PREVIOUS YEARS' QUESTIONS EXERCISE-II

1. The power factor of an AC circuit having resistance R and inductance L (connected in series) and an angular velocity ω is- **[AIEEE - 2002]**

(1) $\frac{R}{\omega L}$ (2) $\frac{R}{(R^2+\omega^2L^2)^{1/2}}$

(3) $\frac{\omega L}{R}$ (4) $\frac{R}{(R^2-\omega^2L^2)^{1/2}}$

2. Which of the following are not electromagnetic waves ? **[AIEEE–2002]**

(1) Cosmic-rays (2) γ-rays
(3) β-rays (4) X-rays

3. A metal wire of linear mass density of 9.8 g/m is stretched with a tension of 10 kg-wt between two rigid supports 1 m apart. The wire passes at its middle point between the poles of a permanent magnet and it vibrates in resonance when carrying an alternating current of frequency n. The frequency n of the alternating source is- **[AIEEE - 2003]**

(1) 50 Hz (2) 100 Hz
(3) 200 Hz (4) 25 Hz

4. In an oscillating LC circuit the maximum charge on the capacitor is Q. The charge on the capacitor when the energy is stored equally between the electric and magnetic fields is- **[AIEEE - 2003]**

(1) Q/2 (2) $Q/\sqrt{3}$

(3) $Q/\sqrt{2}$ (4) Q

5. Alternating current can not be measured by DC ammeter because- **[AIEEE - 2004]**

(1) AC cannot pass through DC ammeter
(2) AC changes direction
(3) average value of current for complete cycle is zero
(4) DC ammeter will get damaged

6. In an LCR series ac circuit, the voltage across each of the components. L, C and R is 50 V. The voltage across the LC combination will be- **[AIEEE - 2004]**

(1) 50 V (2) $50\sqrt{2}$ V (3) 100 V (4) 0

7. In an LCR circuit, capacitance is changed from C to 2C. For the resonant frequency to remain unchanged, the inductance should be changed from L to- **[AIEEE - 2004]**

(1) 4 L (2) 2L (3) L/2 (4) L/4

8. The self-inductance of the motor of an electric fan is 10 H. In order to impart maximum power at 50 Hz, it should be connected to a capacitance of- **[AIEEE - 2005]**

(1) 4 μF (2) 8 μF (3) 1 μF (4) 2 μF

9. A circuit has a resistance of 12 Ω and an impedance of 15 Ω. The power factor of circuit will be- **[AIEEE - 2005]**

(1) 0.8 (2) 0.4 (3) 1.25 (4) 0.125

10. The phase difference between the alternating current and emf is π/2. which of the following cannot be the constituent of the circuit ? **[AIEEE - 2005]**

(1) C alone (2) R, L
(3) L, C (4) L alone

11. In a series resonant LCR circuit, the voltage across R is 100 volts and R = 1 kΩ with C = 2μF. The resonant frequency ω is 200 rad/s. At resonance the voltage across L is- **[AIEEE - 2006]**

(1) 2.5×10^{-2} V (2) 40 V
(3) 250 V (4) 4×10^{-3} V

12. The rms value of the electric field of the light coming from the sun is 720 N/C. The average total energy density of the electromagnetic wave is- **[AIEEE–2006]**

(1) 4.58×10^{-6} J/m^3
(2) 6.37×10^{-9} J/m^3
(3) 81.35×10^{-12} J/m^3
(4) 3.3×10^{-3} J/m^3

13. In an AC circuit the voltage applied is $E = E_0 \sin\omega t$. The resulting current in the circuit is $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$. The power consumption in the circuit is given by- **[AIEEE - 2007]**

(1) $P = \frac{E_0 I_0}{\sqrt{2}}$ (2) P = zero

(3) $P = \frac{E_0 I_0}{2}$ (4) $P = \sqrt{2}\, E_0 I_0$

14. In a series LCR circuit R = 200Ω and the voltage and the frequency of the main supply is 220 V and 50 Hz respectively. On taking out the capacitance from the circuit the current lages behind the voltage by 30°. On taking out the inductor from the circuit the current leads the voltage by 30°. The power dissipated in the LCR circuit is : **[AIEEE - 2010]**

(1) 242 W (2) 305 W
(3) 210 W (4) Zero W

15. An AC voltage source of variable angular frequency w and fixed amplitude V_0 is connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When w is increased **[JEE 2010]**

(1) the bulb glows dimmer
(2) the bulb glows brighter
(3) total impedance of the circuit is unchanged
(4) total impedance of the circuit increases

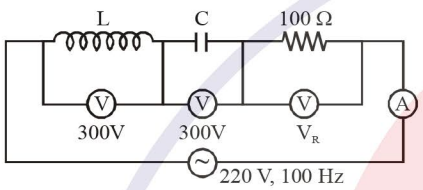
16. A series R-C circuit is connected to AC voltage source. Consider two cases ; (A) when C is without a dielectric medium and (B) when C is filled with dielectric of constant 4. The current I_R through the resistor and voltage V_C across the capacitor are compared in the two cases. Which of the following is/are true? **[JEE 2011]**

(1) $I_R^A > I_R^B$ (2) $I_R^A < I_R^B$

(3) $V_C^A > V_C^B$ (4) $V_C^A < V_C^B$

17. In an LCR circuit shown in the following figure, what will be the readings of the voltmeter across the resistor and ammeter if an a.c. source of 220 V and 100 Hz is connected to it as shown ?

