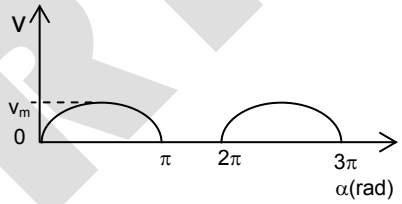
ALTERNATING CURRENT PROBLEMS

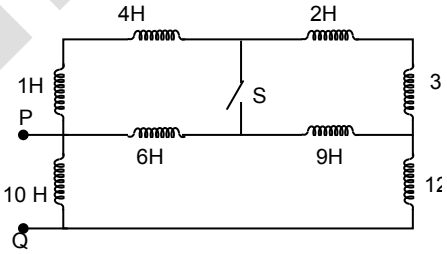
Q.1. Determine the rms value of current given by I = 10 + 5 sin(628t) for pure resistive circuit.

Q.2. A coil has an inductance of 0.7 H and is joined in series with a resistance of 220 Ω. When an alternating voltage of 220 V, 50 Hz is applied to it. Determine the power factor.

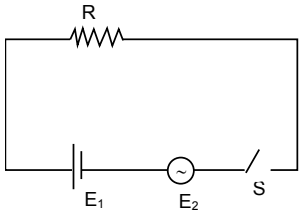
Q.3. (a) From the following graph find $v_{average}$ and $v_{effective}$ values of the wave



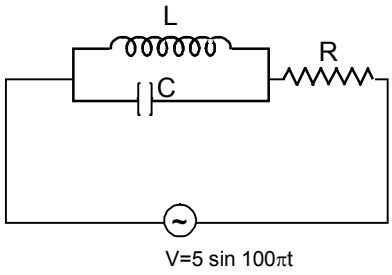
(b) Find the equivalent inductance between P and Q when 'S' is closed.



Q.4. In the circuit shown in figure R = 50 Ω, $E_1 = 25\sqrt{3}$ volt and $E_2 = 25\sqrt{6}$ sin ωt volt where ω = 100 π s^{-1}. The switch s is closed at time t = 0 and is opened at t = 14 min. Find the amount of heat produced in the resistor.



Q.5. In the given circuit inductance L = $\frac{50}{\pi^2}\times 10^{-2}$ Henry, capacitance C = 200 μF and R = 100 Ω are attached as shown. An alternating voltage V = 5 sin 100 πt is applied across the circuit. Find
(i) current in the resistance R.
(ii) voltage across inductor as a function of time t.

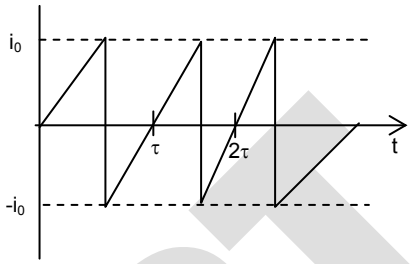


Q.6. An alternating voltage E = $100\sqrt{2}\sin(100\ t)$ v is connected to a 1 μF capacitor through an ac ammeter. What will be the reading of the ammeter.

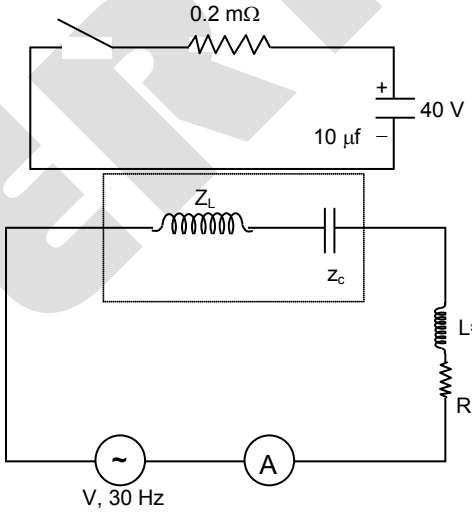
Q.7. An inductor of inductance 2.0 mH is connected across a charged capacitor of capacitance 5.0 μF. and the resulting L – C circuit is set oscillating at its natural frequency. Let Q denotes the instantaneous charge on the capacitor and i the current in the circuit. It is found that the maximum value of Q is 200 μC.
(a) when Q = 100 μC, find the rate of change of current.

(b) when Q = 200 μC, what is the value of current.

Q.8. The current in a certain circuit varies with time as shown in figure. Find the average current and the rms current in terms of I_0.



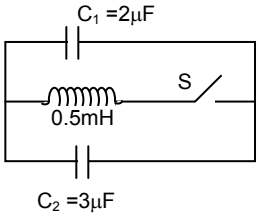
Q.9. From the values given in the circuit find total energy dissipated in the resistor during the transient state when 'S" is closed.



Q.10. Given $|Z_L| = |Z_c|$, Ammeter reads 1A current. Find V and p.f. of the circuit.

Q.11. An alternating current of 1.5mA and angular frequency ω = 300 rad/s flows through 10kΩ resistor and a 0.50μF capacitor in series. Find the impedance of the circuit and the r.m.s. voltage across the capacitor.

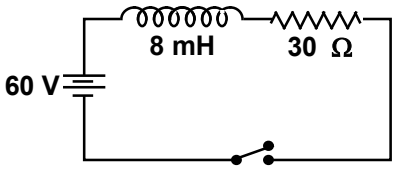
Q.12. In an oscillating circuit shown in figure, the capacitors were charged to a voltage of 200 V and then the switch s is closed. Find
(a) the frequency of oscillation.
(b) the peak value of the current flowing through the coil.



