

## JEE MAIN ALTERNATING CURRENT — PYQS

Max. Marks: 180

Questions: 45

### Section A (MCQ) — 28 questions

- Q.1** A LCR series circuit driven with  $E_{\text{rms}} = 90 \text{ V}$  at frequency  $f_d = 30 \text{ Hz}$  has resistance  $R = 80 \Omega$ , an inductance with inductive reactance  $X_L = 20.0 \Omega$  and capacitance with capacitive reactance  $X_C = 80.0 \Omega$ . The power factor of the circuit is \_\_\_\_\_. [JEE Main 2026 (Online) 6th April Morning Shift]
- (1) 0.8      (2) 0.64      (3) 0.9      (4) 0.5

Scan or tap for the full solution



- Q.2** An a.c. source of angular frequency  $\omega$  is connected across a resistor  $R$  and a capacitor  $C$  in series. The current is observed as  $I$ . Now the frequency of the source is changed to  $\omega/4$ , (keeping the voltage unchanged) the current is found to be  $I/3$ . The ratio of resistance to reactance at frequency  $\omega$  is \_\_\_\_\_.

[JEE Main 2026 (Online) 5th April Morning Shift]

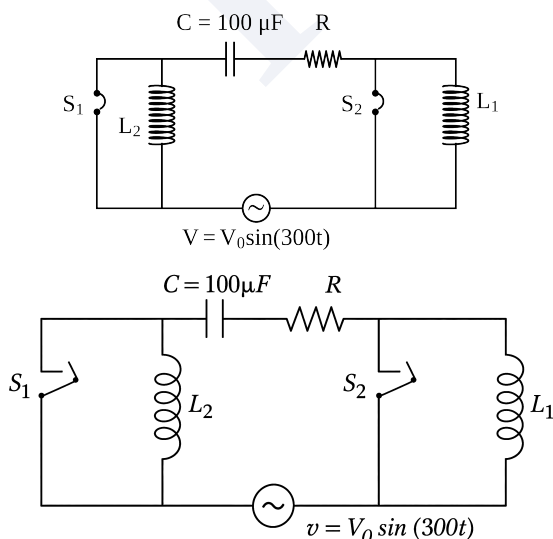
- (1)  $\sqrt{\frac{6}{7}}$       (2)  $\sqrt{\frac{3}{5}}$       (3)  $\sqrt{\frac{7}{8}}$       (4)  $\sqrt{\frac{3}{4}}$

Scan or tap for the full solution



- Q.3** The figure given below shows an LCR series circuit with two switches  $S_1$  and  $S_2$ . When switch  $S_1$  is closed keeping  $S_2$  open, the phase difference ( $\phi$ ) between the current and source voltage is  $30^\circ$  and phase difference is  $60^\circ$  when  $S_2$  is closed keeping  $S_1$  open. The value of  $(3L_1 - L_2)$  is \_\_\_\_\_ H.

[JEE Main 2026 (Online) 2nd April Evening Shift]



- (1)  $\frac{9}{2}$       (2)  $\frac{2}{9}$       (3)  $\frac{1}{3}$       (4) 3

Scan or tap for the full solution



- Q.4** The electric current in the circuit is given as  $i = i_0(t/T)$ . The r.m.s current for the period  $t = 0$  to  $t = T$  is \_\_\_\_\_.

[JEE Main 2026 (Online) 28th January Morning Shift]

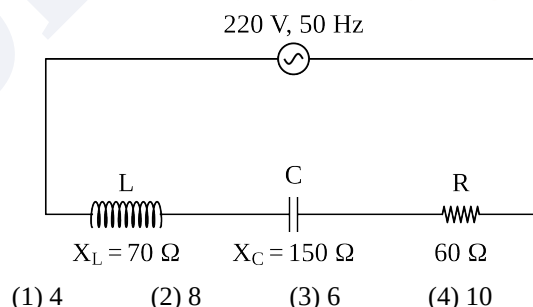
- (1)  $\frac{i_0}{\sqrt{2}}$       (2)  $\frac{i_0}{\sqrt{3}}$       (3)  $i_0$       (4)  $\frac{i_0}{\sqrt{6}}$

Scan or tap for the full solution



- Q.5** For the series LCR circuit connected with 220 V, 50 Hz a.c. source as shown in the figure, the power factor is  $\frac{\alpha}{10}$ . The value of  $\alpha$  is \_\_\_\_\_.

