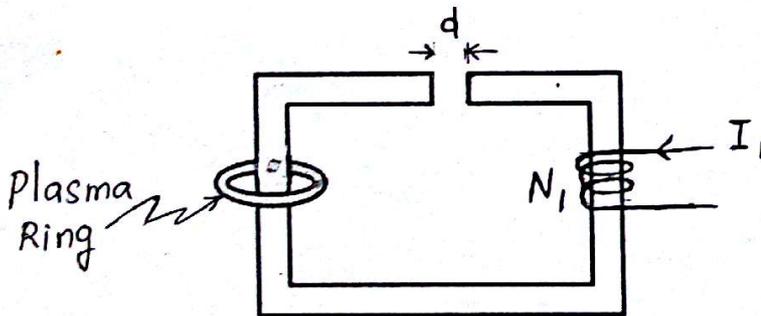


PHL 110 Fields and waves. Minor II exam
09 October 2012, 09.30AM to 10.30AM

Answer all the questions.

Maximum : 20marks

1. An electromagnetic wave propagating in a medium of $\epsilon_r = 9$, has $\vec{E} = A(\hat{x} + \alpha\hat{z})\exp\{-i(\omega t - \omega\frac{x}{c} + \beta z)\}$. Obtain (i) β (ii) α (iii) \vec{B} (iv) \vec{S}_{av} . (5marks)
2. A transformer comprises a frame of cross section s , relative magnetic permeability μ_r and length l but with a small airgap of width d . The primary is a coil with N turns carrying current $I_1 = I_0 \exp(-i\omega t)$ and the secondary is a plasma ring of radius R . Estimate the induced electric field in the plasma. (5marks)



3. An electromagnetic wave of 10^{12} Hz frequency normally incident on a collisionless plasma suffers 100% reflection with phase change of $\frac{\pi}{3}$. What would be the reflectivity and phase change on reflection of EM wave of frequency 2×10^{12} Hz. (5marks)
4. (a) A dipole $m\hat{z}$ is placed at the centre of an imaginary hollow sphere of radius R . Obtain the magnetic flux linked to the upper half hemisphere. (3 marks)
(b) A sphere of radius R with centre at the origin has uniform magnetization $M\hat{z}$. The magnetic field inside the sphere is $\vec{B} = \frac{2}{3}\mu_0\vec{M}$. Obtain \vec{H} inside and just outside the sphere at (R, θ, φ) . (2 marks)