[AIEEE - 2012 (Online)]



(1) 300 V, 3A (2) 800 V, 8A

(3) 110V, 1.1A (4) 220V, 2.2A

18. An electromagnetic wave with frequency ω and wavelength λ travels in the +y direction. Its magnetic field is along +x axis. The vector equation for the associated electric field (of amplitude E_0) is :-

[AIEEE–2012 (Online)]

(1) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right)\hat{x}$

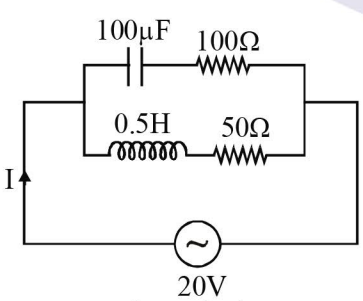
(2) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right)\hat{x}$

(3) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right)\hat{z}$

(4) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right)\hat{z}$

19. In the given circuit, the AC source has ω = 100 rad/s. Considering the inductor and capacitor to be ideal, the correct choice (s) is(are)

[IIT - 2012]



(1) The current through the circuit, I is 0.3 A.

(2) The current through the circuit, i is 0.3 √2A.

(3) The voltage across 100Ω resistor = 10√2V.

(4) The voltage across 50Ω resistor = 10V.

20. A plane electromagnetic wave in a non-magnetic dielectric medium is given by $\vec{E} = \vec{E}_0 \sin\left(4\times10^{-7}x - 50t\right)$ with distance being in meter and time in seconds. The dielectric constant of the medium is : **[JEE (Main)–2013 (On Line)]**

(1) 2.4 (2) 4.8 (3) 5.8 (4) 8.2

21. During the propagation of electromagnetic waves in a medium : **[JEE(Main)-2014]**

(1) Electric energy density is equal to the magnetic energy density

(2) Both electric magnetic energy densities are zero

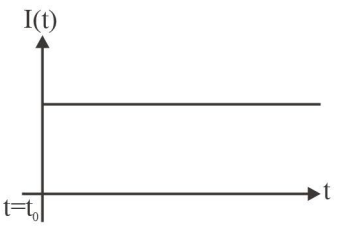
(3) Electric energy density is double of the magnetic energy density

(4) Electric energy density is half of the magnetic energy density.

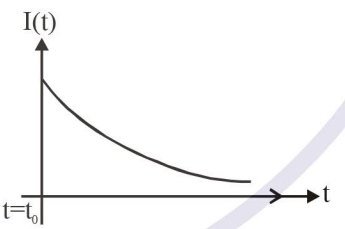
22. A series LR circuit is connected to a voltage source with $V(t) = V_0 \sin\Omega t$. After very large time, current I(t) behaves as $\left(t_0 >> \frac{L}{R}\right)$:

[JEE (Main)–2016 (On Line)]

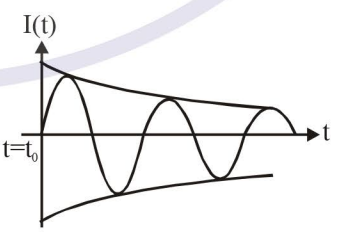
(1)



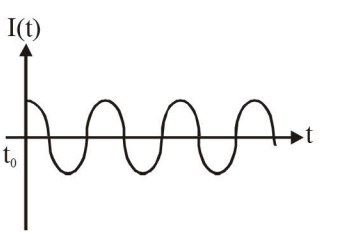
(2)



(3)



(4)



23. Consider an electromagnetic wave propagating in vacuum. Choose the correct statement :-

[JEE (Main)–2016 (On Line)]

(1) For an electromagnetic wave propagating in +y direction the electric field is $\vec{E}=\frac{1}{\sqrt{2}}E_{yz}(x,t)\hat{y}$ and the magnetic field is $\vec{B}=\frac{1}{\sqrt{2}}B_{yz}(x,t)\hat{z}$

(2) For an electromagnetic wave propagating in +y direction the electric field is $\vec{E}=\frac{1}{\sqrt{2}}E_{yz}(x,t)\hat{z}$ and the magnetic field is $\vec{B}=\frac{1}{\sqrt{2}}B_{z}(x,t)\hat{y}$

(3) For an electromagnetic wave propagating in +x direction the electric field is $\vec{E}=\frac{1}{\sqrt{2}}E_{yz}(x,t)(\hat{y}-\hat{z})$ and the magnetic field is $\vec{B}=\frac{1}{\sqrt{2}}B_{yz}(x,t)(\hat{y}+\hat{z})$

(4) For an electromagnetic wave propagating in +x direction the electric field is $\vec{E}=\frac{1}{\sqrt{2}}E_{yz}(y,z,t)(\hat{y}+\hat{z})$ and the magnetic field is $\vec{B}=\frac{1}{\sqrt{2}}B_{yz}(y,z,t)(\hat{y}+\hat{z})$

24. Magnetic field in a plane electromagnetic wave is given by

$\vec{B}=B_0\sin(kx+wt)\hat{j}T$

Expression for corresponding electric field will be: Where c is speed of light.

