

淡江大學八十八學年度碩士班招生考試試題

系別：電機工程學系

科目：電磁學

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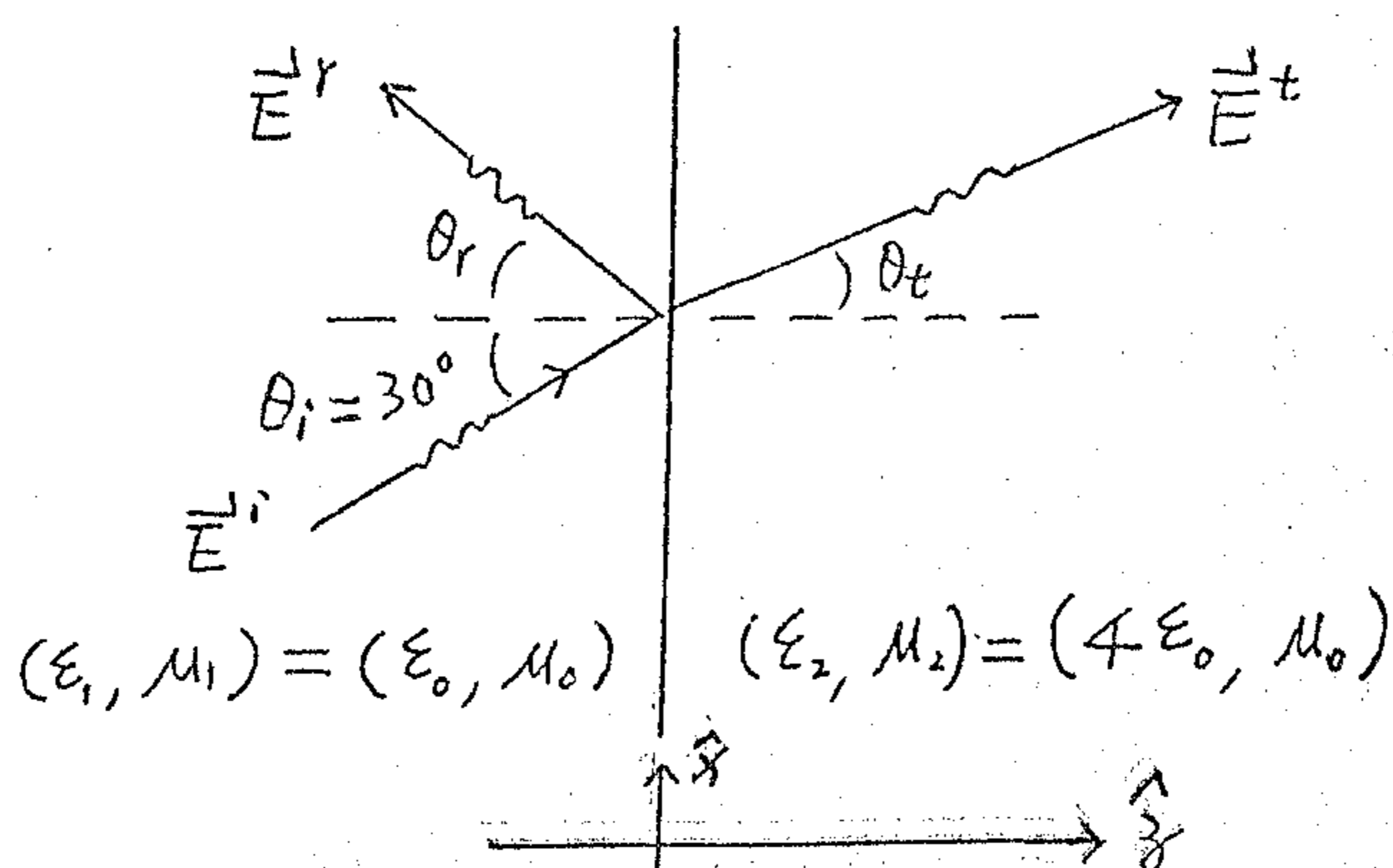
一. For an arbitrary vector field $\vec{A}(\vec{r})$, write down the definition of $\nabla \cdot \vec{A}$ 10% and $\nabla \times \vec{A}$, respectively. Note that the definitions should be coordinate independent. Also explain the geometrical meaning of $\nabla \cdot \vec{A}$ and $\nabla \times \vec{A}$.

二. A linearly polarized plane TEM wave is incident obliquely upon an air-dielectric interface as shown below. Let the incident angle $\theta_i = 30^\circ$. Also assume the electric field amplitude is 1 volt/m, the angular frequency $\omega = 10^9$ rad/sec and the polarization of electric field is in y -direction.

① write down all the field expressions including \vec{E}^i , \vec{H}^i , \vec{E}^r , \vec{H}^r , \vec{E}^t , \vec{H}^t as detailed as possible.

② Determine θ_r , θ_t and the amplitudes of the reflected and transmitted wave.

③ Justify your solution in step ② by arguing that they satisfy Maxwell's equation at "all" space points



◀ 注意背面尚有試題 ▶

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三. The governing equations for the voltage and current on a transmission
15% line are

$$\frac{\partial V}{\partial z} = -L \frac{dI}{dt}$$

$$\frac{\partial I}{\partial z} = -C \frac{dV}{dt}$$

while, the governing equations for an EM field in free space
are

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$\nabla \times \vec{B} = \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t}$$

What are the similarities between these two sets of equations?
What are the physical phenomena these two sets of equations
imply?

四. Under what conditions will an EM wave be generated?
10%

① a resting e^-

② an electron e^- moving with constant velocity in the air.

③ an electron e^- moving with constant accelerating velocity

④ a conducting wire with d.c. current I .

五. Under what conditions would an electrical circuit become a good
15% radiator (antenna).

六. (a) What is the transmission line effect?

15% (b) Under what condition, can't an electrical circuit engineer neglect
the transmission line effect?