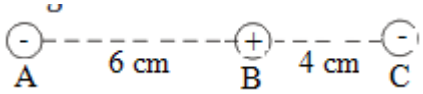
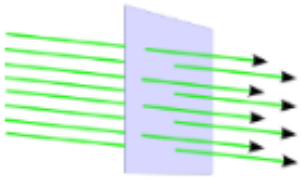
Department of Electrical Engineering
Assignment
B.tech(E)
Date: 14/04/2020

Course Details

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

Student Details

Name: AZHAD NIAZ **Student ID:** 15493

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 = -9μC. 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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Q1 (a): State the relationship between potential and electric field intensity with relevant example.

ANS: (a)

RELATIONSHIP BETWEEN POTENTIAL & ELECTRIC FIELD INTENSITY

POTENTIAL	ELECTRIC FIELD INTENSITY
Electric potential is defined as amount of energy or work per charge.	Electric field is defined as amount force per charge
It is measured in volts or joules per coulomb	It is measured in Newton per coulomb Or volt per meter
It is scalar quantity	It is vector quantity
It is the negative rate of derivative of potential difference	It is equal to the negative rate of charge of potential
V(r)= $\frac{q1}{4\pi e_0 (r-r1)}$	Formula = E =K*Q/d^2

EXAMPLE OF POTENTIAL: magnetic and gravitational field are examples

EXAMPLE OF ELECTRIC FIELD: Light X RAYS, radio waves, microwaves,

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Q1; (**b**) Consider a point A (1,-2, 2), Find a unit vector extending from point A.

Solution:

Let suppose

A = 1ax -2ay -2az

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

Magnitude of A

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

$= \sqrt{9} = 3$

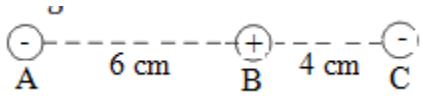
Find unit vector

$aA = \frac{A}{|A|} = \frac{ax - 2ay - 2az}{3}$

$= \frac{1}{3}ax - \frac{2}{3}ay \ \frac{2}{3}az$

aA = 0.333ax – 0.666ay – 0.666az..

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



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ANS:

SOLUTION:

Given data:

Charge A = QA = -3μC = -3 $\times 10^{-6}$c

Charge B QB = 8μC = 8$\times$ 10^{-6}C

Charge C = QC = -9μC = -9$\times 10^{-6}$C

Required:

The magnitude and the direction of net electromagnetic force on particles B The force exerted on particle B by particle A.

$$F_{AB} = k \frac{qA\ qB}{rAB}$$

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

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

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

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

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

= -60 NEWTON

The direction of the electrostatic force points to particles A point left the force FBc exerted on particle B by A

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ANS 2:

$$F_{Bc} = k\frac{qb\ qc}{rBc}$$

$$F_{Bc} = 9\times10^{9}\frac{8\times10^{-6}(-9\times10^{-6})}{(4\times10^{-2})^{2})}$$

$$F_{Bc} = \frac{9\times10^{9}(-72\times10^{-12})}{16\times10^{-4}}$$

$$F_{Bc} = \frac{-648\times10^{-3}}{16\times10^{-4}}$$

$$F_{Bc} = -40.5\times10^{-3}\times10^{4}$$

$$F_{Bc} = -40.5\times10^{1}$$

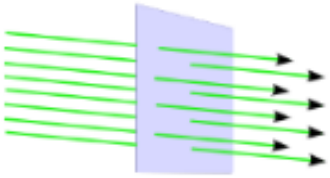
$$F_{Bc} = -405\text{Newton}$$

The net electrostatics force on particles B

Fb = Fab – Fbc =

(-60) – (-405) = 345 Newton

Q3: (**a**) A uniform electric field E = 6000 N/C passing through a flat square area A = 10 m^2. Determine the electric flux.



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ANS 3: (a)

Solution:

Given data: E = 6000 N/C

$A = 10m^2$

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

Φ= electric flux (Nm^2/C),

E = electric field (N/C)

A = Area (m^2),

θ = angle between electric field

We know that

$$\Phi_c = EA\cos\theta$$

Putting values in formula

Φ_c = (6000) (10) (cos θ) =

= (6000) (10) (1)

= 6×10^4 Nm^2/C

Q3 (b); Electric flux density is a function of charge', Comment how and explain the effect of charge on flux density.

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ANS 3: (b)

ELECTRIC FLUX DENSITY:

Electric flux density assigned the symbol D, is an alternative electric field intensity E as way to the electric field.

Simply it can define as the measure of strength of an electric field generated by free electric charge.

Particles having charge q give rise to the electric field intensity

It is measured in coulombs $Q = \Psi$

$$E = R^{\wedge} q \frac{1}{4\pi R^2} \quad \frac{1}{E}$$

Where R is the distance from charge R^ point away from the charge.

E is inversely proportional to $4\pi R^2$, indicating the E decreases in proportional to the area of sphere surrounding the charge

Q is the charge of the body

As the number of electric lines of force emanated from a charge body is equal to the quantity of charge body is equal to the quantity of charge of the body measured in coulombs we can also define the electric flux density at any point in the electric field of the body as the number of lines of force passing through a unit surface area at that point

EFFECT OF CHARGE:

With the increase of charge electric flux density will increase

Because due to force on it.

It is out close surface and depended only on charge enclosed.