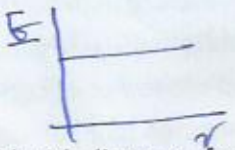
Ch. Himanshu

KP[illegible]/042(Physics)/SET – 2/SELECTION EXAMINATION/2017-18

Time: 3 Hrs. **Max. Marks: 70**

General Instructions:

1. Q.No. 1 – 5 carry 1 mark each.
2. Q.No. 6 – 10 carry 2 marks each
3. Q.No. 11 – 22 carry 3 marks each
4. Q.No. 23 carry 4 marks.
5. Q.No. 24 – 26 carry 5 marks each



1. Represent graphically the variation of electric field with distance, for a uniformly charged plane sheet.
2. Draw a graph to show a variation of resistance of a metal wire as a function of its diameter keeping its length and material constant.

3. Two polaroids are placed with their axis perpendicular to each other. One of them is rotated through 45^0, what is the intensity of light emerging from the second polaroid if I_0 Is the intensity of unpolarised light?
4. How is the speed of em waves in vacuum determined by the electric and magnetic fields?
5. At a place, the horizontal component of earth's magnetic field is B and angle of dip is 60^0. What is the value of horizontal component of the earth magnetic field at equator?
6. How does Ampere- Maxwell law explain the flow of current through a capacitor when it is being charged by a battery? Write the expression for the displacement current in terms of the rate of change of electric flux.
7. Two wires A and B of the same material and having same length, have their cross sectional areas in the ratio 1:6. What would be the ratio of heat produced in these wires when same voltage is applied across each?
8. The focal length of a convex lens made of glass is 20cm. What will be its new focal length when placed in a medium of refractive index 1.25?
9. Find the intensity at a point on a screen in Young's double slit experiment where the interfering waves of equal intensity have a path difference of (i) $\lambda/4$ and (ii) $\lambda/3$.
10. A light bulb and a solenoid are connected in series across an ac source of voltage. Explain, how the glow of the light bulb will be affected when an iron rod is inserted in the solenoid.
11. A monochromatic light of wavelength λ is incident normally on a narrow slit of width 'a' to produce a diffraction pattern on the screen placed at a distance D from the slit. With the help of a relevant diagram, deduced the conditions for obtaining maxima and minima on the screen. Use these conditions to show that angular width of central maximum is twice the angular width of secondary maximum.
12. (a) State the condition under which a charged particle moving with velocity v goes undeflected in a magnetic field B.

    (b) An electron, after being accelerated through a potential difference of 10^4V, enter a uniform magnetic field of 0.04T, perpendicular to its direction of motion. Calculate the radius of curvature of its trajectory.
13. A source of ac voltage $V= V_0 \sin \omega t$, is connected across a pure inductor of inductance L. Derive the expression for the instantaneous current in the circuit. Show that average power dissipated in the circuit is zero.

14. Using Biot- Sawart law, deduce the expression for the magnetic field at a point on the axis of a circular current carrying loop of radius R. How is the direction of the magnetic field determined at this point?

15. Draw a ray diagram depicting the formation of image by an astronomical telescope at least distance and obtain the expression of magnifying Power.

16. Define mutual inductance between a pair of coils. Derive an expression for the mutual inductance of two long coaxial solenoids of same length wound one over the other.

17. **(a)** Monochromatic light of wavelength 589nm is incident from air on a water surface. If μ for water is 1.33, find the wavelength, frequency and speed of the refracted light.

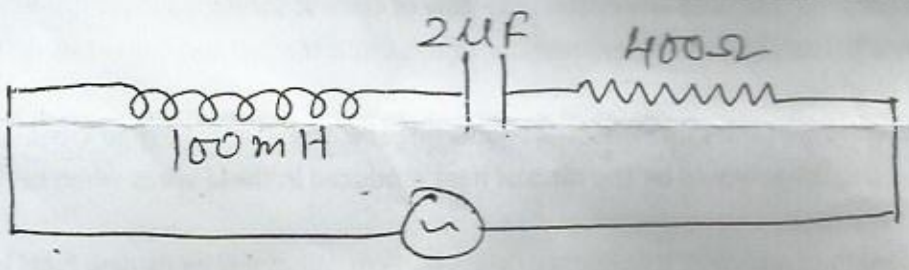
(b) A double convex lens is made of a glass of refractive index 1.55, with both faces of the same radius of curvature. Find the radius of curvature required, if the focal length is 20cm

18. A 12pF capacitor is connected to a 50V battery. How much electrostatic energy is stored in the capacitor? If another capacitor of 6pF is connected in series with it with the same battery connected across the combination, find the charge stored and potential difference across each capacitor.

19. An electron of mass m_e revolves around a nucleus of charge +Ze. Show that it behaves like a tiny magnetic dipole. Hence prove that the magnetic moment associated with is expressed as $\mu = -eL/2m_e$ where L is the orbital angular momentum of the electron.

20. **(a)** Find the value of the phase difference between the current and the voltage in the series LCR circuit shown below. Which one leads in phase: current or voltage?

(b) Without making any other change, find the value of the additional capacitor, C_1 to be connected in parallel with the capacitor C, in order to make the power factor of the circuit unity.



21. Describe the working principle of a moving coil galvanometer. Why is it necessary to use (i) a radial magnetic field and (ii) a cylindrical soft iron core in a galvanometer? Write the expression for current sensitivity of the galvanometer.

Can a galvanometer as such be used for measuring the current? Explain.

22. If N drops of same size each having the same charge, coalesce to form a big drop. How will the following vary with respect to single small drop?

(i) Total charge on bigger drop

(ii) Potential on the bigger drop

(iii) Capacitance

23. Manish and Rajnish lived in an unauthorised colony. They found that most people of that colony stole power from transmission lines using hooks. They had read in the news papers about different fire accidents caused due to electric circuits. Along with some of their friends and some responsible representatives of that area, they visited house to house of that colony and made people aware of the risks involved in short circuiting. They succeeded in changing the mind set of the people.

(a) What according to you, are the values being displayed by

(b) A household circuit has a fuse of 5A rating. Find the maximum number of bulbs of rating 60W-220 V each which can be connected in this circuit.

24. (a) Distinguish between unpolarised light and linearly polarised light. How does one get linearly polarised light with the help of a polaroid?

(b) A narrow beam of unpolarised light of intensity I_0 is incident on a polaroid P_1. The light transmitted by it is then incident on a second polaroid P_2 with its axis making an angle of 60^0 relative to the axis of P_1. Find the intensity of the light transmitted by P_2.

25. (a) Draw a labelled diagram of AC generator. Derive the expression for the instantaneous value of the emf induced in the coil.

(b) A circular coil of cross sectional area $200cm^2$ and 20 turns is rotated about the vertical diameter with angular speed of 50 rad/s in a uniform magnetic field of magnitude 3×10^{-2} T. Calculate the maximum value of the current in the coil.

OR

(a) Draw a labelled diagram of a step up transformer. Obtain the ratio of secondary to primary voltage in terms of number of turns and currents in the two coils.

(b) A power transmission line feeds input power at2200 V to a step down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

26. (a) State the two Kirchhoff's laws. Explain briefly how these rules are justified.

(b)Using Kirchhoff's law, calculate the current in the arm AC of the given circuit.