Quarterly Examination 2017-2018

Std. : XII **Full Marks : 70**

Subject : Physics **Time : 3hrs.+15 min.**

Part I

Q.1. (A) Choose the correct alternative. [5]

(i) Intensity of electric field at a point at a distance 'r' from an infinite line charge, having linear charge density 'λ' is given by

(a) $E = \frac{1}{4\pi\epsilon_0}\frac{2\lambda}{r}$ (b) $E = \frac{1}{4\pi\epsilon_0}\frac{2\lambda}{r}$

(c) $E = \frac{1}{4\pi\epsilon_0}\frac{\lambda}{r^2}$ (b) $E = \frac{1}{4\pi\epsilon_0}\frac{2\lambda}{r^2}$

(ii) A capacitor of 5μf is connected to a 9v battery. What is the potential on each plate of the capacitor ?

(a) 9v (b) 4.5v (c) 3v & 6v (d) None of the these

(iii) P, Q, R and S resistance of a wheat stone's bridge are 4Ω, 6Ω, 8Ω and 20Ω respectively. What resistance should be added to S to balance the bridge.

(a) 40Ω in parallel to resistance S

(b) 30Ω in series to resistance S

(c) 30Ω in parallel to resistance S

(d) 40Ω in series to resistance S

(iv) Maximum work done in rotating an electric dipole in an electric field is

(a) W = PE (b) W = 2PE (c) $W = {}^{P}/_{E}$ (d) $W = \frac{E}{P}$

(v) Fig. 1 below shows five d.c. sources (cells). Their emfs are shown in figure EMF of the battery AB is.

(a) 8V (b) 16V

(c) 4V (d) 2V

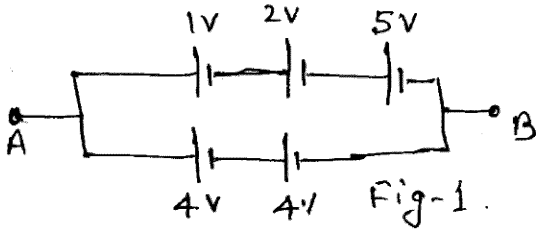


Fig-1.

Q.1. (B) Answer these questions in brief and to the point. [1x7]

(a) Two charges a_1 and a_2 separated by a small distance, satisfy the equation $q_1+q_2=0$. What does it tell us about the charges ?

(b) A point charge of $5x10^{-6}$ c experiences a force of $2x10^{-3}$ N when kept in a uniform electric field of intensity E. Fine E.

(c) Two charges each of 5μc separated by a distance of 25cm. What is the P.E of the system.

(d) If an electric dipole is kept in a non uniform electric field. What type of motion it should exhibit?

(e) Resistance of a resistor is 4Ω. It is stretched twice in length. Calculate its new resistance.

(f) State when emf of a battery is less than potential difference across it.

(g) What is the purpose of a shunt in an electrical instrument.

Q.1. (C) Answer all of the following in brief. [2x4]

(a) 2μc charge is placed at each corner of a square of side $2\sqrt{2}$cm. Calculate electric potential at the centre of the square due to all the charges.

(b) Define equipotential surface. Mention at least two important properties of it.

(c) A uniformly charged circular ring having total charge 'Q'. A sphere is plotted with centre at the periphery of ring & the same radius as the ring. Find the flux through the surface of sphere.

(d) Draw a labelled graph for intensity Verses distance in case of uniformly charged sphere.

Part II

(Answer all the questions in this part)

Q.2. Define electric lines of force and give its two important properties. [2]

Q.3. Why does the electric field inside a dielectric decrease when it is placed in an electric field [2]

Or

Three point changes of +2uc, - 2uc & - 3 mc are kept at the vertices, A, B and C respectively of an equilateral triangle of side 20 cm. Find the resultant electric field strength at the centre 'O' of the triangle.

Q.4. Give the vector form of ohm's law indicating the different terms used. [2]

Q.5. A parallel plate capacitor with air between the plates has capacitance of 8μf. What will be the capacitance if the distance between the plates be reduced by half and the space between them is filled with a substance of dielectric constant K=6.

Q.6. A water tap is maintained at constant potential 'V'. Water droplets each of radius 'r' falling from it is collected in a spherical vessel of radius 'R'. Find the potential of vessel when it in completely filled.

