EE351 / Fall 2004	Home work # 2	Due: Wednesday 9/08/04

I. Text Book:: 10.26 , 10.29, 10.31, 10.32

II:

(1) Auniform plane wave emitted by a communication repeater is propagating in lossless dielectric medium along the positive z direction. The phasor form of the electric field (in V/m) is given by:

$$E(z,t) = \hat{a}_x\, 377\ \cos(\ \omega t - \frac{4\pi}{3} z + \frac{\pi}{6})$$

The time-average power density of the emitted wave is 377 W/m^2. Determine the following:

(a) properties of the propagation medium assuming $\mu=\mu_0$ (i.e. η , ε).
(b) frequency of the wave
(c) expression for the time domain form of the magnetic field .

(2) Auniform plane wave is propagating in lossless dielectric medium along the positive z direction. The time domain form of the electric field (in V/m) is given by:

$$\bar{E}_s(z) = \hat{a}_x (40\pi e^{j\frac{4\pi}{6}}) e^{-j\frac{4\pi}{3}z}$$

The time-average power density for this wave is 377 W/m^2. Determine the following:

(d) if $\mu=\mu_0$, determine the relative dielectric constant of the medium ε_r.
(e) frequency of the wave
(f) expression for the time domain form of the magnetic field **H**(z,t) .

(3) A plane wave is incident normal to the surface of sea water ($\mu_r = 1$, $\varepsilon_r = 79$, $\sigma = 3$ S/m). The electric field is parallel to the surface and its magnitude is 10V/m just inside the surface of water(at air-water interface). At the following frequencies: (i) 20 kHz, (ii) 20 GHz, calculate the depth at which a submarine will be able to receive a signal if the receivers on board the subamarine require a minimum field intensity of 10 μV/m.