S&K CLASSES

Creating innovative minds. . . .

Times Allowed – 3 Hours

Maximum Marks – 70

SAMPLE PAPER **PHYSICS**

GENERAL INSTRUCTION:-

(i) All questions are compulsory

(ii) Q. no 1 to 5 are very short answer questions and carry 1 mark each

(iii) Q. no 6 to 10 are short answer questions and carry 2 marks each.

(iv) Q. no 11 to 22 are also short answer questions and carry 3 marks each.

(v) Q. no. 23 is a value based question and carries 4 marks.

(vi) Q. no. 24 to 26 are long answer questions and carry 5 marks each.

(vii) Use log tables if necessary, use of calculations is not allowed.

SECTION – A

1. What is the phase difference between electric field and magnetic field in an electromagnetic wave?

2. Draw the logic diagram for NOT gate using NOR gate.

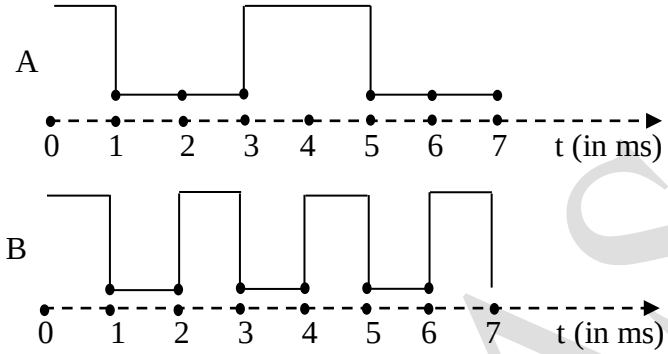
3. What types of fields are produced by a moving electron?

4. Write the expression of torque (τ) acting on a dipole of moment P making an angle? θ with the direction of electric field of magnitude E.

5. What is the origin of displacement current?

SECTION – B

6. Two input waveforms A and B as shown are applied to an AND gate. Write the output wave form.



7. How are the electric vector $\vec{E}$, the magnetic vector $\vec{B}$ and velocity vector $\vec{C}$ oriented in an electromagnetic wave?

8. An alternating voltage given by V = 140 sin 314 t is connected across a pure resistor of 50 Ω. Find

(i) the frequency of the source.

(ii) the rms current through the resister.

9. Define the term 'quality factor' of resonance in series LCR circuit. What is its SI unit ?

10. An X-ray tube is operating at 2 million volt. What is the wavelength of the shortest wavelength produced?

SECTION – C

11. Show that rms value of sinusoidal alternating current over a complete cycle is $\frac{l_0}{\sqrt{2}}$ where l_0 is the peak value of alternating current.

12. State the law of radioactive disintegration, show that N = $N_0 e^{-\lambda t}$ where the terms have their usual meaning.

13. State Gauss law of electrostatics. Using this theorem, derive an expression for the electric field at any point due to an infinite plane sheet of uniform charge density σ Cm^2

14. The refractive index of glass sphere of diameter 8 cm is 1.5. Find the position of image of an object at infinity formed by the sphere.

Or

An object is placed 27 cm in front of a concave mirror of curvature 10 cm. A glass slab of thickness 6 cm and refractive index 1.5 is then placed close to the mirror in the space between the object and the mirror. Find the position of final image of object.

15. (a) Total energy of an electron orbiting around the nucleus of an atom is always negative. What is the significance of this?

(b) The electron energy in the first orbit of hydrogen atom is $-E_0$. What will it be in singly-ionised helium atom?

16. The speed of a photoelectron is 10^6 m/s. what should be the frequency of the incident radiations on potassium metal whose work function is 2.3 eV?

17. In a series resonant LCR circuit, the voltage across R is 100V and R = 1 kΩ, C = 2 μF. The resonant frequency ω is 200 rad/s. Find the voltage across inductor.

18. Prove that magnifying power of astronomical telescope in normal adjustment is m = $\frac{-f_0}{f_e}$ where f_0 is focal energy of objective and f_e is focal length of eyepiece.

