T.E. CET(R)X 4B-M) sem V (R)   18-5-09
3.pm to 6 pm

Con. 2786–09.   (REVISED COURSE)   **VR–5094**

(3 Hours)   [Total Marks : 100]

Engineering Electromagnetics

N.B. : (1) Question No. **1** is **compoulsory**.
(2) Attempt any **four** questions from Q. No. **2** to Q. No. **7**.
(3) Use vector notations for vectors.
(4) **Necessary** assumptions made should be **clearly** stated.

1. (a) Write down Maxwell's equations in phasor form and derive the wave equation for Electric field.   **5**

   (b) Explain the significance of the propagation constant and arrive at expressions for its real and imaginary parts for a uniform plane wave.   **5**

   (c) Derive Ampere's circuital law in point form for circuits that include capacitors.   **10**

2. (a) Derive loundary conditions for field vectors $\bar{E}$, $\bar{D}$, $\bar{B}$ and $\bar{H}$.   **10**

   (b) State Poynting theorem and derive the expression for instantaneous Poynting vector.   **10**

3. (a) Derive expressions for the reflection and transmission coefficients of a perfect dielectric when a plane e.m. wave is incident normally on it.   **10**

   (b) For free space, show that the intrinsic impedance is equal to 377 ohms.   **10**

4. (a) Obtain the transmission line equations for a two wire transmission line. Define characteristic impedance of the transmission line. Derive an expression for its characteristic impedance.   **10**

   (b) A load of impedance $Z_L = 50 - j\,100\,\Omega$ is connected to a lossless transmission line of characteristic impedance $Z_0 = 100\,\Omega$. The line operates at 300 MHz and the speed of propagation on the line is 0.8C. Calculate—   **10**
   (i) the input admittance at a distance of 2.5 m from the load.
   (ii) the input impedance at a distance of 2.5 m from the load.
   Use Smith chart.

5. (a) For an e.m. wave travelling between a pair of parallel perfectly conducting infinite planes, analyse the TE mode.   **10**

   (b) An electromagnetic wave propagates downward from an aircraft and into water at frequency of 10 GHz. Assume water has no loss and a relative permittivity of 81. Neglecting interface effects, Calculate—   **10**
   (i) the wave no. in air
   (ii) the wave no. in water.

6. Show that the power radiated by a dipole is —   **20**

$$P = 80\pi^2\, I^2_{rms} \left(\frac{dl}{\lambda}\right)^2$$

7. Write short notes on :—   **20**
   (a) Displacement Current
   (b) Gauss's Law
   (c) Poisson's equation
   (d) Impedance Matching.