[JEE (Main)–2017 (On Line)]

(1) $\vec{E}=-B_0c\sin(kx+\omega t)\hat{k}\,V/m$

(2) $\vec{E}=B_0c\sin(kx-\omega t)\hat{k}\,V/m$

(3) $\vec{E}=\frac{B_0}{c}\sin(kx+\omega t)\hat{k}\,V/m$

(4) $\vec{E}=B_0c\sin(kx+\omega t)\hat{k}\,V/m$

25. A sinusoidal voltage of peak value 283 V and angular frequency 320/s is applied to a series LCR circuit. Given that R = 5 Ω, L = 25 mH and C = 1000 μF. The total impedance, and phase difference between the voltage across the source and the current will be respectively be :

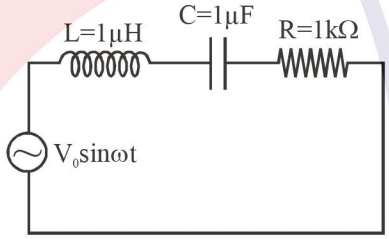
[JEE (Main)–2017 (On Line)]

(1) 10Ω and $\tan^{-1}\left(\frac{8}{3}\right)$ (2) 7Ω and $\tan^{-1}\left(\frac{5}{3}\right)$

(3) 10Ω and $\tan^{-1}\left(\frac{5}{3}\right)$ (4) 7Ω and 45°

26. In the circuit shown, L = 1 μH, C = 1 μF and R = 1 kΩ. They are connected in series with an a.c. source $V = V_0 \sin \omega t$ as shown. Which of the following options is/are correct ?

[JEE Advance-2017]



(1) The frequency at which the current will be in phase with the voltage is independent of R.

(2) At $\omega \sim 0$ the current flowing through the circuit becomes nearly zero

(3) At $\omega >> 10^6$ rad.s^{-1}, the circuit behaves like a capacitor.

(4) The current will be in phase with the voltage if $\omega = 10^4$ rad.s^{-1}.

27. For an RLC circuit driven with voltage of amplitude v_m and frequency $w_0 = \frac{1}{\sqrt{LC}}$ the current exhibits resonance. The quality factor, Q is given by :-

[JEE Main-2018]

(1) $\frac{\omega_0 R}{L}$ (2) $\frac{R}{(\omega_0 C)}$

(3) $\frac{CR}{\omega_0}$ (4) $\frac{\omega_0 L}{R}$

28. In an a. c. circuit, the instantaneous e.m.f. and current are given by

$e = 100 \sin 30\, t$

$i = 20 \sin\left(30t - \frac{\pi}{4}\right)$

In one cycle of a.c., the average power consumed by the circuit and the wattless current are, respectively. **[JEE Main-2018]**

(1) $\frac{1000}{\sqrt{2}}$, 10 (2) $\frac{50}{\sqrt{2}}$, 0

(3) 50, 0 (4) 50, 10

29. A plane electromagnetic wave of wavelength l has an intensity I. It is propagating along the positive Y-direction. The allowed expressions for the electric and magnetic fields are given by :-

[JEE (Main)–2018 (On Line)]

(1) $\vec{E} = \sqrt{\frac{I}{\epsilon_0 c}} \cos\left[\frac{2\pi}{\lambda}(y - ct)\right]; \vec{B} = \frac{1}{c}E\hat{k}$

(2) $\vec{E} = \sqrt{\frac{2I}{\epsilon_0 c}} \cos\left[\frac{2\pi}{\lambda}(y + ct)\right]\hat{k}; \vec{B} = \frac{1}{c}E\hat{i}$

(3) $\vec{E} = \sqrt{\frac{2I}{\epsilon_0 c}} \cos\left[\frac{2\pi}{\lambda}(y - ct)\right]\hat{k}; \vec{B} = +\frac{1}{c}E\hat{i}$

(4) $\vec{E} = \sqrt{\frac{I}{\epsilon_0 c}} \cos\left[\frac{2\pi}{\lambda}(y - ct)\right]\hat{k}; \vec{B} = \frac{1}{c}E\hat{i}$

30. A power transmission lines feeds input power at 2300 V to a step down transformer with its primary windings having 4000 turns, giving the output power at 230 V. If the current in the primary of the transformer is 5A, and its efficiency is 90%, the output current would be:-

[JEE (Main)–2018 (On Line)]

(1) 50 A (2) 25 A

(3) 45 A (4) 20 A

PREVIOUS YEARS QUESTIONS				ANSWER KEY						Exercise-II
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**2**	**1,3**	**1**	**3**	**3**	**4**	**3**	**3**	**1**	**2**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**3**	**1**	**2**	**1**	**2**	**1**	**4**	**4**	**1,3**	**2**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**1**	**4**	**3**	**4**	**4**	**1,2**	**4**	**1**	**3**	**3**