Code No: RR211002 **RR**

II B.Tech I Semester(RR) Supplementary Examinations, May/June 2010

ELECTROMAGNETIC THEORY

(Common to Electronics & Instrumentation Engineering and Electronics & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Distinguish between potential and potential gradient. Explain why in the analysis of electrostatic fields, it is simpler to use electric potential that electric field strength. [10M]
   (b) State and explain conservative property of electric field. [6M]

2. Obtain an expression for the energy stored in a capacitor.
   An air field capacitor consists of two parallel square plates of 50cm side is charged to potential difference of 250V when the plates are 1mm apart. Find the work done in separating the plates from 1 to 3mm. Assume perfect insulation. [16M]

3. (a) Two magnetic materials with relative permeabilities 500 and 300 are separated by aplane boundary . The magnetic field in the first material makes an angle of 30 degree with a normal to the plane boundary. Find the corresponding angle in the second material. [8M]
   (b) A series magnetic circuit consisting 1m length of air , 10 cm length of cast iron ($\mu_r = 200$) and 10 cm length of high permeability material ($\mu_r = 6000$) . All having the cross section area of 10 cm^3. If the circuit has total mmf of 1200 AT. Calculate the stored energy in each part of the magnetic circuit. [8M]

4. (a) A certain material has $\sigma = 0$, $\varepsilon = \varepsilon_0$. If H = 4 sin ($10^6$ t - 0.01z) a_z A/m. Use Maxwell's equations to find the electric field E(z, t) and μ of the material.
   [8M]
   (b) Region 1, z < 0, has $\mu_{r1} = 1.5$, while region 2, $\mu_{r2} = 5$. Near (0, 0, 0), $B_1 = 2.4a_x + 10a_z$ Tesla, $B_2 = 25.75\ a_x$ - 17.7 a_y + $10a_z$ Tesla. If the interface carries a sheet current, what is the current density at the origin? [8M]

5. (a) Obtain the wave equations for sinusoidally varying fields. [8M]
   (b) Derive the wave equation in terms of magnetic field H. [8M]

6. (a) Show that expression for the attenuation of a lossy dielectric medium is $(\sigma/\ 2)\ (\mu/\varepsilon)^{0.5}$. [6M]
   (b) A plane wave of frequency 1 GHz is travelling in a large block of Teflon with $\mu_r = 1$, $\varepsilon_r = 2.1$,σ = 0 mhos/m. Determine α, η, λ and β. [10M]

7. (a) Determine the normal incidence reflection coefficients for seawater at 60 Hz, 1 MHz and 10 GHz. For seawater σ=4, ε_r =80. [8M]
   (b) A perpendicularly polarized wave propagates from region 1 for which σ=0, ε_r=6, μ_r=1, to free space with an angle of incidence of 20 degrees. The incident electric field is 2 micro volts/m. Determine the reflected and transmitted electric fields. [8M]

8. (a) Discuss the significance and applications of Poynting Theorem. [8M]
   (b) Explain the utility of Poynting vector. If the peak poynting vector in free space is $10w/m^2$find the amplitudes of electric and magnetic fields. [8M]

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