Additional Problems For Self Practice (APSP)

PART -I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions :

1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

1. The current in a circuit containing a capacitance C and a resistance R in series leads over the applied voltage of frequency $\frac{\omega}{2\pi}$ by.

(1) $\tan^{-1}\left(\frac{1}{\omega CR}\right)$ (2) $\tan^{-1}(\omega CR)$ (3) $\tan^{-1}\left(\omega\frac{1}{R}\right)$ (4) $\cos^{-1}(\omega CR)$

2. In a circuit, an inductance of 0.1 Henry and a resistance of 1Ω are connected in series with an AC source of voltage V = 5 sin 10 t. The phase difference between the current and applied voltage will be

(1) π (2) 2π (3) π/4 (4) 0

3. In a series LR circuit, the voltage drop across inductor is 8 volt and across resistor is 6 volt. Then voltage applied and power factor of circuit respectively are:

(1) 14 V, 0.8 (2) 10 V, 0.8 (3) 10 V, 0.6 (4) 14 V, 0.6

4. The output of an AC generator is given by : $E = E_m\sin(\omega t - \pi/4)$ and current is given by $i = i_m\sin(\omega t - 3\pi/4)$. The circuit contains a single element other than the generator. It is :

(1) a capacitor. (2) a resistor.

(3) an inductor. (4) not possible to decide due to lack of information.

5. A 2μF capacitor is initially charged to 20 Volts and then shorted across a 8 μH inductor. The maximum value of the current in the circuit is :

(1) 10.0 A (2) 7.5 A (3) 12.0 A (4) 8.2 A

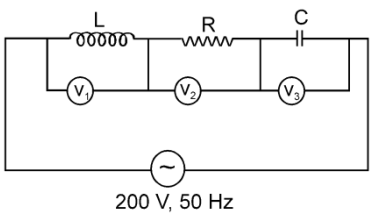
6. If the readings of v_1 and v_3 are 100 volt each then reading of v_2 is

(1) 0 volt

(2) 100 volt

(3) 200 volt

(4) cannot be determined by given information.



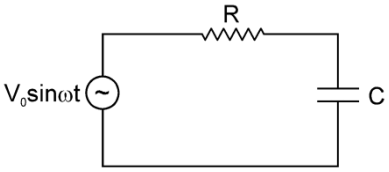
7. In a step-up transformer the turns ratio is 10. If the frequency of the current in the primary coil is 50 Hz then the frequency of the current in the secondary coil will be

(1) 500 Hz (2) 5 Hz (3) 60 Hz (4) 50 Hz

8. In an LRC series circuit at resonance current in the circuit is $10\sqrt{2}$ A. If now frequency of the source is changed such that now current lags by 45° than applied voltage in the circuit. Which of the following is correct :

(1) Frequency must be increased and current after the change is 10 A
(2) Frequency must be decreased and current after the change is 10 A
(3) Frequency must be decreased and current is same as that of initial value
(4) The given information is insufficient to conclude anything

9. An ac voltage source $V = V_0 \sin \omega t$ is connected across resistance R and capacitance C as shown in figure. It is given that $R = \frac{1}{\omega C}$. The peak current is I_0. If the angular frequency of the voltage source is changed to $\frac{\omega}{\sqrt{3}}$ then the new peak current in the circuit is



(1) $\frac{I_0}{2}$ (2) $\frac{I_0}{\sqrt{2}}$
(3) $\frac{I_0}{\sqrt{3}}$ (4) $\frac{I_0}{3}$

10. A coil has an inductance of $\frac{2.2}{\pi}$ H and is joined in series with a resistance of 220 Ω. When an alternating e.m.f. of 220 V at 50 cps is applied to it, then the wattless component of the rms current in the circuit is
(1) 5 ampere (2) 0.5 ampere (3) 0.7 ampere (4) 7 ampere

11. A resistor and a capacitor are connected to an AC supply of 200 volt, 50 Hz in series. The current in the circuit is 2 ampere. If the power consumed in the circuit is 100 watt, then the resistance in the circuit is:
(1) 100 Ω (2) 25 Ω (3) $\sqrt{125 \times 75}$ Ω (4) 400 Ω

12. A transformer is used to light a 140 watt, 24 volt lamp from 240 V AC mains. The current in the main cable is 0.7 amp. The efficiency of the transformer is :
(1) 48% (2) 63.8% (3) 83.3% (4) 90%

13. In a step-up transformer the voltage in the primary is 220 V and the current is 5A. The secondary voltage is found to be 22000 V. The current in the secondary (neglect losses) is
(1) 5 A (2) 50 A (3) 500 A (4) 0.05 A

14. The voltage of an AC source varies with time according to the equation, $V = 100 \sin 100 \pi t \cos 100 \pi t$. Where t is in second and V is in volt. Then :
(1) the peak voltage of the source is 100 volt
(2) the peak voltage of the source is $(100/\sqrt{2})$ volt
(3) the peak voltage of the source is 50 volt
(4) the frequency of the source is 50 Hz