[JEE Main 2026 (Online) 24th January Morning Shift]



Scan or tap for the full solution



- Q.6** A capacitor  $C$  is first charged fully with potential difference of  $V_0$  and disconnected from the battery. The charged capacitor is connected across an inductor having inductance  $L$ . In  $t$  s, 25% of the initial energy in the capacitor is transferred to the inductor. The value of  $t$  is \_\_\_\_\_ s.

[JEE Main 2026 (Online) 21st January Evening Shift]

- (1)  $\frac{\pi\sqrt{LC}}{3}$       (2)  $\frac{\pi\sqrt{LC}}{2}$   
(3)  $\pi\sqrt{\frac{LC}{2}}$       (4)  $\frac{\pi\sqrt{LC}}{6}$

Scan or tap for the full solution



**Q.7** An ac current is represented as

$$i = 5\sqrt{2} + 10\cos\left(650\pi t + \frac{\pi}{6}\right) \text{ Amp}$$

The r.m.s. value of the current is

[JEE Main 2025 (Online) 7th April Morning Shift]

- (1) 10 Amp (2)  $5\sqrt{2}$  Amp  
(3) 100 Amp (4) 50 Amp

Scan or tap for the full solution



**Q.8** An alternating current is represented by the equation,  $i = 100\sqrt{2}\sin(100\pi t)$  ampere. The RMS value of current and the frequency of the given alternating current are

[JEE Main 2025 (Online) 4th April Morning Shift]

- (1)  $\frac{100}{\sqrt{2}}$  A, 100 Hz  
(2)  $50\sqrt{2}$  A, 50 Hz  
(3)  $100\sqrt{2}$  A, 100 Hz  
(4) 100 A, 50 Hz

Scan or tap for the full solution



**Q.9** An electric bulb rated as 100 W – 220 V is connected to an ac source of rms voltage 220 V. The peak value of current through the bulb is:

[JEE Main 2025 (Online) 3rd April Evening Shift]

- (1) 0.32 A (2) 0.64 A (3) 0.45 A (4) 2.2 A

Scan or tap for the full solution



**Q.10** Given below are two statements: one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

**Assertion (A):** Choke coil is simply a coil having a large inductance but a small resistance. Choke coils are used with fluorescent mercury-tube fittings. If household electric power is directly connected to a mercury tube, the tube will be damaged.

**Reason (R):** By using the choke coil, the voltage across the tube is reduced by a factor  $\left(\frac{R}{\sqrt{R^2 + \omega^2 L^2}}\right)$ , where  $\omega$  is frequency of the supply across resistor R and inductor L. If the choke coil were not used, the voltage across the resistor would be the same as the applied voltage.

In the light of the above statements, choose the most appropriate answer from the options given below :

[JEE Main 2025 (Online) 29th January Morning Shift]

- (1) (A) is true but (R) is false  
(2) Both (A) and (R) are true and (R) is the correct explanation of (A).  
(3) Both (A) and (R) are true but (R) is not the correct explanation of (A)

(4) (A) is false but (R) is true

Scan or tap for the full solution



**Q.11** An alternating current is given by  $I = I_A \sin \omega t + I_B \cos \omega t$ . The r.m.s current will be

[JEE Main 2025 (Online) 24th January Morning Shift]

- (1)  $\frac{\sqrt{I_A^2 + I_B^2}}{2}$  (2)  $\sqrt{\frac{I_A^2 + I_B^2}{2}}$   
(3)  $\frac{|I_A + I_B|}{\sqrt{2}}$  (4)  $\sqrt{I_A^2 + I_B^2}$

Scan or tap for the full solution



**Q.12** A series LCR circuit is connected to an alternating source of emf E. The current amplitude at resonant frequency is  $I_0$ . If the value of resistance R becomes twice of its initial value then amplitude of current at resonance will be

[JEE Main 2025 (Online) 22nd January Evening Shift]

