Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B.Tech.

Branch	**:Electronics & CommunicationEngineering**	**Semester**	**: V**
Title of the Course	**:Antenna & Wave Propagation**	**Course Code**	**: ECL 301**
Time: 2 Hours		**Maximum Marks: 25**	

Answer all the questions

1. The magnetic field of a plane wave propagating in free space is given by the following expression:

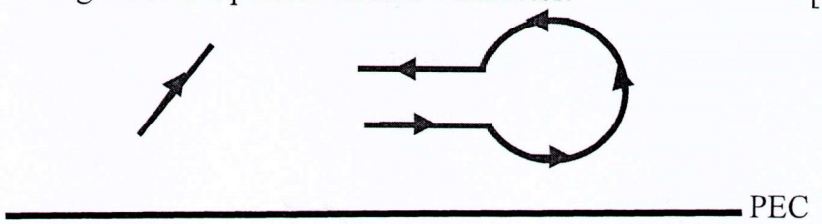
$$\vec{H} = 0.5[\hat{a}_y - j\hat{a}_x]e^{-j6\pi} \text{ A/m}$$

(a) Find the corresponding electric field in phasor form. [2]

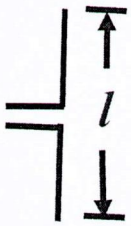
(b) Determine the polarization of the wave, and the sense of polarization. [2]

(c) Compute the time-average power density associated with the wave. [1]

2. Draw the image of the electric current elements shown in the following figure. Assume that the ground is a perfect electric conductor. [1+1 = 2]



3. Draw the current distribution along with the direction of current on a finite length dipole antenna of length l as shown below, if (a) $l = \lambda/2$ (b) $l = \lambda$ (c) $l = 1.25\lambda$ and (d) $l = 1.75\lambda$ [2]



4. A hypothetical isotropic antenna is radiating in free-space. At a distance of 100 m from the antenna, the total electric field measured to be 5 V/m. Find the

(a) Power density (W_{rad}) [1.5]

(b) Power radiated (P_{rad}) [1.5]

5. A small circular parabolic reflector, often referred to as dish, is now being advertised as a TV antenna for direct broadcast. Assuming the diameter of the antenna is 1 meter, the frequency of operation is 3 GHz, and its aperture efficiency is 68%, determined the following:

   (a) Physical area of the reflector [1]

   (b) Maximum effective area of the antenna [1]

   (c) Maximum directivity (in dB) [1]

   (d) Maximum power that can be delivered to the TV if the power density of the wave incident upon the antenna is 10 μwatts/m2. Assume no losses between the incident wave and the receiver (TV). [2]

6. The radiation intensity of an antenna can be approximated by

$$U(\theta,\emptyset) = \begin{cases} cos^4\theta, & 0^0 \le \theta < 90^0 \\ 0, & 90^0 \le \theta \le 180^0 \end{cases} \text{With} 0^0 \le \phi \le 360^0$$

   Determine the maximum effective aperture (in m2) of the antenna if its frequency of operation is $f = 10$ GHz. [4]

7. Two lossless, polarization matched antennas are aligned for maximum radiation between them, and are separated by a distance of 50λ. The antennas are matched to their transmission lines and have directivities of 20 dB. Assuming that the power at the terminals of the transmitting antenna is 10 W, find the power at the terminals of the receiving antenna. [4]