# Quiz 2

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E&M II
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Name:

Prob. 1(4)

A plane wave is propagating in a medium having $\varepsilon=2\varepsilon_0$ and $\mu=\mu_0$ and its H-field is characterized as $\overline{H} = \bar{y}H_0 \exp(jx - jz)\exp(\omega t)$, where $H_0$ is a real constant. x, z are in meter and $\omega$ is in radian/sec.

(a)(1) In what direction in the x-z plane does this wave propagate? Draw an arrow in the x-z plane indicating the propagation direction and express the angle the arrow makes with the x-axis.

(b)(1) What is the numerical value for $\omega$?

(c)(2) What is the E-field of this wave? Give your answer in terms of parameters given in this problem.

## Prob. 2 (2)

Consider an electromagnetic wave having $\overline{H} = \bar{x}\exp(-jz)\exp(j\omega t).$

**(a)(1)** What is the polarization of this EM wave?

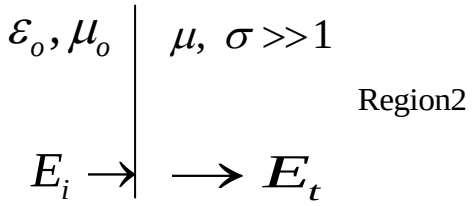
**(b)(1)** Show that this wave can be expressed by a sum of two circular polarized wave.

## Prob. 3 (2)

A plane wave having with frequency $\omega$ is normally incident from vacuum into a highly conductive material as shown below.

**(a)(1)** What is the penetration depth for the wave in region 2? Give your answer in terms of $\omega, \mu$ and $\sigma$.

**(b)(1)** What is the phase difference between E-field and H-field ($(\angle\overline{E} - \angle\overline{H})$? Give your answer in degree with the correct sign.



## Prob. 4 (2)

A plasma has the plasma frequency of $\omega_P$.

**(a)(1)** Plot the dependence of $\beta$ (propagation constant) on $\omega$ (angular frequency) for the EM wave propagating in the plasma when $\omega > \omega_P$.

**(b)(1)** How does the group velocity of the EM wave change as $\omega$ increases?