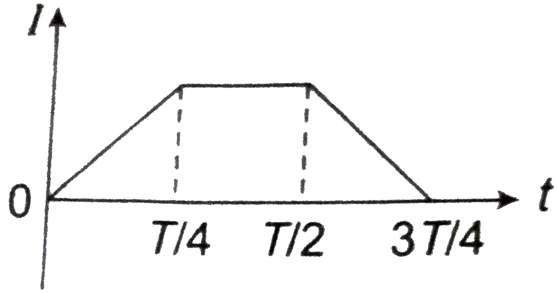
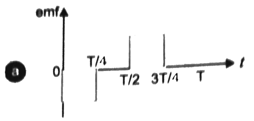
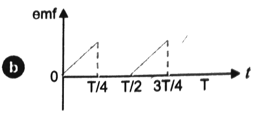
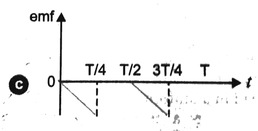
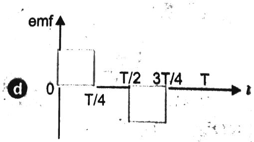
261. The current i in a coil varies with time as shown in the figure. The variation of induced emf with time would be



A. 

B. 

C. 

D. 

Answer: A

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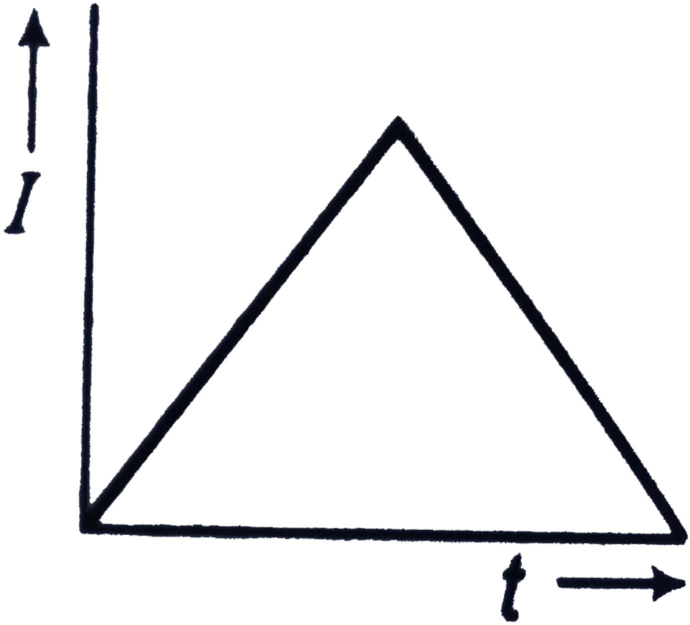
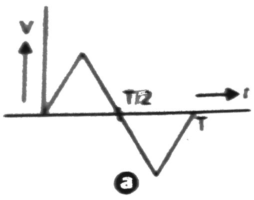
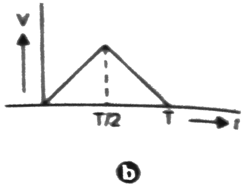
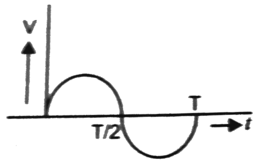
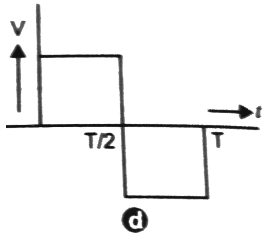
262. An alternating current I in an inductance coil varies with time t according to the graph as shown: Which one of the following graph gives the variation of voltage with time?



A. 

B. 

C. 

D. 

Answer: D

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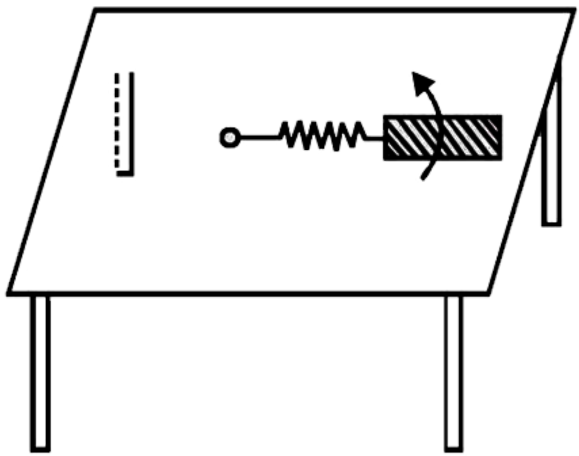
263. A metallic rod of length 'l' is tied to a string of length 2l and made to rotate with angular speed w on a horizontal table with one end of the string fixed. If there is a vertical magnetic field 'B' in the region, the e.m.f. Induced across the ends of the rod

is



A. $\dfrac{2B\omega l^2}{2}$

B. $\dfrac{3B\omega L^2}{2}$

C. $\dfrac{5B\omega l^2}{2}$

D. $\dfrac{4B\omega L^2}{2}$

Answer: C

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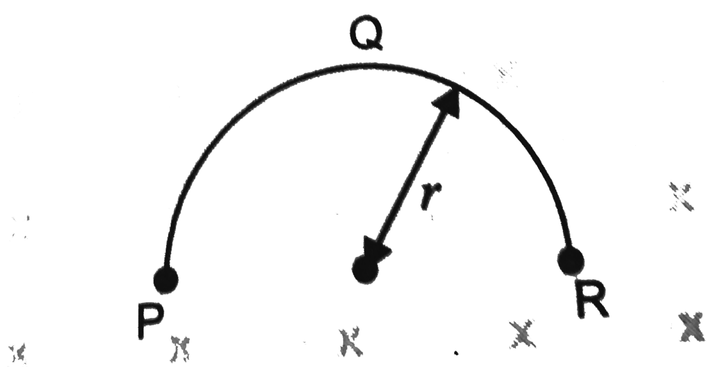
264. A thin semicircuilar conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in Fig. The potential difference developed across the ring when its speed is v, is



A. zero

B. $Bv\pi r^2$ and P is at higher potential

C. πrBv and R is at higher potential

D. $2rBv$ and R is at higher potential

Answer: D

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265. A small square loop of wire of side l is placed inside a large square loop of wire of side $L(L > > l)$. The loops are co-planer and their centres coincide. The mutual inductance of the system is proportional to

A. l/L

B. l^2/L

C. L/l

D. L^2/l

Answer: B

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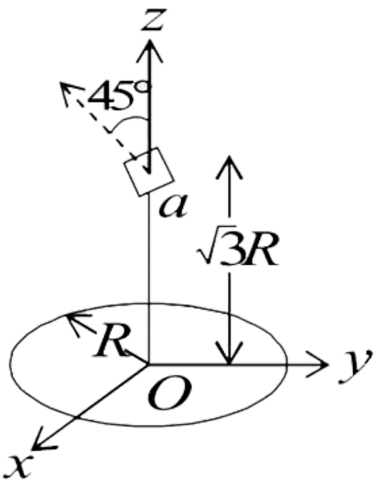
266. A circular wire loop of radius R is placed in the x-y plane centered at the origin O. A square loop of side a ($a < < R$) having two turns is placed with its centre at $= \sqrt{3}R$ along the axis of hte circular wire loop, as shown in figure. The plane of the square loop makes an angle of 45° with respect to the z-axis. If the mutual inductance between the loops is given bu $\frac{\mu_0 a^2}{2^{p/2}R}$, then the value of p is



A. 2

B. 4

C. 7

D. 9

Answer: C

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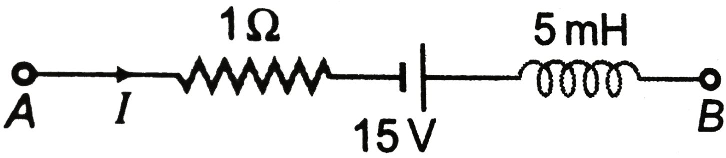
267. The network shown in the figure is a part of complete circuit. What is the potential difference $V_B - V_A$ when the current I is $5A$ and is decreasing at a rate of $10^3 A / s$?



A. 5 V

B. 10 V

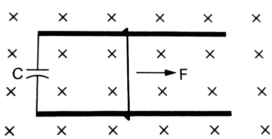
C. 15 V

D. 20 v

Answer: C

Watch Video Solution

268. A wire of mass m and length l can freely slide on a pair of parallel, smooth, horizontal rails placed in a vertical magnetic field B . The rails are connected by a capacitor of capacitance C. The electric resistance of the rails and the wire is zero. If a constant force F acts on the wire as shown in the figure, find the acceleration of the wire.



