

**2020
PHYSICS**

Total marks : 70

Time : 3 hours

General instructions:

- i) Approximately 15 minutes is allotted to read the question paper and revise the answers.
- ii) The question paper consists of 30 questions. All questions are compulsory.
- iii) Marks are indicated against each question.
- iv) Internal choice has been provided in some questions.

N.B: Check that all pages of the question paper is complete as indicated on the top left side.

1. A strong magnetic field is applied on a stationary electron. Then the electron 1
 - (a) moves in the direction of the field
 - (b) remains stationary
 - (c) moves perpendicular to the direction of the field
 - (d) moves opposite to the direction of the field

2. A convex lens of focal length 40cm is in contact with a concave lens of focal length 25cm. The power of the combination is 1
 - (a) + 6.5 D
 - (b) - 1.5 D
 - (c) + 1.5 D
 - (d) - 6.5 D

2. The angular momentum for an electron in second orbit of hydrogen atom as per Bohr's model is 1
 - (a) $\frac{h}{\pi}$
 - (b) $2\pi R$
 - (c) $\frac{2h}{\pi}$
 - (d) $\frac{\pi}{R}$

4. In an n – type silicon, which of the following statement is true? 1
 - (a) Electrons are majority carriers and trivalent atoms are the dopants.
 - (b) Electrons are minority carriers and pentavalent atom are the dopants.
 - (c) Holes are minority carriers and pentavalent atoms are the dopants.
 - (d) Holes are minority carriers and trivalent atoms are the dopants.

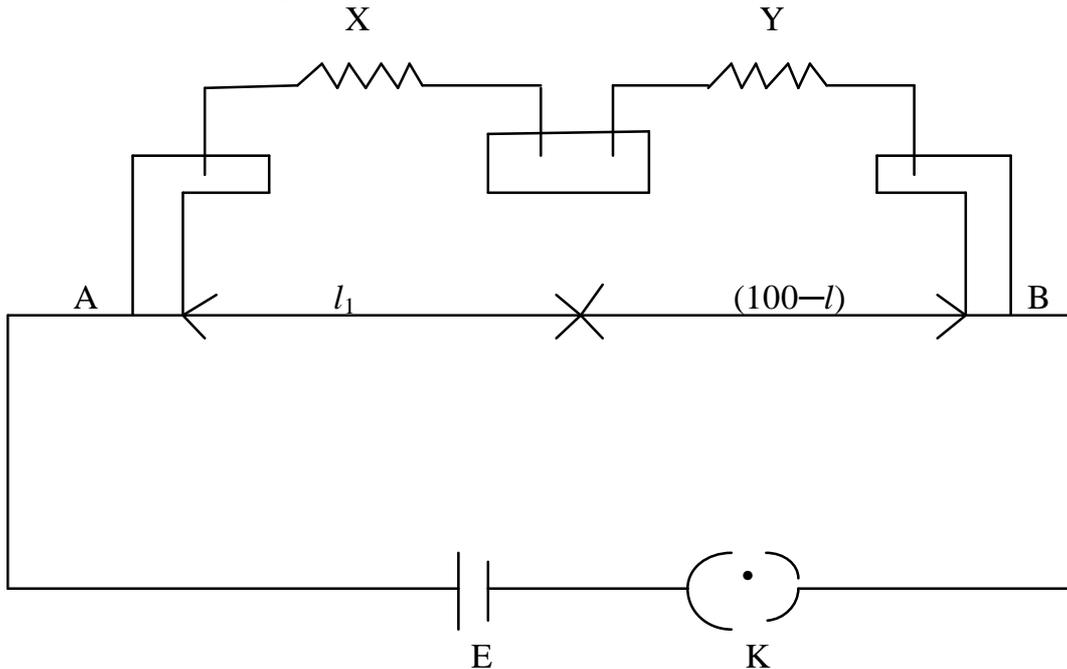
5. Long distance short- wave radio broadcasting uses 1
 - (a) ground waves
 - (b) sky waves
 - (c) surface waves
 - (d) space waves.

