试卷

1. 全电流包括_____、_____、_____

2. 真空中点电荷 Q 位于 (0, 0, 1)，点电荷 $-Q$ 位于 (1, 0, 0)，则坐标原点 (0, 0, 0) 处的电场强度为_____，该点处的电位为_____。

3. 国际单位制中，电场强度的单位是_____，磁场强度的单位是_____。

4. 下列平面电磁波的极化形式分别为：

$\vec{E} = \vec{a}_x \sin(\omega t + kz) + \vec{a}_y \cos(\omega t + kz)$ _____

$\dot{\vec{E}} = \vec{a}_x \dot{E}_0 e^{-jkz} + \vec{a}_y j2\dot{E}_0 e^{-jkz}$ _____

$\vec{E} = \vec{a}_x 2\sin(\omega t - ky) - \vec{a}_z 2\sin(\omega t - ky)$ _____

5. 写出 Maxwell 方程的微分形式及其各自对应的物理定律：

_____ _____

_____ _____

_____ _____

_____ _____

6. 时变电磁场中，电场强度、磁感应强度与标量电位、矢量磁位之间的关系为_____、_____，洛仑兹规范为_____。

7. 理想介质的波阻抗为 Z，在其中传播的正弦平面电磁波的电场强度为 $\dot{\vec{E}} = \vec{a}_y E e^{-jkz}$，其磁场强度为_____，其坡印亭

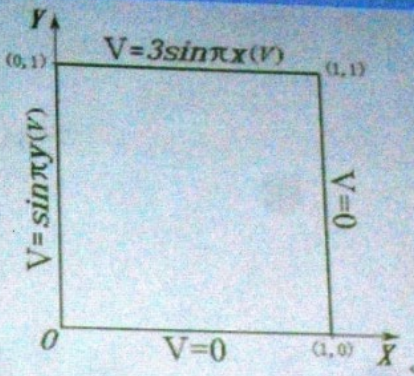
大量为_____。

8. 平板电容器两极间距离变大则电容变_____，两极间介质的介电常数_____则电容越小。

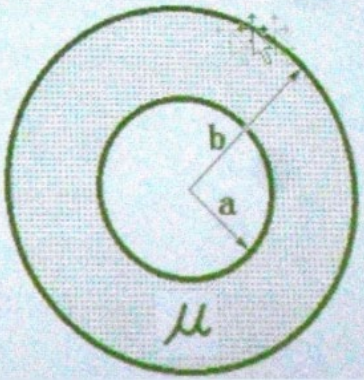
二. 简述题（任选 4 题，不得多选；每题 5 分，共 20 分）

1. 无限大自由空间中有两个分别带+Q、$-Q$ 的导体。当两导体之间的距离变大，电场能量如何变化？为什么？
2. 为什么说“电磁能量是通过导线周围的空间由电源向负载传播的”？
3. 什么是透入深度？它有什么工程意义？可举例说明。
4. 复数坡印亭矢量的定义是什么？它与坡印亭矢量的关系如何？
5. 静电场边值问题解的唯一性定理的内容是什么？为什么说它是镜像法的基础？
6. 通过本课程的学习，你认为“场”和“路”的分析方法有何异同？可举例说明。

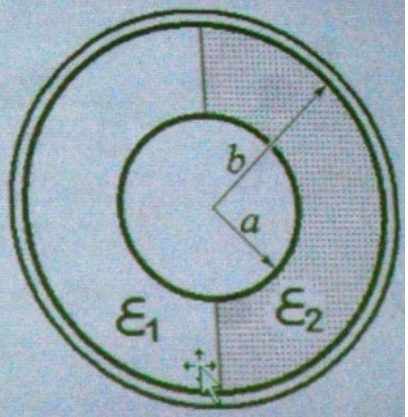
1. The electric potential mapping on the walls of a long, straight vessel with square cross section is shown in the figure. Find the electric potential at (0.5, 0.5).（本题 6 分）



2. A long straight hollow cylindrical conductor with inner radius a and outer radius b, as shown in the figure. Determine its inner inductance per length.（本题 10 分）



3. A spherical capacitor, with inner conductor of radius a and outer conductor of inner radius b, is filled with two different dielectrics of permittivity ε_1 and ε_2, respectively, in a half of the in-between space and another, as shown in the figure. Determine the capacitance.（本题 10 分）



4. A point charge of 10^{-9}C is at a distance $60cm$ from the center of a grounded spherical conducting shell of inner radius $1m$. Determine the electric potential V at center of the shell.（本题 10 分）

5. The seawater (μ_r=1, ε_r=81, σ=4 S/m) is in z > 0 area and the air is in z < 0 area, with their inter-surface at z=0. A time harmonic plane wave of electric field $\vec{E} = \vec{a}_x 1\cos(2\pi \times 10^8 t)$ at z=0 impinges normally from air to seawater. Find:

(a) Electric and magnetic field at z = -1m;

(b) Magnetic field at z = +0.2m;

(c) Average electromagnetic Power density at z = 0m in seawater.

（本题 14 分）

习题

8-1 A uniform time-harmonic plane wave of frequency f=1GHz is traveling in pure water (μ_r=81, ε_r=1), in (+x)-direction. Assume the electric field intensity is in (+y)-direction with amplitude of 1V/m. Find (a) time and complex expressions of the wave, (b) average power density.

8-2 Determine polarization form of the following plane waves:

1. $\vec{E}(t)=\vec{a}_y 0.3\cos(\omega t-kx)+\vec{a}_z 3\sin(\omega t-kx)$
2. $\vec{E}(t)=\vec{a}_x 5\cos(\omega t+kz)-\vec{a}_y 0.3\cos(\omega t+kz)$
3. $\dot{\vec{E}}=\vec{a}_x 0.1e^{-jky}-\vec{a}_z j0.1e^{-jky}$

8-3 The seawater(μ_r=1, ε_r=81, σ=4 S/m) is in z > 0 area with its surface is at z = 0. A uniform time-harmonic plane wave of frequency f =100MHz impinges normally from air to sea water. Assume the electric field intensity of incident wave is +x-polarized with amplitude of 1V/m. Find (a) the distance at which the amplitude of ***E*** is 10% of its value at z=0 in seawater. (b) electric and magnetic field at z = +0.5m; (c) electric and magnetic field at z = -0.5m.