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EE214000 Electromagnetics, Fall 2020

Your name: _____ ID: _____ Nov. 23rd, 2020

EE214000 Electromagnetics, Fall, 2020
Quiz #11-1, Open books, notes (22 points), due 11 pm, Wednesday, Nov. 25th, 2020
(請上傳到 iLMS)

Late submission won't be accepted!

1. An electron moves under the force of an electric field. In Newton's mechanics, the electron is accelerated under the electric force. Explain why the Ohmic law, valid for a Ohmic material, gives a linear relationship between I and V. In other words, what is an Ohmic material? (5 points)

2. The I-V relationship in an Ohmic material is I ∝ V; whereas that in a space-charge limited vacuum diode is $I \propto V^{3/2}$. What could be the I-V relationship in a vacuum diode with negligible space charge field? (4 points)

3. An electron is accelerated between two electrode plates of voltage V to gain a kinetic energy of $e \times V$, where e is the electron charge. Therefore, eV is a common energy unit for an electron beam from an accelerator. Suppose, in vacuum, an electron beam of current I = 0.1 Ampere has energy of 1 GeV (values comparable to those in the Taiwan Synchrotron facility). What is the total power carried by this electron beam? (5 points)

4. State the assumption and physical meaning of the equation of continuity. (5 points)

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5. What is Joule's law? Does it apply to both Ohmic and non-Ohmic materials? (3 points)