CLASS XII – PHYSICS (042)
PRACTICE PAPER – CHAPTER 7: ALTERNATING CURRENT

Academic Session 2026–27

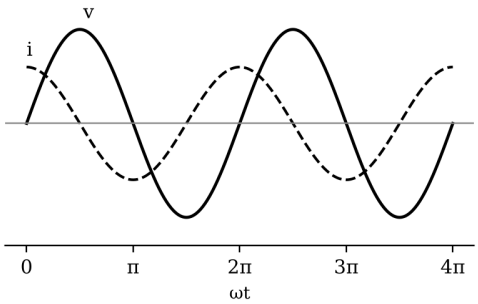
Maximum Marks : 35 **Time Allowed : 1 hour 15 minutes**

General Instructions

(1) There are 18 questions in all. All questions are compulsory.
(2) The question paper has five sections: Section A, B, C, D and E.
(3) Section A (Q.1–9) has seven MCQs and two Assertion–Reasoning questions of 1 mark each. Section B (Q.10–13) has four questions of 2 marks each. Section C (Q.14–16) has three questions of 3 marks each. Section D (Q.17) is one case study based question of 4 marks. Section E (Q.18) is one long answer question of 5 marks.
(4) There is no overall choice. An internal choice is provided in Q.12 (Section B), Q.15 (Section C), Q.17 part (iv) (Section D) and Q.18 (Section E). Attempt only one of the choices in such questions.
(5) Use of calculators is not allowed.
(6) You may use the following values of physical constants wherever necessary: $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}, $\pi = 3.14$, $\sqrt{2} = 1.41$.

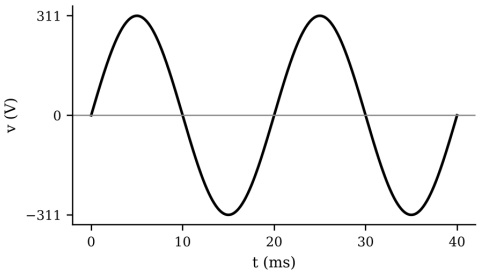
SECTION A (9 × 1 = 9)

1. The graph shows the variation of the voltage v applied to a circuit element and of the current i through it. The element is **1**



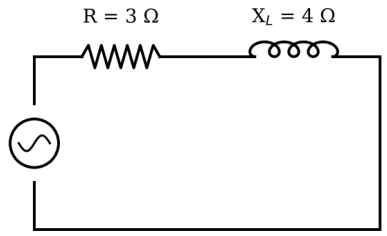
(a) a pure resistor
(b) a pure inductor
(c) a pure capacitor
(d) a resistor and an inductor in series

2. The graph shows the variation of an ac voltage with time. The rms value of the voltage and its frequency are respectively **1**



(a) 311 V, 50 Hz
(b) 220 V, 100 Hz
(c) 220 V, 50 Hz
(d) 440 V, 50 Hz

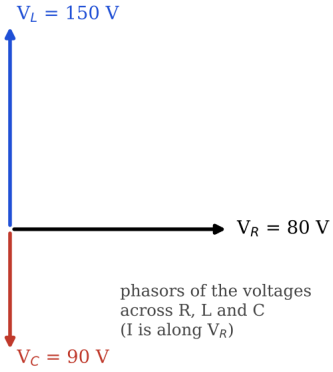
3. A resistor of 3 Ω and an inductor of reactance 4 Ω are connected in series to an ac source, as shown. The power factor of the circuit is **1**



series circuit connected to an ac source

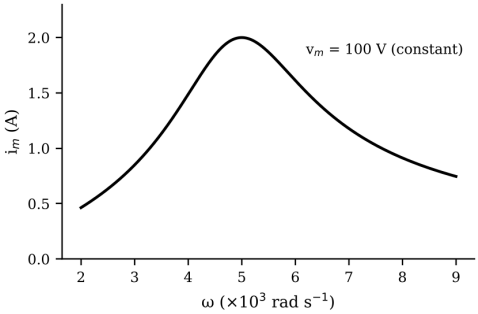
(a) 0.6
(b) 0.8
(c) 0.75
(d) 1.0

4. In a series LCR circuit the voltages across the resistor, inductor and capacitor are 80 V, 150 V and 90 V respectively (rms), as shown by the phasors. The rms voltage of the source is **1**



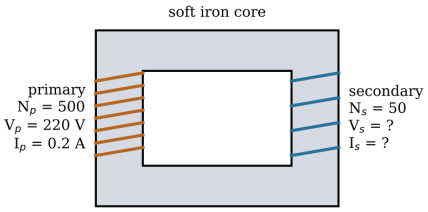
(a) 140 V
(b) 190 V
(c) 320 V
(d) 100 V

5. The graph shows the variation of the current amplitude with the angular frequency of the source for a series LCR circuit, the voltage amplitude of the source being 100 V. The resistance of the circuit is **1**