A. $a = \dfrac{C^2B^2l - F}{m}$

B. $a = \dfrac{F}{m + CBl}$

C. $a = \dfrac{FC^2B^2l}{m}$

D. $a = \dfrac{F}{m + cB^2 l^2}$

Answer: D

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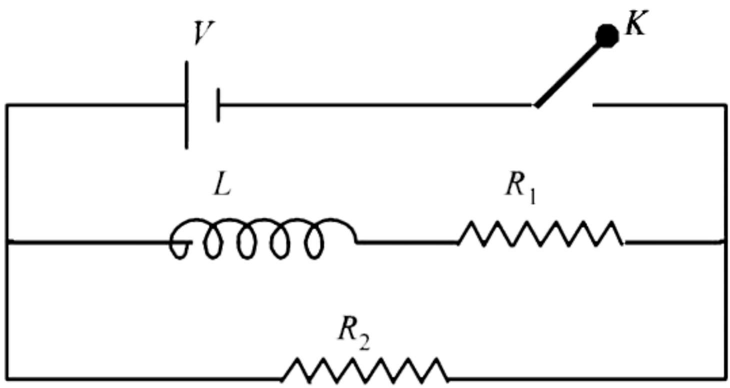
269. In the circuit shown below, the key K is closed at t =0. The current through the battery is



A. $\frac{V}{R_2} att = 0$ and $\frac{VR_1R_2}{R_1^2 + R_2^2} at = t = \propto$

B. $\frac{V}{R_2} att = 0$ and $\frac{VR_1R_2}{\sqrt{R_1^2 + R_2^2}} at = t = \propto$

C. $\frac{V(R_1R_2)}{R_1^2 + R_2^2} at = t = 0$ and $\frac{V}{R_2} att = \propto$

D. $\frac{VR_1R_2}{\sqrt{R_1^2 + R_2^2}} at = t = 0$ and $\frac{V}{R_2} att = \propto$

Answer: A

Watch Video Solution

270. A resistor 'R' and $2(\mu)F$ capacitor in series is connected through a switch to 200 V direct supply. A cross the capacitor is a neon bulb that lights up at 120 V. Calculate the value of R to make the bulb light up 5 s after the switch has been closed. ($\log_{10} 2.5 = 0.4$)

A. $1.7 \times 10^5 \Omega$

B. $2.7 \times 10^6 \Omega$

C. $3.3 \times 10^7 \Omega$

D. $1.3 \times 10^4 \Omega$

Answer: B

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271. LetC be the capacitance of a capacitor discharging through a resistor R. Suppose t_1 is the time taken for the energy stored in the capacitor to reduce to half its initial value and t_2 is the time taken for the charge to reduce to one-fourth its initial value. Then the ratio t_1 / t_2 will be

A. 2

B. 1

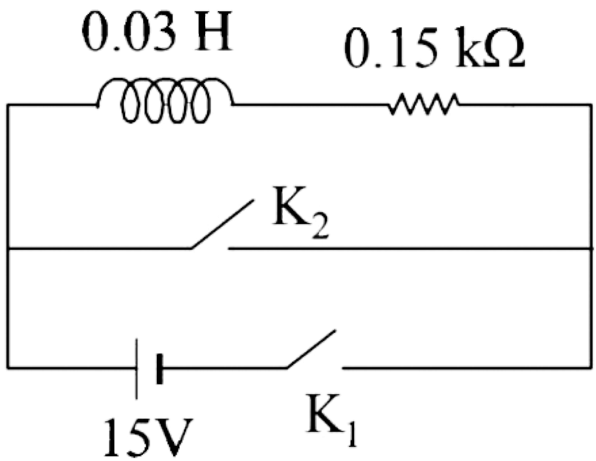
C. $\frac{1}{2}$

D. $\frac{1}{4}$

Answer: D

Watch Video Solution

272. An inductor (L =0.03 H) and a resistor $(R = 0.15k(\Omega))$ are connected in series to a battery of 15 V EMF in a circuit shown below. The key K_1 is opened and Key K_2 is closed simultaneously. At t =1 ms, the current in the circuit will be $(e^5 = 150)$



A. 100 mA

B. 67 mA

C. 6.7 mA

D. 0.67 mA

Answer: D

Watch Video Solution

273. A 150 ohm resistor and inductor of inductance L are connected in series to a 200 V, 50 Hz source of negligilbe impedance. The current comes to 1 A.

when the source is changed to 400 V, 100 Hz, the current will be

A. less than 1.0 A

B. 1.0 A

C. between 1 A and 2 A

D. between 4A and 2 A

Answer: C

Watch Video Solution

274. In a circuit, the instantaneous values of alternating current and voltages in a circuit is given by

$I = \frac{12}{\sqrt{2}} \sin(100\pi t) A$ and

$E = \frac{1}{\sqrt{2}} \sin\left(100\pi t + \frac{\pi}{3}\right) V.$

The average power in watts consumed in the circui is

A. $\frac{1}{4}$

B. $\frac{\sqrt{3}}{4}$

C. $\frac{1}{2}$

D. $\frac{1}{8}$

Answer: D

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275. In an ac circuit , $L = \frac{0.4}{\pi} H$ and $R = 30\Omega$. If the circuit has an alternating emf of 220 V, 50 cps, the impedance and the current in the circuit will be :

A. 40.4Ω, $4.4A$

B. 50Ω, $4.4A$

C. 3.07Ω, $6.2A$

D. 11.4Ω, 17.5Ω

Answer: B

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276. In an ac circuit , an alternating voltage $e = 200\sqrt{2}\sin 100t$ volts is connected to a capacitor of capacitance $1\mu F$. The rms value of the current in the circuit is :

A. 20 mA

B. 10 mA

C. 100 mA

D. 200 mA

Answer: A

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277. An ideal coil of 10H is connected in series with a resistance of $5(\Omega)$ and a battery of 5V. 2second after the connections is made, the current flowing in ampere in the circuit is

A. $\left(1-e^{-1}\right)$

B. $(1-e)$

C. e

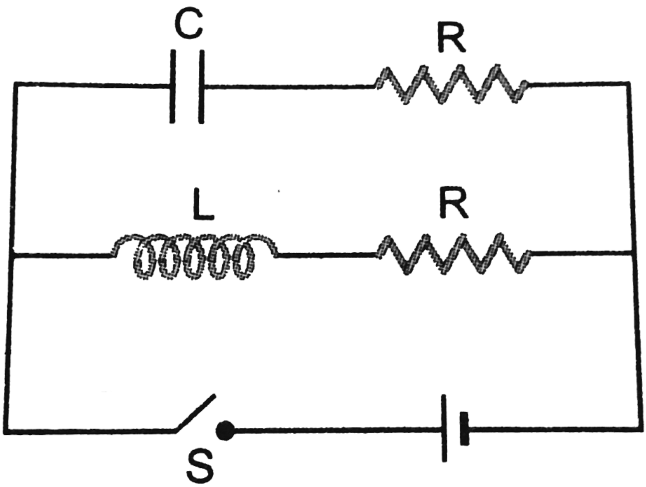
D. e^{-1}

Answer: A

Watch Video Solution

278. In the circuit shown if Fig. the switch S is closed at time t = 0. The current through the capacitor and inductor will be equal at time t equal (given

$$R = \sqrt{L/C}$$



A. RC

B. $RC \log_e 2$

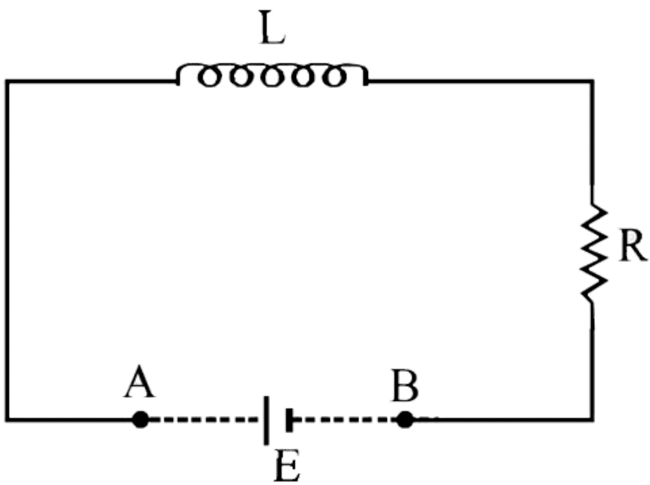
C. $\frac{1}{R \log_e}$

D. LR

Answer: B

Watch Video Solution

279. An inductor $(L = 100mH)$, a resistor $(R = 100(\Omega))$ and a battery $(E = 100V)$ are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the point A and B. The current in the circuit 1 ms after the short circuit is



A. e A

B. $0.1A$

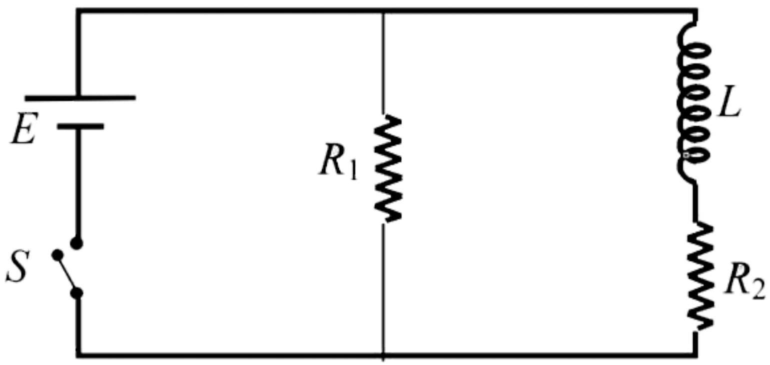
C. $1A$

D. $\frac{1}{e}A$

Answer: D

Watch Video Solution

280. An inductor of inductance L=400 mH and resistor of resistance $R_1 = 2(\Omega)$ and $R_2 = 2(\Omega)$ are connected to a battery of emf E = 12 Vas shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at time t =0. What is the potential drop across L as a function of time? After the steady state is reached, the switch is opened. What is the direction and the magnitude of current through R_1 as a function of time?



