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EE214000 Electromagnetics, Fall 2020

Your name: _____ ID: _____ Nov. 15nd, 2020

EE214000 Electromagnetics, Fall, 2020
Quiz #10-1, Open books, notes 30 points), due 11 pm, Wednesday, Nov. 18th, 2020
(請交至 iLMS 作業區)

Late submission won't be accepted!

1. The possible solutions for a 1-D Laplace equation include: $\sin kx, \cos kx, \sinh kx, \cosh kx, e^{kx}, e^{-kx}$, where k is a positive real number.

(a) Which solution(s) would you choose for a boundary condition $V(x=0)=0$? Explain your choice. (2 points)

(b) Which solution(s) would you choose for a boundary condition $V(x=\infty)=0$? (2 points)

(c) Which solution(s) would you choose for a boundary condition $V(x_0)=V(x_0+ma)$, where m = 1, 2, 3, …is an integer? Calculate k for this case. (4 points)

2. A two dimensional potential problem in the x-y plane satisfies Laplace's equation

$$\frac{\partial^2 V}{\partial x^2}+\frac{\partial^2 V}{\partial y^2}=0$$

(a) If the dependence of V in the x direction is $\sin kx$, where k is a nonzero real number, and $V(x, y=0) = 0$, what is(are) the possible solution(s) of $V(x, y)$? (2 points)

(b) If the dependence of V in the x direction is $\sin kx$, where k is a nonzero real positive number, and $V(x, y=\infty) = 0$, what is(are) the possible solution(s) of $V(x, y)$? (2 points)

(c) If the dependence of V in the x direction is e^{kx}, where k is a nonzero real number and $V(x, y=0) = 0$, what is(are) the possible solution(s) of $V(x, y)$? (2 points)

3. Calculate the value of $\int_0^{\pi} \sin(mx)\sin(nx)dx$ for $m \neq n$ with m, n nonzero integers? (3 points)

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4. What is the value of $\int_0^{2\pi} \cos(mx/2)\cos(nx/2)dx$ for $m = n$ with m, n nonzero integers? (3 points)

5. Refer to the following 2D figure and find (1) the electric potential (6 points), and (2) electric field intensity in the boxed region. (4 points)