國立成功大學

115學年度碩士班招生考試試題

編　號：135

系　所：通訊工程研究所

科　目：電磁場與波

日　期：0203

節　次：第 2 節

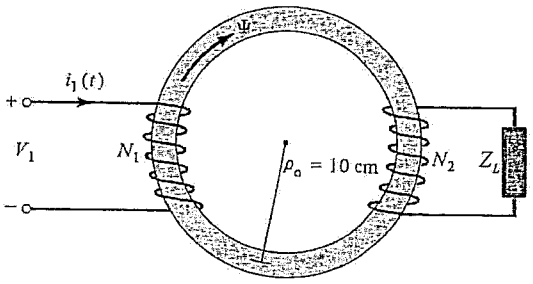
注　意：1.可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

Problem 1 *(20 Points)*

Two conducting plates are located at $x=+0.01\ (m)$ and $x=-0.01\ (m)$. The space between the plates is filled by a material with $\varepsilon=40\times10^{-12}\ (F/m)$, and it provides a space charge density $\rho_v=10^{-5}-0.3x^2\ (C/m^3)$. Find the potential (as a function of x) between the plates if they are both at $5\ (Volts)$?

Problem 2 *(20 Points)*

The transformer shown has a uniform cross section of $10^{-3}\ (m^2)$, an average radius of $0.1\ (m)$, and $\mu=5000\mu_0$. The turn numbers of coils are $N_1=200$ turns and $N_2=100$ turns, respectively. (a) Find the self-inductance L_1, L_2, and the mutual inductance M if there is no magnetic flux leakage.



(b) If the voltage $V_1=\cos(20t)\ (Volts)$ and the load is $Z_L=5\ (Ohms)$, find $i_1(t)$.

Problem 3 *(20 Points)*

Medium 1 is free space and is defined by $r<a$, while medium 2 is a magnetic material with the relative permeability μ_{r2} and defined by $r>a$. The magnetic flux densities in the media are:

$\bar{B}_1=B_{01}\left[(1+0.4a^2/r^2)\cos\theta\hat{a}_r-(1-0.8a^3/r^3)\sin\theta\hat{a}_\theta\right]\ (Weber/m^2)$,

$\bar{B}_2=B_{02}\left(\cos\theta\hat{a}_r-\sin\theta\hat{a}_\theta\right)\ (Weber/m^2)$. There is no current at $r=a$. Find μ_{r2}.

Problem 4 *(20 Points)*

The electric field phasor of a uniform plane wave is given by $\bar{E}(z,t)=\hat{a}_y10e^{j(2\pi ft+0.4\pi z)}\ (V/m)$. If the phase velocity of the wave is $1.5\times10^8\ (m/s)$ and the relative permeability of the medium is $\mu_r=2.4$, find the following: (a) the wavelength, (b) the frequency f of the wave, (c) the relative permittivity of the medium, and (d) the magnetic field $\bar{H}(z,t)$.

Problem 5 *(20 Points)*

A 50-ohm transmission line is terminated in a load with the impedance Z_L. If the voltage reflection coefficient measured at the load location is $\Gamma_L=0.5\angle-60°$ and the wavelength is $\lambda=0.24\ (m)$, find the load impedance Z_L, VSWR on the line, and the locations of the voltage maximum and minimum *nearest* to the load.