Kafrelsheikh University
Faculty of Engineering
Department: Electrical Power & Machines
Year: 2nd electrical [New (R-2007)]
Subject: Electromagnetic Fields
Examiner: **Dr. Ragab El-Schiemy**
Dr. Bedir Yousif

Final Exam
First Semester 2016/2017
Time allowed: 3 Hours
Date: 10 /01/2017
Full Marks: 90
Pages: Two pages
Academic Number: EPM2103

Solve the following questions

Part 1: (60 Marks)

1. Transforming the vector field $\mathbf{G}=(xz/y)\mathbf{a}_x$ into spherical coordinates .
2. Drive an expression for the electric field strength $\mathbf{E}(x,y,z)$ of an infinite line charge extended from point B $(0, 0,\infty)$ to A $(0, 0, -\infty)$, with uniform charge density ρ_l.
3. Planes $x = 2$ and $y = -3$, respectively, carry charges 10 nC/m^2 and 15 nC/m^2. If the line $x = 0$, $z = 2$ carries charge 10π nC/m, calculate E at $(1, 1, -1)$ due to the three charge distributions.
4. Given that $D = z\rho\cos^2\varphi\, a_z$ C/m^2, calculate the charge density at $(1, \frac{\pi}{4}, 3)$ and the total charge enclosed by the cylinder of radius 1 m with $-2 \le z \le 2$ m.
5. Sketch the stream field lines of the uniform line charge with $\rho_L = 2\pi\varepsilon_0$.
6. Given the potential field, $V = 2x^2y - 5z$, and a point P(-4, 3, 6), we wish to find several numerical values at point P: the potential V, the electric field intensity **E**, the direction of E, the electric flux density **D**, and the volume charge density ρ_v.
7. Drive and sketch the streamlines of an electric dipole located along the z-axis?
8. Given the current density $\mathbf{J} = -10^4[\sin(2x)e^{2y}a_x + \cos(2x)e^{2y}a_y]$ kA/m^2:
   (i) Find the total current crossing the plane $y=1$ in the a_y direction in the region $0<x<1$,
   (ii) Find the total current leaving the region $0 < x, x < 1, 2 < z < 3$ by $\int \mathbf{J}\cdot d\mathbf{S}$ over the surface of the cube

<<<<<<<.See Page 2 for Second Part >>>>>>>>>>

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Part 2 (30 Marks)

A. Check the errors for the following:

1. Gauss's law states that the circulation of electric flux density around a closed path is equal to the charge enclosed by the path
2. A magnetic flux line is a path or line drawn in such a way that its direction at any point is the direction of the magnetic field at that point.
3. There are two types of flux density configurations the source and the sink.
4. A perfect conductor contains an electrostatic field within it.
5. The magnetic field B is defined as the force per unit current element.
6. An isolated magnetic charge does not exist.
7. The dielectric strength is the maximum electric field that a dielectric can tolerate or withstand without breakdown.
8. Electric flux density at (4, 0, 3) equals $240a_x + 42a_z\ \mu C/m^2$ if there is a point charge $-5\pi\ \mu C$ at (4, 0, 0) and a line charge $3\pi\ \mu C/m$ along the y-axis.

B. Discuss in brief the general classifications of electric and magnetic materials.

C. State passion's equation, Ampere's law, Stokes theorem.

D. Determine the equivalent capacitance and the equivalent relative permittivity of each of the capacitors in Figures 1 and 2. Taking, d = 5 mm and S = 30 cm^2. What is happen if the width w is doubled on the equivalent capacitances obtained?

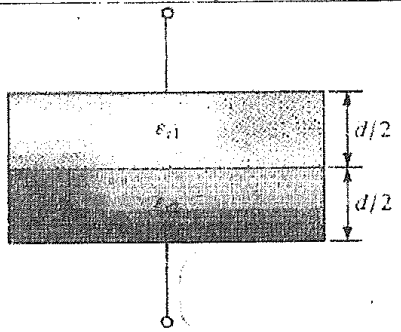

Figure 1

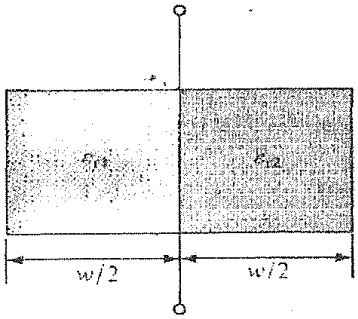

Figure 2

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