



## COLLEGE OF ENGINEERING & TECHNOLOGY

Department : Electrical & Computer Control Engineering

Lecturer : Dr. M. Abdel-Rahim

Course : Electric & Magnetic Fields (1)

Course Code : EE 331

Marks : 40

Date : 15 / 1 / 2015

Time : 2 hour

### Final Exam

Answer the following questions :-

1-(a) Let a point charge  $Q_1 = 50 \text{ nC}$  be located at  $P_1(3,-4,5)$  and a charge  $Q_2 = 30 \text{ nC}$  be at  $P_2(-2,5,-1)$ .

- If  $\epsilon = \epsilon_0$ , find  $\mathbf{E}$  at  $P(1,2,3)$ .
- At what point on the  $y$  axis is  $E_x = 0$ ?

(b) Find  $\mathbf{E}$  at the origin if the following charge distributions are present in free space: point charge  $20 \text{ nC}$  at  $P(2,0,6)$ ; uniform line charge density  $5 \text{ nC/m}$  at  $x = -2$ ,  $y=3$ ; uniform surface charge density  $0.4 \text{ nC/m}^2$  at  $x = 2$ .

(10marks) (A5)

2- (a) Cylindrical surfaces at  $\rho = 4, 6$ , and  $8 \text{ m}$  carry uniform charge densities of  $15 \text{ nC/m}^2$ ,  $-4 \text{ nC/m}^2$ , and  $4 \text{ nC/m}^2$  respectively. Find  $\mathbf{D}$  at  $\rho = 3, 5, 7, 9 \text{ m}$ .

(b) Let  $\mathbf{D} = (15xyz^2 + 5x)\mathbf{a}_x + 8x^2z^2\mathbf{a}_y + 12x^2yza_z \text{ nC/m}^2$ .

(i) Find the total charge enclosed in a cube having a volume  $10^{-10} \text{ m}^3$  located at  $(2,3,4)$ .

(ii) How much flux leaves this volume?

(10marks) (A5)

3- (a) If  $\mathbf{G} = 4x^3y\mathbf{a}_x + (2x - z)\mathbf{a}_y$ , evaluate  $\int \mathbf{G} \cdot d\mathbf{L}$  from an initial point  $P(4,2,2)$  to a final point  $Q(4,5,2)$  using the path:

- a straight line :  $y = x - 2, z = 2$ .
- a parabola :  $6y = x^2 + 1, z = 2$ .

(b) A point charge of  $20 \text{ nC}$  is located at  $Q(2,3,5)$  in free space, and a uniform line charge of  $10 \text{ nC/m}$  is at the intersection of the planes  $x = 2$  and  $y = 4$ . If the potential at the origin is  $100 \text{ V}$ , find  $V$  at  $P(4,1,3)$ .

(10marks) (C1)

| Members of course Examination Committee:        | Signature:            | Date:           |
|---|-----------------------|-----------------|
| Lecturer: <i>Dr. M. Abdel-Rahim</i>             | <i>M. Abdel-Rahim</i> | <i>5/1/2015</i> |
| Course Coordinator: <i>Prof. Samah EP Safty</i> | <i>Safty</i>          | <i>5/1/2015</i> |
| Head of Department: <i>Prof. Hamdy Ashour</i>   | <i>Hamdy</i>          | <i>5/1/2015</i> |

4- (a) A dipole having a moment  $\mathbf{p} = 10\mathbf{a}_x - 3\mathbf{a}_y + 5\mathbf{a}_z$  nC.m is located at Q(4,3,2) in free space.

(i) Find  $V$  at P(x, y, z).

(ii) Find  $V$  at P(6,2,1).

(b) A coaxial capacitor has dimensions  $a = 3\text{mm}$ ,  $b = 12\text{mm}$ , and a length of 1 m.

The region between the conducting cylinders contains three different dielectrics:

$\epsilon_{R1} = 5$ ,  $3 < \rho < 6$  mm;  $\epsilon_{R2} = 3$ ,  $6 < \rho < 9$  mm; and  $\epsilon_{R3} = 1$ ,  $9 < \rho < 12$  mm.

Calculate C.

(10marks) (CI)

GOOD LUCK

| Members of course Examination Committee:        | Signature:            | Date:           |
|---|-----------------------|-----------------|
| Lecturer: <i>Dr. M. Abdel-Rahim</i>             | <i>M. Abdel-Rahim</i> | <i>5/1/2015</i> |
| Course Coordinator: <i>Prof. Samah El Salfy</i> | <i>salfy</i>          | <i>5/1/2015</i> |
| Head of Department: <i>Prof. Hamdy Ashour</i>   | <i>Hamdy</i>          | <i>5/1/2015</i> |