

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

1. Charge is distributed with density $\rho = \rho_0 (r/a)^2$, where ρ_0 is a constant, in the spherical region $r < a$. Find electric field \mathbf{E} everywhere and plot E_r versus r . (10 分)
2. A voltage source connected to a parallel-plate capacitor by means of wires sets up a uniform electric field of $E = 180 \sin 2\pi \times 10^6 t \sin 4\pi \times 10^6 t$ V/m between the plates of the capacitor and normal to the plates. Assume that no field exits outside the region between the plates. If the area of each plate is 0.1 m^2 and the medium between the plates is free space, find the root-mean-square value of the current draw from the voltage source. (15 分)
3. Current flows with density $\mathbf{J} = J_0 (r/a) \mathbf{a}_z$ A/m² along an infinitely long solid cylindrical wire of radius a having the z -axis as its axis. Find \mathbf{H} everywhere and plot H_ϕ versus r . (10 分)
4. Write the expressions for the electric- and magnetic-field intensities of a sinusoidally time-varying uniform plane wave propagating in free space and having the following characteristics: (a) $f = 1 \text{ GHz}$ (b) direction of propagation is the $+x$ -direction; and (c) polarization is right circular with the electric field in the $x = 0$ plane at $t = 0$ having a y -component equal to E_0 and a z -component equal to $0.5 E_0$. (15 分)

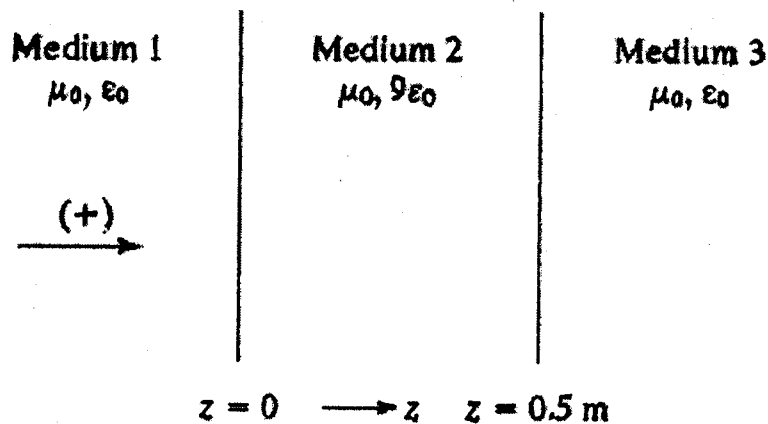
(背面仍有題目,請繼續作答)

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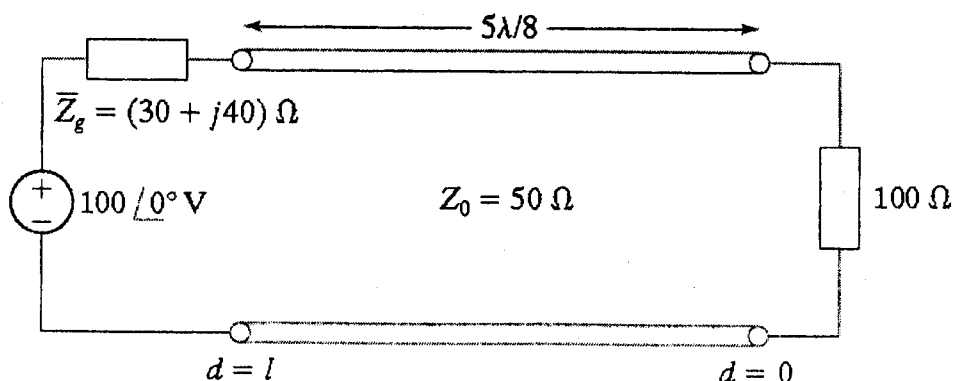
5. In the following figure, medium 3 extends to infinity so that no reflected (-) wave exists in that medium. For a uniform plane wave having the electric field

$$\mathbf{E}_i = E_0 \cos(3 \times 10^8 \pi t - \pi z) \mathbf{a}_x \quad \text{V/m}$$

incident from medium 1 onto the interface $z = 0$, obtain the expressions for the expressions for phasor electric- and magnetic-field components in all three medium. What are the reflection and transmission coefficients for the system? (20 分)



6. For the system shown below, find the input impedance of the line and the time-average power delivered to the load. (20 分)



7. Find the spacing a for a parallel-plate waveguide having a dielectric of $\epsilon = 9\epsilon_0$ and $\mu = \mu_0$ such that 5000 MHz is the cutoff frequency of the dominant mode. (10 分)