ÇANKAYA UNIVERSITY

PHYS 132 – PHYSICS II

CHAPTER 33

ELECTROMAGNETIC WAVES

PROBLEM SET

1) *** If the magnetic field in a traveling EM wave has a peak magnitude of 12.5 nT, what is the peak magnitude of the electric field? **[Answer: 3.75 V/m]**

2) In an EM wave traveling west, the B field oscillates vertically and has a frequency of 80.0 kHz and an rms strength of $7.75 \times 10^{-9}\ T$. Determine the frequency and rms strength of the electric field. What is its direction?
   [Answer: 80.0 kHz, 2.33 V/m, horizontal nourth-sourth line]

3) *** The electric field of a plane EM wave is given by $E_x = E_0 \cos(kz + \omega t]$, $E_y = E_z = 0$. Determine (*a*) the direction of propagation and (*b*) the magnitude and direction of $\vec{\mathbf{B}}$.
   [Answer: a) $-\hat{\mathbf{k}}$, b) E_0/c , $-\hat{\mathbf{j}}$]

4) Estimate the average power output of the Sun, given that about 1350 W/m² reaches the upper atmosphere of the Earth. **[Answer: 3.80×10^{26} W]**

5) *** A high-energy pulsed laser emits a 1.0-ns-long pulse of average power $1.8 \times 10^{11}\ W$ .The beam is 2.2×10^{-3} m in radius. Determine (*a*) the energy delivered in each pulse, and (*b*) the rms value of the electric field.
   [Answer: a) 180 J, b) 2.1×10^9 V/m]