ISTANBUL AYDIN UNIVERSITY

Name, Surname	: AKAY KARA
Number	: B1105.020020
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	:□ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A planar vacuum diode has a heated cathode at $z = 0$ $[\Phi(0) = 0]$ and an anode at $z = d$ $[\Phi(d) = V_0]$. If an electron escapes from the cathode with zero initial velocity, then thc total initial energy is zero, and the total energy is constant and zero $(-e\Phi + mu^2/2 = 0)$. It can then be shown that $\Phi(z) = V_0(z/d)^{4/3}$.

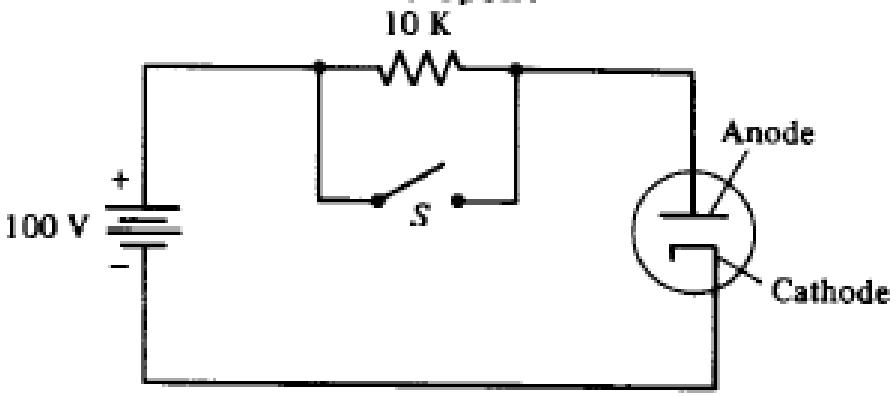
(a) Find $\rho_v(z)$.

(b) Find $J_z(z)$ (A/m^2).

(c) Show that $I = K V_0^{3/2}$ (*Child–Langmuir* or *three-halves power law*).

(d) Find the time required for an electron to leave the cathode and reach the anode (*transit time*) if $V_0 = 100$ V and $d = 1$ mm.

(e) If the current in Figure _ is 10 mA when the switch is closed, what is the current when the switch is open?



ISTANBUL AYDIN UNIVERSITY

Name, Surname	: ALPEREN TAŞBAŞI
Number	: B1105.020015
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	:□ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

An *idealized toroid* can be thought of as a finite length solenoid bent around to close on itself to form a doughnut shape as shown in Figure The surface current density at $\rho = \rho_a - a$ is J_{sz}. It can be shown that

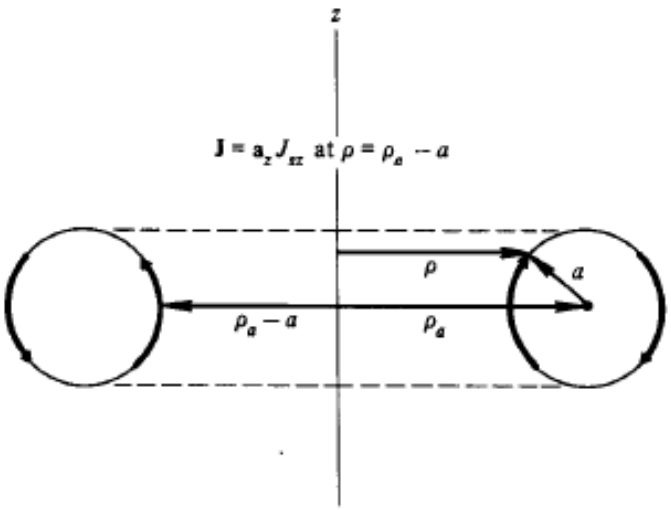
$$\mathbf{H} = \begin{cases} J_{sz}\dfrac{\rho_a - a}{\rho}\mathbf{a}_\phi, & \text{inside toroid;} \\ 0, & \text{outside toroid.} \end{cases}$$

Find $\oint \mathbf{H} \cdot d\mathbf{l}$ for a circular path of radius b in the $z = 0$ plane if

(a) $0 < b < \rho_a - a$,

(b) $\rho_a - a < b < \rho_a + a$, and

(c) $b > \rho_a + a$.

