

FIITJEE INTERNAL TEST

C.B.S.E. TEST – III

PHYSICS

Class – XII

Maximum Marks: 30

Time Allowed: 1 hour

General Instructions:

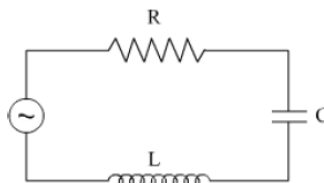
- (i) There are 11 questions in all. All Questions are compulsory.
- (ii) This question paper has four sections: Section A, Section B, Section C and Section D.
- (iii) Section A contains four questions of two marks each, Section B contains two questions of three marks each, Section C contains two question of five mark each. In Section D contains one case study (paragraph) having 3 questions objective single correct option two marks each question.
- (iv) You may use log tables if necessary but use of calculator is not allowed.

SECTION-A

1. A narrow beam of protons and deuterons, each having the same momentum, enters a region of uniform magnetic field directed perpendicular to their direction of momentum. What would be the ratio of the radii of the circular path describe by them?
2. What is meant by the transverse nature of electromagnetic waves? Draw a diagram showing the propagation of an electromagnetic wave along the x-direction, indicating clearly the directions of the oscillating electric and magnetic fields associated with it.
3. Define the terms 'Magnetic Dip' and 'Magnetic Declination' with the help of relevant diagrams.
4. Derive the expression for Electric Field due to infinite long straight wire at a distance 'r' from it, using Gauss Law.

SECTION-B

5. Define mutual inductance and give its S. I. unit. Derive an express on for the mutual inductance of two long coaxial solenoids of same length wound one over the other.
6. The figure shows a series LCR circuit with $L = 10.0 \text{ H}$, $C = 40 \mu\text{F}$, $R = 60 \Omega$ connected to variable frequency 240 V source, calculate
 - (i) the angular frequency of the source which drives the circuit at resonance,
 - (ii) the current at the resonating frequency,
 - (iii) the rms potential drop across the inductor at resonance.



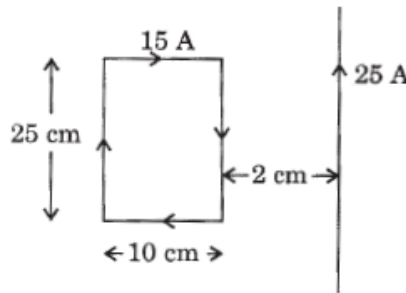
SECTION-C

7. (a) Derive an expression for the average power consumed in a series LCR circuit connected to a.c. source, in which the phase difference between the voltage and the current in the circuit is ϕ .
- (b) Define the quality factor in an a.c. circuit. Why should the quality factor have high value in receiving circuits? Name the factors on which it depends.

OR

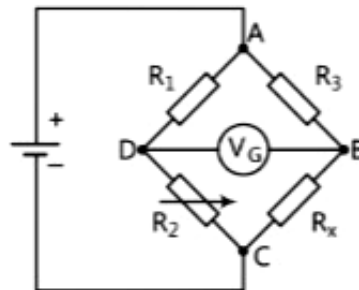
- (a) Derive the relationship between the peak and the rms value of current in an a.c. circuit.
- (b) Describe briefly, with the help of a labeled diagram, working of a step-up transformer. A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain.
8. Depict the magnetic field lines due to two straight, long, parallel conductors carrying currents I_1 and I_2 in the same direction. Hence deduce an expression for the force acting per unit length on one conductor due to the other. Is this force attractive or repulsive?

Figure shows a rectangular current-carrying loop placed 2 cm away from a long, straight, current-carrying conductor. What is the direction and magnitude of the net force acting on the loop?



SECTION-D
Paragraph Based Questions

Wheatstone bridge is an electrical circuit used to measure an unknown electrical resistance by balancing two legs of a bridge circuit, one leg of which includes the unknown component. The primary benefit of the circuit is its ability to provide extremely accurate measurements.



The resistance is adjusted until the bridge is 'balanced' and no current flows through the galvanometer. At this point, the voltage between the two mid-points (B and D) will be zero.

Therefore, the ratio of the two resistances in the known leg is equal to the ratio of the two resistances in the unknown leg.

Read the given passage carefully and give the answer of the following questions:

9. In balanced Wheatstone bridge:
(A) potential at points B and D remain same
(B) large current flows through the circuit
(C) battery becomes over heated
(D) resistances becomes small
10. Wheatstone bridge is used to measure:
(A) unknown current
(B) unknown voltage
(C) unknown charge
(D) unknown resistance
11. Wheatstone bridge is implemented in lab using:
(A) ammeter
(B) voltmeter
(C) meter bridge
(D) potentiometer