DPP - Daily Practice Problems

Name : _____ Date : _____

Start Time : _____ End Time : _____

PHYSICS 46

SYLLABUS : ALTERNATING CURRENT - 1 (Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance, Pure circuits, LR, CR ac circuits.)

Max. Marks : 116 **Time : 60 min.**

GENERAL INSTRUCTIONS

- The Daily Practice Problem Sheet contains 29 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.
- You have to evaluate your Response Grids yourself with the help of solution booklet.
- Each correct answer will get you 4 marks and 1 mark shall be deduced for each incorrect answer. No mark will be given/ deducted if no bubble is filled. Keep a timer in front of you and stop immediately at the end of 60 min.
- The sheet follows a particular syllabus. Do not attempt the sheet before you have completed your preparation for that syllabus. Refer syllabus sheet in the starting of the book for the syllabus of all the DPP sheets.
- After completing the sheet check your answers with the solution booklet and complete the Result Grid. Finally spend time to analyse your performance and revise the areas which emerge out as weak in your evaluation.

DIRECTIONS (Q.1-Q.21) : There are 21 multiple choice questions. Each question has 4 choices (a), (b), (c) and (d), out of which **ONLY ONE** choice is correct.

Q.1 The resistance of a coil for dc is 5 ohm. In ac, the resistance will

(a) remain same (b) increase

(c) decrease (d) be zero

Q.2 If instantaneous current is given by $i = 4\cos(\omega t + \phi)$ amperes, then the r.m.s. value of current is

(a) 4 ampere (b) $2\sqrt{2}$ ampere

(c) $4\sqrt{2}$ ampere (d) zero ampere

Q.3 In an ac circuit I = 100 sin 200πt. The time required for the current to achieve its peak value will be

(a) $\frac{1}{100}$sec (b) $\frac{1}{200}$sec (c) $\frac{1}{300}$sec (d) $\frac{1}{400}$sec

Q.4 The frequency of ac mains in India is

(a) 30 c/s or Hz (b) 50 c/s or Hz

(c) 60 c/s or Hz (d) 120 c/s or Hz

Q.5 The peak value of an alternating e.m.f. E given by $E = E_0 \cos \omega t$ is 10 volts and its frequency is 50 Hz. At time $t = \frac{1}{600}$sec, the instantaneous e.m.f. is

(a) 10 V (b) $5\sqrt{3}$ V (c) 5 V (d) 1 V

RESPONSE GRID	1. ⓐⓑⓒⓓ	2. ⓐⓑⓒⓓ	3. ⓐⓑⓒⓓ	4. ⓐⓑⓒⓓ	5. ⓐⓑⓒⓓ

Space for Rough Work

Q.6 An alternating current is given by the equation $i = i_1 \cos\omega t + i_2 \sin\omega t$. The r.m.s. current is given by

(a) $\frac{1}{\sqrt{2}}(i_1 + i_2)$ (b) $\frac{1}{\sqrt{2}}(i_1 + i_2)^2$

(c) $\frac{1}{\sqrt{2}}(i_1^2 + i_2^2)^{1/2}$ (d) $\frac{1}{2}(i_1^2 + i_2^2)^{1/2}$

Q.7 In a circuit, the value of alternating current is measured by hot wire ammeter as 10 ampere. Its peak value will be

(a) 10 A (b) 20 A (c) 14.14 A (d) 7.07 A

Q.8 The frequency of an alternating voltage is 50 cycles/sec and its amplitude is 120V. Then the r.m.s. value of voltage is

(a) 101.3V (b) 84.8V (c) 70.7V (d) 56.5V

Q.9 A resistance of 20Ω is connected to a source of an alternating potential $V = 220\sin(100\pi t)$. The time taken by the current to change from its peak value to r.m.s. value is

(a) 0.2 sec (b) 0.25 sec

(c) 25×10^{-3} sec (d) 2.5×10^{-3} sec

Q.10 An alternating current of frequency f is flowing in a circuit containing a resistor of resistance R and a choke of inductance L in series. The impedance of this circuit is

(a) $R + 2\pi fL$ (b) $\sqrt{R^2 + 4\pi^2 f^2 L^2}$

(c) $\sqrt{R^2 + L^2}$ (d) $\sqrt{R^2 + 2\pi fL}$

Q.11 An alternating voltage is connected in series with a resistance R and an inductance L. If the potential drop across the resistance is 200 V and across the inductance is 150 V, then the applied voltage is

(a) 350 V (b) 250 V

(c) 500 V (d) 300 V

Q.12 An inductive circuit contains resistance of 10Ω and an inductance of 20 H. If an ac voltage of 120 V and frequency 60 Hz is applied to this circuit, the current would be nearly