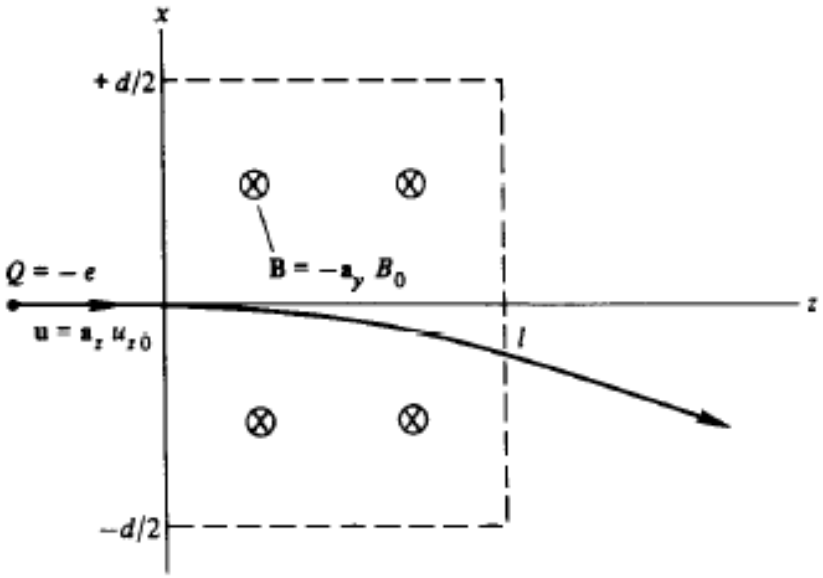


ISTANBUL AYDIN UNIVERSITY

Name, Surname	: BAHAR DAŞ
Number	: B1205.020008
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A uniform magnetic flux density $\mathbf{B} = -B_0\mathbf{a}_y$ exists in the region, $-d/2 \leq x \leq d/2$, $0 \leq z \leq l$. Assume that there are no variations with y. An electron enters this field at (0,0,0) with an initial velocity $u_{z0}\mathbf{a}_z$ as shown in Figure . Find the equations of motion for the electron while in the applied field (*magnetostatic deflection system*).



ISTANBUL AYDIN UNIVERSITY

Name, Surname	: BARIŞ BERKAY BAYAZIT
Number	: B1005.020021
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

Find the force of repulsion per unit length between the two conductors of a planar transmission line. The two conductors are parallel plane strips, of width b and separation d, carrying equal and opposite surface currents. Assume $b \gg d$, and ignore fringing.

ISTANBUL AYDIN UNIVERSITY

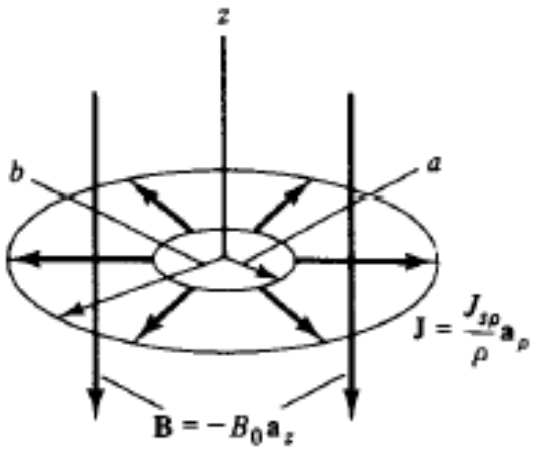
Name, Surname	: BURAK YAPICI
Number	: B1205.020009
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

An idealized current density is given by $\mathbf{J} = \mathbf{a}_\rho J_{s\rho}/\rho$, $a \leq \rho \leq b$, $z = 0$, when a uniform external magnetic flux density $\mathbf{B} = -B_0\mathbf{a}_z$ (Wb/m^2) is applied. This is an *idealized axial gap motor*. See Figure .

(a) Find the vector torque on the current if $J_{s\rho} = 10^3$ (A/m), $a = 1$ cm, $b = 5$ cm, and $B_0 = 1$ Wb/m^2.

(b) If the armature rotates at 500 rpm, what power is provided?



ISTANBUL AYDIN UNIVERSITY

Name, Surname	: EGEMEN KÜÇÜK
Number	: B1205.020002
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

Region $z > 0$ has $\mu_R = 4$, while region $z < 0$ has $\mu_R = 1$. $\mathbf{B}$ is uniform for $z > 0$ with a magnitude of 1 Wb/m^2 and in a radial direction for which $\theta = 60°$ and $\phi = 45°$. Find $\mathbf{B}$ and $\mathbf{H}$ for $z < 0$.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: GÖKHAN ÇALIŞKAN
Number	: B1205.020027
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

An infinitely long cylinder of relative permeability μ_R and a radius a is placed so that its axis is the z axis in a magnetic field that was (in free space) previously uniform $\mathbf{H} = H_0\mathbf{a}_x$.