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

Scan or tap for the full solution



**Q.13** A bulb and a capacitor are connected in series across an ac supply. A dielectric is then placed between the plates of the capacitor. The glow of the bulb :

[JEE Main 2024 (Online) 9th April Morning Shift]

- (1) becomes zero (2) remains same  
(3) increases (4) decreases

Scan or tap for the full solution



**Q.14** A LCR circuit is at resonance for a capacitor C, inductance L and resistance R. Now the value of resistance is halved keeping all other parameters same. The current amplitude at resonance will be now:

[JEE Main 2024 (Online) 8th April Morning Shift]

- (1) halved (2) same (3) Zero (4) double

Scan or tap for the full solution



**Q.15** A coil of negligible resistance is connected in series with  $90 \Omega$  resistor across 120 V, 60 Hz supply. A voltmeter reads 36 V across resistance. Inductance of the coil is :

[JEE Main 2024 (Online) 8th April Evening Shift]

- (1) 0.91 H (2) 0.76 H (3) 2.86 H (4) 0.286 H

Scan or tap for the full solution



**Q.16** Given below are two statements :

**Statement-I:** In an LCR series circuit, current is maximum at resonance.

**Statement-II:** Current in a purely resistive circuit can never be less than that in a series LCR circuit

when connected to same voltage source.

In the light of the above statements, choose the correct answer from the options given below :

[JEE Main 2024 (Online) 6th April Morning Shift]

- (1) Statement-I is true but Statement-II is false
- (2) Statement-I is false but Statement-II is true
- (3) Both Statement-I and Statement-II are true
- (4) Both Statement-I and Statement-II are false

Scan or tap for the full solution



**Q.17** A series LCR circuit is subjected to an ac signal of 200 V, 50 Hz. If the voltage across the inductor ( $L = 10 \text{ mH}$ ) is 31.4 V, then the current in this circuit is \_\_\_\_\_.

[JEE Main 2024 (Online) 5th April Evening Shift]

- (1) 10 A      (2) 10 mA      (3) 68 A      (4) 63 A

Scan or tap for the full solution



**Q.18** In an ac circuit, the instantaneous current is zero, when the instantaneous voltage is maximum. In this case, the source may be connected to :

- A. pure inductor.
  - B. pure capacitor.
  - C. pure resistor.
  - D. combination of an inductor and capacitor.
- Choose the correct answer from the options given below :

[JEE Main 2024 (Online) 4th April Morning Shift]

- (1) A, B and C only      (2) A and B only
- (3) A, B and D only      (4) B, C and D only

Scan or tap for the full solution

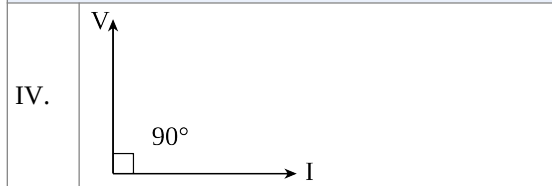


**Q.19** Match List I with List II

| LIST I |                           |
|--------|---------------------------|
| A.     | Purely capacitive circuit |
| B.     | Purely inductive circuit  |
| C.     | LCR series at resonance   |
| D.     | LCR series circuit        |

| LIST II |  |
|---------|--|
| I.      |  |
| II.     |  |
| III.    |  |

## LIST II



Choose the correct answer from the options given below:

[JEE Main 2024 (Online) 4th April Evening Shift]

- (1) A-IV, B-I, C-III, D-II
- (2) A-I, B-IV, C-II, D-III
- (3) A-IV, B-I, C-II, D-III
- (4) A-I, B-IV, C-III, D-II



Solution

**Q.20** In series LCR circuit, the capacitance is changed from  $C$  to  $4C$ . To keep the resonance frequency unchanged, the new inductance should be:

[JEE Main 2024 (Online) 1st February Morning Shift]

- (1) increased by  $2L$
- (2) reduced by  $\frac{1}{4}L$
- (3) reduced by  $\frac{3}{4}L$
- (4) increased to  $4L$

Scan or tap for the full solution



**Q.21** A transformer has an efficiency of 80% and works at 10 V and 4 kW. If the secondary voltage is 240 V, then the current in the secondary coil is :

