

# Electromagnetics, Spring 2019

## Homework 6

说明:

全用英文作答;

每道题要对所有小问作答, 要给出全部必要的推导过程, 计算题要算出最终的数值结果, 比如开根号之类的;

所有计算出来的结果如果有单位的物理量, 一定要写明单位;

每题的分数在括号中给出;

可以互相讨论, 也可以上网查, 但是不能抄袭, 也不能找别人代做;

所有的解答必须全部是手写的原件, 不接受扫描件与照片;

有问题就给我发邮件;

4 月 18 日星期四上课之前交, 如到时未完成, 可以 4 月 20 日星期六中午之前交给助教, 但是分数会减去 20%。

第一部分 In textbook book *Fundamentals of Applied Electromagnetics*, 7<sup>th</sup> edition

7.18 (20 points)

7.22 (10 points)

7.24 (20 points)

7.27 (20 points)

8.4 (50 points)

8.9 (30 points)

8.16 (20 points)

第二部分 Homemade

1. (50 points) If a material has conductivity of 0.4 S/m at 5 GHz and wavelength in it is 2 cm, express its permittivity in a complex number and determine its loss tangent. Assuming the material is non-magnetic ( $\mu = \mu_0$ ), calculate the phase velocity and wave impedance. How big is the phase difference between the electric field and magnetic field of a plane wave propagating in this material? Is this material a good conductor at 5 GHz? Calculate its complex propagation constant. How many percentage of the electric field intensity is lost after a plane wave propagates 5 cm in this material?

2. (20 points) Calculate the Poynting vector of a left-hand circular polarized plane wave in air using time-domain expressions. Assume the electric field intensity magnitude is  $a$ .