

**ECE 604 Electromagnetic Field Theory
Fall 2020**

Homework No. 1. Due Date: Sep 3, 2020

Read lecture notes 1, 2, and 3.

1. For Lecture 1:

- (i) Explain why the electric flux going through ΔS_1 and ΔS_2 are the same in Figure 1.8.
- (ii) Find the answer in Example 1.
- (iii) Find the answer in Example 2.
- (iv) Find the answer in Example 3.
- (v) Given an infinitely long cylindrical circular wire carrying a DC current I , find the magnetic field around the wire using symmetry argument, and Ampere's law.

2. For Lecture 2:

- (i) By going through proper flux counting, show that (2.1.9) is valid.
- (ii) By going through the math carefully, show that (2.2.10) is correct.
- (iii) Explain why Stokes' theorem can be generalized to curved surfaces.
- (iv) In Section 3 of Lecture 2, show that for the four Maxwell's equations, equations (2.3.3) and (2.3.4) are derivable from the first two Maxwell's equations.
- (v) Explain why this derivation is not valid for static electromagnetic fields.
- (vi) By converting the current continuity equation into integral form, explain why it is the same a charge conservation.

3. For Lecture 3:

- (i) Show that (3.2.14) and (3.2.15) are solutions to (3.2.12) and (3.2.13), respectively.
- (ii) For static electromagnetics, explain why when a resistive medium exists, the electrostatic system is not decoupled from the magnetostatic system.
- (iii) Explain why (3.3.16) is the solution to (3.3.15).
- (iv) Find the answer to Examples in this lecture.
- (v) Show that your solution to Example 3 is in agreement with the solution of Problem 1.(iii) above.