15. In an L-R series circuit ($L = \frac{175}{11}$ mH and R = 12Ω), a variable emf source ($V = V_0 \sin \omega t$) of $V_{rms} = 130\sqrt{2}$ V and frequency 50 Hz is applied. The current amplitude in the circuit and phase of current with respect to voltage are respectively(Use $\pi = 22/7$)

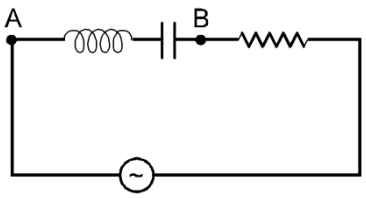
(1) 14.14A, 30° (2) $10\sqrt{2}$ A, $\tan^{-1}\frac{5}{12}$
(3) 10 A, $\tan^{-1}\frac{5}{12}$ (4) 20 A, $\tan^{-1}\frac{5}{12}$

16. A series LCR circuit containing a resistance of 120ohm has angular resonance frequency 4×10^3 rad s^{-1}. At resonance, the voltage across resistance and inductance are 60V and 40 V respectively. The values of L and C are respectively :
(1) 20 mH, 25/8 μF (2) 2mH, 1/35 μF
(3) 20 mH, 1/40 μF (4) 2mH, 25/8 nF

17. The secondary coil of an ideal step down transformer is delivering 500 watt power at 12.5 A current. If the ratio of turns in the primary to the secondary is 5 : 1, then the current flowing in the primary coil will be :

(1) 62.5 A (2) 2.5 A (3) 6 A (4) 0.4 A

18. An inductor $\left(L = \frac{1}{100\pi}H\right)$, a capacitor $\left(C = \frac{1}{500\pi}F\right)$ and a resistance (3Ω) is connected in series with an AC voltage source as shown in the figure. The voltage of the AC source is given as V = 10 cos(100 πt) volt. What will be the potential difference between A and B ?



(1) 8 cos(100 πt – 127º) volt (2) 8 cos(100 πt – 53º) volt
(3) 8 cos(100 πt – 37º) volt (4) 8 cos(100 πt + 37º) volt

19. A 300 Ω resistor is connected in series with a parallel -plate capacitor across the terminals of a 50.0 Hz ac generator. When the gap between the plates is empty, its capacitance is $\frac{70}{22}$ μF. The ratio of the rms current in the circuit when the capacitor is empty to that when ruby mica of dielectric constant k = 5.0 is inserted between the plates, is equal to :

(1) 0.1 (2) 0.3 (3) 0.6 (4) 2.9

20. In an LC oscillations, charge on the capacitor is Q and the current in the circuit is I such that the energy stored in the capacitor is equal to that in the inductor at an instant .The time period of the electrical oscillations will be:

(1) $2\pi\frac{Q}{I}$ (2) $2\pi\sqrt{\frac{I}{Q}}$ (3) $2\pi\sqrt{\frac{Q}{I}}$ (4) $2\pi\frac{I}{Q}$

21. From a metallic charged body a current is drawn. The rate of increase of current at an instant is equal to the charge on the body at that instant.If the initial charge on the body is Q

(1) the minimum time it will take for the charge to become zero is $\frac{\pi}{2}$ sec.
(2) the minimum time it will take for the charge to become zero is 2 sec.
(3) The value of the current when the charge on the body is Q/2 is $Q\sqrt{\frac{3}{2}}$
(4) The value of the current when the charge on the body is Q/2 is $\frac{Q}{\sqrt{3}}$.

22. For a LCR series circuit with an A.C. source of angular frequency ω.

(1) circuit will be capacitive if $\omega > \frac{1}{\sqrt{LC}}$
(2) circuit will be inductive if $\omega = \frac{1}{\sqrt{LC}}$
(3) power factor of circuit will by unity if capacitive reactance equals inductive reactance
(4) current will be leading voltage if $\omega > \frac{1}{\sqrt{LC}}$

23. EMF induced by a powerplant is given by ε = 2 + 3 sinωt + 3 cosωt in volts. Then RMS value of potential difference is :

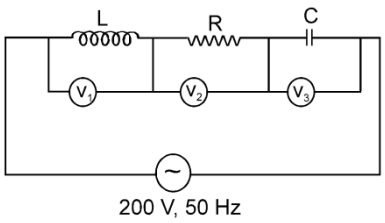
(1) $\sqrt{13}$ volt (2) $\sqrt{22}$ volt (3) $\sqrt{11}$ volt (4) None of these

24. If the readings of v_1 and v_3 are 100 volt each then reading of v_2 is :

(1) 0 volt (2) 100 volt

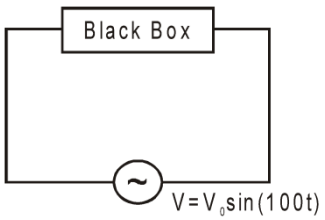
(3) 200 volt

(4) cannot be determined by given information.

