Prof. Yen-Chieh Huang *office: Delta 856*
Dept of Electrical Engineering *ext: 62340*
National Tsing-Hua University *email:ychuang@ee.nthu.edu.tw*
EE214000 Electromagnetics, Fall 2020

Your name: _____ ID: _____ Oct. 12th, 2020

EE214000 Electromagnetics, Fall, 2020
Quiz #6-1, Open books, notes (31 points), due 11 pm, Wednesday, Oct. 14th, 2020
(email solutions to 劉峰麒 alex851225@gmail.com)

Late submission won't be accepted!

1. (review) Use the Gauss law to calculate the electric field at R from a point charge q located at the origin in a spherical coordinate system. (3 points) (2) Given the point charge q at the origin, calculate the work you have to do to move another point charge Q from (R_1, θ_1, ϕ_1) to a distance (R_2, θ_2, ϕ_2). (3 points)

2. Explain why the static electric field in an ideal conductor must be zero. (3 points)

3. Explain why the electric field lines entering a perfect conductor must be along the surface normal of the conductor. (3 points)

4. In Sec. 6.4, we first derived the induced surface charge of the conducting sphere at $R = a$, given by $\rho_s = \hat{a}_{n2} \cdot \vec{D} = -\frac{q}{4\pi a^2}$

Argue from charge conservation that the surface charge at $R = b$ must be $\rho_s = \frac{q}{4\pi b^2}$.

(3 points)

5. What is the physical meaning of the polarization density vector $\vec{P}$? How is it related to the electric field?

6. Compare the electric field intensity at a distance R from a point charge q in vacuum and in a space filled with a dielectric having relative permittivity $\varepsilon_r > 1$.
(3 points)

7. In the example of Sec. 6.2, what are the total polarization charges induced at spherical surfaces of $R = a$ and b. Do the answers agree with or violate the charge conservation? Take the relative permittivity of the dielectric to be ε_r.

8. What are the boundary conditions for the tangential and normal components of E at a dielectric-dielectric interface, where the relative permittivities of the 1st and 2nd dielectrics are ε_{r1} and ε_{r2}, respectively.