6. How does cyclotron increase the energy of charged particles? 1

7. Define impact parameter. 1
8. Write the value of Bohr's radius. 1
9. Write the truth table of AND gate. 1
10. What is the use of transducer in communication system? 1
11. Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field. 2
12. a. A silver wire has a resistance of 2.7Ω at 100°C . Determine the temperature coefficient of resistivity of silver. 2
- Or**
- b. The storage battery of a car has an emf of 12V. If the internal resistance of the battery is 0.4Ω , what is the maximum current that can be drawn from the battery? 2
13. a. Show that the speed of propagation of an electromagnetic wave is equal to the speed of light. 2
- Or**
- b. What is displacement current? Write the expression for Ampere-Maxwell law. 2
14. Explain the effect of potential on photoelectric current with the help of its figure. 2
15. a. Derive the relation $\lambda = \frac{h}{p}$ where the symbols have their usual meanings. 2
- Or**
- b. Derive the equation $V_o = \left(\frac{h}{e}\right)\nu - \frac{\Phi_o}{e}$ from Einstein's photoelectric equation. 2
16. Sketch the energy level diagram for hydrogen atom and mark the transition corresponding to Lyman and Balmer series. 2
17. Derive an expression for electric potential due to a point charge. How do electric potential vary with distance 'r' for a point charge? 3
18. a. A parallel plate capacitor with air between the plates has a capacitance of 8pF ($1\text{pF} = 10^{-12}\text{F}$). What will be the capacitance of the distance between the plates is reduced by half, and the space between them is filled with a substance of dielectric constant 6? 3
- Or**
- b. A 600pF capacitor is charged by a 200V supply. It is then disconnected from the supply and is connected to another uncharged 600pF capacitor. How much electrostatic energy is lost in the process? 3

19. Derive the expression for equivalent emf (E_{eq}) for the cells in series combination. 3

20. a. In a meter bridge, the balance point is found to be at 39.5cm from A. When the resistor Y is of 12.5Ω .
- (i) Determine the resistance of X.
 - (ii) Determine balance point of the bridge above, if X and Y are interchanged.
 - (iii) What happens if the galvanometer and cell are interchanged at the balance point of the bridge?



Or

3

- b. Three resistors 1Ω , 2Ω , 3Ω are combined in series.
- (i) What is the total resistance of the combination?
 - (ii) If the combination is connected to a battery of emf 12V, and negligible internal resistance, obtain the potential drop across the resistor.

21. a. State and prove Ampere's circuital law.

Or

3

b. Define Lorentz force. Derive an expression for the force on a current carrying conductor placed inside a uniform magnetic field.

22. Explain how a moving coil galvanometer can be converted into

- i) an ammeter and
- ii) a voltmeter of a given range.

3

23. Show that the total energy of LC circuit is $V = V_E = \frac{1}{2} \frac{q_m^2}{C}$. 3

24. Deduce the relation between object and image distance in terms of refractive index of the medium and the radius of curvature of curved spherical surface. 3
25. a. i) If $f = 0.5\text{m}$ for a glass lens, what is the power of the lens?
ii) The radii of curvature of the faces of a double convex lens are 10cm and 15cm, its focal length is 12cm. What is the refractive index of glass?
iii) A convex lens has 20cm focal length in air. What is the focal length in water? [Refractive index of water = 1.33, Refractive index of air-glass = 1.5] 3
- Or**
- b. A small telescope has an objective lens of focal length 140cm and eyepiece of focal length 50cm. What is the magnifying power of telescope when image is at infinity and image is formed at least distance of distinct vision?
26. Explain the process of release of energy in a nuclear reactor. Draw a schematic diagram of the nuclear reactor. 3
27. Draw the block diagram of a receiver of AM radio wave. Explain each of the components used. 3
28. a. Define average power of an AC circuit and derive an expression for average power in LCR circuit. What is the value of average power in a purely resistive circuit? 5
- Or**
- b. State Faradays law of electromagnetic induction and express it mathematically. Quantitatively show that Lenz law is consistent with the law of conservation of energy.
29. a. Derive the expression for the fringe width of the bright and dark fringes in Young's double slit experiment for interference of light. 5
- Or**
- b. Explain the reflective telescope with diagram and write its advantages over refractive telescope. On what factors does its resolving power depend?
30. a. With the help of a circuit diagram, explain the input and output characteristics of a common emitter n-p-n transistor configuration. State the conclusions drawn from the characteristics curves. 5
- Or**
- b. What is a transistor? Explain with circuit diagram, the working of a transistor as an oscillator.