[JEE Main 2024 (Online) 1st February Evening Shift]

- (1) 1.33 A      (2) 13.33 A
- (3) 1.59 A      (4) 15.1 A

Scan or tap for the full solution



**Q.22** An AC voltage  $V = 20\sin 200\pi t$  is applied to a series LCR circuit which drives a current

$I = 10\sin\left(200\pi t + \frac{\pi}{3}\right)$ . The average power dissipated is:

[JEE Main 2024 (Online) 31st January Evening Shift]

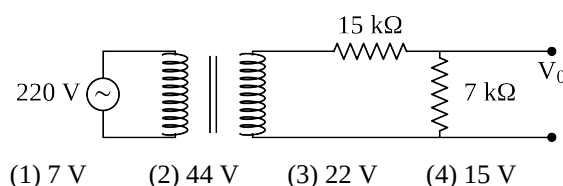
- (1) 21.6 W      (2) 200 W
- (3) 173.2 W      (4) 50 W



Solution

**Q.23** Primary coil of a transformer is connected to 220 V ac. Primary and secondary turns of the transformer are 100 and 10 respectively. Secondary coil of transformer is connected to two series resistances shown in figure. The output voltage ( $V_0$ ) is :

[JEE Main 2024 (Online) 30th January Morning Shift]



- (1) 7 V      (2) 44 V      (3) 22 V      (4) 15 V

Scan or tap for the full solution



- Q.24** A series L.R circuit connected with an ac source  $E = (25\sin 1000t) \text{ V}$  has a power factor of  $\frac{1}{\sqrt{2}}$ . If the source of emf is changed to  $E = (20\sin 2000t) \text{ V}$ , the new power factor of the circuit will be :

[JEE Main 2024 (Online) 30th January Morning Shift]

- (1)  $\frac{1}{\sqrt{3}}$  (2)  $\frac{1}{\sqrt{2}}$  (3)  $\frac{1}{\sqrt{5}}$  (4)  $\frac{1}{\sqrt{7}}$

Scan or tap for the full solution



- Q.25** An alternating voltage  $V(t) = 220\sin 100\pi t$  volt is applied to a purely resistive load of  $50 \Omega$ . The time taken for the current to rise from half of the peak value to the peak value is:

[JEE Main 2024 (Online) 30th January Evening Shift]

- (1) 7.2 ms (2) 3.3 ms (3) 5 ms (4) 2.2 ms

Scan or tap for the full solution



- Q.26** A capacitor of capacitance  $100 \mu\text{F}$  is charged to a potential of  $12 \text{ V}$  and connected to a  $6.4 \text{ mH}$  inductor to produce oscillations. The maximum current in the circuit would be :

[JEE Main 2024 (Online) 29th January Morning Shift]

- (1) 2.0 A (2) 3.2 A (3) 1.5 A (4) 1.2 A

Scan or tap for the full solution



- Q.27** In an a.c. circuit, voltage and current are given by:  
 $V = 100\sin(100t) \text{ V}$  and  $I = 100\sin\left(100t + \frac{\pi}{3}\right) \text{ mA}$  respectively.

The average power dissipated in one cycle is:

[JEE Main 2024 (Online) 29th January Evening Shift]

- (1) 5 W (2) 25 W (3) 2.5 W (4) 10 W

Scan or tap for the full solution



- Q.28** Primary side of a transformer is connected to  $230 \text{ V}$ ,  $50 \text{ Hz}$  supply. Turns ratio of primary to secondary winding is  $10:1$ . Load resistance connected to secondary side is  $46 \Omega$ . The power consumed in it is :

[JEE Main 2024 (Online) 27th January Evening Shift]

- (1) 11.5 W (2) 12.5 W (3) 10.0 W (4) 12.0 W

Scan or tap for the full solution



## Section B (Numerical) — 17 questions

- Q.29** A series LCR circuit with  $R = 20 \Omega$ ,  $L = 1.6 \text{ H}$  and  $C = 40 \mu\text{F}$  is connected to a variable frequency a.c. source. The inductive reactance at resonant frequency is  $\_\_\_\_\_\_ \Omega$ .