A. $\frac{12}{t} e^{-t} V$

B. $6\left(1 - e^{-t/0.2}\right) V$

C. $12e^{-5t} V$

D. $6e^{-5t}V$

Answer: C

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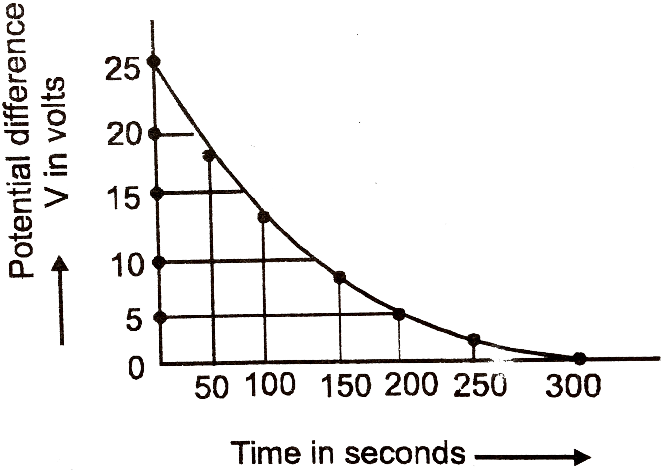
281. The figure shows an experimental plot discharging of a capacitor in an RC circuit. The time constant of this circuit lies between:



A. 150 sec and 200 sec

B. 0 and 50 sec

C. 50 sec and 100 sec

D. 100 sec and 150 sec

Answer: D

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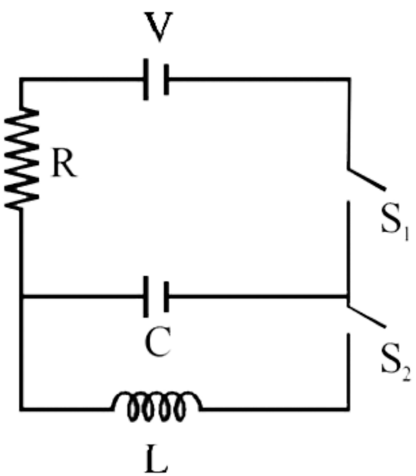
282. In an LCR circuit as shown below both switches are open initially. Now switch S_1 kept open. (q is charge on the capacitor and $\tau = RC$ is Capacitive time constant). Which of the following statement is correct?



A. Work done by the battery is half of the energy dissipated in the resistor

B. At $t = \tau$, $q = CV/2$

C. At $t = 2\tau$, $q = CV(1 - e^{-2})$

D. At $t = \frac{\tau}{2}$, $q = CV(1 - e^{-1})$.

Answer: C

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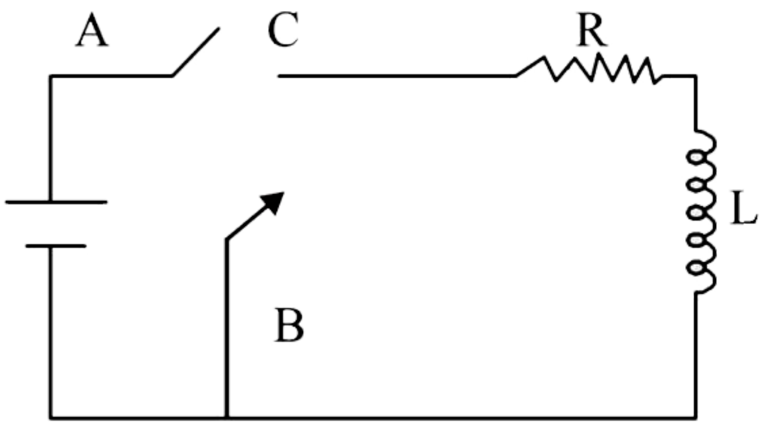
283. In the circuit shown here, the point 'C' is kept connected to point 'A' till the current flowing through the circuit becomes constant. Afterward, suddenly, point 'C' is disconnected from point 'A' an connected to point 'B' at time t =0. Ratio of the voltage across resistance and the inductor at $t = L/R$ will be equal to:



A. -1

B. $\frac{1-e}{e}$

C. $\frac{e}{1-e}$

D. 1

Answer: D

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284. A pure resistive circuit element X when connected to an a.c. supply of peak voltage $200V$ gives a peak current of $5A$. A second current element Y when connected to same a.c. supply gives the same value of peak current but the current lags behind by 90°. If series combination of X and Y is connected to the same supply, what is the impedance of the circuit ?

A. $40\sqrt{2}ohm$

B. 40Ω

C. 80Ω

D. $2\sqrt{40}ohm$

Answer: A

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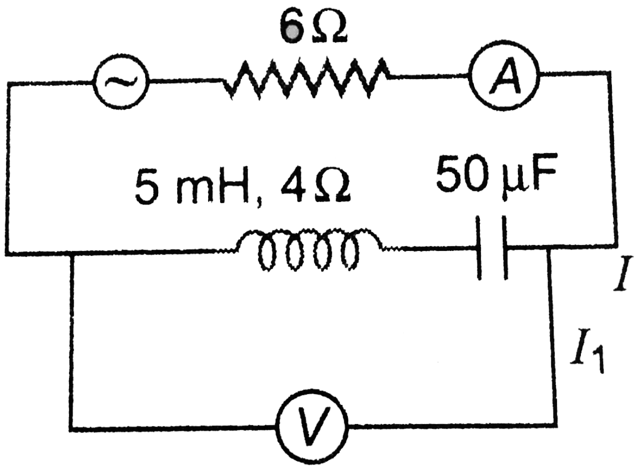
285. In the circuit shown in figureure the AC source gives a voltage $V = 20\cos(2000t)$. Neglecting source resistance, the voltmeter and and ammeter readings will be



A. $0V, 0.47A$

B. $1.68V, 0.47A$

C. $4\sqrt{2}V, \sqrt{2}A$

D. $2\sqrt{2}A, oA$

Answer: C

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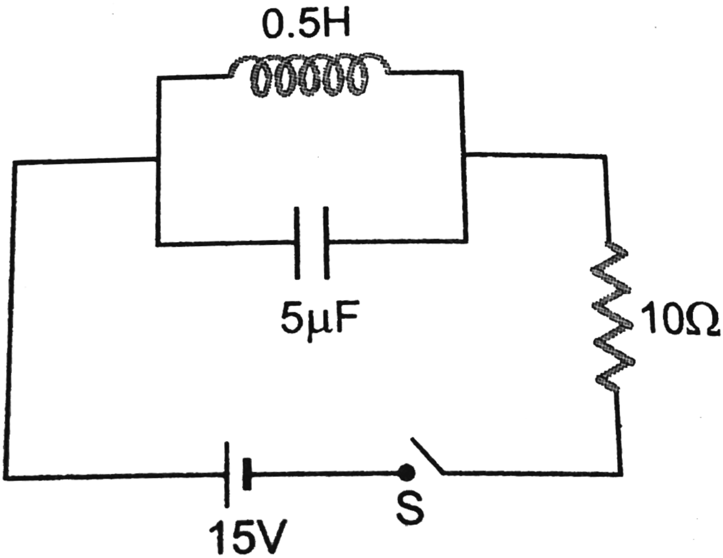
286. In the circuit shown in Fig. currrent through the battery at $t=0$ and $t=\infty$ is



A. $1.5A$, $1.5A$

B. 0, 0

C. $1A, 1.5A$

D. $1.5A, 0$

Answer: A

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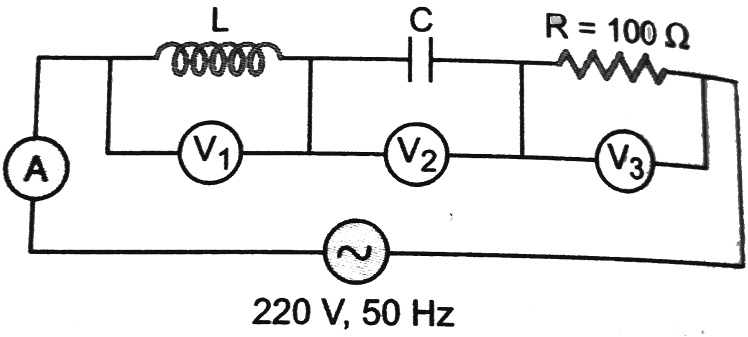
287. In the given circuit, Fig., the reading of voltmeter V_1 and V_2 300 votls each. The reading of the voltemeter V_3 and ammeter A are respectively



