PARISHRAM PUBLICATIONS
PUNE

NAME of Student : _____

Subject : Physics

Class : XII **Max. Marks :- 100**

Topic : Alternating Current & EM Waves

Chapter Test 19

JEE MAIN CHAPTER TEST

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 In an L-C-R series circuit R = $\sqrt{5}\,\Omega$, X_L = 9Ω and X_C = 7Ω. If applied voltage in the circuit is 50 volt then impedance of the circuit in ohm will be -

(A) 2 (B) 3

(C) $2\sqrt{5}$ (D) $3\sqrt{5}$

Q.2 A pure inductor of 50.0 mH is connected to a source of 220V. Find the inductive reactance.

(A) 15.7 Ω (B) 18.4 Ω

(C) 12.7 Ω (D) 10.5 Ω

Q.3 A circuit contains an ac generator and a resistor. What happens to the average power dissipated in the resistor when the frequency is doubled and the rms voltage is tripled?

(A) Nothing happens, because the average power does not depend on either the frequency or the rms voltage.

(B) The average power doubles since it is proportional to the frequency.

(C) The average power triples because it is proportional to the rms voltage.

(D) The average power increases by a factor of 3^2= 9 since is proportional to the square of the rms voltage.

Q.4 A resistance R and inductance L and a capacitor C all are connected in series with an AC supply. The resistance of R is 16 ohm and for a given frequency, the inductive reactance of L is 24 ohm and capacitive reactance of C is 12 ohm. If the current in the circuit is 5 amp., find the potential difference across R, L and C.

(A) 30, 20, 50 volt (B) 40, 100, 60 volt

(C) 70, 110, 60 volt (D) 80, 120, 60 volt

Q.5 The same ac voltage is applied across a resistor and a capacitor, and the same rms current exists in each. Do both dissipate the same average power?

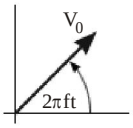
(A) Yes, because average power is the product of the current I_{rms} and the voltage V_{rms}, and they are the same for the resistor and the capacitor.

(B) Yes, because average power is the product of the square I^2_{rms} of the current and the voltage V_{rms}, and they are the same for the resistor and the capacitor.

(C) No, because, on the average, power is dissipated by the resistor, but not by the capacitor.

(D) No, because, on the average, power is not dissipated by the resistor, but is dissipated by the capacitor.

Q.6 The maximum voltage V_0 supplied by the generator in an ac circuit can be represented by a rotating phasor (figure). The value of the instantaneous voltage V at a time t is given by–



(A) the component of the phasor along the vertical axis.

(B) the component of the phasor along the horizontal axis.

(C) the length of the phasor.

(D) the angle between the phasor and the horizontal axis.

Q.7 The table shows the rms voltage V_C across the capacitor and the rms voltage V_L across the inductor for three series RCL circuits. In which circuit does the rms voltage across the entire RCL combination lead the current through the combination?

Circuit	V_C	V_L
1	50V	100V
2	100V	50V
3	50V	50V

(A) Circuit 1

(B) Circuit 2

(C) Circuit 3

(D) The total rms voltage across the RCL combination does not lead the current in any of the circuits.

Q.8 In an AC circuit the potential differences across an inductance and resistance joined in series are respectively 16V and 20V. The total potential difference across the circuit is–

(A) 20 V (B) 25.6 V

(C) 31.9 V (D) 53.5 V

Q.9 Current in an ac circuit is given by

i = 3 sin ωt + 4 cos ωt then –

(A) rms value of current is 5 A

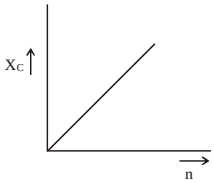
(B) mean value of this current in one half period will be 6/π

(C) if voltage applied is V = V_m sin ωt then the circuit must be containing resistance and capacitance.

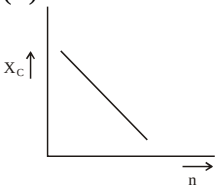
(D) if voltage applied is $V = V_m \sin \omega t$, the circuit may contain resistance and inductance.

Q.10 Which of the following curves show the variation of capacitive reactance (X_c) with frequency n –

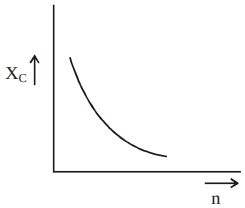
(A)



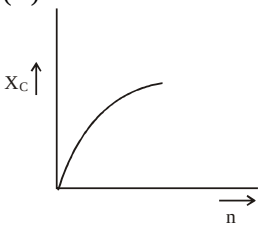
(B)



(C)



(D)

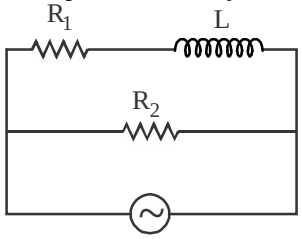


Q.11 An inductor 20×10^{-3} Henry, a capacitor 100μF and a resistor 50Ω are connected in series across a source of EMF V=10 sin 314t. If resistance is removed from the circuit and the value of inductance is doubled, then the variation of current with time in the new circuit is –

(A) 0.52 cos 314 t (B) 0.52 sin 314 t

(C) 0.52 sin (314 t + π/3) (D) None of these

Q.12 When the ac generator in the figure operates at a very high frequency, is the current delivered by the generator greater than, less than, or the same as when the generator operates at a very low frequency?