[JEE Main 2026 (Online) 5th April Evening Shift]

Scan or tap for the full solution



- Q.30** An inductor of  $10 \text{ mH}$ , capacitor of  $0.1 \mu\text{F}$  and a resistor of  $100 \Omega$  are connected in series across an a.c. power supply  $220 \text{ V}$ ,  $70 \text{ Hz}$ . The power factor of the given circuit is  $0.5$ . The difference in the inductive reactance and capacitive reactance is  $\sqrt{3} \alpha \Omega$ . The value of  $\alpha$  is  $\_\_\_\_\_\_$ .

[JEE Main 2026 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.31** An inductor stores  $16 \text{ J}$  of magnetic field energy and dissipates  $32 \text{ W}$  of thermal energy due to its resistance when an a.c. current of  $2 \text{ A}$  (rms) and frequency  $50 \text{ Hz}$  flows through it. The ratio of inductive reactance to its resistance is  $\_\_\_\_\_\_$ . ( $\pi = 3.14$ )

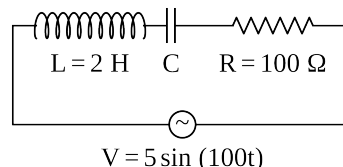
[JEE Main 2026 (Online) 28th January Evening Shift]

Scan or tap for the full solution



- Q.32** Using a variable frequency a.c. voltage source the maximum current measured in the given LCR circuit is  $50 \text{ mA}$  for  $V = 5\sin(100t)$ . The values of  $L$  and  $R$  are shown in the figure. The capacitance of the capacitor ( $C$ ) used is  $\_\_\_\_\_\_ \mu\text{F}$ .

[JEE Main 2026 (Online) 23rd January Morning Shift]

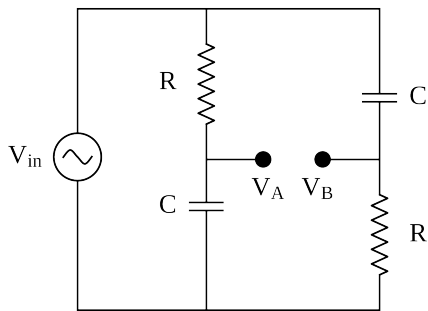


Scan or tap for the full solution



- Q.33** For ac circuit shown in figure,  $R = 100 \text{ k}\Omega$  and  $C = 100 \text{ pF}$  and the phase difference between  $V_{\text{in}}$  and  $(V_B - V_A)$  is  $90^\circ$ . The input signal frequency is  $10^x \text{ rad/sec}$ , where ' $x$ ' is  $\_\_\_\_\_\_$ .

[JEE Main 2025 (Online) 7th April Morning Shift]



Scan or tap for the full solution



- Q.34** An inductor of reactance  $100\ \Omega$ , a capacitor of reactance  $50\ \Omega$ , and a resistor of resistance  $50\ \Omega$  are connected in series with an AC source of  $10\text{ V}$ ,  $50\text{ Hz}$ . Average power dissipated by the circuit is \_\_\_\_\_ W.

[JEE Main 2025 (Online) 7th April Evening Shift]

Scan or tap for the full solution



- Q.35** An inductor of self inductance  $1\text{ H}$  is connected in series with a resistor of  $100\pi\text{ ohm}$  and an ac supply of  $100\pi\text{ volt}$ ,  $50\text{ Hz}$ . Maximum current flowing in the circuit is \_\_\_\_\_ A.

[JEE Main 2025 (Online) 4th April Evening Shift]

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- Q.36** In a series LCR circuit, a resistor of  $300\ \Omega$ , a capacitor of  $25\text{ nF}$  and an inductor of  $100\text{ mH}$  are used. For maximum current in the circuit, the angular frequency of the ac source is \_\_\_\_\_  $\times 10^4\text{ radians s}^{-1}$

[JEE Main 2025 (Online) 23rd January Evening Shift]

Scan or tap for the full solution



- Q.37** When a coil is connected across a  $20\text{ V}$  dc supply, it draws a current of  $5\text{ A}$ . When it is connected across  $20\text{ V}$ ,  $50\text{ Hz}$  ac supply, it draws a current of  $4\text{ A}$ . The self inductance of the coil is \_\_\_\_\_ mH. (Take  $\pi = 3$ )

[JEE Main 2024 (Online) 9th April Morning Shift]

Scan or tap for the full solution



- Q.38** A capacitor of reactance  $4\sqrt{3}\ \Omega$  and a resistor of resistance  $4\ \Omega$  are connected in series with an ac source of peak value  $8\sqrt{2}\text{ V}$ . The power dissipation in the circuit is \_\_\_\_\_ W.

