Prof. Yen-Chieh Huang
Dept of Electrical Engineering
National Tsing-Hua University
office: HOPE 301
ext: 62340
email:ychuang@ee.nthu.edu.tw

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EE214000 Electromagnetics, Fall
Quiz #1, Open books, notes (20 points)

1. Write down the symbols and units of (1) electric field intensity, (2) electric flux density, (3) magnetic field intensity, (4) magnetic flux density. (8 points)

Ans: (1) E (V/m), (2) D (C/m^2), (3) H (A/m), (4) B (Tesla)

2. What are the MKSA units of the volume current density and surface current density? (2 points)

Ans: Volume current density A/m^2, line current density A/m

3. What is a wavefront? (2 points)

Ans: A wavefront is a constant phase plane of a wave.

4. The amplitude of a sinusoidal wave function is written as $\Psi(t,z) = \Psi_0 \cos[\omega(t - z/u) + \phi_0]$, where t is the time variable, z is distance, and ϕ_0 is an arbitrary phase. (1) "Derive" the frequency of this wave. (2) "Derive" the wavelength of this wave. (3) "Derive" the phase velocity of this wave. (4) What is the amplitude of the wave at t =0, z = 0. (8 points) *no credit point will be given without a "derivation".

Ans:

(1) $\omega(t+T)=\omega t+2\pi \Rightarrow T=\frac{2\pi}{\omega}=\frac{1}{f} \Rightarrow f=\frac{\omega}{2\pi}$, where T is the period.

(2) $\frac{\omega\lambda}{u}=2\pi \Rightarrow \lambda=\frac{u2\pi}{\omega}=\frac{u}{f}$

(3) $\omega(t-\frac{z}{u})+\phi_0=\text{constant} \Rightarrow \frac{d}{dt}[\omega(t-\frac{z}{u})+\phi_0]=0 \Rightarrow \omega(1-\frac{dz}{dt}\frac{1}{u})=0 \Rightarrow \frac{dz}{dt}=u$

(4) $\psi_{(t,z)} = \psi_0 \cos\left[\omega\left(t-\frac{z}{u}\right)+\phi_0\right]$

when t = 0 and z = 0, $\psi_{(0,0)} = \psi_0 \cos(\phi_0)$