A. $150V, 2.2A$

B. $220V, 2.2A$

C. $220V, 2.0A$

D. $100V, 2.0A$

Answer: B

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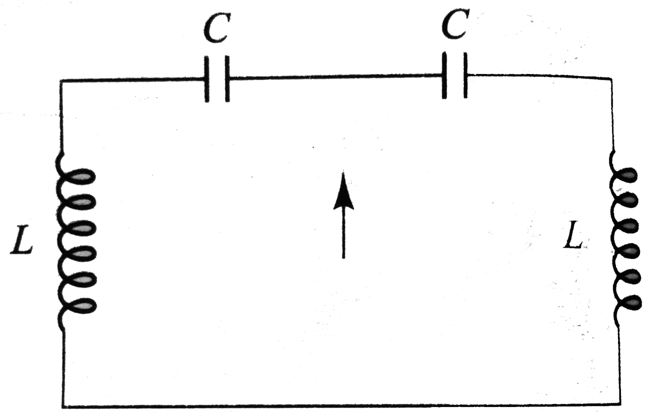
288. The natural frequency of the circuit shows in Fig. is



A. $\dfrac{1}{2\pi\sqrt{LC}}$

B. $\dfrac{1}{2\pi\sqrt{2LC}}$

C. $\dfrac{2}{2\pi\sqrt{LC}}$

D. none of these

Answer: A

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289. An $L-C-R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular frequency $300 rad / s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L-C-R$ circuit

A. $50W$

B. $100W$

C. $200W$

D. $400W$

Answer: D

Watch Video Solution

290. In a certain circuit current changes with time accroding to $i = 2\sqrt{t}$. r.m.s. value of current between $t = 2$ to $t = 4s$ will be

A. $3A$

B. $3sqt3A$

C. $2sqt3A$

D. $sqt3A$

Answer: C

Watch Video Solution

291. An ac source of angular frequency ω is fed across a resistor R and a capacitor C in series. The current registered is I. If now the frequency of source is changed to $\omega/3$ (but maintaining the same voltage), the current in the circuit is found to be halved. Calculate the ratio of the reactance to resistance at the original frequency ω.

A. $\sqrt{\frac{3}{5}}$

B. $\sqrt{\frac{2}{5}}$

C. $\sqrt{\frac{1}{5}}$

D. $\sqrt{\frac{4}{5}}$

Answer: A

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292. A pure resistive circuit element X when connected peak current of $5A$ which is in phase with the voltage. A second circuit element Y, when connected to the same AC supply also gives the same value of peak current but the current lags behind by 90°. If the series combination of X and Y is connected to the same supply, what will be the rms value of current ?

A. $\frac{10}{\sqrt{2}} A$

B. $\frac{5}{\sqrt{2}} A$

C. $(5/2) A$

D. $5A$

Answer: C

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293. In series LR circuit, $X_L = 3R$. Now a capacitor with $X_C = R$ is added in series. The ratio of new to old power factor

A. $\sqrt{2}$

B. $\frac{1}{\sqrt{2}}$

C. 2

D. 1

Answer: A

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294. In a circuit L, C and R are connected in series with an alternating voltage source of frequency f. The current lead the voltages by 45°. The value of C is :

A. $\dfrac{1}{2\pi f(2\pi fL - R)}$

B. $\dfrac{1}{2\pi f(2\pi fL + R)}$

C. $\dfrac{1}{\pi f(2\pi fL - R)}$

D. $\dfrac{1}{\pi f(2\pi fL + R)}$

Answer: B

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295. A condenser of $250\mu F$ is connected in parallel to a coil of inductance $0.16mH$ while its effective resistance is 20Ω. Determine the resonant frequency

A. $9 \times 10^4 Hz$

B. $16 \times 10^7 Hz$

C. $8 \times 10^5 Hz$

D. $9 \times 10^3 Hz$

Answer: C

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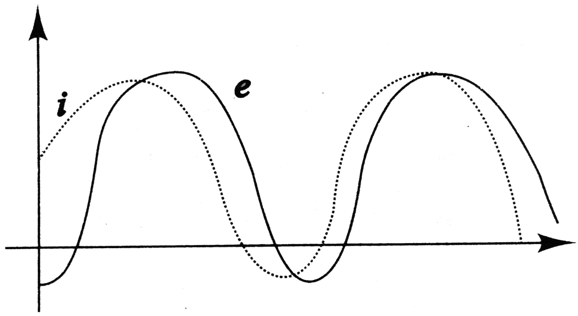
296. When an ac source of emf$e = E_0 \sin(100t)$ is connected across a circuit, the phase difference between emf e and currnet I in the circuit is observed to be $(\pi)/(4)$ as shown in fig. If the circuit consists possibly only of R-C or R-C of L-R series, find the relationship find the relationship between the two elements.



A. $R = 1k\Omega, C = 10\mu F$

B. $R = 1k\Omega, C = 1\mu F$

C. $R = 1k\Omega, L = 10mH$

D. $R = 10k\Omega, L = 10\mu H$

Answer: A

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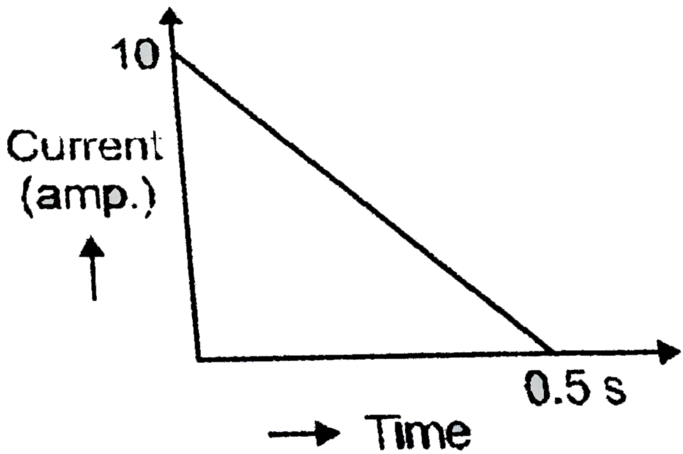
297. In a coil of resistance 100Ω , a current is induced by changing the magnetic flux through it as shown in the figure. The magnitude of change in flux through the coil is



A. $250 Wb$

B. $275 Wb$

C. $200Wb$

D. $225Wb$

Answer: A

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298. An AC voltage source of variable angular frequency ω and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance Zero). When ω is increase.

A. the bulb glows dimmer

B. the bulb glows brighter

C. total impedance of the circuit is unchanged

D. total impedance of the circuit increases

Answer: B

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299. In a series LCR circuit $R = 200(\Omega)$ and the voltage and the frequency of the main supply is 220V and 50 Hz respectively. On taking out the capacitance from the circuit the current lags behind the voltage by $30(\circ)$. On taking out the inductor from the circuit the current leads the voltage by $30(\circ)$. The power dissipated in the LCR circuit is

A. $210W$

B. $ZeroW$

C. $242W$

D. $305W$

Answer: C

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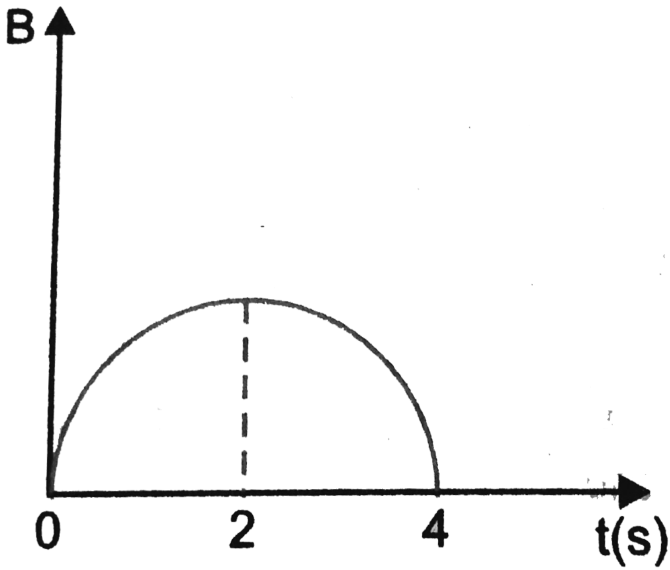
300. In a closed loop, which has some inductance but negligible resistance, uniform but time varying magentic field is applied directed into the plane of the loop. Variation of field with time is shown in Fig. Initially current in loop was zero. Then .



A. emf induced in the loop is zero at $t = 2s$

B. current in the loop will be maximum at $t = 2s$

C. direciton of emf in the loop will not change at

$t = 2s$

D. none of above

Answer: A

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301. A sereis R-C circuit is connected to AC voltage source. Consider two cases, (A) when C is without a dielectric medium and (B) when C is filled with dielectric of constant 4. The current I_R through the resistor and voltage V_c across the capacitor are compared in the two cases. Which of the following is/ are true?