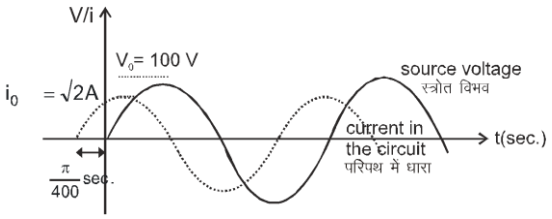


Comprehension - 1

A voltage source $V = V_0 \sin(100\ t)$ is connected to a black box in which there can be either one element out of L, C, R or any two of them connected in series.



At steady state. the variation of current in the circuit and the source voltage are plotted together with time, using an oscilloscope, as shown



25. The element(s) present in black box is/are :

(1) only C (2) L C (3) L and R (4) R and C

26. Values of the parameters of the elements, present in the black box are -

(1) R = 50Ω , C = 200 μf (2) R = 50Ω , L = 2mH

(3) R = 400 Ω , C = 50 μ f (4) None of these

27. If AC source is removed, the circuit is shorted for some time so that capacitor is fully discharsed and then a battery of constant EMF is connected across the black box. At t = 0, the current in the circuit will

(1) increase exponentially with time constant = 0.02 sec.

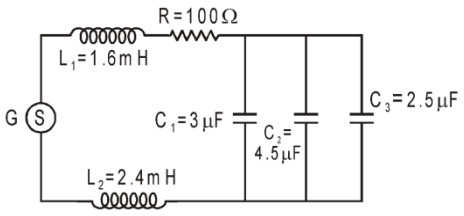
(2) decrease exponentially with time constant = 0.01 sec.

(3) oscillate with angular frequency 20 sec^{-1}

(4) first increase and then decrease

Comprehension-2

An ac generator G with an adjustable frequency of oscillation is used in the circuit, as shown.



28. Current drawn from the ac source will be maximum if its angular frequency is -

(1) 10^5 rad/s (2) 10^4 rad/s (3) 5000 rad/s (4) 500 rad/s

29. To increase resonant frequency of the circuit, some of the changes in the circuit are carried out. Which change(s) would certainly result in the increase in resonant frequency ?

(1) R is increased.
(2) L_1 is increased and C_1 is decreased.
(3) L_2 is decreased and C_2 is increased.
(4) C_3 is removed from the circuit.

30. If the ac source G is of 100 V rating at resonant frequency of the circuit, then average power supplied by the source is -
(1) 50 W (2) 100 W (3) 500 W (4) 1000 W

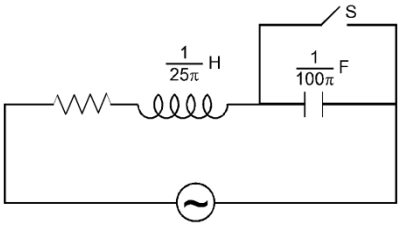
Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

Comprehension-1



In the LCR circuit shown in figure unknown resistance and alternating voltage source are connected. When switch 'S' is closed then there is a phase difference of $\frac{\pi}{4}$ between current and applied voltage and voltage accross resister is $\frac{100}{\sqrt{2}}$ V. When switch is open current and applied voltage are in same phase. Neglecting resistance of connecting wire answer the following questions :

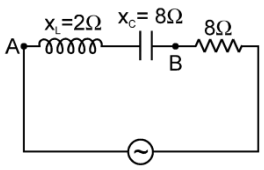
1. Peak voltage of applied voltage sources is :
(1) $200\sqrt{2}$ V (2) 100 V (3) $100\sqrt{2}$ V (4) $\frac{100}{\sqrt{2}}$ V

2. Resonance frequency of circuit is :
(1) 50 Hz
(2) 25 Hz
(3) 75 Hz
(4) Data insufficient for caculation

3. Average power consumption in the circuit when 'S' is open :
(1) 2500 W (2) 3000 W (3) 5000 W (4) 1250 W

4. An inductor ($x_L = 2\Omega$) a capacitor ($x_C = 8\Omega$) and a resistance (8Ω) is connected in series with an ac source.
The voltage output of A.C source is given by $v = 10 \cos 100\pi t$.
(a) Find the impedance of the circuit.

(b) Find the instantaneous p.d. between A and B when it is half of the voltage output fromsource at that instant.



APSP Answers

PART -I

1.	(1)	**2.**	(3)	**3.**	(3)	**4.**	(3)	**5.**	(1)	**6.**	(3)	**7.**	(4)
8.	(1)	**9.**	(2)	**10.**	(2)	**11.**	(2)	**12.**	(3)	**13.**	(4)	**14.**	(3)
15.	(4)	**16.**	(1)	**17.**	(2)	**18.**	(3)	**19.**	(2)	**20.**	(1)	**21.**	(1)
22.	(3)	**23.**	(1)	**24.**	(3)	**25.**	(4)	**26.**	(1)	**27.**	(2)	**28.**	(3)
29.	(4)	**30.**	(2)										

PART - II

1.	(3)	**2.**	(2)	**3.**	(3)