(a) List the boundary conditions on $\mathbf{H}$ in terms of Φ_m.

(b) Find Φ_m. Use Laplace's equation.

(c) Show that the field inside the cylinder is uniform.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: HAKAN KOÇER
Number	: B1305.020054
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

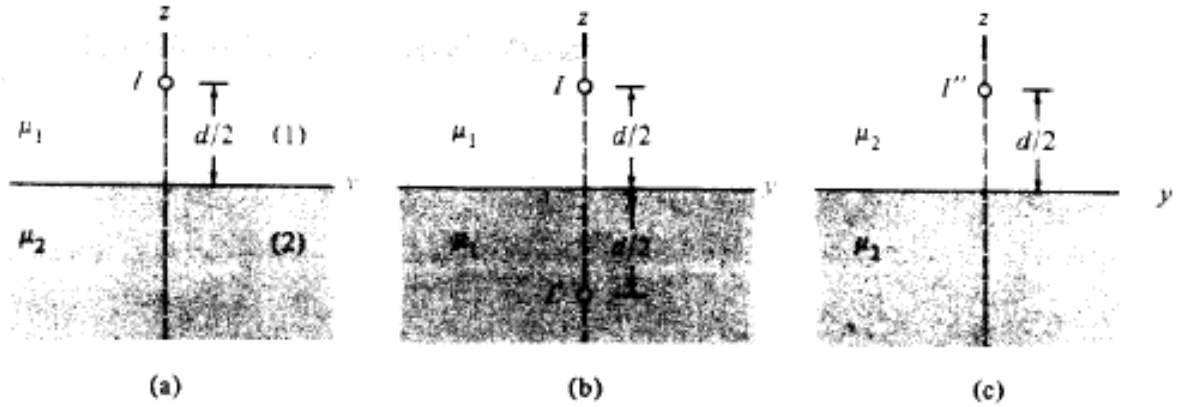
QUESTION

The differential equations and boundary conditions for Figure (a) are

$$\nabla^2 A_x = 0, \text{ except at } (x, 0, d/2);$$

$$H_{y1} = H_{y2}, \quad z = 0; \qquad \mu_1 H_{z1} = \mu_2 H_{z2}, \quad z = 0.$$

Show that this problem is equivalent to that in Figure (b) for $z > 0$ (only) if $I' = I(\mu_2 - \mu_1)/(\mu_2 + \mu_1)$, and that this problem is equivalent to that in Figure (c) for $z < 0$ (only) if $I'' = I(2\mu_1)/(\mu_2 + \mu_1)$.



ISTANBUL AYDIN UNIVERSITY

Name, Surname	: HIRA JANAT
Number	: B1305.020084
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

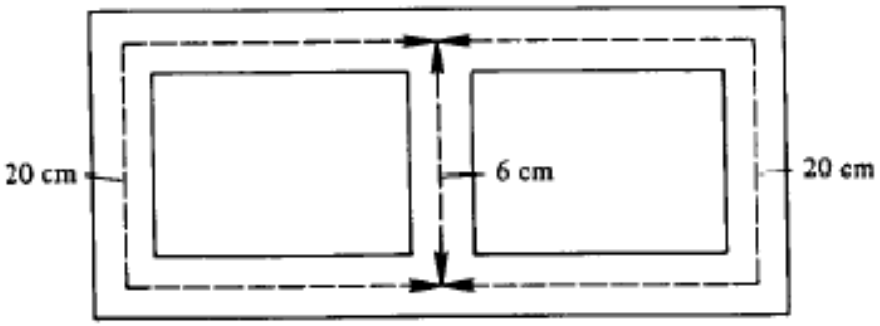
QUESTION

A magnetic core is shown in Figure ·. The mean lengths are as shown and the cross-sectional area is 4 cm^2 everywhere. If $H = 500B$, and a 1000-turn coil carrying 50 mA is placed on the left leg, find

(a) B in each leg.

(b) The inductance of the coil.

(c) Repeat (a) and (b) if a 0.1 mm air gap is cut in the center leg.

