

United International University

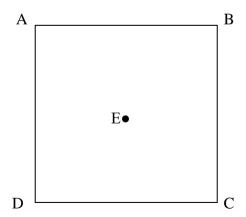
School of Science and Engineering

Final Examination; Year 2021; Semester: Summer Course: PHY 2105/105; Title: Physics Full Marks: 25; Section: A-F; Time: 1:15 hour

1. a) $\begin{array}{c|c} +++++++\\ \hline & & \text{higher}\\ \hline & & \text{potential} \\ \hline & & \text{lower}\\ \hline & & \text{potential} \\ \end{array}$

In figure, negative and positive charges are moving from lower to upper and upper to lower plates respectively. (i) Does negative/positive charge increase/decrease its electrical potential energy? (ii) Is the negative/positive work done by the electric field on negative/positive charge?

- b) The direction of a uniform electric field is parallel to the +X axis. A dipole consists of ±q charges separated by a distance d. The dipole is placed with an angle θ =60° in the electric field. (i) Draw the arrangement of dipole and electric field. (ii) Show the direction of rotation of dipole in the electric field.
- 2. a) Two equal positive charges are on a line established an electric field at a point in the same line of magnitude E = (last two digits of your ID) N/C. If charges are separated by a distance 20cm and the point is 5cm from the first charge, find the value of the positive charge. ($k=9x10^9 Nm^2/C^2$)
 - b) Suppose you have a 5 V battery, a 6 μ F capacitor, and a 7 μ F capacitor which is acting in an electric field of 8 N/C. (i) Find the equivalent charge and (ii) energy stored, if the capacitors are connected to the battery in series. ($\epsilon_0 = 8.854 \times 10^{-12} F/m$)
 - c) A square of side 50cm is shown in fig. below. Charge arrangements at four corners are [3] CO3 A= B = (last two digits of your ID) C, C= D= (last two digits of your ID) C. What is the electric potential at E due to charge at A, B, C and D?



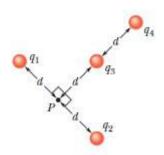
3. a) A fuse in an electric circuit is a wire that is designed to melt, and thereby open the circuit, if the current exceeds a predetermined value. Suppose that the material to be used in a fuse melts when the current density rises to 440 A/cm². What diameter of cylindrical wire should be used to make a fuse that will limit the current to 0.50 A?

[2.5] CO3

[3]

CO₁

b) In Fig. below the four particles are fixed in place and have charges $q_1 = q_2 = +5e$, [2.5] CO3 $q_3 = +3e$, and $q_4 = -12e$. Distance $d = 5.0 \,\mu\text{m}$. What is the magnitude of the net electric field at point P due to the particles? (e=1.6×10⁻¹⁹C)



- c) A cube of side 50cm and it placed in a uniform electric field $\vec{E} = 4\hat{j} + 2\hat{k}$. Find out [2] CO3 electric flux for all faces of the cube. [You must draw the cube with axes]
- Derive expression for electric field due to a dipole. Modify the expression when z>>d.
 OR Find the electrical potential due to line of charges.

CO1: Define or Justify different physical quantities; CO2: Derive various equations of Electric Field, Potential and Electricity, and Capacitance; CO3: Evaluate different numerical problems