

Your name: _____ ID: _____ Nov. 29rd, 2020

EE214000 Electromagnetics, Fall, 2020

Quiz #12-1, Open books, notes (22 points), due 11 pm, Wednesday, Dec. 2nd, 2020
(請交至 iLMS)

Late submission won't be accepted!

1. On Slide 11 of Lec. 12, the condition to have no charge accumulation at two lossy dielectric is

$$\frac{\sigma_1}{\sigma_2} = \frac{\epsilon_1}{\epsilon_2}.$$

Give a **thorough explanation** on the consequence of such a condition. (5 points)

2. Previously, we asserted that there's no electric field in a good conductor. Explain why it takes time for a good conductor to reach the zero-field condition upon some excitation. (3 points) Assume the dielectric constant of silver is equal to the vacuum value. Estimate the time constant, within which the electric in silver is not zero, when an external electric field excite a piece of silver. (3 points)

3. An electromagnetic wave has an oscillating electric field. In most electromagnetics textbooks, you are taught that an electromagnetic wave cannot penetrate a metal, because the electric field in a conductor is zero. Would you be able to explain why a hard x -ray or gamma ray (wavelength ~ 1 Angstrom or frequency $\sim 3 \times 10^{18}$ Hz) can penetrate metal? (5 points)

4. A leaky capacitor consists of two parallel plate electrodes as shown below. The two electrodes are separated by a distance d and biased with a voltage of V_0 , each having an area of S . The material sandwiched between the two electrodes has a permittivity ϵ and conductivity σ . Ignore the fringe field near the electrode edges. (1) What is the capacitance of this capacitor? (2 points) (2) What is the resistance between the two electrodes? (2 points) (3) What is the electric power dissipated in this capacitor? (2 points)