Q.7. Define potential energy of two charge system. Find the potential energy of the system of two charges of 3μc each separated by a distance of $1x10^{-2}$m in eV unit.

Q.8. Define specific resistance. On what basic factors it depends. [2]

Q.9. Derive coulomb's law with the help of Gauss's theorem. [3]

Q.10. An electric dipole is held in a uniform electric field of strength 'E' [3]

(i) Using suitable diagram, show that it does not undergo any translatory motion.

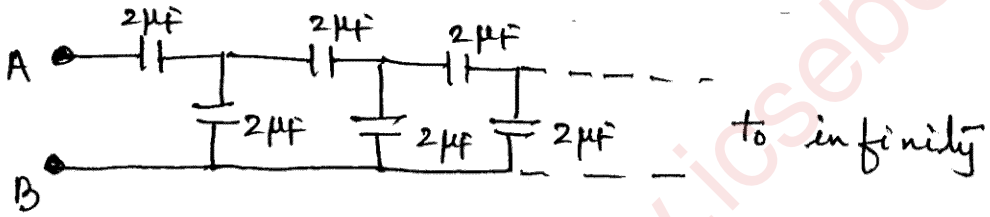
(ii) Derive an expression for the torque acting on it and specify its direction.

Q.11. A potential difference is set up between the plates of a parallel plate capacitor and then the battery is removed. If now the distance between the plates is decreased. With the help of suitable formula explain how the (a) charge (b) pot. diff. (c) Energy of capacitor will change.

Or

Derive the capacity of a parallel plate capacitor with the introduction of dielectric slab of smaller thickness than the plate separation.

Q.12. Find the effective capacity between the points A & B in the given circuit. [3]



Q.13. A uniformly charged circular ring of radius 'r' having total charge 'Q'. Find the intensity due to it at a point at a distance 'x' from its centre and on the axis of ring. Also decide the intensity at its centre.

Q.14. Derive the relation between drift velocity and current density. [3]

Q.15. What do you understand by neutral points. How can you locate the neutral points when a bar magnet with its north pole kept in (i) geographical north (ii) geographical south.

Q.16. What is dipole moment of an electric dipole. Derive the expression of electric field strength at a point in case of broad side on position due to an electric dipole. [5]

Or

Define electric flux. Find the intensity at a point near a uniformly charged cylindrical conductor using Gauss's theorem.

Q.17. State Kirchoff's Law. Find the condition for balanced wheatstone's bridge using Kirchoff's law. [5]

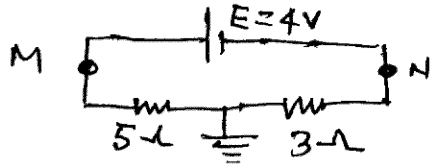
Or

(a) A coil of resistance 120Ω of galvanometer gives full scale deflection for a current of 2.5 mA. How will you convert this galvanometer into an ammeter of range 0 to 7.5A Determine the resistance of this ammeter. When this ammeter is put in a circuit, does it read slightly less or more than the actual current in the original circuit ? Justify the answer.

(b) Calculate what amount of copper is required in order to drill a wire of length 1km so that its resistance is 10Ω. Specific resistance and density of Cu are respectively 1.7×10^{-8} Ω m and $9 \times 10^{3} kg/m^{3}$.

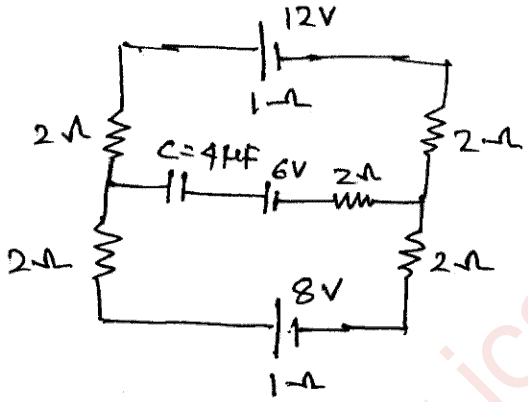
Q.18. (a) Explain the basic principle of potentiometer. How can you measure the internal resistance of a cell using potentiometer. [5]

(b) What do you understand by emf of a cell. Find the potential of point M & N in the given figure.



Or

(a) In the circuit shown in figure calculate the energy stored in the capacitor



(b) Find the value of current strength I, I_2 & I in the given figure.