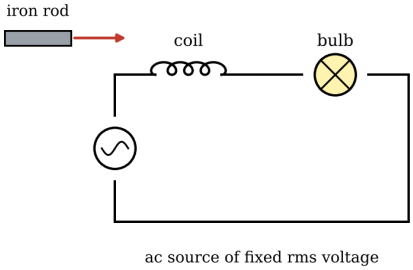
(a) 25 Ω
(b) 50 Ω
(c) 100 Ω
(d) 200 Ω

6. An ideal transformer has 500 turns in its primary and 50 turns in its secondary. The primary is connected to a 220 V ac supply and carries a current of 0.2 A, as shown. The voltage and current in the secondary are respectively **1**



(a) 2200 V, 0.02 A
(b) 22 V, 2 A
(c) 22 V, 0.02 A
(d) 2200 V, 2 A

7. A bulb and an air-cored coil are connected in series to an ac source of fixed rms voltage, as shown. An iron rod is slowly pushed into the coil. The glow of the bulb **1**



(a) increases
(b) remains unchanged
(c) flickers
(d) decreases

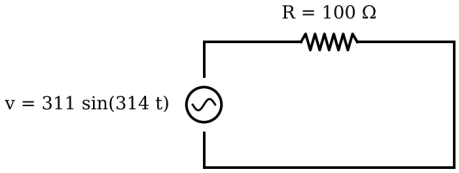
For Questions 8 and 9, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct answer from the options below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

8. **Assertion (A):** A capacitor blocks dc but allows ac to pass through the circuit. **1**
Reason (R): The capacitive reactance $X_C = 1/\omega C$ is infinitely large for dc ($\omega = 0$) and finite for ac.

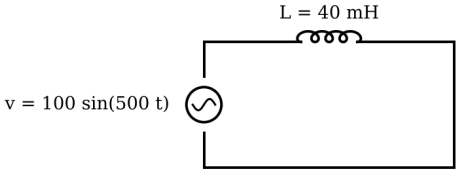
9. **Assertion (A):** Resonance can be obtained in a series circuit containing only a resistor and a capacitor. **1**
Reason (R): At resonance the inductive reactance and the capacitive reactance are equal, so that their voltages cancel each other.

SECTION B (4 × 2 = 8)

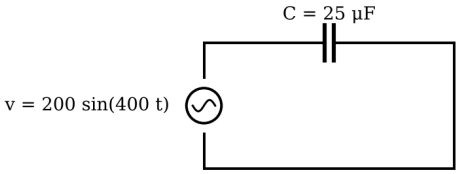
10. An ac source of voltage v = 311 sin(314 t) volt is connected across a resistor of 100 Ω, as shown. Find the rms current in the circuit and the average power dissipated in the resistor. **2**



11. A pure inductor of 40 mH is connected to an ac source v = 100 sin(500 t) volt, as shown. Find the inductive reactance and the amplitude of the current. Write the expression for the instantaneous current in the circuit. **2**



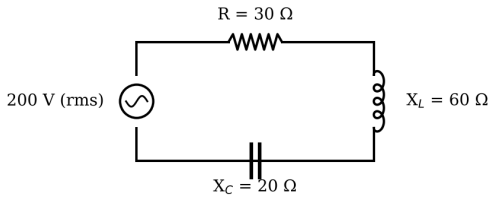
12. **(A)** A capacitor of 25 μF is connected to an ac source v = 200 sin(400 t) volt, as shown. Find the capacitive reactance and write the expression for the instantaneous current in the circuit. **2**



OR

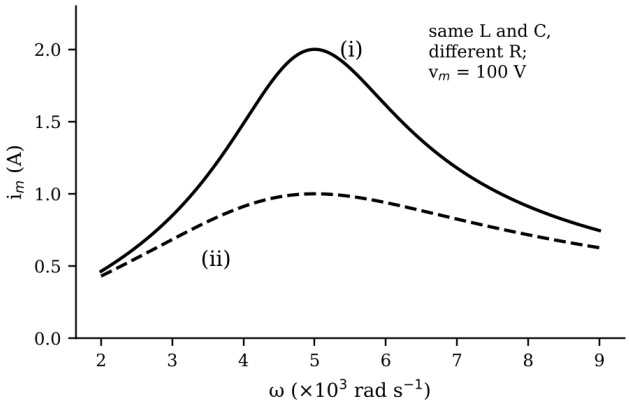
(B) Show that the average power supplied to a pure inductor over one complete cycle of ac is zero.

