# 大同大學八十九學年度研究所招生入學考試試題

考試科目:電磁學　　所別:**通訊工程研究所**　　

註:本次考試不可以參考自己的書籍及筆記；　不可以使用字典；　可以使用計算器。

1.(a)For a scalar function f(x,y,z)=$12x^2 + yz^2$, the magnitude of the maximum rate of change of f at point P(-1,0,1) is [(1-1)], and the magnitude of the rate of change of f along the line directed from P to (1,1,1), evaluated at (-1,0,1) is [(1-2)].

(b)Two point charges in a medium with $\varepsilon_r = 4, and \mu_r = 1$, one is 7C located at point (1,4,1) and the other is –4C at (1,2,3). Now consider a fictitious sphere with radius of 10, centered at (1, 3,2), find $\int(\vec{D})\bullet(\vec{n})ds$ [(1-3)] over the surface of this sphere, where $\vec{D}$ is the electric flux density generated by these two charges. (all units are in MKS system).

(c)Two infinite sheets of charge lie parallel to each other, separated by a distance d, The upper and lower sheets have surface charge densities $\rho_1$ and $\rho_2$ $c/m^2$, respectively. Find the voltage difference [1-4] from the top to the bottom surface.

(d)A light bulb is placed in a microwave oven. When the oven is turned on, do you think the light bulb will be lighted up? Explain your reason [1-5].

2.A 1.8-GHz wave propagates in a medium characterized with $\varepsilon_r = 25, \mu_r = 1.6$ and $\sigma = 2.5 S/m$. The electric field intensity in the region is given by $\vec{E} = 0.1e^{-\alpha z}\cos(\omega t - \beta z)\vec{a}_x$ V/m. Determine the attenuation constant [2-1],the propagation constant [2-2],the intrinsic impedance [2-3],the phase velocity [2-4],and the skin depth [2-5] of the wave. (please using MKS units in your answer).

3. At point A the instantaneous voltage is $V_A = 100\ \sin\left(\omega t + \frac{\pi}{6}\right) + 5\sin\left(\omega t - \frac{\pi}{6}\right)$.

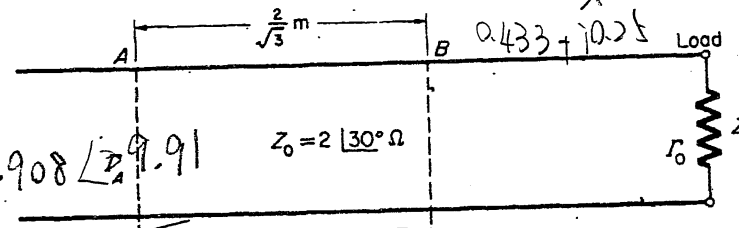
At point B the instantaneous voltage is $V_B = 100\ e^{-1}\sin\left(\omega t + \frac{\pi}{6} - \frac{1}{\sqrt{3}}\right) + B^{-}\sin(\phi_{B^-})$.

(1) Calculate the associated attenuation constant $\alpha$ [3-1] and phase propagation constant $\beta$ [3-2].

(2) What is the voltage reflection coefficient $\Gamma_A$ [3-3]?.

(3) What is R+jX part of characteristic impedance for the line [3-4]?.

(4) If $\Gamma_0 = 0.5\angle 30^\circ$, what is $Z_L$ [3-5]




④ As for the antenna engineering, please give the definitions for the following parameters:

(1) Radiation pattern [4-1].

(2) Directivity [4-2] and Gain [4-3].

(3) Radiation resistance [4-4].

(4) Polarization of antenna [4-5]