A. $I_R^B > I_R^B$

B. $I_R^B = I_R^B$

C. $V_A^C > V_c^B$

D. $V_A^C < V_c^B$

Answer: C

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302. A fully charged capacitor C with initial charge q_0 is connected to a coil of self inductance L at t=0. The time at which the energy is stored equally between the electric and the magnetic fields is

A. $\frac{\pi}{4}\sqrt{LC}$

B. $2\pi\sqrt{LC}$

C. $\sqrt{LC}$

D. $\pi\sqrt{LC}$

Answer: A

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303. Combination fo two identical capacitors, a resistor R and a dc voltage source of voltage $6V$ is used in an experiment on a $(C-R)$ circuit. It is found that for a parallel combination of the capacitor the time in which the voltage of the fully charged combinatiomn reduces to half its original voltage is 10 second. For series combination the time needed for reducing teh voltage of the fully charged series combination by half is-

A. 20 second

B. 10 second

C. 5 second

D. 2.5 second

Answer: D

Watch Video Solution

304. An alternating voltage $E = 200\sqrt{2}\sin(100t)$ is connected to a 1 microfarad capacitor through an AC ammeter. The reading of the ammeter shall be

A. $10mA$

B. $100mA$

C. $200mA$

D. $20mA$

Answer: D

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305. A coil has resistance $30ohm$ and inductive reactance $20ohm$at $50Hz$ frequency. If an ac source of 200 volts. $100Hz$, is connected across the coil, the current in the coil will be

A. $4.0A$

B. $8.0A$

C. $\frac{20}{\sqrt{12}}A$

D. $2.0A$

Answer: A

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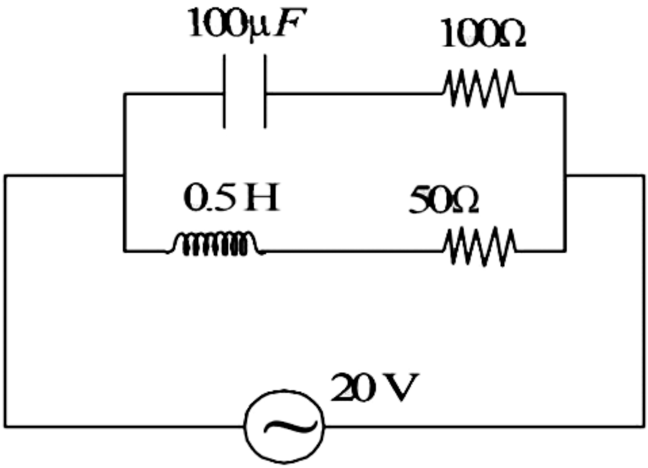
306. In the given circuit, the AC source has $(\omega) = 100 rad/s$. Considering the inductor and capacitor to be ideal, the correct choice(s) is (are)



A. The current through the circuit, I is $0.3A$

B. The current through the circuit, I is $0.3\sqrt{2}A$

C. The voltage across 100Ω resistor $= 15\sqrt{2}V$

D. The voltage across 50Ω resistor $= 10V$

Answer: A

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307. In an electrical circuit R, L, C and an AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the circuit is $\pi / 3$. If instead, C is removed from the circuit, difference the phase difference is again $\pi / 3$. The power factor of the circuit is

A. $1 / 2$

B. $1 / \sqrt{2}$

C. 1

D. $\sqrt{3} / 2$

Answer: C

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308. A coil of self-inductance L is connected in series with a bulb B and an AC source. Brightness of the bulb decreases when

A. an iron rod is inserted in the coil

B. frequency of the AC source is decreased.

C. number of turns in the coil is reduced.

D. A capacitance of reactanc $X_C = X_L$ is inclued in the same circuit.

Answer: A

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309. In an ac generator, the number of turns in the coil is 2000 and the area of coil is $0.2m^2$. If the coil is rotated at an angular frequency of $400S^{-1}$ in a magnetic field of $0.5T$, then what is the peak value of induced emf ?

A. $40, 000V$

B. $60, 000V$

C. $80, 000V$

D. $20,000V$

Answer: C

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310. An electric motor operator on $15V$ supply, draws a current of $5A$ and yields mechanical power of $60W$. The energy lost as heat in one hour (in kJ) is.

A. 0.54

B. 5.4

C. 54

D. 540

Answer: C

Watch Video Solution

311. A wire loop is rotated in magneitc field. The frequency of change of direction of the induced e.m.f. is.

A. Six times per revolution

B. Once per rovolution

C. twice per revolution

D. four times per revolution

Answer: C

Watch Video Solution

312. The primary and secondary coils of a transmformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in weber, t is time in second and ϕ_0 is a constant, the output voltage across the secondary coil is

A. $120V$

B. $220V$

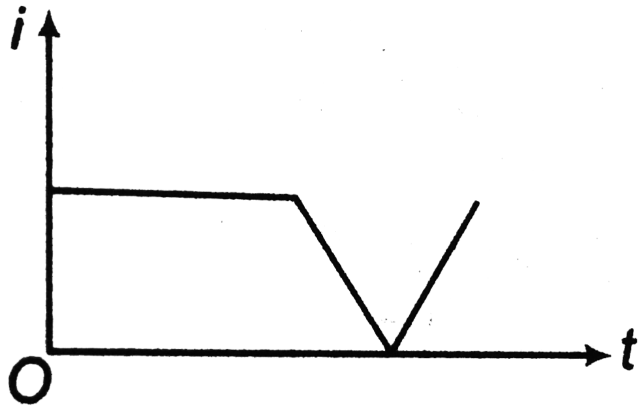
C. $30V$

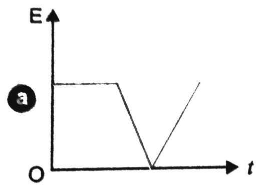
D. $90V$

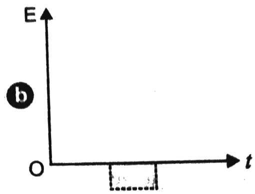
Answer: A

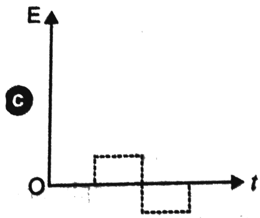
Watch Video Solution

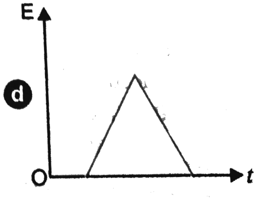
313. The current i in an inductionn coil varies with time t according to the graph shown in the figure. Which of the following grahs shows athe induced emf (ε) in the coil with time?



A. 

B. 

C. 

D. 

Answer: C

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314. A transformer is used to light a $100W$ and $110V$ lamp from a $220V$ mains. If the main current is $0.5A$, the Efficiency of the transformer is approximately:

A. 91%

B. 100%

C. 95%

D. 55%

Answer: A

Watch Video Solution

315. A transformer having efficiency of 90% is working on $200V$ and $3kW$ power supply. If the current in the secondary coil is $6A$, the voltage across the secondary coil and current in the primary coil respectively are

A. $300v15A$

B. $450V, 15A$

C. $450V, 135A$

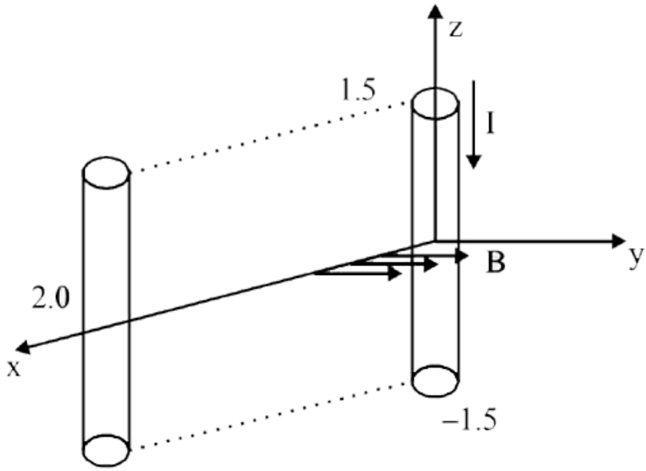
D. $600V, 15A$

Answer: B

Watch Video Solution

316. A conductor lies along the z-axis at $-1.5 \leq z < 1.5m$ and carries a fixed current of $10.0A$ in $-\widehat{a}_z$ direction (see figure). For a field $\overrightarrow{B} = 3.0 \times 10^{-4} e^{-0.2x} \widehat{a}_y T$, find the power required to move the conductor at constant speed to $x = 2.0m, y = 0m$ in $5 \times 10^{-3}s$. Assume

parallel motion along the $x - a\xi s$.



A. $14.85W$

B. $29.7W$

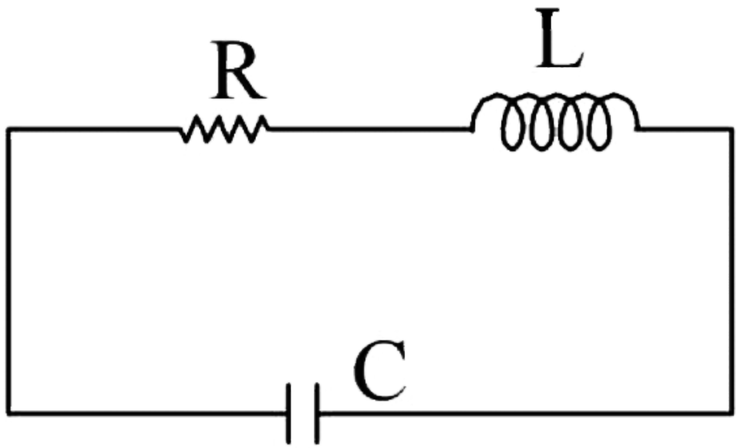
C. $1.57W$

D. $2.97W$

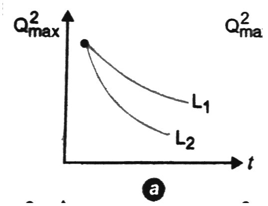
Answer: D

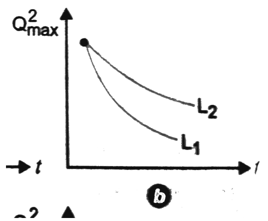
Watch Video Solution

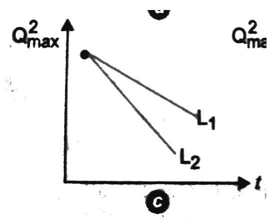
317. An LCR curcuit is equivalent to a damped pendulum. In an LCR circuit the capacitor is charged to (Q_0) and then connected to the L ans R as shown below.

