系所組別：生物醫學工程學系乙組

考試科目：電磁學

※ 考生請注意：本試題不可使用計算機

1. State the Gauss's theorem and Stokes's theorem both in equations and words. (20%)

2. Given a potential function $V(x, y, z) = (\sin(\pi x/4))(\sin(\pi y/2))\exp(-2z)$, find (a) the magnitude and the direction of the electric field at the point $P(1, 1, 1)$, and (b) the magnitude of the electric field at P in the direction of origin. (20%)

3. Consider two spherical conductors with radii a and b that are connected by a conducting wire. The distance of separation between the conductors is assumed to be very large in comparison to the radius of conductors. A total charge Q is deposited on the spheres. Find (a) the charges on these two spheres respectively, and (b) the electric field intensities at the sphere surfaces. (20%)

4. A current I flows in the inner conductor of an infinitely long coaxial line and returns via the outer conductor. The radius of the inner conductor is $r1$, and the inner and outer radii of the outer conductor are $r2$ and $r3$, respectively. Find the magnetic flus density $\boldsymbol{B}$ for all regions and plot the magnitude of $\boldsymbol{B}$ versus r. (20%)

5. Consider the plane waves in a lossy, conducting medium with the given parameters ω, σ, μ, and ε. Derive the general expressions of the attenuation (α) and phase constants (β) basing on the homogeneous vector Helmholtz's equation. (20%)