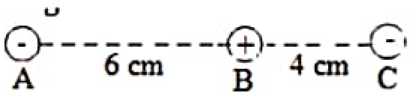
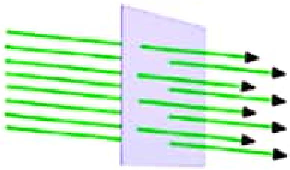
Department of Electrical Engineering
Assignment
B.tech(E)
Date: 14/04/2020

Course Details

Course Title: Electromagnetic Fields **Module:** 4th
Instructor: Engr. Perniya akram **Total Marks:** 30

Student Details

Name: shafeq khan **Student ID:** 14859

Q1.	(a)	State the relationship between potential and electric field intensity with relevant example.	Marks 5
	(b)	Consider a point A(1,-2,2), Find a unit vector extending from point A.	Marks 5
Q2.	(a)	Three charged particles are arranged in a line as shown in figure below. Charge A = -3 μC, charge B = +8 μC and charge C = -9 μC. Calculate the net electrostatic force on particle B due to the other two charges. 	Marks 10
Q3.	(a)	a) A uniform electric field E = 6000 N/C passing through a flat square area A = 10 m^2. Determine the electric flux. 	Marks 5
	(b)	'Electric flux density is a function of charge', Comment how and explain the effect of charge on flux density.	Marks 5

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Q2 Three Charged Particles are arranged in a line as shown in figure below. charge A = -3μC, charge B = +8 μC and Charge C = -9μC, Calculate the net electrostatic force on Particle B due to the other two charges?

Ans **Solution:**

Charge A = QA = -3μC = -3×10^{-6}C

Charge B QB = 8μC = 8×10^{-6}C

Charge C = QC = -9μC = -9×10^{-6}C

Required:

$$F_{AB} = k \frac{q_A q_B}{r_{AB}}$$

$$F_{AB} = 9 \times 10^{9} \frac{-3 \times 10^{-6} (8 \times 10^{-6})}{(6 \times 10^{-2})^2)}$$

$$= \frac{9 \times 10^{9} (-24 \times 10^{-12})}{36 \times 10^{-4}}$$

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$$F_{AB} = \frac{-216 \times 10^{-3}}{36 \times 10^{-4}}$$

$$F_{AB} = -6 \times 10^{-3} \times 10^{4}$$

$$F_{AB} = -6 \times 10^{1}$$

$$= -60 \text{ Newton}$$

$$F_{BC} = k \frac{q_b q_c}{r_{BC}}$$

$$F_{BC} = 9 \times 10^{9} \frac{8 \times 10^{-6}(-9 \times 10^{-6})}{(4 \times 10^{-2})^{2})}$$

$$F_{BC} = \frac{9 \times 10^{9}(-72 \times 10^{-12})}{16 \times 10^{-4}}$$

$$F_{BC} = \frac{-648 \times 10^{-3}}{16 \times 10^{-4}}$$

$$F_{BC} = -40.5 \times 10^{-3} \times 10^{4}$$

$$F_{BC} = -40.5 \times 10^{1}$$

$$F_{BC} = -405 \text{ Newton}$$

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The net electrostatics force on Particles B

$F_b = F_{ab} - F_{bc} =$

$(-60) - (-405) = 345$ Newton

Q3 (a) A uniform electric field $E = 6000$ N/C Passing through a flat Square area $A = 10m^2$ Determine the electric ~~field~~ flux.

Ans3(a) Solution

Given Data

$E = 6000$ N/C

$A = 10m^2$

Formula: $\phi_c = EA \cos\theta$

$\phi =$ electric flux (Nm^2/C)

$E =$ electric field (N/C)

$A =$ Area (m^2).

$\theta =$ angle between electric field

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we know that

$$\phi_c = EA \cos\theta$$

Putting values in formula

$$\phi_c = (6000)(10)(\cos\theta)$$

$$= (6000)(10)(1)$$

$$= 6 \times 10^4 \ Nm^2/C$$

Question 3 (b) Electric flux density is a function of charge?, Comment how and explain the effect of charge on flux density.

=> **Answer:**

lectric flux density, assigned the Symbol D is an alternative ~~description offers Some~~ to electric field intensity (E) as a way to quantify an electric field. This alternative description offers Some actionable Insight, as we shall point out at the end of this Section.

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First, what is electric flux density? Recall that a Particle having charge q gives rise to the electric field Intensity =

R^q 14πR2 E=R^q 14πR2 1∈

where R is distance from the charge and R^ Points away from the charge. Note that E is inversely Proportional to 4πR2 Indicating that E decreases in Proportion to the area of a sphere surrounding the charge

Now integrate both sides of Equation over a sphere S of radius R

Factoring out constants that do not vary with the variables of integration, the right-hand side becomes:

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Note that ds = R^ ds in this Case, and also that R^ = 1 Thus the right- hand Side Simplifies to:

q 14πR2 1ε ∮s ds

Question 1(b) Consider a Point A(1,-2,2). Find a unit vector extending from Point A.

Solution:

Let Suppose

$A = 1a_x - 2a_y - 2a_z$

$[A] = \sqrt{(1)^2 + (-2)^2 + (-2)^2}$

Magnitude of A

$= \sqrt{1+4+4} = \sqrt{9} = 3$

Find unit vector.

$a_A = \frac{A}{|A|} = \frac{a_x - 2a_y - 2a_z}{3}$

$= \frac{1}{3}a_x - 2/3\, a_y\ 2/3\, a_z$

$a_A = 0.333a_x - 0.668a_y - 0.666\, a_z$