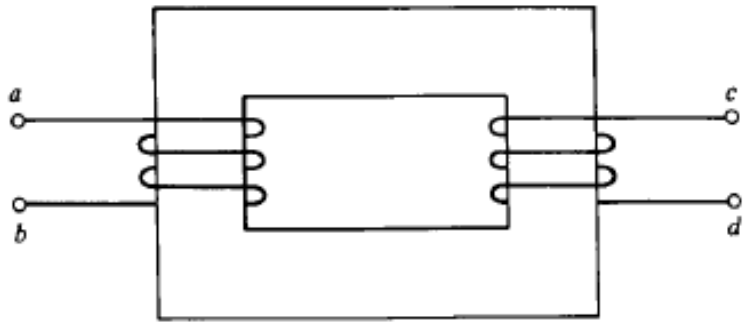


ISTANBUL AYDIN UNIVERSITY

Name, Surname	: KEMAL KÖKSAL
Number	: B1305.020090
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

If a convention is adopted whereby a dot is placed at a terminal of each of the windings where an *entering* current produces a flux that is *adding* to the flux being produced by the other winding, where should the dots be placed for the transformer in Figure ?



ISTANBUL AYDIN UNIVERSITY

Name, Surname	: KORAY YILDIZ
Number	: B1205.020018
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

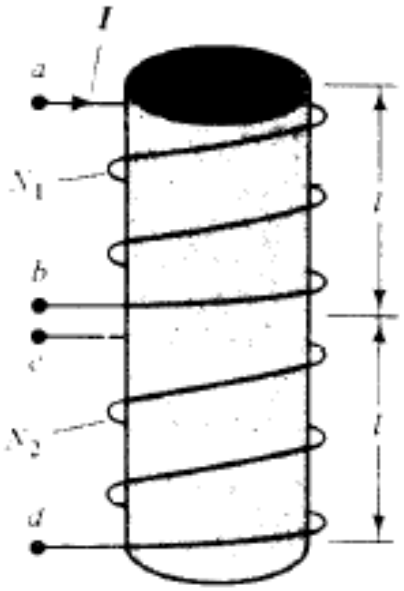
A transmission line is often fabricated as stripline. Assume that it consists of a thin strip of width 2 cm and spaced 0.25 cm from a large ground plane with a solid dielectric ($\varepsilon_R = 4$) between the two. Ignoring fringing of the field find the capacitance per unit length.

ISTANBUL AYDIN UNIVERSITY

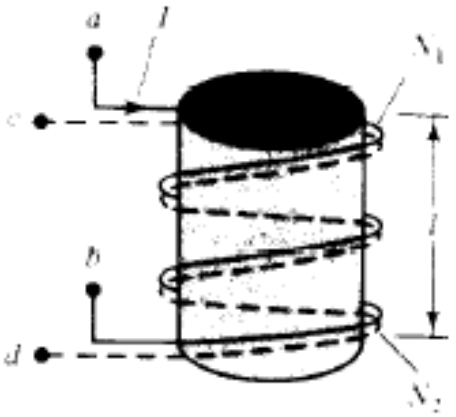
Name, Surname	: METE NUYAN
Number	: B1205.020030
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	:□ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A solenoid has N_1 turns, length l, and area s. A second solenoid has N_2 turns, length l, and area s. The physical arrangement is shown in Figure (a). Assume that a current I enters terminal a. If terminals b and c are connected, make reasonable approximations and find L for (a) an iron core, $\mu \gg \mu_0$; (b) an air core, $\mu = \mu_0$; (c) repeat (a) if terminals b and d are connected instead of b and c; (d) repeat (b) for terminals b and d connected; (e) repeat for the arrangement shown in Figure (b).



(a)



(b)

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Name, Surname	: MEVLÜT EKİCİ
Number	: B1005.020006
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A cylindrical washer has inner and outer radii a and b, respectively. Its conductivity is σ and its thickness is t. Find the resistance between:

(a) Inner and outer radii.

(b) The flat sides.

(c) The sides of a very thin radial cut all the way through the material.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: MURAT FURUNCU
Number	: B1305.020061
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A parallel-plate capacitor is charged to V_0 volts and the battery is disconnected. The solid dielectric is then removed. What is the new potential difference between the plates.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: ONUR KÖKTAŞ
Number	: B1305.020062
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

