SY-424

Reg. No.

Name : ..

SECOND YEAR HIGHER SECONDARY EXAMINATION, MARCH 2025

Part – III

PHYSICS

Maximum : 60 Scores

Time : 2 Hours

Cool-off time : 15 Minutes

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 നല്കിയിട്ടുണ്ട്.
- ആവശ്യമുള്ള സ്ഥലത്ത് സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാൽക്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും പരീക്ഷാഹാളിൽ ഉപയോഗിക്കുവാൻ പാടില്ല.

Answer any 5 questions from 1 to 7. Each carries 1 score. **(5 × 1 = 5)**

1. The electrostatic force per unit charge is known as _____.
   (a) Electric current
   (b) Electric potential
   (c) Electric field

2. A circle of radius r is drawn with a charge +q placed at the centre. The work done in moving a point charge once around the circumference of the circle is _____.

3. Which of the following gives the polarity of the induced emf?
   (i) Biot-Savart Law
   (ii) Lenz's Law
   (iii) Ampere's circuital Law
   (iv) Fleming's right-hand Rule

4. The frequencies of gamma-rays, ultraviolet rays, and X-rays are ν_1, ν_2 and ν_3 respectively. Then
   (i) $\nu_1 = \nu_2 = \nu_3$
   (ii) $\nu_1 > \nu_3 > \nu_2$
   (iii) $\nu_1 > \nu_2 > \nu_3$
   (iv) $\nu_3 > \nu_2 > \nu_1$

5. If radius of first electron orbit of hydrogen is r_0, radius of second electron orbit of hydrogen is _____.

6 Two thin lenses of power + 4D and – 2D are in contact. The focal length of the combination is _____.

7. _____ process is responsible for the production of energy in sun. (Nuclear fission / Nuclear fusion)

Answer any 5 questions from 8 to 14. Each carries 2 scores. **(5 × 2 = 10)**

8. Show that the resistance of a conductor can be expressed by $R = \frac{ml}{ne^2\tau A}$, where symbols have their usual meanings.

9. Relative permeability of a material $\mu_r < 1$, identify the magnetic material. Write the relation between relative permeability and magnetic susceptibility.

10. The instantaneous current and voltage of an a.c. circuit are given by $i = 10 \sin 314t$ Ampere and $v = 50 \sin (314t + \pi/2)$ Volt.

What is the

(a) phase difference between voltage and current ? (1)

(b) power dissipation in the circuit ? (1)

11. (a) Which electromagnetic wave is used in cellular phones to transmit voice communication ? (1)

(b) In the process of charging of a parallel plate capacitor, the current produced between the plates of the capacitor is

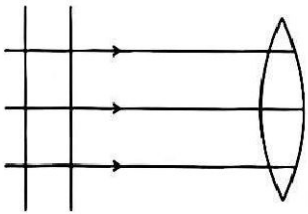
(i) $\mu_0 \frac{d\phi_E}{dt}$ (ii) $\frac{1}{\mu_0} \frac{d\phi_E}{dt}$

(iii) $\varepsilon_0 \frac{d\phi_E}{dt}$ (iv) $\frac{1}{\varepsilon_0} \frac{d\phi_E}{dt}$

where symbols have their usual meanings. (1)

12 (a) Define wavefront. (1)

(b) Figure shows a plane wavefront incident on a convex lens, draw the corresponding refracted wavefront. (1)



13. What is meant by ionisation energy ? Write its value for hydrogen atom.

14. The carbon isotope $_6C^{12}$ has a nuclear mass of 12.000000 u. Calculate the binding energy of its nucleus. Given $m_p = 1.007825$ u; $m_n = 1.008665$ u, 1 a.m.u. (u) = 931 MeV.

Answer any 6 questions from 15 to 21. Each carries 3 scores. **(6 × 3 = 18)**

15. (a) Define electric dipole moment. (1)

(b) Write an expression for torque acting on an electric dipole placed in a uniform electric field. When will it become maximum ? (2)

16. (a) What is equipotential surface ? (1)

(b) Write two properties of equipotential surfaces. (2)

17. (a) What is the working principle of a moving coil galvanometer ? (1)

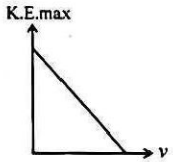
(b) How will you convert a galvanometer into an ammeter ? (1)

(c) An ammeter is always connected in series with a circuit. Why ? (1)

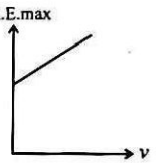
18. Using Huygens concept of wavefront, derive Snell's law of refraction.

