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National Institute of Technology Delhi

Mid Semester Examinations Sept.-Oct. 2019

Roll No:

Name of Specialization – B.Tech (ECE) Year – 3rd Semester -1st

Course Name- Antennas &Propgation **Maximum Marks – 25**

Course Code: ECL-301 **Total Time: 2:00 Hours**

Instructions: All questions are compulsory.
Symbols used in the questions are having their usual meaning.
Assume if any data is missing.

Q-1: What do you understand by retarded scalar and vector potentials for the time varying fields? Derive the wave equations in terms of these potentials. **(5)**

Q-2: What is physical significance of Poynting vector associated with electromagnetic waves? In a nonmagnetic medium $\boldsymbol{E} = 4\sin(2\pi \times 10^7 t - 0.8x)\boldsymbol{a_z}$ V/m. Find (a)- ϵ_r *and* η (b)- the time average power carried by wave, and (c)- the total power crossing 100 cm^2 of plane $2x + y = 5$. **(5)**

Q-3: Define the directive gain and power gain of an Antenna. The radiation intensity of a certain antenna is $U(\theta, \varphi) = \begin{cases} 2\sin\theta \sin^3\varphi, & 0 \le \theta \le \pi, 0 \le \varphi \le \pi \\ 0, & elsewhere \end{cases}$

Determine the directivity of the antenna. **(5)**

Q-4: What do you understand by radiation resistance of an antenna? A thin linear dipole of length $\boldsymbol{l}$ is placed symmetrically about z-axis. Find the far-zone spherical electric and magnetic components radiated by the dipole whose current distribution can be approximated by $I_z(z') = I_0 \cos(\frac{\pi}{l} z')$, $-l/2 \le z' \le l/2$. **(5)**

Q-5: A circular loop, of loop radius $\lambda/30$ and wire radius $\lambda/1000$, is used as a transmitting/receiving antenna in a back-pack radio communication system at 10 MHz. The wire of the loop is made of copper with a conductivity of $5.7 \times 10^7\ S/m$. Assuming the antenna is radiating in free space, determine the (a)- radiation resistance of the loop; (b)- loss resistance of the loop (assume that its value is the same as if the wire were straight); (c)- input impedance and (d)-radiation efficiency. **(5)**

**********End of paper********** *****