Time: 3 hours **PHYSICS (NEET|IIT-JEE)** **Marks: 50**

(ELECTROSTATICS)

NAME OF STUDENT:-_____ **DATE:- …./…../…….**

- **INSTRUCTION:- ATTEMT ALL QUESTION.**

Q1. A positive charge of 4×10^{-9} coulomb is uniformly distributed over the surface of a ring-shaped conductor of radius 0.3 m. calculate the intensity of the electric field at a point on the axis of the ring at a distance of 0.4 m from the plane of the ring and specify its direction. What is the intensity at the center of the ring?

Q2. A thin fixed ring of radius 1 m has a positive charge 1×10^{-5} C uniformly distributed over it. A particle of mass 0.9 g and having a negative charge 1×10^{-6} C is placed on the axis at a distance of 1 cm from the center of the ring. Show that the motion of the negatively charge -d particle is approximately simple harmonic. Calculate the time period of oscillations?

Q3. A particle of mass 12×10^{-24} kg and charge 1.6×10^{-19} C enters midway between the plates of a parallel plate capacitor. The initial velocity of the particle is parallel to the plates. A potential difference of 300 V is applied to the capacitor plates. If the length of the Capacitor plates is 10 cm and they are separated by 2 cm, calculate the greatest initial Velocity for which the particle will not be able to come out of the plates?

Q4. An infinite number of charges, each equal to q, are placed along the x-axis at $x = 1$ m, $x = 2$ m, $x = 4$ m, $x = 8$ m … and so on. (a) Find the potential and the electric field at the point $x = 0$ due to this set of charges. (b) What will be the potential and the electric field if in the above set up the consecutive charges have opposite signs ?

Q5. Four charges $+q$, $+q$, $-q$, and $-q$ are placed respectively, at the corners A, B, C and *D* of a square of side a, arranged in the given order. Calculate the electric potential and intensity at O, the center of the square. If *E* and *F* are the midpoints of sides *BC* and *CD*, respectively, what will be the work done in carrying a charge *e* from *O* to *E* and from *O* to *F* ?

Q6. Two fixed, equal positive charges, each of magnitude 5×10^{-5} C, are located at points A and B separated by a distance of 6 m. An equal and opposite charge moves towards them Along the line *COD*, the perpendicular bisector of the line *AB*. The moving charge, when it reaches the point *C* at a distance of 4 m from *O*, has a kinetic energy of 4 joules. Calculate the distance of the farthest point *D* which the negative charge will reach before returning towards *C*.

Q7. Three point charges *q*, *2*q and 8*q* are to be placed on a 9 cm long straight line. Find the Position where the charges should be placed such that the potential energy of the system Is minimum. In this situation, what is the electric field at the position of the charge *q* due to the other two charges?

Q8. A ball of mass 5 g and charge $+10^{-7}$ C moves from point A whose potential is 500 V to a point *B* whose potential is zero. If the speed of the ball at point *B* is 25 cm/s, what was its speed at point *A*.

Q9. A charge Q is distributed over two concentric hollow spheres of radii *r* and *R* (>*r*) such that the surface densities are equal. Find the potential at the common center.

Q10. Three point charges, each of 0.1 C, are placed at the corners of an equilateral triangle of side 1m. How much energy is required to move one of the charges to the mid-point of the line joining the other two?

Q11. Three point charges 1C, 2C and 3C are placed at the corners of an equilateral triangle of side 1m. Calculate the work required to move these charges to the corners of a smaller equilateral triangle of side 0.5 m, as shown in the figure.

Q12. A particle of mass 40 milligrams and carrying a positive charge 5×10^{-9} C is moving Directly towards a fixed positive point charge of magnitude 10^{-8} C. when it is at a distance Of 10 cm from the fixed positive point charge, it has a velocity of 50 cm/s. At what distance From the fixed point charge will the particle come momentarily to rest? Is the acceleration constant during the motion?

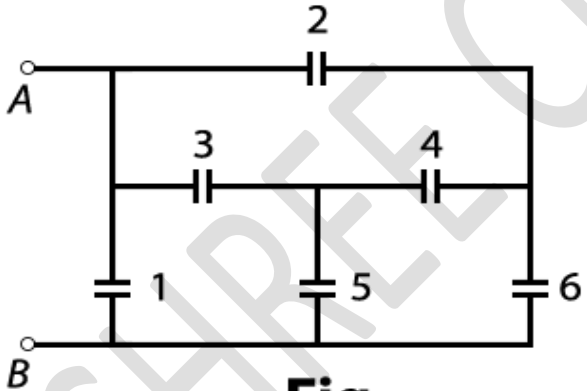
Q13. A circular ring of radius *R* with uniform positive charge density λ per unit length is located In the *y-z* plane with its center at the origin *O*. *A* particle of mass *m* and positive charge *q* Is projected from the point *P* ($R\sqrt{3}$, 0, 0) on the positive x-axis directly towards *O,* with an initial speed v. Find the smallest (non-zero) value of the speed v such that the particle does not return to *P.*

Q14. Two identical particles of mass *m* carry a charge Q each. Initially one is at rest on a smooth horizontal plane and the other is projected along the plane directly towards the first particle from a large distance, with speed v. Find the distance of closest approach.

Q15. A proton moves with a speed of 7.45×10^5 m/s directly towards a free proton originally at rest . Find the distance of closest approach for the two protons. Mass of proton 1.66×10^{-27} kg.

Q16. Two capacitors $C_1 = 2\ \mu F$ and $C_2 = 5\ \mu F$ are connected in series and the combination is connected in parallel with a third capacitor $C_3 = 3\ \mu F$. The arrangement is connected across a 6.0 V battery. How much work is done by the battery in charging the system?

Q17. Six identical capacitors, each of capacitance *C*, are connected as shown. Find the equivalent capacitance between the point *A* and *B*.



Fig

Q18. A 3 μF capacitor is charged to a potential of 300 V and a 2 μF capacitor is charged to 200 V. The capacitors are connected in parallel with plates of the (*a*) same polarity (*b*) opposite polarities being connected together. What is the common potential across the combination in each case?

Q19. Two capacitors of capacitances C_1 and C_2 are connected in series across a source of emf *V*. What is the potential difference across each capacitor?

Q20. Two capacitors of capacitances 6 μF and 3 μF are connected in series across a source of 900 V. The source is now removed and the capacitors are reconnected in parallel. What is the potential difference across the combination.