

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Vector analysis plays an important role in electromagnetics. Describe the *divergence theorem*, *Stoke's theorem*, and *Helmholtz's theorem* in detail. (25%)

2. Suppose that the polarization vector in a dielectric sphere of radius r_0 is $\mathbf{P} = \mathbf{a}_y P_0$. (25%)

(a) What are the *equivalent polarization surface and volume charge densities*? (15%)

(b) What is the *total equivalent charge* on the surface and inside of the sphere? (10%)

3. Given a conducting material of uniform thickness d and conductivity σ that has the shape of a quarter of a flat circular washer, with inner radius r_i and outer radius r_o . Find the *resistance* between the end faces. (25%)

4. Suppose a very large slab of material with thickness h lies perpendicular to a uniform magnetic field of intensity $\mathbf{H}_0 = \mathbf{a}_x H_0$. Find the magnetic field intensity in the slab (25%)

(a) if the slab has a permeability μ , (10%)

(b) if the slab is a permanent magnet with a magnetization vector $\mathbf{M} = \mathbf{a}_x M$. (15%)