19. (a) Which one of the following is the correct graph showing the variation between the maximum kinetic energy (K.E.max) of the emitted photoelectrons and the frequency of incident radiation (ν) for a given photosensitive surface ? (1)

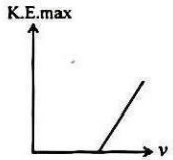
(i)



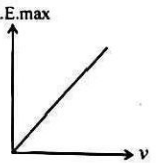
(ii)



(iii)



(iv)



(b) A photosensitive surface has a work function of 2.00 eV. Find the maximum kinetic energy of electrons ejected from this surface by radiation of wavelength 300 nm. (Planck's constant, $h = 6.63 \times 10^{-34}$ J s) (2)

20. (a) State Gauss's law in magnetism. (1)

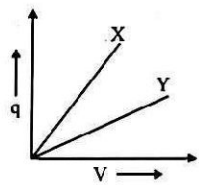
(b) A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.3 T experiences a torque of magnitude equal to 5×10^{-2} J. What is the magnitude of the magnetic moment of the magnet ? (2)

21. With the help of a circuit diagram, explain the working of a half wave rectifier. Draw the input and output waveforms.

Answer any 3 questions from 22 to 25. Each carries 4 scores. **(3 × 4 = 12)**

22. (a) Obtain an expression for the equivalent capacitance when two capacitors C_1 and C_2 are connected in parallel. **(2)**

(b) Given graph shows variation of charge 'q' with potential difference 'V' for two capacitors C_1 and C_2. Both the capacitors have same plate separation but plate area of C_2 is greater than that of C_1. Which line (X or Y) corresponds to C_1 and why ? **(2)**



23. (a) Kirchhoff's voltage law is in accordance with the conservation of

(i) mass (ii) energy

(iii) momentum (iv) charge **(1)**

(b) With the help of diagram, arrive at the Wheatstone's principle. **(3)**

24. (a) What is the working principle of an a.c. generator ? **(1)**

(b) With the help of a diagram, explain theory and working of an a.c. generator. **(3)**

25. (a) Draw a ray diagram of simple microscope showing image formation at the least distance of distinct vision (D). **(2)**

(b) The magnification of a compound microscope is 20. The focal length of the eyepiece is 5 cm and the image is formed at the near point (25 cm). Find the magnification of objective lens. **(2)**

Answer any 3 questions from 26 to 29. Each carries 5 scores. **(3 × 5 = 15)**

26. (a) A spherical shell of radius 'R' is uniformly charged with charge '+q'. Using Gauss's law find the electric field intensity at a point

(i) Outside the spherical shell. **(2)**

(ii) On the surface of the spherical shell. **(1)**

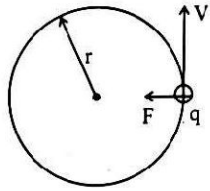
(b) A point charge causes an electric flux -2×10^{14} Nm^2/C to pass through a spherical Gaussian surface. ($\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$)

(i) Calculate the value of the point charge. (1)

(ii) If the radius of the Gaussian surface is doubled, how much flux would pass through the surface ? (1)

27. (a) What is Lorentz force ? (1)

(b) The figure shows the path of motion of a charged particle (+q) in a uniform magnetic field :



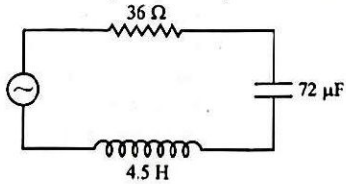
(i) What will be the direction of magnetic field with respect to the velocity of the charged particle ? (1)

(ii) Show that the frequency of revolution of charged particle is independent of the radius of the path. (2)

(iii) Is there any change in kinetic energy of the charged particle ? Explain. (1)

28. (a) With the help of a phasor diagram, find the impedance of a series LCR circuit. (3)

(b) A series LCR circuit is connected to an ac source of variable frequency as shown in figure below. At what frequency the impedance of this circuit will be minimum ? (2)



29. (a) Draw the path of a light ray, through the prism, which suffers minimum deviation. Mark the angle of deviation, angle of incidence and angle of emergence in the figure. (2)

(b) Using the above diagram, show that sum of the angle of deviation and the angle of the prism is equal to the sum of the angle of incidence and angle of emergence. (2)

(c) What do you mean by angle of minimum deviation ? (1)