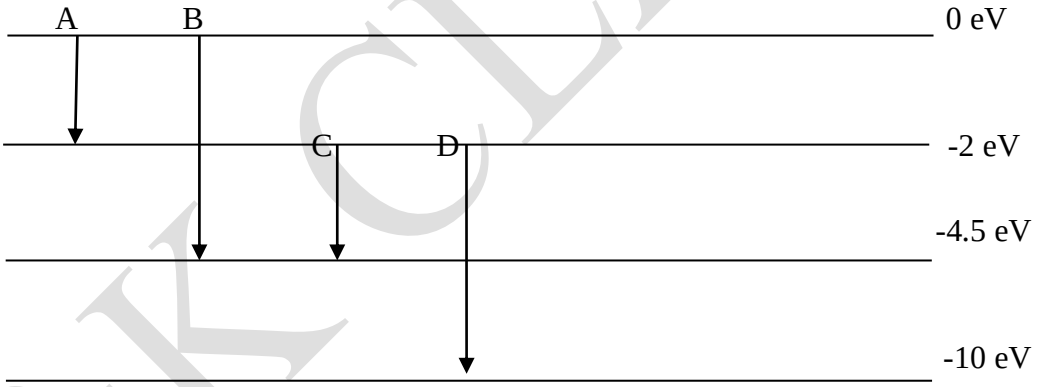
19. Prove that resistivity of a conductor is inversely proportional to relaxation time

20. Define resistivity of a conductor. Explain the variation of resistivity with temperature in
(a) metallic conductors (b) electrolytes

21. A straight rod of length L moves on a rectangular conducting frame kept inside a uniform magnetic field θ perpendicular to its length with uniform velocity v. Derive an expression for the
(a) EMF induced in the rod. (b) power required to move the rod.

22. A 0.02 cm wide slit is illuminated at normal incidence by light having wavelength 5000$\dot{A}$. What would be the width of central maximum, if the apparatus is immersed in water of refractive index 4/3 and the screen is 2 m away from the slit?

23. (a) The energy levels of a hypothetical hydrogen like atom are shown in the figure. Find out the transition, from the ones shown in the figure, which will result in the emission of a photon of wavelength 275 nm.
(b) Which of these transitions corresponds to the emission of radiation of (i) maximum and (ii) minimum wavelength ?



SECTION – D

24. (a) Define total internal reflection and critical angle. Find the relation between critical angle and refractive index. Under what conditions does total internal reflection take place?
(b) a compound microscope has lenses of focal length 10 mm and 30 mm. An object placed at 1.2 cm from the first lens is seen through the second lens at 0.25 m from the eye lens. Calculate distance between the two lenses.

Or

(a) What is meant by diffraction? Draw a graph to show the relative intensity distribution for a single slit diffraction pattern.
(b) What do you understand by wavefront? Prove Snell's law of reflection on the basis of wave theory.

25. (a) A and B are two concentric hollow metallic shells of radius R_A and R_B. A is given a change Q_A while B is given a charge Q_B. find the electric potential at a distance R from the center such that

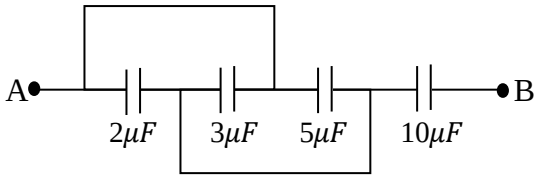
(i) $R < R_A$ (ii) $R > R_B$

(b) Calculate electric field on axis of a uniformly charged ring having charge Q. radius R at distance x from the center.

Or

(a) Derive an expression for the capacitance of a parallel plate capacitor with a dielectric slab placed in between the two plates partially.

(b) Find the equivalent capacitance of the combination between A and B in the figure.



26. (a) using Biot-Savart's law derive an expression for the magnetic field due to a finite straight wire at a perpendicular distance d. The angle subtended by the two ends of the wire at the point area ϕ_1 and ϕ_2.

(b) a long straight solid metal wire of radius R carries a current l, uniformly distributed over its circular cross-section. Find the magnetic field at a distance r from axis of wire (i) inside and (ii) outside the wire.

Or

(a) Show mathematically that in an A.C. circuit containing inductance only, the current lags behind the voltage by $\frac{\pi}{2}$

(b) A capacitor, a resistor of 5 Ω an inductor of 50 mH are in series with an A.C. source marked 100 V, 50 Hz. It is found that voltage is in phase with the current. Calculate the capacitance of the capacitor.