13. A series LCR circuit with the values shown is connected to a 200 V (rms) ac source. Find the impedance of the circuit and the rms current. State whether the current leads or lags the source voltage, and find the phase angle. **2**



SECTION C (3 × 3 = 9)

14. The graph shows the variation of the current amplitude with the angular frequency of the source for two series LCR circuits (i) and (ii), which have the same inductance L = 20 mH and the same capacitance but different resistances. The source amplitude is 100 V in both cases. (a) Find the resistance in each circuit. (b) Find the capacitance. (c) Find the quality factor $Q = \omega_0 L/R$ of circuit (i) and say which circuit has the sharper resonance. **3**

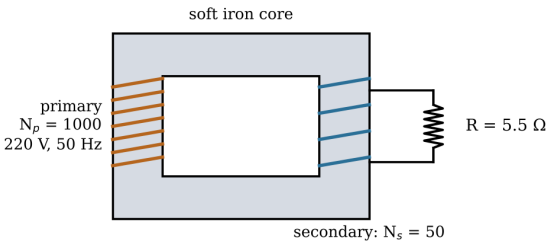


15. **(A)** An ac voltage $v = v_m \sin \omega t$ is applied to a capacitor C. Derive an expression for the current in the circuit and obtain the capacitive reactance. State the phase relation between the current and the voltage. **3**

OR

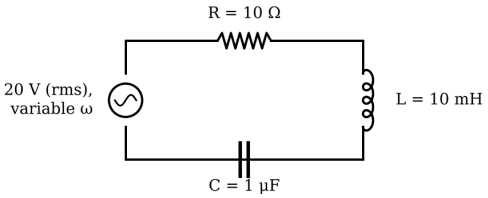
(B) A series LCR circuit carries a current $i = i_m \sin(\omega t + \varphi)$ when connected to the source $v = v_m \sin \omega t$. Show that the average power dissipated is $P = VI \cos \varphi$. Find the power factor and the average power for a purely inductive circuit and for a circuit at resonance.

16. A transformer has 1000 turns in its primary and 50 turns in its secondary. The primary is connected to a 220 V, 50 Hz supply and the secondary feeds a resistor of 5.5 Ω, as shown. (a) Find the output voltage. (b) Find the current in the secondary and the power delivered to the resistor. (c) If the efficiency of the transformer is 90%, find the current drawn from the supply, and name one cause of energy loss with its remedy. **3**



SECTION D (1 × 4 = 4)

17. **Case Study.** A radio is tuned to a station by adjusting a series LCR circuit so that its natural frequency equals the frequency of the signal. The impedance then becomes minimum, equal to R, and the current is maximum. The circuit shown has R = 10 Ω, L = 10 mH and C = 1 μF and is driven by a source of 20 V (rms) whose frequency can be varied. Answer the following: **4**



(i) For resonance to occur in a series circuit it is essential that
(a) the circuit contains only a resistor (b) the circuit contains only an inductor
(c) the circuit contains both L and C (d) the circuit contains a transformer

(ii) The resonant angular frequency of the circuit is
(a) 10^2 rad s^{-1} (b) 10^3 rad s^{-1} (c) 10^4 rad s^{-1} (d) 10^5 rad s^{-1}

(iii) The rms current in the circuit at resonance is
(a) 0.2 A (b) 2 A (c) 20 A (d) 200 A

(iv) The quality factor Q = $\omega_0 L/R$ of the circuit is
(a) 1 (b) 5 (c) 10 (d) 100

OR

(iv) The rms voltage across the inductor at resonance is
(a) 20 V (b) 2 V (c) 100 V (d) 200 V

SECTION E (1 × 5 = 5)

18. **(A)** With a labelled diagram, explain the construction and working of a transformer. Derive the relations $V_s/V_p = N_s/N_p$ and $I_p/I_s = N_s/N_p$ for an ideal transformer. (3) **5**

A step-down transformer reduces 11 kV to 220 V and supplies 22 kW to a load. Find its turns ratio and the currents in the primary and secondary coils (assume it to be ideal). (2)

OR

(B) A series LCR circuit is connected to the source $v = v_m \sin \omega t$. Using the phasor diagram, derive expressions for the impedance of the circuit and for the phase angle between the current and the voltage. State the condition for the current to lead the voltage. (3)

A series LCR circuit has R = 12 Ω, X_L = 25 Ω and X_C = 20 Ω and is connected to a source of 130 V (rms). Find the impedance, the rms current, the average power dissipated and the power factor. (2)

— End of Question Paper —