SECOND YEAR HIGHER SECONDARY EXAMINATION, MARCH 2022

Part – III

Time : 2 Hours

PHYSICS

Cool-off time : 15 Minutes

Maximum : 60 Scores

General Instructions to Candidates :

- There is a 'Cool-off time' of 15 minutes in addition to the writing time.
- Use the 'Cool-off time' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- Read the instructions carefully.
- Calculations, figures and graphs should be shown in the answer sheet itself.
- Malayalam version of the questions is also provided.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the Examination Hall.

വിദ്യാർത്ഥികൾക്കുള്ള പൊതുനിർദ്ദേശങ്ങൾ :

- നിർദ്ദിഷ്ട സമയത്തിന് പുറമെ 15 മിനിറ്റ് 'കൂൾ ഓഫ് ടൈം' ഉണ്ടായിരിക്കും.
- 'കൂൾ ഓഫ് ടൈം' ചോദ്യങ്ങൾ പരിചയപ്പെടാനും ഉത്തരങ്ങൾ ആസൂത്രണം ചെയ്യാനും ഉപയോഗിക്കുക.
- ഉത്തരങ്ങൾ എഴുതുന്നതിന് മുമ്പ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- നിർദ്ദേശങ്ങൾ മുഴുവനും ശ്രദ്ധാപൂർവ്വം വായിക്കണം.
- കണക്ക് കൂട്ടലുകൾ, ചിത്രങ്ങൾ, ഗ്രാഫുകൾ, എന്നിവ ഉത്തരപേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ചോദ്യങ്ങൾ മലയാളത്തിലും നല്ലിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

PART – I

A. Answer any 5 questions from 1 to 9. Each carries 1 score. $(5 \times 1 = 5)$

1. SI unit of electric field

   (a) NC^{-1}

   (b) V_m

   (c) C_m

   (d) N_m

2. Name the force experienced by a charge q moving through a uniform magnetic field with a velocity V.

3. Changing magnetic fields can set up current loops in nearby metal bodies. They dissipate electrical energy as heat. Such currents are _____.

4. In purely inductive or capacitive circuit, power factor $(\cos \phi)$ is _____.

   (a) 0

   (b) 1

   (c) –1

5. Relation between velocity of light (c), permeability of free space (μ_0), permittivity of free space (ε_0) is _____.

   (a) $C = \dfrac{1}{\mu_0 \varepsilon_0}$

   (b) $C = \dfrac{1}{\sqrt{\mu_0 \varepsilon_0}}$

   (c) $C = \mu_0 \varepsilon_0$

   (d) $C = \sqrt{\mu_0 \varepsilon_0}$

6. Light waves are _____ in nature.

   (transverse, longitudinal)

7. Photons are electrically _____.

   (a) neutral

   (b) positive

   (c) negative

   (d) unpredictable

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8. The minimum energy required to free an electron from the ground state of hydrogen atom is _____.

(a) + 13.6 J
(b) − 13.6 J
(c) + 13.6 eV
(d) − 13.6 eV

9. Complete the general equation of α-decay.

$$_{Z}^{A}X \longrightarrow \underline{\quad} + \,_{2}^{4}He$$

(a) $_{Z-4}^{A-2}Y$
(b) $_{Z-2}^{A-4}Y$
(c) $_{Z-2}^{A-2}Y$
(d) $_{Z+1}^{A}Y$

B. **Answer all questions from 10 to 13. Each carries 1 score.** (4 × 1 = 4)

10. Electrostatic field at the surface of a charged conductor must be normal to the surface at every point. Is the statement true or false ?

11. Magnitude of the drift velocity per unit electric field is _____.

12. The temperature at which a ferromagnetic material become paramagnetic is _____.

(a) Cut-off temperature
(b) Absolute temperature
(c) Curie temperature

13. Optical fibres make use the phenomenon of _____.

PART – II

A. **Answer any 2 questions from 14 to 17. Each carries 2 scores.** (2 × 2 = 4)

14. Draw the input and output waveform of a half-wave rectifier.

15. State Malus' law.

16. What is angle of dip ?

17. A light bulb is rated at 100 W for a 220 V supply. Find the resistance of the bulb.

B. Answer any 2 questions from 18 to 20. Each carries 2 scores.   (2 × 2 = 4)

18. Infra-red waves are also referred to as heat waves. Why ?

19. (i)   What is a solenoid ?   (1)

    (ii) Write down the equation for magnetic field inside a solenoid.   (1)

