

每大題 10 分，共 10 題，合計 100 分

1. A vector field $\vec{D} = \vec{e}_r (\cos^2 \phi / r^3)$ exists in the region between two spherical shells defined by $r = 2$ and $r = 3$. Evaluate $\oint_S \vec{D} \cdot d\vec{a}$.
2. A spherical distribution of charge $\rho = \rho_0 [1 - (r^2/b^2)]$ exists in the region $1 \leq r \leq b$. This charge distribution is concentrically surrounded by a conducting shell with inner radius R_i ($>b$) and outer radius R_o . Determine \vec{E} everywhere.
3. An air coaxial transmission line has a solid inner conductor of radius a and a very thin outer conductor of inner radius b . Determine the inductance per unit length of the line.
4. A right-hand circularly polarized plane wave represented by the phasor $\vec{E}(z) = E_0(e_x - je_y)e^{-j\beta z}$ impinges normally on a perfectly conducting wall at $z = 0$.
 - (a) Determine the polarization of the reflected wave.
 - (b) Obtain the instantaneous expression of the total electric intensity based on a cosine time reference.
5. A sinusoidal voltage generator $V_g = 100\sin(\omega t)$ (V) and internal impedance $Z_g = 50 \Omega$ is connected to a quarter-wave lossless line having a characteristic impedance $R_0 = 50 \Omega$ that is terminated in a purely reactive load $Z_L = j 50 \Omega$. Please obtain the instantaneous power and the average power delivered to the load.

6. A spherical capacitor consists of an inner conducting sphere of radius a and an outer conductor with a spherical inner wall of radius b . The space in between is filled with a dielectric of permittivity ϵ . Determine the capacitance.
7. (a) When does Brewster angle exist at an interface of two nonmagnetic media?
 (b) Why is a Brewster angle also called a polarizing angle?
8. (a) Write the instantaneous field expressions for the TE_{10} mode in a perfectly conducting rectangular waveguide having sides a and b .
 (b) Find the cutoff frequency for the TE_{10} mode.
9. A spherical region carries a uniform charge per unit volume ρ . Let \mathbf{r} be the vector from the center of the sphere to a general point P within the sphere. Please find the electric field at P .
10. A conducting sliding bar oscillates over two parallel conducting rails in a sinusoidally varying magnetic field $\mathbf{B} = \mathbf{a}_z 5\cos(\omega t)$ (mT), as shown in Fig. 1. The position of the sliding bar is given by $x = 0.4[1 - \cos(\omega t)]$ (m), and the rails are terminated in a resistance $R = 0.2$ (Ω). Find i .

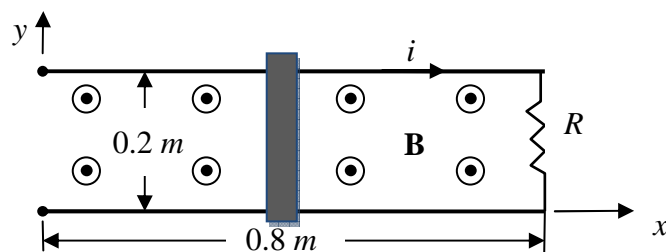


Fig. 1