2018
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. An electric bulb is rated 220 volt, 100 watt. Power consumed by it when operated on 110 volt is **1**
   (a) 50 watt (b) 75 watt
   (c) 90 watt (d) 25 watt.

2. The material of a permanent magnet should have **1**
   (a) high retentivity and low coercivity
   (b) low retentivity and high coercivity
   (c) low retentivity and low coercivity
   (d) high retentivity and high coercivity.

3. In a circular coil if number of turns is doubled and resistance becomes $\frac{1}{4}th$ of the initial value, then inductance becomes **1**
   (a) 4 times
   (b) 2 times
   (c) 8 times
   (d) no change.

4. A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then, its focal length will **1**
   (a) become zero (b) become infinite
   (c) remain unchanged (d) become small, but non-zero.

5. The typical ionization energy of a donor in silicon is **1**
(a) 10.0 ev (b) 1.0 ev
(c) 0.1 ev (d) 0.001 ev.

6. The resistivity of a constantan wire is $49 \times 10^{-8}\ \Omega$ m. What is its conductivity? **1**

7. Define angle of declination at a place. **1**

8. What is displacement current? **1**

9. If the intensity of incident radiation on a metal is doubled, what happens to the kinetic energy of emitted photoelectrons? **1**

10. What are the majority and minority charge carriers in a p –type semiconductor? **1**

11. **a.** Establish an expression for the electric field at a point along the axial line of an electric dipole.

Or **2**

b. Establish a relationship between electric potential and electric field.

12. **a.** Derive an expression for self-inductance of a long solenoid of length *l*, cross-sectional area A having number of turns N.

Or **2**

b. Explain how Lenz's law supports the law of conservation of energy.

13. Show that the speed of propagation of an electromagnetic wave is equal to the speed of light. **2**

14. Define atomic mass unit. Find the energy equivalent to 1u (atomic mass unit). **2**

15. **a.** Mass of an electron is 9.11×10^{-31}kg. Calculate mass-energy of electron in Joule as well as electron volts. Given that speed of light in vacuum $C = 3.0 \times 10^{8} ms^{-1}$ and 1 ev = 1.60×10^{-19}J.

Or **2**

b. Calculate the binding energy per nucleon for ${}^{20}_{10}Ne$. Given that m_H = 1.007825u, m_n = 1.008665u and mass of ${}^{20}_{10}Ne$ atom = 19.992440 u.

`

16. What are line communication and space communication? Give examples of each. **2**

17. Using Gauss theorem, deduce an expression for the electric field at a point due to a uniformly charged infinite plane sheet. **3**

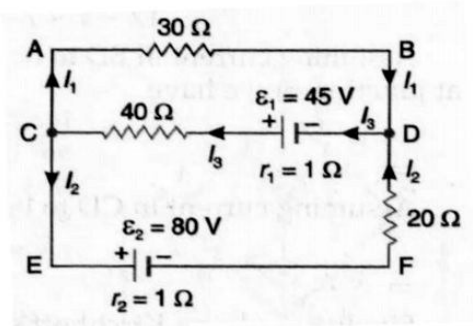
18. Two point charges of +1.5 μC and +2.5 μC are placed 30cm apart. Calculate the magnitude of electric potential and electric field at the mid-point of the line joining the two charges. **3**

19. **a.** With the help of a circuit diagram, explain the use of a potentiometer for comparison of emf's of two cells.

Or **3**

b. Two cells of emf E_1 and E_2 having internal resistances r_1 and r_2 respectively are connected in parallel. Deduce the expression for the equivalent emf and equivalent internal resistance of this parallel combination.

20. An electrical network is shown in figure. Applying Kirchoff's rules, determine the values of I_1, I_2 and I_3. **3**



21. With the help of a diagram, explain the principle and working of a moving coil galvanometer. **3**

22. **a.** Derive an expression for force per unit length between two long straight parallel current-carrying conductors. Hence, define one ampere.

Or **3**

b. Derive an expression for the torque on a rectangular current-carrying loop suspended in a uniform magnetic field.

23. Draw a labelled diagram of an astronomical telescope and explain its working. Give an expression for its magnifying power. **3**

24. **a.** Use Huygen's principle to verify the laws of refraction.

Or **3**

b. Define polarizing angle. Derive the relation connecting polarizing angle and the refractive index of a medium.

25. Draw and explain the graph showing the variation of stopping potential with frequency of incident radiation in relation to photoelectric effect. **3**

26. **a.** Define the terms "half-life period" and "decay constant" of a radioactive sample. Derive the relation between them.

Or **3**

b. Explain the process of release of energy in a nuclear reactor. Draw a schematic diagram of a nuclear reactor and write the function of each part.

27. Distinguish between sky wave and space wave propagations. Explain with the help of suitable diagram indicating how these waves are propagated. **3**

28. **a.** Define power in an A.C circuit and obtain an expression for the average power over a complete cycle in case of a circuit containing inductance, resistance and capacitance. What is meant by wattless current?

Or **5**

b. With the help of a labelled diagram, explain the working of a transformer. Write any two sources of energy loss in a transformer.

29. **a.** Explain Young's double slit experiment to produce interference pattern due to monochromatic source of light. Deduce an expression for fringe-width.

Or **5**

b. Explain diffraction of light due to a single slit and illustrate formation of a pattern of fringes obtained on the screen and plot a graph showing variation of intensity with angle θ in single slit diffraction.

30. **a**. Explain with the help of a labelled circuit diagram, the use of the transistor as an oscillator.

Or **5**

b. With the help of circuit diagram, explain the action of an n-p-n and p-n-p transistor.

****