20. Explain earthing.

PART – III

A. Answer any 3 questions from 21 to 24. Each carries 3 scores.   (3 × 3 = 9)

21. Write down any three properties of an equipotential surfaces.

22. (i)   SI unit of resistance is ____ .   (1)

    (ii) Obtain the equivalent value of resistance when two resistors R_1 and R_2 are
          connected in series.   (2)

23. (i)   The angle between magnetic meridian and geographic meridian is ____ .   (1)

    (ii) The declination is ____ (higher/smaller) at higher lattitudes and ____
          (higher/smaller) near the equator.   (2)

24. (i)   If f = 0.5 m, for a glass lens, what is the power of the lens ?   (1)

    (ii) The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm.
          Its focal length is 12 cm. What is the refractive index of glass ?   (2)

B. Answer any 2 questions from 25 to 27. Each carries 3 scores. (2 × 3 = 6)

25. (i) Draw the energy level diagram for hydrogen atom and mark the transition corresponding to Balmer series. (2)

    (ii) Name the spectral series which lies in the ultraviolet region of the spectrum. (1)

26. (i) What is meant by the threshold frequency of a photosensitive metal ? (2)

    (ii) Draw the graph showing the variation of stopping potential with frequency. (1)

27. Nuclear reactor is a device used to initiate and control a nuclear chain reaction. Explain the major parts of a nuclear reactor.

PART – IV

A. Answer any 3 questions from 28 to 31. Each carries 4 scores. (3 × 4 = 12)

28. (i) SI unit of capacitance is _____. (1)

    (ii) Two capacitors C_1 and C_2 are connected in series. Derive an expression for the capacitance of the combination. (3)

29. (i) Which law help us to find the magnetic field on the axis of a circular current loop ? (1)

    (ii) Consider a tightly wound 100 turn coil of radius 10 cm, carrying current of 1 A. What is the magnitude of the magnetic field at the centre of the coil ? (3)

30. (i) Which is the working principle of an a.c. generator ? (1)

    (ii) With the help of a diagram explain the working of a.c. generator. (3)

31. (i) Identify the logic gate. (1)

    (ii) Write down the truth table of this gate. (2)

    (iii) Why this gate is also called universal gate ? (1)

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B. **Answer any 1 question from 32 to 33. Each carries 4 scores.** **(1 × 4 = 4)**

32. Using Huygen's principle, explain refraction of a plane wave, with the help of a diagram.

33. (i) State the principle of working of a transformer. **(1)**

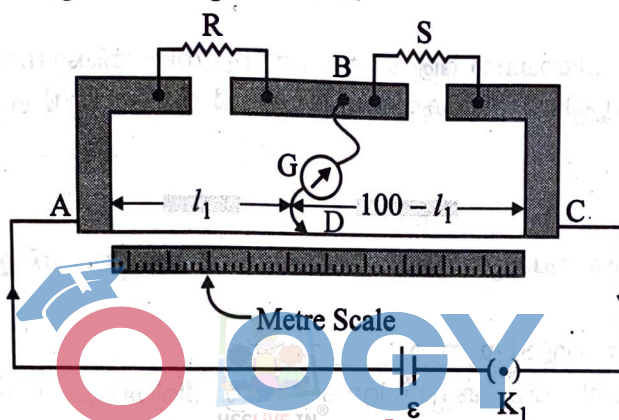   (ii) Explain briefly any three energy losses in a transformer. **(3)**

PART – V

Answer any 2 questions from 34 to 36. Each carries 6 scores. **(2 × 6 = 12)**

34. (i) Write down the wheatstone bridge principle. **(1)**

    (ii) A meter bridge circuit is given below.

R – unknown resistance
S – known resistance

Using this circuit, derive an expression for finding the unknown resistance. **(2)**

    (iii) In the above circuit, the balance point is found to be at 40 cm from the end A, when the resistance S is of 12Ω. Determine the resistance R. **(2)**

    (iv) Would the galvanometer show any current if the galvanometer and cell are interchanged ? **(1)**

35. (i) State Gauss's law. **(2)**

    (ii) What is meant by a Gaussian surface ? **(1)**

    (iii) Using Gauss's law, find the electric field due to a uniformly charged thin spherical shell at a point outside the shell. **(3)**

36. (i) State Laws of refraction. **(2)**

    (ii) Obtain a relation for the total deviation produced for a ray incident on a prism with the help of a ray diagram. **(4)**