Alternating Current

Q.No.1:
Describe briefly, with the help of a labelled diagram, the basic elements of an A.C. generator. State its underlying principle. Show diagrammatically how an alternating emf is generated by a loop of wire rotating in a magnetic field. Write the expression for the instantaneous value of the emf induced in the rotating loop.
OR
A series LCR circuit is connected to a source having voltage $v = v_m \sin \omega t$. Derive the expression for the instantaneous current I and its phase relationship to the applied voltage.
Obtain the condition for resonance to occur. Define 'power factor'. State the conditions under which it is (i) maximum and (ii) minimum.
CBSE Board Paper 2010

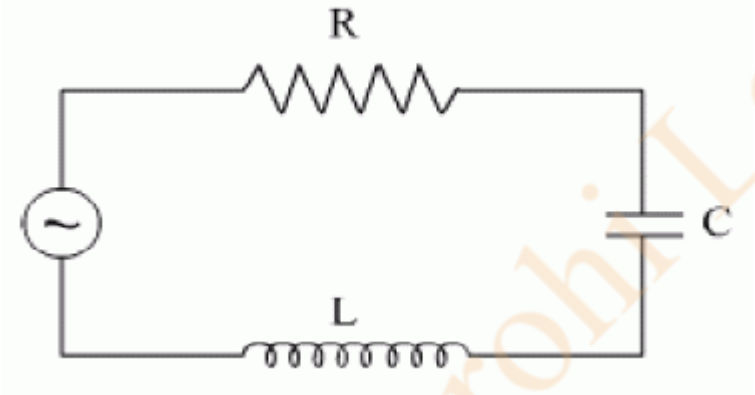
Q.No.2:
State the principle of working of a transformer. Can a transformer be used to step up or step down a d.c. voltage? Justify your answer.
CBSE Board Paper 2011

Q.No.3:
State the working of a.c. generator with the help of a labeled diagram.
The coil of an a.c. generator having N turns, each of area A, is rotated with a constant angular velocity ω. Deduce the expression for the alternating e.m.f. generated in the coil.
What is the source of energy generation in this device?
CBSE Board Paper 2011

Q.No.4:
In a series LCR circuit connected to an ac source of variable frequency and voltage $v = v_m \sin \omega t$, draw a plot showing the variation of current (I) with angular frequency (ω) for two different values of resistance R_1 and R_2 ($R_1 > R_2$). Write the condition under which the phenomenon of resonance occurs. For which value of the resistance out of the two curves, a sharper resonance is produced? Define Q-factor of the circuit and give its significance.

CBSE Board Paper 2013

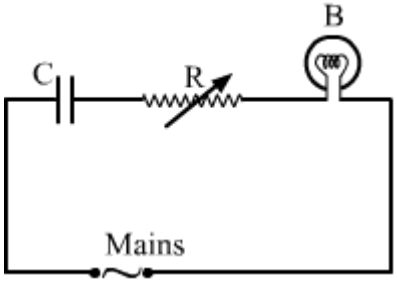
Q.No.5:
The figure shows a series LCR circuit with L = 10.0 H, C = 40 μF, R = 60 Ω connected to a variable frequency 240 V source, calculate
(i) the angular frequency of the source which drives the circuit at resonance,
(ii) the current at the resonating frequency,
(iii) the rms potential drop across the inductor at resonance.



CBSE Board Paper 2012

Q.No.6: A capacitor 'C', a variable resistor 'R' and a bulb 'B' are connected in series to the ac mains in circuit as shown. 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 R to be the same; (ii) the resistance R is increased keeping the same capacitance?

CBSE Board Paper 2014



Q.No.7: Define capacitive reactance. Write its S.I units.

CBSE Board Paper 2015

Q.No.8: An inductor L of inductance X_L is connected in series with a bulb B and an ac source. How would brightness of the bulb change when (i) number of turn in the inductor is reduced, (ii) an iron rod is inserted in the inductor and (iii) a capacitor of reactance $X_C = X_L$ is inserted in series in the circuit. Justify your answer in each case.

CBSE Board Paper 2015

Q.No.9: Define 'quality factor' of resonance in a series LCR circuit. What is its SI unit?

CBSE Board Paper 2016

Q.No.10: (i) An a.c. source of voltage $V = V_0 \sin \omega t$ is connected to a series combination of L, C and R. Use the phasor diagram to obtain expression for impedance of a circuit and the phase angle between voltage and current. Find the condition when current will be in phase with the voltage. What is the circuit in this condition called?
(ii) In a series LR circuit, $X_L = R$ and power factor of the circuit is P_1. When capacitor with capacitance C such that $X_L = X_C$ is put in series, the power factor becomes P_2. Calculate P_1/P_2.

OR

(i) Write the function of a transformer. State its principle of working with the help of a diagram. Mention various energy losses in this device.
(ii) The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltage and power are 220 V and 1100 W, respectively. Calculate the
(a) number of turns in secondary
(b) current in primary
(c) voltage across secondary
(d) current in secondary
(e) power in secondary

CBSE Board Paper 2016

Q.No.11: (a) Draw a labelled diagram of AC generator. Derive the expression for the instantaneous value of the emf induced in the coil.
(b) A circular coil of cross-sectional area 200 cm^2 and 20 turns is rotated about the vertical diameter with angular speed of 50 rad s^{-1} in a uniform magnetic field of magnitude 3.0×10^{-2}T. Calculate the maximum value of the current in the coil.