Q.13. A circuit consisting of 1 ohm resistance and 0.01 H inductance is connected to a 200 V line of frequency 50 cycles/s. Calculate the reactance, impedance and the power factor

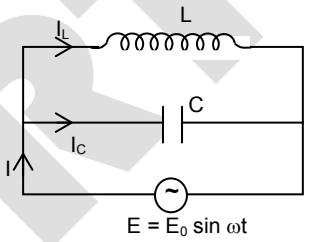
Q.14. A 200 Km. long telegraph wire has a capacity of 0.014 μF/Km. If it carries an alternating current of 50 Kc/s, what should be the value of an inductance required to be connected in series so that impedance is minimum?

Q.15. A constant potential difference of 60 V is suddenly applied to a coil which has a resistance of 30W and a self inductance of 8mH. At what rate does the current begin to rise? What is the current at the instant the rate of charge of current is 500 A/s ? What is the final current ?

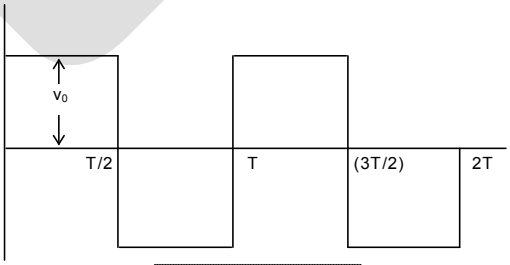


Q.16. A closed circuit in steady state consists of a battery of 20 volt and a coil of inductance 0.2 H and total resistance of the circuit equals 2 Ω. At the moment t = 0 the inductance of the coil is suddenly decreased by 10 times. Find the time dependent expression for the current.

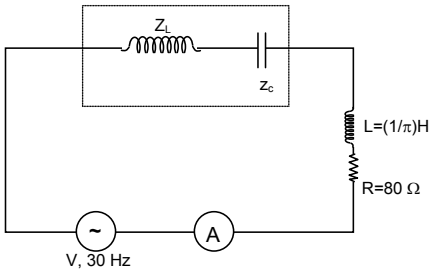
Q.17. For the circuit shown in figure maximum current in inductance is 0.4 A while in capacitance is 0.3 A. What is the maximum current drawn from the source.



Q.18. For a square wave having peak value v_0 find the average value of voltage for half cycle and rms value for complete cycle of voltage.



Q.19. Given $|Z_L| = |Z_c|$, Ammeter reads 1A current. Find V and p.f. of the circuit.

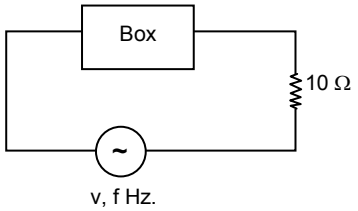


Q.20. A current of 4A flows in a coil when connected to a 12 V d.c. source. If the same coils is connected to a 12 V, 50 rad/s, a.c. source, a current of 2.4 A flows in the circuit. Determine the inductance of coil. Also find the power developed in the circuit if a 2500 μF condenser is connected in series with the coil.

Q.21. (a) A 100 v potential difference is suddenly applied to a coil of inductance 100 mH and resistance 50 Ω. Find the rate at which the current increases after one second.

(b) The current in the circuit is given by $I = I_0 (t / \tau)$. Calculate the rms current for the period t = 0 to t = τ.

Q.22. In circuit p.f. of box is given 0.5 and p.f. of circuit is given $\frac{\sqrt{3}}{2}$ leading. Find the effective resistance of the box and effective inductive reactance or capacitive reactance nature of element in box capacitive or inductive.

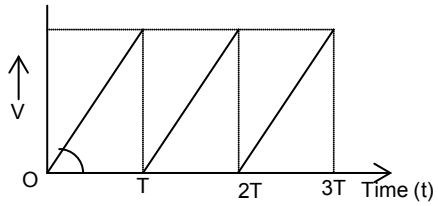


Q.23. An LCR circuit has L =10 mH, R = 3 ohms and C = 1 μF connected in series to a source of 15 cos ωt volts. Calculate the current amplitude and the average energy dissipated per cycle at a frequency that is 10 % lower than the resonance frequency.

Q.24. An L-C circuit consist of an inductor with L = 0.09 H and a capacitor of C = 4.00×10^{-4} F. The initial charge on the capacitor is 5.00 μC and the initial current in the inductor is zero. (a) Find the value of maximum current in the inductor.
(b) When the current in the inductor has half its maximum value, what is the charge on the capacitor.

Q.25. Prove that in a seris LCR circuit, the frequency at which the current amplitude falls to $\frac{1}{\sqrt{2}}$ of the current at resonance are separated by an interval equal to $\frac{R}{2\pi L}$.

Q.26. Find the root mean square voltage and average voltage of the given variation of voltage.



Q.27. A coil of self inductance 0.7 henry is joined in series with a non-inductive resistance of 50 Ω. Calculate the wattless and power components of current when connected to a supply of 200 volts at a frequency of 50 cycles/ sec.

Q.28. A circuit containing a two position switch S is shown in figure.

(i) The switch S is in position 1. Find the potential difference $V_A - V_B$ and the rate of production of joule heat in R_1 in steady state.

(ii) If now the switch S is put in position 2 at t = 0, find the time when the current in R_4 is half the steady value. Also calculate the energy stored in the inductor L at that time.