[JEE Main 2024 (Online) 9th April Evening Shift]

Scan or tap for the full solution



- Q.39** An alternating emf  $E = 110\sqrt{2}\sin 100t$  volt is applied to a capacitor of  $2\ \mu\text{F}$ , the rms value of current in the circuit is \_\_\_\_\_ mA.

[JEE Main 2024 (Online) 8th April Evening Shift]

Scan or tap for the full solution



- Q.40** When a dc voltage of  $100\text{ V}$  is applied to an inductor, a dc current of  $5\text{ A}$  flows through it. When an ac voltage of  $200\text{ V}$  peak value is connected to inductor, its inductive reactance is found to be  $20\sqrt{3}\ \Omega$ . The power dissipated in the circuit is \_\_\_\_\_ W.

[JEE Main 2024 (Online) 6th April Morning Shift]

Scan or tap for the full solution



- Q.41** For a given series LCR circuit it is found that maximum current is drawn when value of variable capacitance is  $2.5\text{ nF}$ . If resistance of  $200\ \Omega$  and  $100\text{ mH}$  inductor is being used in the given circuit. The frequency of ac source is \_\_\_\_\_  $\times 10^3\text{ Hz}$  (given  $\pi^2 = 10$ )

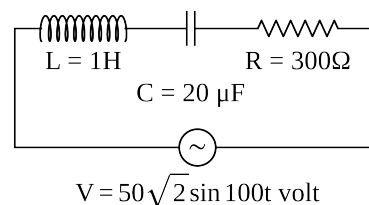
[JEE Main 2024 (Online) 6th April Evening Shift]

Scan or tap for the full solution



- Q.42** An ac source is connected in given series LCR circuit. The rms potential difference across the capacitor of  $20\ \mu\text{F}$  is \_\_\_\_\_ V.

[JEE Main 2024 (Online) 5th April Morning Shift]



Scan or tap for the full solution



- Q.43** An alternating current at any instant is given by  $i = [6 + \sqrt{56}\sin(100\pi t + \pi/3)]\text{ A}$ . The rms value of the current is \_\_\_\_\_ A.

[JEE Main 2024 (Online) 4th April Morning Shift]

Scan or tap for the full solution



- Q.44** A power transmission line feeds input power at 2.3 kV to a step down transformer with its primary winding having 3000 turns. The output power is delivered at 230 V by the transformer. The current in the primary of the transformer is 5 A and its efficiency is 90%. The winding of transformer is made of copper. The output current of transformer is \_\_\_\_\_ A.

[JEE Main 2024 (Online) 30th January Evening Shift]

Scan or tap for the  
full solution



- Q.45** A series LCR circuit with  $L = \frac{100}{\pi}$  mH,  $C = \frac{10^{-3}}{\pi}$  F and  $R = 10 \Omega$ , is connected across an ac source of 220 V, 50 Hz supply. The power factor of the circuit would be \_\_\_\_\_.

[JEE Main 2024 (Online) 27th January Evening Shift]

Scan or tap for the  
full solution



## ANSWER KEY

### Section A (MCQ) — 28 questions

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

### Section B (Numerical) — 17 questions

| Ques. | 29  | 30  | 31  | 32 | 33  | 34 | 35 |
|-------|-----|-----|-----|----|-----|----|----|
| Ans.  | 200 | 100 | 314 | 50 | 5   | 1  | 1  |
| Ques. | 36  | 37  | 38  | 39 | 40  | 41 | 42 |
| Ans.  | 2   | 10  | 4   | 22 | 250 | 10 | 50 |
| Ques. | 43  | 44  | 45  |    |     |    |    |
| Ans.  | 8   | 45  | 1   |    |     |    |    |