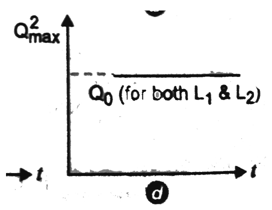


If a student plaots graphs of the square of maximum charge $(Q^2_{\max})$ on the capacitor with time (t) for two different values L_1 and $L_2 (L_1 > L_2)$ of L then which of the following represents this graph correclty? (plots are schematic and not drawn to scale).

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

318. A long solenoid has 1000 turns. When a current of $4A$ flows through it, the magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} Wb$. The self-inductance of the solenoid is

A. $3H$

B. $2H$

C. $1H$

D. $4H$

Answer: C

Watch Video Solution

319. A small signal voltage $V(t) = V_0 \sin \omega t$ is applied across an ideal capacitor C:

A. over a full cycle, the capacitor does not consume any energy form the voltage source

B. current $I(t)$ is in phase with the voltage $V(t)$

C. Current $(I(t)$ leads the voltage $V(t)$ by 180°

D. current $I(t)$ lags behind the voltage $V(t)$ by 90°

Answer: A

Watch Video Solution

320. An inductor $20mH$, a capacitor $50\mu F$ and a resistor $40\Omega$are connected in series across of emf $V = 10\sin 340t$. The power loss in $A.C.$ circuit is

A. $0.6W$

B. $0.76W$

C. $0.89W$

D. $0.046W$

Answer: D

Watch Video Solution

321. An are lamp requires a direct current of 10A at 80V to function. If it is connected to a 220V(rms), 50 Hz AC supply, the series inductor needed for it to work is close to:

A. $80H$

B. $0.08H$

C. $0.044H$

D. $0.065H$

Answer: D

Watch Video Solution

322. Two inductors L_1(inductors 1 mH, internal resistance 3 Ω) and L_2 (inductance 2mH, internal resistance 4Ω),and a resistor R(resistance12ω) are all connected in parallelacross a 5 V battery. The circuit is switched on at time t=0. The ratio of the maximum to the minimum current $\left(I_{\max} / I_{\min}\right)$ drawn from the battery is

A. 8

B. 7

C. 5

D. 6

Answer: A

Watch Video Solution

323. L,C and R represent the physical quantities inductance, capacitance and resistance respectively. Which of the following combinations have dimensions of frequency?

A. $\frac{1}{RC}$

B. $\frac{R}{L}$

C. $\frac{1}{\sqrt{LC}}$

D. $\frac{C}{L}$

Answer: A::B::C

Watch Video Solution

324. Two different coils have self-inductances $L_1 = 8mH$ and $L_2 = 2mH$. The current in one coil is increased at a constant rate. The current in the second coil is also increased at the same constant rate. At a certain instant of time, the power given to the two coil is the same. At that time, the current, the induced voltage and the energy stored in the first coil are i_1, V_1 and W_1 respectively. Corresponding values for the second coil at the same instant are i_2, V_2 and W_2 respectively. Then:

A. $\frac{i_1}{i_2} = \frac{1}{4}$

B. $\frac{i_1}{i_2} = 4$

C. $\frac{W_1}{W_2} = \frac{1}{4}$

D. $\frac{V_1}{V_2} = 4$

Answer: A::C::D

Watch Video Solution

325. The SI unit of inductance, the henry can be written as

A. Weber/Ampere

B. Volt-Second/ampere

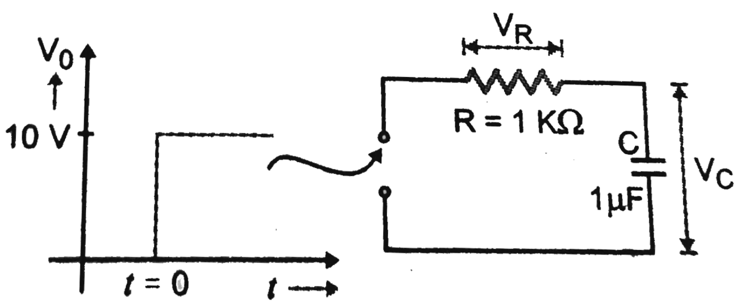
C. $\text{Joule}/(\text{ampere})^2$

D. ohm-second

Answer: A::B::C::D

Watch Video Solution

326. A step voltage V_0 is applied to a series combination of R and C as shown Fig. Then



A. after sufficienty long time $V_R = 0$

B. as time passes, V_R decreases as $(1/t)$

C. after $1ms$, $V_C = 6.3$ volt (approximately)

D. initially, current through R is $10mA$.

Answer: A::C::D

Watch Video Solution

327. When an alternating current flows through a circuit consisting of a resistor in series with a capacitor, during the cycle at some instant,it is possible to have (a) voltage across the circuit is zero but current through it is not zero.

A. voltage across the circuit is zero but current through it is not zero

B. current through the circuit is zero but the voltage across it is not zero

C. current throught the capacitor is not zero but the voltage across it is zero

D. current throught the resistor is not zero but the voltage across it is zero

Answer: A::B::C

Watch Video Solution

328. A conducting loop is placed in a uniform magnetic field with its plane perpendicular to the field with its plane perpendicular to the field. An emf is induced in the loop if

(i) it is translated

(ii) it is rotated about its axis

(iii) it is rotated about a diameter

(iv) it is deformed

A. It is translated

B. It is rotated about its axis

C. Is rotated about a diameter

D. It is deformed

Answer: C::D

Watch Video Solution

329. The reactance of a circuit is zero. It is possible that the circuit contains

A. an inductor and a capacitor

B. an inductor but no capacitor

C. a capacitor but no inductor

D. neither an inductor nor a capacitor

Answer: A::D

Watch Video Solution

330. An AC source rated $100V(rms)$ supplies a current of $10A(rms)$ to a circuit. The average power delivered by the source

A. must be $1000W$

B. may be $1000W$

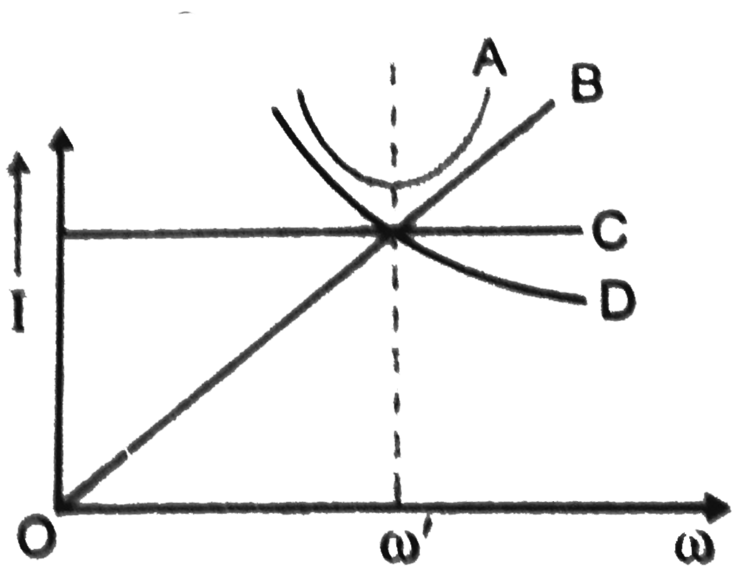
C. may be greater than $1000W$

D. may be less than $1000W$

Answer: B::C::D

Watch Video Solution

331. For an LCR circuit,



A. A and B represent R and Z respectively

B. A and B represent Z and R respectively

C. A, B, C, D represent Z, X_L, R, X_C respectively

D. for `omega = omega', the phase difference between current and voltage is zero

Answer: C::D

Watch Video Solution

332. A current carrying infinitely long wire is kept along the diameter of a circular wire loop, without touching it, the correct statements(s) is(are)

A. The emf induced in the loop is zero if the current is constant

B. The emf induced in the loop is finite if the current is constant

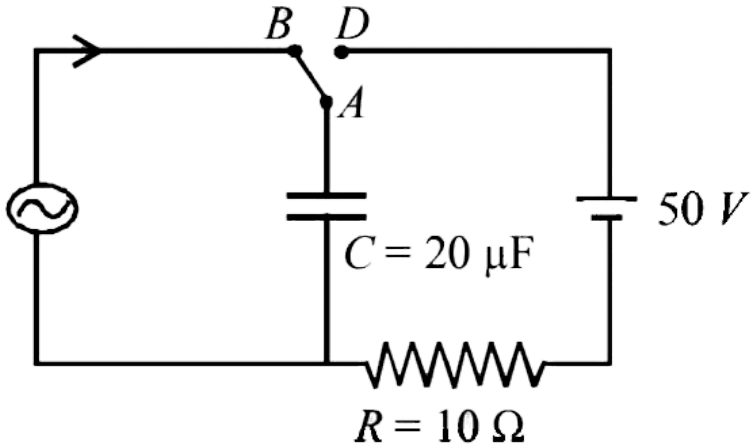
C. The emf induced in the loop is zero if the current decreases at a steady rate

D. The emf induced in the loop is finite is the current decreases at a steady rate

Answer: A::C

Watch Video Solution

333. At time $t = 0$, terminal A in the circuit shown in the figure is connected to B by a key and an alternating current $I(t) = I_0 \cos(\omega t)$, with $I_0 = 1A$ and $(\omega) = 500 rads^{-1}$ starts flowing in it with the initial direction shown in the figure. At $t = (7\pi / 6\omega)$, the key is switched from B to D. Now onwards only A and D are connected. A total charge Q flows from the battery to charge the capacitor fully. If `C=20(mu)F, R = 10(Omega) and the battery is ideal with emf of 50 V, identify the correct statement(s).



