National Institute of Technology Delhi

Mid Semester Examinations Oct. 2022

Roll No:

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

Course Name- Antenna & Wave Propgation | **Maximum Marks – 25**

Course Code: ECL-301 | **Total Time: 1:30 Hours**

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

Q-1: Explain why accelerated charge leads to radiation? Derive the wave equations in terms of these potentials. **(5)**

Q-2: 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 Power density and Radiation intensity of the EM signal. 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 $I_z(z') = I_0 \cos\left(\frac{\pi}{l} z'\right)$, $-l/2 \le z' \le l/2$. **(5)**

Q-5: An S-band radar transmitting at 3 GHz radiates 200 kW. Determine the signal power density at ranges 100 and 400 nautical miles if the effective area of the radar antenna is 9 m^2. With a 20 m^2 target at 300 nautical miles, calculate the power of the reflected signal at the radar. **(5)**

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