(a) 0.32 A (b) 0.016 A

(c) 0.48 A (d) 0.80 A

Q.13 A 20 volt ac is applied to a circuit consisting of a resistance and a coil with negligible resistance. If the voltage across the resistance is 12 V, the voltage across the coil is

(a) 16 volt (b) 10 volt

(c) 8 volt (d) 6 volt

Q.14 An alternating voltage $E = 200\sqrt{2}\sin(100t)$ is connected to a 1 microfarad capacitor through an ac ammeter. The reading of the ammeter will be

(a) 10 mA (b) 20 mA

(c) 40 mA (d) 80 mA

Q.15 A resistor and a capacitor are connected in series with an a.c. source. If the potential drop across the capacitor is 5 V and that across resistor is 12 V, applied voltage is

(a) 13 V (b) 17 V

(c) 5 V (d) 12 V

Q.16 A 120 volt ac source is connected across a pure inductor of inductance 0.70 henry. If the frequency of the ac source is 60 Hz, the current passing through the inductor is

(a) 4.55 amp (b) 0.355 amp

(c) 0.455 amp (d) 3.55 amp

Q.17 The instantaneous value of current in an A.C. circuit is I = 2 sin (100 πt + π/3)A. The current will be maximum for the first time at

(a) $t = \frac{1}{100}s$ (b) $t = \frac{1}{200}s$

(c) $t = \frac{1}{400}s$ (d) $t = \frac{1}{600}s$

Q.18 In an L – R circuit, the value of L is $\left(\frac{0.4}{\pi}\right)$ henry and the value of R is 30 ohm. If in the circuit, an alternating *e.m.f.* of 200 volt at 50 cycles per sec is connected, the impedance of the circuit and current will be

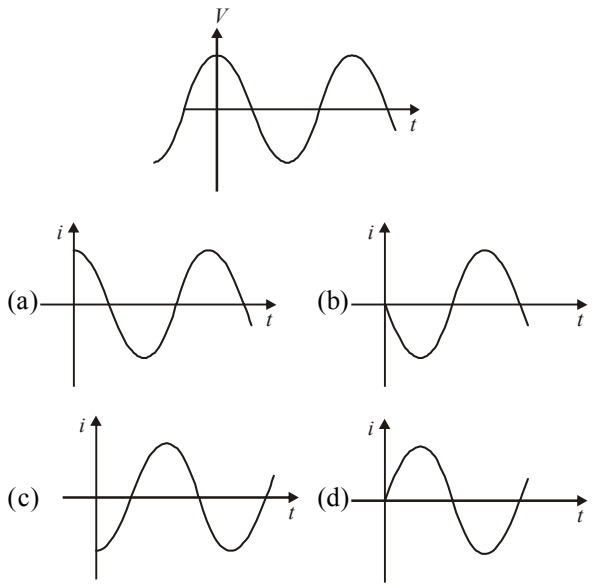
(a) $11.4\Omega, 17.5A$ (b) $30.7\Omega, 6.5A$

(c) $40.4\Omega, 5A$ (d) $50\Omega, 4A$

RESPONSE GRID					
	6. ⓐⓑⓒⓓ	7. ⓐⓑⓒⓓ	8. ⓐⓑⓒⓓ	9. ⓐⓑⓒⓓ	10. ⓐⓑⓒⓓ
	11. ⓐⓑⓒⓓ	12. ⓐⓑⓒⓓ	13. ⓐⓑⓒⓓ	14. ⓐⓑⓒⓓ	15. ⓐⓑⓒⓓ
	16. ⓐⓑⓒⓓ	17. ⓐⓑⓒⓓ	18. ⓐⓑⓒⓓ		

Space for Rough Work

Q.19 The voltage across a pure inductor is represented by the following diagram. Which one of the following diagrams will represent the current?



Q.20 One 10 V, 60 W bulb is to be connected to 100 V line. The required induction coil has self-inductance of value ($f = 50$ Hz)

(a) 0.052 H (b) 2.42 H
(c) 16.2 mH (d) 1.62 mH

Q.21 A resistance of 300Ω and an inductance of $\frac{1}{\pi}$ henry are connected in series to a ac voltage of 20 volt and 200 Hz frequency. The phase angle between the voltage and current is

(a) $\tan^{-1}\frac{4}{3}$ (b) $\tan^{-1}\frac{3}{4}$
(c) $\tan^{-1}\frac{3}{2}$ (d) $\tan^{-1}\frac{2}{5}$

DIRECTIONS (Q.22-Q.23) : In the following questions, more than one of the answers given are correct. Select the correct answers and mark it according to the following codes:

Codes :
(a) 1, 2 and 3 are correct
(b) 1 and 2 are correct
(c) 2 and 4 are correct
(d) 1 and 3 are correct