A. Magnitude of the maximum charge on the capacitor before $t = \frac{7\pi}{6\omega}$ is $1 \times 10^{-3} C$

B. This current in the left part of the circuit just before $t = \frac{7\pi}{6\omega}$ is clockwise

C. Immediatley after A is connected to D, the current in R is $10A$

D. $Q = 2 \times 10^{-3} C$

Answer: C::D

Watch Video Solution

334. In an a.c circuit, value of voltage and current change every instant. Therefore, power of an a.c. circuit at any instant is the product of instantaneous voltages (E) and instantaneous current (I). The average power supplied to a pure resistance R over a complete cycle of a.c is $P = E_v . I_v$. When circuit is inductive, average power//cycle $= E_v I_v \cos \phi$, where ϕ is the phase angle between alternating voltage an altenating current in the circuit.

In an a.c. circuit, $800 mH$ inductor and a $60 \mu F$ capacitor are connected in series with $15 ohm$ resistance. The a.c. supply to the circuit is $230 V, 50 Hz$

This average power transferred per cycle to resistance is

A. $2.05 W$

B. $20.05 W$

C. Zero

D. $230W$

Answer: B

Watch Video Solution

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The average power transferred per cycle t inductors is

A. zero

B. $40.10W$

C. $20.05W$

D. $20.5W$

Answer: A

Watch Video Solution

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In an a.c. circuit, $800 mH$ inductor and a $60 \mu F$ capacitor are connected in series with $15 ohm$ resistance. The a.c. supply to the circuit is $230 V, 50 Hz$

The average power transferred per cycle ot capacitor is

A. $230 W$

B. $220 W$

C. $40 W$

D. Zero

Answer: D

Watch Video Solution

337. In an a.c circuit, value of voltage and current change every instant. Therefore, power of an a.c. circuit at any instant is the product of instantaneous voltages (E) and instantaneous current (I). The average power supplied to a pure resistance R over a complete cycle of a.c is $P = E_v. I_v$. When circuit is inductive, average power/cycle $= E_v I_v \cos\phi$, where ϕ is the phase angle between alternating voltage an altenating current in the circuit.

In an a.c. circuit, $800mH$ inductor and a $60\mu F$ capacitor are connected in series with $15ohm$ resistance. The a.c. supply to the circuit is $230V, 50Hz$

The total power abosrbed per cycle by all the three circuit elements is

A. $230W$

B. $690W$

C. $60.15W$

D. $20.05W$

Answer: D

Watch Video Solution

338. In an a.c circuit, value of voltage and current change every instant. Therefore, power of an a.c. circuit at any instant is the product of instantaneous voltages (E) and instantaneous current (I). The average power supplied to a pure resistance R over a complete cycle of a.c is $P = E_v . I_v$. When circuit is inductive, average power/cycle $= E_v I_v \cos \phi$, where ϕ is the phase angle between alternating voltage an altenating current in the circuit.

In an a.c. circuit, $800mH$ inductor and a $60 \mu F$

capacitor are connected in series with $15 ohm$ resistance. The a.c. supply to the circuit is $230V, 50Hz$

The electrial energy spent in running the circuit for one hour is

A. $20.0.5J$

B. $20.05kwh$

C. $7.22 \times 10^4 J$

D. Zero

Answer: C

Watch Video Solution

339. A transformer is an electrical device which is used for changing the a.c. voltage. It is based on the phenomenon of mutual induction. It can be shown that

$$\frac{E_s}{E_P} = \frac{I_P}{I_s} = \frac{n_s}{n_P} = K$$

Where the symbols have their standard meaning. For a step up transformer, $K > 1$ and for a step down transformer, $K < 1$. The above relations are on the assumption that efficiency of transformer is $100\,\%$. In fact, efficiency

$$\eta = \frac{\text{output power}}{\text{input power}} = \frac{E_s I_s}{E_P I_P}$$

The number of turns in the primary and secondary coils of a transformer are 2000 and 50 respectively.

The primary coil is connected to main supply of $120V$ and secondary to a night bulb 0.6Ω. The efficiency of transformer is 80%.

Voltage across the secondary coil of transformer is:

A. $125V$

B. $360V$

C. $40V$

D. $3V$

Answer: D

Watch Video Solution

340. A transformer is an electrical device which is used for changing the a.c. voltage. It is based on the phenomenon of mutual induction. It can be shown that

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$120V$ and secondary to a night bulb $0.6 ohm$. The efficiency of transformer is 80%.

Current in night bulb is:

A. $5A$

B. $3A$

C. $0.5A$

D. $0.6A$

Answer: A

Watch Video Solution

341. A transformer is an electrical device which is used for changing the a.c. voltage. It is based on the phenomenon of mutual induction. It can be shown that

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The primary coil is connected to main supply of $120V$ and secondary to a night bulb 0.6Ω. The efficiency of transformer is 80%.

Current in primary coil is:

A. $15A$

B. $\frac{5}{2}A$

C. $\frac{5}{32}A$

D. $0.6A$

Answer: C

Watch Video Solution

342. A transformer is an electrical device which is used for changing the a.c. voltage. It is based on the phenomenon of mutual induction. It can be shown that

$$\frac{E_s}{E_P} = \frac{I_P}{I_s} = \frac{n_s}{n_P} = K$$

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The number of turns in the primary and secondary coils of a transformer are 2000 and 50 respectively. The primary coil is connected to main supply of

$120V$ and secondary to a night bulb 0.6Ω. The efficiency of transformer is 80%.

Power in primary coil is:

A. $\frac{12}{225}W$

B. $\frac{75}{4}W$

C. $125W$

D. $50W$

Answer: B

Watch Video Solution

343. A transformer is an electrical device which is used for changing the a.c. voltage. It is based on the phenomenon of mutual induction. It can be shown that

$$\frac{E_s}{E_P} = \frac{I_P}{I_s} = \frac{n_s}{n_P} = K$$

Where the symbols have their standard meaning. For a step up transformer, $K > 1$ and for a step down transformer, $K < 1$. The above relations are on the assumption that efficiency to transformer is $100\ \%$. In fact, efficiency

$$\eta = \frac{\text{output power}}{\text{input power}} = \frac{E_s I_s}{E_P I_P}$$

The number of turns in the primary and secondary coils of a transformer are 2000 and 50 respectively.

The primary coil is connected to main supply of $120V$ and secondary to a night bulb 0.6Ω. The efficiency of transformer is 80%.

Power in secondary coil is:

A. $15W$

B. $225W$

C. $120W$

D. $7W$

Answer: A

Watch Video Solution

344. At a certain frequency ω_1, the reactance of a certain capacitor equals that of a certain inductor. If the frequency is changed to $\omega_2 = 2\omega_1$, the ratio of reactance of the inductor to that of the capacitor is :

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345. The sum and difference of self-inductances of two coils are $13mH$ and $5mH$ respectively. What is the maximum value of mutual inductance (in milli henry) of the two coil ?

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346. The magnetic flux of ϕ (in weber) in a closed circuit of resistance $3ohm$ varies with time t (in second according to the equation $\phi = 2t^2 - 10t$ at $t = 0.25s$?

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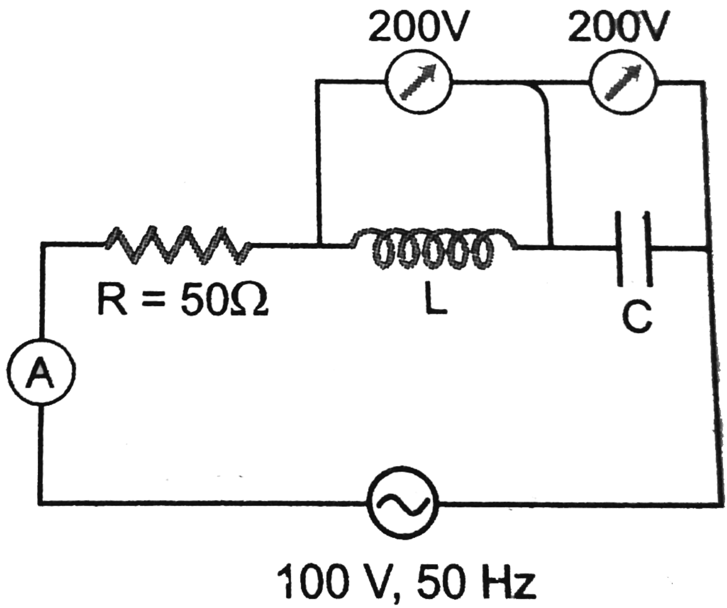
347. A condenser of capacitor $0.144pF$ is used in a transmitte to transmit at wavelength λ. If inductace of $1/\pi^2 mH$ is used for resonance, what is the value of λ (in m) ?