(A) The current is greater at the higher generator frequency, because the inductor has a very small reactance and behaves as if it were replaced by a wire with no resistance. Therefore, the circuit behaves as two resistors, R_1 and R_2, connected in parallel.

(B) The current is greater at the higher generator frequency, because the inductor has a very large reactance and behaves as if it were cut out of the circuit, leaving a gap in the connecting wires. Therefore, the circuit behaves as a single resistor R_2 connected across the generator

(C) The current is greater at the lower generator frequency, because the inductor has a very small reactance and behaves as if it were replaced by a wire with no resistance. Therefore, the circuit behaves as two resistors, R_1 and R_2, connected in parallel.

(D) The current is greater at the lower generator frequency, because the inductor has a very large reactance and behaves as if it were cut out of the circuit, leaving a gap in the connecting wires. Therefore, the circuit behaves as a single resistor R_2 connected across the generator.

Q.13 The value of current in two series LCR circuits at resonance is same when connected across a sinusoidal voltage source. Then –

(A) both circuits must be having same value of capacitance and inductor.

(B) in both circuits ratio of L and C will be same.

(C) for both the circuits X_L/X_C must be same at that frequency.

(D) both circuits must have same impedance at all frequencies.

Q.14 A 10Ω resistance, 5 mH coil and 10 μF capacitor are joined in series. When a variable frequency alternating current source is joined to this combination, the circuit resonates. If the resistance is halved, the resonance frequency :

(A) is halved (B) is doubled

(C) remains unchanged (D) is quadrupled.

Q.15 An electromagnetic wave travels in a vacuum. The wavelength of the wave is tripled. How is this accomplished?

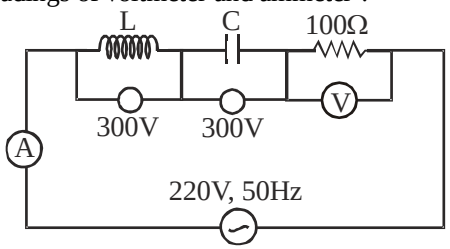
(A) By tripling the frequency of the wave.

(B) By tripling the speed of the wave.

(C) By reducing the frequency of the wave by a factor of three.

(D) By reducing the speed of the wave by a factor of three.

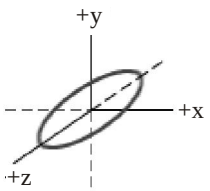
Q.16 In the circuit shown in figure, what will be the readings of voltmeter and ammeter ?



(A) 800 V, 2 A (B) 220 V, 2.2 A

(C) 300 V, 2 A (D) 100 V, 2 A

Q.17 The figure shows an x, y, z coordinate system. A circular loop of wire lies in the z, x plane and, when used with an LC tuned circuit, detects an electromagnetic wave. Which one of the following statements is correct?



(A) The wave travels along the x axis, and its electric field oscillates along the y axis.

(B) The wave travels along the z axis, and its electric field oscillates along the x axis.

(C) The wave travels along the z axis, and its electric field oscillates along the y axis.

(D) The wave travels along the y axis, and its electric field oscillates along the x axis.

Q.18 An electromagnetic wave is traveling in a vacuum. The electric field E of the wave is doubled. What happens to the magnetic field B, the total energy density u, and the intensity S of the wave?

(A) B doubles, u increases by a factor of four, S increases by a factor of four.

(B) B doubles, u doubles, S doubles.

(C) B increases by a factor of four, u increases by a factor of four, S increases by a factor of four.

(D) B doubles, u increases by a factor of four, S doubles.

Q.19 An alternating e.m.f. 10cos 100 t volts is connected in series with a resistance of 10 ohms and inductance of 100mH. What is the phase difference?

(A) $\pi/4$ (B) $\pi/2$

(C) π (D) $\pi/6$

Q.20 The equation of AC voltage is $E = 200 \sin(\omega t + \pi/6)$ and the A.C. current is $I = 10 \sin(\omega t + \pi/6)$. The average power dissipated is –

(A) 150 W (B) 550 W

(C) 250 W (D) 50 W

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 The p.d. across an instrument in an a.c. circuit of frequency f is V and the current flowing through it is I such that $V = 5 \cos 2\pi ft$ volt and $I = 2 \sin(2\pi ft)$ amp. The power (in watt) dissipate in the instrument is :

Q.22 In an A.C. circuit, maximum value of voltage is 423 volt. Its effective voltage (in V) is :

Q.23 Resonance frequency of a circuit is f. If the capacitance is made 4 times the initial value, then the resonance frequency will become (1/X) f. Find the value of x.

Q.24 The current flowing in a coil is 3 A and the power consumed is 108 W. If the a.c. source is of 120 V, 50 Hz, the resistance (in Ω) of the circuit is :

Q.25 Calculate the power factor of L–C–R circuit at resonance ?