Q.22 If an alternating voltage is represented as E = 141 sin (628t), then
(1) the rms voltage is 141V
(2) the rms voltage is 100V
(3) the frequency is 50 Hz
(4) the frequency is 100 Hz

Q.23 The r.m.s. value of an ac of 50 Hz is 10 A.
(1) The time taken by the alternating current in reaching from zero to maximum value is 5×10^{-3} sec
(2) The time taken by the alternating current in reaching from zero to maximum value is 2×10^{-3} sec
(3) The peak current is 14.14 A
(4) The peak current is 7.07 A

DIRECTIONS (Q.24-Q.26) : Read the passage given below and answer the questions that follows :

If the voltage in an ac circuit is represented by the equation, $V = 220\sqrt{2}\sin(314t - \phi)$, then

Q.24 RMS value of the voltage is
(a) 220 V (b) 314 V
(c) $220\sqrt{2}$ V (d) $200/\sqrt{2}$ V

Q.25 Average voltage is
(a) 220 V (b) $622/\pi$V
(c) $220\sqrt{2}$ V (d) $200/\sqrt{2}$ V

Q.26 Frequency of ac is
(a) 50 Hz (b) $50\sqrt{2}$ Hz
(c) $50\sqrt{2}$ Hz (d) 75 Hz

RESPONSE GRID					
	19. ⓐⓑⓒⓓ	**20.** ⓐⓑⓒⓓ	**21.** ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ
	24. ⓐⓑⓒⓓ	**25.** ⓐⓑⓒⓓ	**26.** ⓐⓑⓒⓓ		

Space for Rough Work

DIRECTIONS (Q. 27-Q.29) : Each of these questions contains two statements: Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

(a) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(b) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
(c) Statement -1 is False, Statement-2 is True.
(d) Statement -1 is True, Statement-2 is False.

Q27 **Statement-1:** The alternating current lags behind the em.f. by a phase angle of $\pi/2$, when ac flows through an inductor.
Statement-2 : The inductive reactance increases as the frequency of ac source decreases.

Q.28 **Statement-1 :** An alternating current does not show any magnetic effect.
Statement-2: Alternating current varies with time.

Q.29 **Statement-1 :** A capacitor of suitable capacitance can be used in an ac circuit in place of the choke coil.
Statement-2 : A capacitor blocks dc and allows ac only.

RESPONSE GRID	27. ⓐⓑⓒⓓ	28. ⓐⓑⓒⓓ	29. ⓐⓑⓒⓓ

DAILY PRACTICE PROBLEM SHEET 46 - PHYSICS			
Total Questions	29	Total Marks	116
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	26	Qualifying Score	44
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

Space for Rough Work

DAILY PRACTICE PROBLEMS

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1. (b) The coil has inductance L besides the resistance R. Hence for ac it's impedance resistance $\sqrt{R^2+X_L^2}$ will be larger than it's impedance R for dc.

2. (b) $i_{r.m.s.}=\frac{i_0}{\sqrt{2}}=\frac{4}{\sqrt{2}}=2\sqrt{2}\ ampere$

3. (d) The current takes $\frac{T}{4}$ sec to reach the peak value.

In the given question $\frac{2\pi}{T}=200\pi \Rightarrow T=\frac{1}{100}$ sec

$\therefore$ Time to reach the peak value $=\frac{1}{400}$ sec

4. (b) 50 c/s or Hz

5. (b) $E=E_0\cos\omega t=E_0\cos\frac{2\pi t}{T}$

$=10\cos\frac{2\pi\times50\times1}{600}=10\cos\frac{\pi}{6}=5\sqrt{3}\ volt.$

6. (c) $i_{rms}=\sqrt{\frac{i_1^2+i_2^2}{2}}=\frac{1}{\sqrt{2}}(i_1^2+i_2^2)^{1/2}$

7. (c) Hot wire ammeter reads rms value of current. Hence its peak value $=i_{rms}\times\sqrt{2}=14.14\ amp$

8. (b) $V_{rms}=\frac{V_0}{\sqrt{2}}=\frac{120}{1.414}=84.8\,V$

9. (d) Peak value to $r.\ m.\ s.$ value means, current becomes $\frac{1}{\sqrt{2}}$ times.