Watch Video Solution

348. In the series RLC circuit as shown in Fig., what would be the ammeter reading in ampere ?



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349. An a.c source of frequency $1000Hz$ is connected to a coil of $\frac{200}{\pi}mH$ and negligible resistance. If effective current through the coil is $7.5mA$, what is the voltage (in volt) across the coil ?

Watch Video Solution

350. An a.c. voltage is represented by

$E = 220\sqrt{2}\cos(8\pi)t.$

How many times will the current become zero in 1 sec ?

Watch Video Solution

351. An a.c. source of voltage $V = 100 \sin 100\pi t$. Is connected to a resistor of $\frac{25}{\sqrt{2}} ohm$. What is the r.m.s value of current (in ampere) through the resistor ?

Watch Video Solution

352. A series R-C combination is connected to an AC voltage of angular frequency $\omega = 500 radian / s$. If the impendance of the R-C circuit is $R\sqrt{1.25}$, the time constant (in millisecond) of the circuit is

Watch Video Solution

353. A transformer working on $220V$ a.c. line gives an output current of $4A$ at $55V$. What is the primary current (in ampere) ? Assume that there is no loss of energy.

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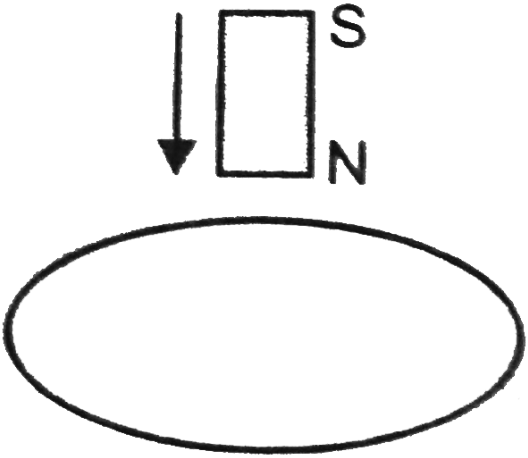
354. Assertion. The bar magnet falling vertically along the axis of the horizontal coil will be having acceleartion less than g.



Resaon. Clockwise current induced in the coil.

A. A

B. B

C. C

D. D

Answer: C

Watch Video Solution

355. Assertoion : An electric motor will have maximum efficiency when back emf becomes equal of half of applied emf.

Reason. Power factor of series R_L circuit is given by

$$\cos\theta = \frac{2R}{\sqrt{R^2 + \omega^2 L^2}}$$

A. A

B. B

C. C

D. D

Answer: C

Watch Video Solution

356. Assertion : An electric motor will have maximum efficiency when back emf becomes equal to half of applied emf.

Reason : Efficiency of electric motor depends only on magnitude of back emf.

A. A

B. B

C. C

D. D

Answer: C

Watch Video Solution

357. Assertion: Only a charge 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.

A. A

B. B

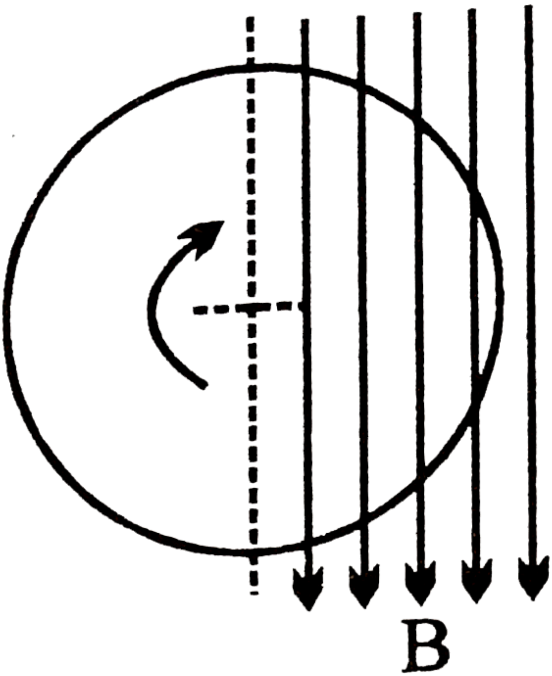
C. C

D. D

Answer: C

Watch Video Solution

358. A thin non conducting disc of radius R is rotating clockwise (see figure) with an angular velocity ω about its central axis which is perpendicular to its plane Both its surfaces carry+ve charges of unifrom surface density Half the disc is in a region of a unifrom unidirectional magnetic field B parallel to the plane of the disc as shown Then



A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

359. Assertion : The magnetic flux through a closed surface containing a bar magnet is zero.

Reason : Gauss's law applies in the case of electric flux only.

A. A

B. B

C. C

D. D

Answer: C

Watch Video Solution

360. Assertion : If a varying current is flowing through a machine of iron, eddy currents are produced.

Reason : change in the magnetic flux thro' an area causes eddy currents.

A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

361. Assertion : A low voltage bulb in a coil glows when a.c. is passed through a neighbouring coil.

Reason : Bulb glows because of e.m.f. induced in the coil due to self induction.

A. A

B. B

C. C

D. D

Answer: C

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362. Assertion : A glowing bulb becomes dim when an iron bar is put in the inductor in the a.c. circuit

Reason : Resistance of the circuit increases.

A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

363. Assertion : In series LCR resonance circuit, the impedance is equal to the ohmic resistance.

Reason : At resonance, the inductive reactance exceeds the capacitive reactance.

A. A

B. B

C. C

D. D

Answer: C

Watch Video Solution

364. Assertion : Use is made of eddy currents in induction brakes.

Reason : As eddy currents always oppose the relative motion.

A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

365. Statement-1 : When a magnet is made to fall freely through a closed coil, its acceleration is always less than acceleration due to gravity.

Statement-2 : Current induced in the coil opposes the motion of the magnet, as per Lenz's law.

A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

366. Statement-1 : When we cousider mutual induction of two coils, their self induction is taken as zero.

Statement-2 : This is because mutual induction of two coils is over and above self induction of each coil.

A. A

B. B

C. C

D. D

Answer: D

Watch Video Solution

367. Statement-1 : In a given situation, the direction of induced current given by Lenz's Law and Fleming's right hand rule is the same.

Statement-2 : Statement of both the laws is the same.

A. A

B. B

C. C

D. D

Answer: C

Watch Video Solution

368. Statement-1 : An inductor cannot have zero resistance.

Statement-2 : This is because inductor has to be made up of some material, which must have some resistance.

A. A

B. B

C. C

D. D

Answer: A

Watch Video Solution

369. Statement-1 : A parallel resonance circuit is called a rejector circuit.

statement-2 : At resonance frequency, current is completely cut off.

A. A

B. B

C. C

D. D

Answer: A

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370. Statement-1 : In $220V$, $50hz$ a.c. wall plug. Peak value of alternating e.m.f. is $220V$.

Statement-2 : Only rms value is specified.

A. A

B. B

C. C

D. D

Answer: D

Watch Video Solution

371. Statement-1 : A step up transformer can also be used as a step down transformer.

Statement-2 : This is because $\frac{E_s}{E_P} = \frac{n_s}{n_P}$

A. A

B. B

C. C

D. D

Answer: A

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372. Statement-1 : The number of turns in secondary coil of a transformer is 10 times the number of turns in primary. An output voltage of $15V$ can be obtained using a cell of $1.5V$.

Statement-2 : This is because in a transformer, $\frac{E_s}{E_P} = \frac{n_s}{n_P}$

A. A

B. B

C. C

D. D

Answer: D

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373. What is meant by one cycle of a.c. ?

A. going from zero to + max.

B. going from + max. to zero

C. going from zero to-max and - max to zero

D. all the three a, b, c combined together

Answer: D

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374. If n is frequency of a.c. mains, then frequency of sonometer wire at resonance is

A. $2n$

B. n

C. $n/2$

D. $4n$

Answer: A

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375. In determination of frequency of a.c. mains using a sonometer, a.c. is supplied to electromagnet

A. directly

B. through a step up transformer

C. through a step down transformer

D. none of the above

Answer: C

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376. The resonance length obatined by a student in determination of frequency by a student in determination of frequency of a.c. mains by sonometer is $26.7cm$. If thickness of sonometer wire were doubled without changing any other parameter, the resonance length would be

A. 26.7 cm

B. 53.4 cm

C. 13.4 cm

D. none of the above

Answer: C

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JEE Mains Ad..(Multiple Choice Question)

1. The r.m.s. value of potential difference V shown in Fig. is

A. V_0

B. $V_0 / 2$

C. $V_0 / \sqrt{2}$

D. $V_0 / \sqrt{3}$

Answer: C

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Multiple Choice Questions

1. For given values to T and m, resonance length in winter is x_1 cm, and in summer, it is x_2 cm. Then

A. $x_1 = x_2$

B. $x_2 > x_1$

C. $x_2 < x_1$

D. cannot say

Answer: B

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