

① Derive free space orthogonality relations involving  $\vec{K}$ ,  $\vec{E}$ ,  $\vec{H}$  for a plane wave from Maxwell's equations.

② Find the propagation angle in a uniaxial material relative to the optic axis for  $n_p = 0.66 c_0$  if

$$\vec{\epsilon}_r = \begin{bmatrix} 2 & & \\ & 2 & \\ & & 2.4 \end{bmatrix}$$

③ Derive a wave equation for  $\phi$ . Give a Green's function solution.

④ Is  $\frac{i}{2k} e^{ik|x-k'|} + e^{ikx}$  a Green's function for the BVP

$$\text{PDE: } \left( \frac{d^2}{dx^2} + k^2 \right) u = f$$

B.C.:  $u$  satisfies the radiation boundary condition.