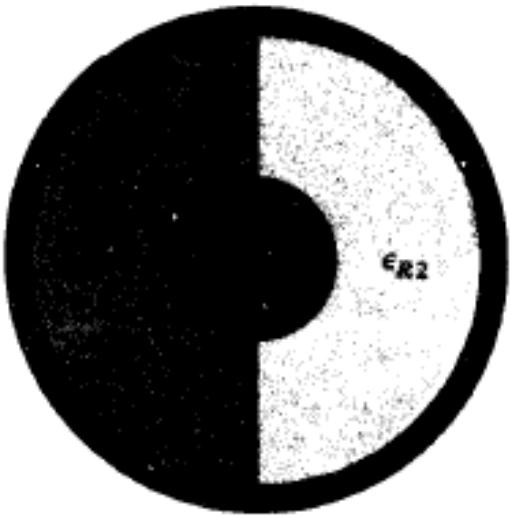
A parallel-plate capacitor has plates of area 10^{-2} m^2 spaced by 10^{-2} m. The relative permittivity varies as $\epsilon_R(z) = 1 + (z/d)^2$ when the lower plate is located at $z = 0$ and the upper plate is located at $z = d$. Find the capacitance.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: ORKUN ÇEKEN
Number	: B1205.020019
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

Find the capacitance per unit length of the two-dielectric coaxial capacitor shown in Figure .



ISTANBUL AYDIN UNIVERSITY

Name, Surname	: ÖMER FARUK ATAYETER
Number	: B1405.020100
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

What is the resistance per 100 m for a circular conductor that is steel for $0 \leq \rho \leq 10^{-2}$ and aluminum for $10^{-2} \leq \rho \leq 2 \times 10^{-2}$? Assume uniform current densities. Use $\sigma = 0.2 \times 10^{7}$ for steel. What is the "effective" conductivity of this conductor?

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: ÖMER YUSUF AKYÜZ
Number	: B1205.020016
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

It is possible to construct an electric circuit with a pencil and a piece of paper. Assuming that graphite has a conductivity of 7×10^4 ℧/m, how "thick" would a 1-kΩ resistor be if it is 2 cm long and 1 mm wide?

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: SAMİ ONUR YAVUZ
Number	: B1205.020105
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

Certain junction diodes, called *varactor diodes*, behave as voltage dependent capacitors:

$$C = K(V_b + V + \Delta V)^{-1/2} = C_0[1 + \Delta V/(V_b + V)]^{-1/2},$$

where V_b is the unbiased barrier voltage, V is the external bias voltage, ΔV is the incremental bias voltage, and C_0 is the capacitance when $\Delta V = 0$. This diode is to be used to produce *frequency modulation*. If $V_b + V = 4$, what frequency deviation is produced for 1-mV modulating source (ΔV) when the carrier frequency is 100 MHz?

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: SAMİ ONUR YAVUZ
Number	: B1205.020105
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

Find the mutual inductance between an infinite filamentary wire on the z axis and a filamentary triangular loop with corners at $(0.5,0,0)$, $(1,0,0.5)$, and $(1,0,-0.5)$.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: SIDDIK BOZBEK
Number	: B1205.020014
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A filamentary current loop described by $\mathbf{m} = \mathbf{a}_z$ is centered at (0,0,0.5) and an identical loop is centered at $(0,0,-0.5)$. Using reasonable approximations, find the mutual inductance if $\mu = \mu_0$ and the loop area is 0.05 m^2.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: TAYFUN SURHA
Number	: B1305.020064
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

A uniform current density $\mathbf{J} = -J_0\mathbf{a}_z$ exists in a conducting slab: $-\infty < x < \infty$, $-t/2 < y < t/2$, $-\infty < z < \infty$.

(a) Show that

$$\frac{d^2A_z}{dy^2} = \mu J_0, \quad -t/2 < y < t/2.$$

(b) Show that $\mathbf{H} = J_0 y\,\mathbf{a}_x$, $-t/2 < y < t/2$, if $H_x(0) = 0$.

ISTANBUL AYDIN UNIVERSITY

Name, Surname	: TUNA MUTLU
Number	: B1205.020011
Course Code	: EEE321
Course Name	: Electromagnetic Fields And Waves
Exam	: □ Quiz ⊗ Assignment □ Final
Date	:08.12.2015

QUESTION

An electron in the uniform field $\mathbf{B} = \mathbf{a}_z B_0$ experiences a force $\mathbf{F} = -e\mathbf{u} \times \mathbf{B} = m\boldsymbol{a}$. Express this relation in cylindrical coordinates, equate the ρ components and the ϕ components, and obtain a pair of coupled equations. Let $\rho = \rho_0$ (constant) to reduce the equations, and show that $\omega_c = eB_0/m$ (the *cyclotron frequency*) is the angular velocity of an electron in a circular orbit with radius $\rho_0 = u_\phi/\omega_c$.