Code No: R5411905 **R5**

IV B.Tech I Semester(R05) Supplementary Examinations, May/June 2010
ELECTROMAGNETIC WAVES AND TRANSMISSION LINES
(Electronics & Computer Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive an expression for the electric field intensity due to a finite length line charge along the z-axis at an arbitrary point Q(x, y, z).
   (b) Find the force on a $100\mu C$ charge at (0, 0, 3)m if four like charges of $20\mu C$ are located on x and y axes at ± 4m. [8+8]

2. (a) State Biot- Savart law
   (b) Derive an expression for magnetic field strength, H, due to a finite filamentary conductor carrying a curent I and placed along Z- axis at a point 'P' on y-axis. Hence deduce the magnetic field strength for the length of the conductor extending from - ∞ to + ∞. [4+12]

3. (a) Derive the equation of continuity for time varying fields.
   (b) A Parallel plate capacitor with a plate area of $5cm^2$ and plate separation of 3mm has a voltage 50 Sin 10^3t V applied to its plates. Calculate the displacement current assuming $\in = 2\ \in_0$ [8+8]

4. (a) Obtain the relation between E and H in a uniform plane wave.
   (b) A Uniform plane wave propagating in a medium has $E = 2e^{-\alpha z}sin(10^8t - \beta z)$ay v/m. If the medium is characterized by $\in r = 1, \mu r = 20 and \sigma = 3mho/m.\ find\ \alpha, \beta,\ and\ H$ [8+8]

5. (a) A uniform plane wave is normally incident from air on a perfect conductor. Determine the resulting E and H fields. Sketch their variations.
   (b) An plane EM wave is normally incident on the boundary between two dielectrics. What must be the ratio of the refractive indices of the two media in order that the reflected and transmitted waves may have equal magnitudes of average power. [8+8]

6. (a) Derive the relation $\lambda = \frac{\lambda_c \quad \lambda_g}{\sqrt{\lambda_g^2 \ + \ \lambda_c^2}}$ where λ is free space wave length, λ_g is the wave length measured in the guide, and λ_c is the cut off wave length.
   (b) Explain the impossibility of TEM wave propagation in wave guides. [10+6]

7. (a) Definite following terms and explain their physical significance.
      i. Attenuation function
      ii. Characteristic impedance
      iii. Phase function, and
      iv. Phase velocity as applied to a transmission line.
   (b) At 8 MHz the characteristic impedance of transmission line is (40-j2) Ω and the propagation constant is (0.01+j0.18) per meter. Find the primary constants. [8+8]

8. (a) Explain clearly why the short circuited stub are preferred over to a open circuited stubs?
   (b) Derive the expression for the input impedance of a loss-less line. Hence evaluate $Z_{SC} and Z_{OC}$ and sketch their variation with line length. [6+10]

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