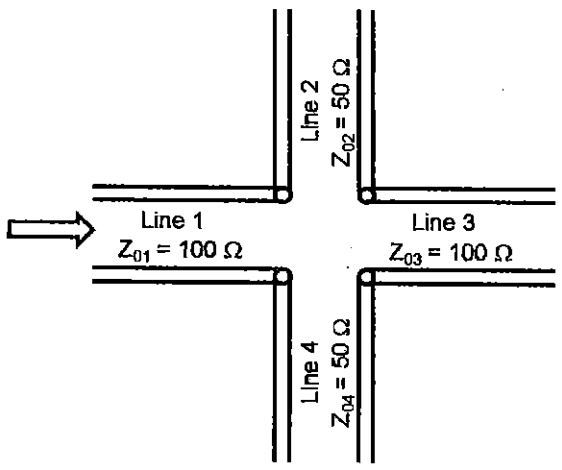
類組：電機類 科目：電磁學 B(3008)　　※請在答案卷內作答

1. (15%) A transmission line signal carrying power P is incident on the cross junction from Line 1. Please answer the following questions.



(1A) (5%) What is the power reflected into Line 1?

(1B) (5%) What is the power transmitted into Line 2?

(1C) (5%) What is the power transmitted into Line 3?

2. (5%) The profile of a harmonic wave, traveling at 1.2 m/s on a string, is given by

$$y = (0.02m)\sin(157m^{-1})x$$

Determine its amplitude, wavelength, frequency, and period.

3. (5%) A plane, harmonic, linearly polarized light wave has an electric field intensity given by

$$E_z = E_0 \cos \pi 10^{15}(t - \frac{x}{0.65c}) \qquad \text{(V/m)}$$

while traveling in a piece of glass. Find

(3A) (2%) The frequency of the light

(3B) (1%) Its wavelength

(3C) (2%) The index of refraction of the glass

4. (5%) What is the momentum and energy of a 10^{19} -Hz X-ray photon?

5. (20%) Prove that a linearly polarized plane wave can be resolved into a right-hand circularly polarized wave and a left-hand circularly polarized wave, and vice versa.

注意:背面有試題

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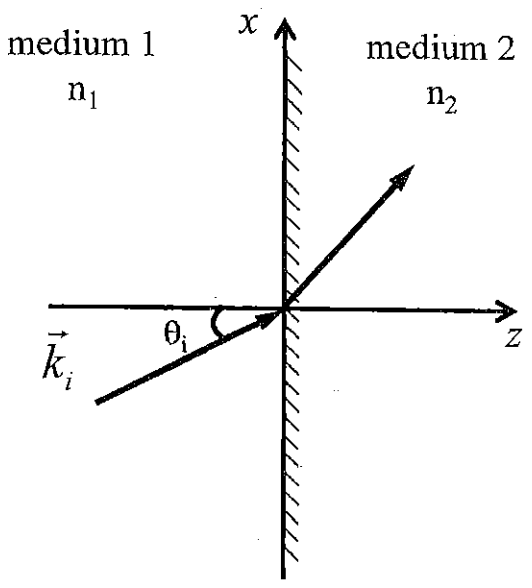
6. (10%) Assuming that the radiation magnetic field intensity of an antenna is $\vec{H} = \hat{a}_\theta H_\theta + \hat{a}_\phi H_\phi$. Find the expression for the average outward power flow per unit area.

7. (10%) Are the field patterns in a cavity resonator traveling waves or standing waves? How do they differ from those in a waveguide?

8. (10%) Explain why single-conductor hollow or dielectric-filled waveguides cannot support TEM waves?

9. (10%) The laws of geometrical optics can be derived from Fermat's principle. Please state Fermat's principle and derive from the principle the law of refraction for oblique incidence on a plane boundary between two different perfect dielectric media.

10. (10%) As shown below, an electromagnetic wave passes from medium 1 with a refractive index n_1 to medium 2 with a refractive index n_2, where $n_2 > n_1$ and both are perfect dielectric media. If the incident angle θ_i exceeds the critical angle θ_c, there is no refracted but only a reflected wave in medium 1. But the field is not zero in medium 2, and we get a disturbance called evanescent wave. Assume the incident wave is with amplitude E_0, angular frequency ω, and wavevector $\vec{k}_i$. From the condition of $\theta_i > \theta_c$, please show your derivation to construct an expression for the electric field of the evanescent wave if the incident wave is a TE wave. The final expression should be expressed only in terms of the given parameters: E_0, ω, n_1, n_2, θ_i, and c (the speed of light).



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