If peak is at $t=0$, current is of the form

$i=i_0\cos100\pi t \Rightarrow \frac{1}{\sqrt{2}}\times i_0=i_0\cos100\pi t$

$\Rightarrow \cos\frac{\pi}{4}=\cos100\pi t \Rightarrow t=\frac{1}{400}\text{sec}=2.5\times10^{-3}\text{ sec}.$

10. (b) $Z=\sqrt{R^2+X_L^2}, X_L=\omega L$ and $\omega=2\pi f$

$\therefore Z=\sqrt{R^2+4\pi^2f^2L^2}$

11. (b) The applied voltage is given by $V=\sqrt{V_R^2+V_L^2}$

$V=\sqrt{(200)^2+(150)^2}=250\ volt$

12. (b)

$i=\frac{V}{\sqrt{R^2+\omega^2L^2}}=\frac{120}{\sqrt{100+4\pi^2\times60^2\times20^2}}=0.016A$

13. (a) The voltage across a L-R combination is given by

$V^2=V_R^2+V_L^2$

$V_L=\sqrt{V^2-V_R^2}=\sqrt{400-144}=\sqrt{256}=16\ volt.$

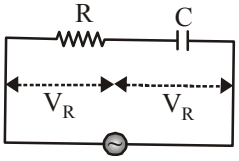
14. (b) Reading of ammeter,

$i_{rms}=\frac{V_{rms}}{X_c}=\frac{V_0\omega C}{\sqrt{2}}$

$=\frac{200\sqrt{2}\times100\times(1\times10^{-6})}{\sqrt{2}}$

$=2\times10^{-2}\text{ A}=20\text{ m A}$

15. (a)



Let the applied voltage be V, volt.

Here, $V_R=12\,V, V_C=5V$

$V=\sqrt{V_R^2+V_C^2}=\sqrt{(12)^2+(5)^2}=13\,V.$

16. (c) $Z=X_L=2\pi\times60\times0.7$

$\therefore i=\frac{120}{Z}=\frac{120}{2\pi\times60\times0.7}=0.455\ ampere$

17. (d) Current will be max at first time when

$100\pi t+\pi/3=\pi/2 \Rightarrow 100\pi t=\pi/6 \Rightarrow t=1/600\ s.$

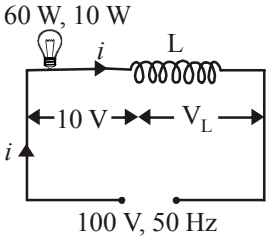
18. (d) $Z=\sqrt{R^2+X^2}=\sqrt{R^2+(2\pi fL)^2}$

$=\sqrt{(30)^2+\left(2\pi\times50\times\frac{0.4}{\pi}\right)^2}=\sqrt{900+1600}=50\Omega$

$i=\frac{V}{Z}=\frac{200}{50}=4\text{ ampere}$

19. (d) In purely inductive circuit voltage leads the current by 90°.

20. (a) Current through the bulb $i=\frac{P}{V}=\frac{60}{10}=6A$



$V = \sqrt{V_R^2 + V_L^2}$

$(100)^2 = (10)^2 + V_L^2 \Rightarrow V_L = 99.5$ Volt

Also $V_L = iX_L = i \times (2\pi\nu L)$

$\Rightarrow \quad 99.5 = 6 \times 2 \times 3.14 \times 50 \times L = \Rightarrow L = 0.052$ H.

21. (a) Phase angle $\tan\phi = \frac{\omega L}{R} = \frac{2\pi \times 200}{300} \times \frac{1}{\pi} = \frac{4}{3}$

$\therefore \ \phi = \tan^{-1}\frac{4}{3}$

22. (a) The root mean square voltage is effective voltage.

23. (c) $E = 141 \sin(628t)$,

$E_{rms} = \frac{E_0}{\sqrt{2}} = \frac{141}{1.41} = 100V$ and $2\pi f = 628$

$\Rightarrow f = 100Hz$

24. (d) Time taken by the current to reach the maximum value

$t = \frac{T}{4} = \frac{1}{4\nu} = \frac{1}{4 \times 50} = 5 \times 10^{-3}$ sec

and $i_0 = i_{rms}\sqrt{2} = 10\sqrt{2} = 14.14$ amp

25. (a) As in case of ac,

$V = V_0 \sin(\omega t - \phi)$

The peak value $V_0 = 220\sqrt{2} = 311$V

and as in case of ac,

$V_{rms} = \frac{V_0}{\sqrt{2}}; V_{rms} = 220$ V

26. (b) In case of ac,

$V_{av} = \frac{2}{\pi}V_0 = \frac{2}{\pi} \times 311 = \frac{622}{\pi}V$

27. (a) As $\omega = 2\pi f, 2\pi f = 314$ i.e., $f = \frac{314}{2 \times \pi} = 50$Hz

28. (d) When ac flows through an inductor current lags behind the emf., by phase of $\pi/2$, inductive reactance, $X_L = \omega L = \pi.2f.L$, so when frequency increases correspondingly inductive reactance also increases.

29. (c) Like direct current, an alternating current also produces magnetic field. But the magnitude and direction of the field goes on changing continuously with time.

30. (b) We can use a capacitor of suitable capacitance as a choke coil, because average power consumed per cycle in an ideal capacitor is zero. Therefore, like a choke coil, a condenser can reduce ac without power dissipation.