Kafrelsheikh University
Faculty of Engineering
Department: Electrical Engineering
Year: 2nd electrical, (R-2007)]
Subject: Electromagnetic Fields

Final Exam - First Semester 2018/2019
Time allowed: 3 Hours
Date: 10 /1/2018
Full Marks: 90
Pages: Two pages

Notes: The exam constitutes five problems; Assume any missing data

Field	*National Academic Reference Standards (NARS)*			
	Knowledge & Understanding	***Intellectual Skills***	***Professional Skills***	***General Skills***
academic standards that the course contribute in achieving it	***a.1, a.3, a.5,***	***b.1, b.2, b.3, b.4, b.7, b.11, b.12,b.13***	***c1, c2, c3, c4, c5***	***d1, d2,***

P-1	18 marks
A	Mention: Ampere's law, divergence concept, charge distributions and current density?
B	Discriminate with aid of figures between the nature of magnetic and electric fields.
C	A multilayer coil of 2000 turns of fine wire is 20 mm long and has a thickness 5 mm of winding. If the coil carries a current of 5 μA. Find the generated mmf.
D	*If* $A = r\cos\phi\, a_r + \sin\phi\, a_\phi$ *evaluate* $\int A.dl$ *around the path in Figure 1.C .*
P-2	18 marks
A	Check the errors for the following: 1) Gauss's law states that the accumulation of magnetic flux density around a closed path equals 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) The dielectric strength is the maximum electric field that a dielectric can tolerate or withstand without breakdown. 5) Electric flux density at (4, 1, 3) equals $240a_x + 42a_z$ μC/m^2 if there is a point charge -5π μC at (4, 0, 0) and a line charge 3π μC/m along the y-axis. 6) Boundary value problem is dependent on Gauss law and possions equation.
B	A charged particle of mass of 2.5 kg and charge 3 C starts at point (1, -2, 0) at velocity 4ax+3az in an electric field 12ax+10ay V/m. At time t=1 sec, **Determine**: The acceleration of the particle and the velocity and Kinetic energy and its position
C	Prove that: * $E = -\nabla V = -grad(V)$, * $\nabla . B = 0$ * $\rho_v = \nabla . D = Div(D)$, * $\nabla . J = -\frac{\partial \rho_v}{\partial t}$
P-3	18 marks
A	Give the mathematical expression for Maxwell's equation for static fields
B	If $D = 2ra_r$ C/m^2, **Find** the total electric flux leaving the surface of the cube $0 \le x, y, z \le 0.4$.

C	A potential measuring device known as an electrometer is shown in below Figure. It is basically a parallel-plate capacitor with the guarded plate being suspended from a balance arm so that the force F on it is measurable in terms of weight. If S is the area of each plate, show that the voltage difference between the two plates is obtained from: $\Delta V = V_1 - V_2 = \sqrt{\frac{2Fd^2}{\varepsilon_0 S}}$.
P-4	18 marks
A	Discuss in brief the general classifications of electric and magnetic materials.
B	In the magnetic circuit of Figure 4, calculate the current in the coil that will produce a magnetic flux density of 1.5 Wb/m^2 in the air gap assuming that $\mu = 50\mu_0$ and that all branches have the same cross-sectional area of 10 cm^2. How do you limit the B in the air gap to 1.2 Wb/m^2
C	Planes x=2 and y=-3, respectively, carry charges 10 nC/m2 and 15 nC/m2. If the line x=0, z=2 carries charge 10π nC/m, and a point charge 2 nC at P(0,0,0), calculate E at (1,1,-1).
P-5	18 marks
A	Discuss the analogy between Electric and Magnetic Circuits.
B	Determine electric flux density at (4, 0, 3) if there is a point charge -5π mC at (4, 0, 0) and a line charge 3π mC/m along the y-axis.
C	Sketch the streamline equation of electric field strength $E = 0.4(ya_x + xa_y)$ kV/m if the streamline passing through point A(2,1,-2).
D	Determine the gradient of the following scalar field $V = \rho z \sin\varphi + z^2\cos^2\varphi + \rho^2$

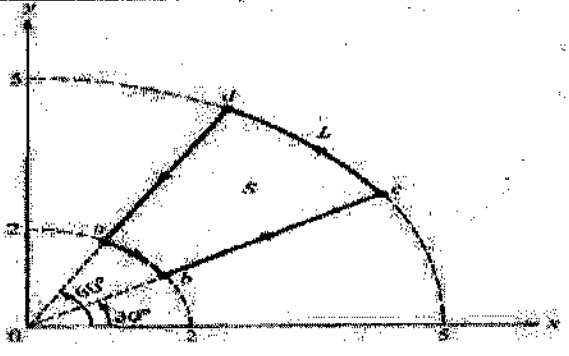

Figure 1.C

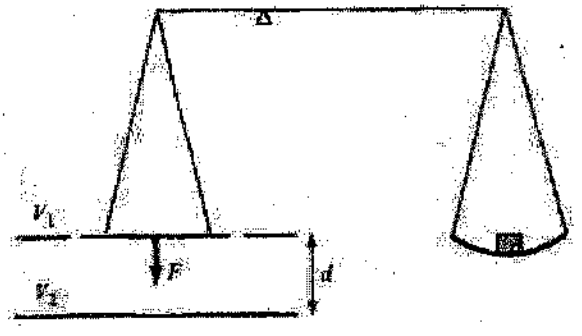

Figure 3.B: An electrometer

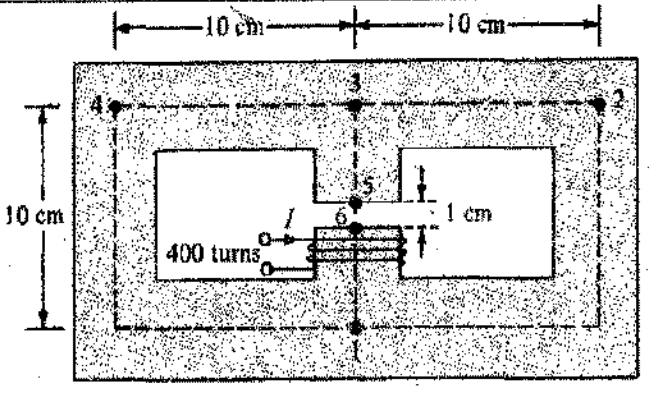

Figure 4.B: Magnetic circuit

Best regards

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