HW 5

Problem 1

$$egin{aligned} egin{aligned} eta & = \overline{\epsilon}^{-1} \ k & = rac{\epsilon}{\epsilon^2 - \epsilon_g^2} \ k_g & = rac{-\epsilon_g}{\epsilon^2 - \epsilon_g^2} \ k_z & = rac{1}{\epsilon_z} \ \end{pmatrix} \ k_z & = rac{1}{\epsilon_z} \ k & = rac{1}{\epsilon_0} \cdot rac{1 - rac{w_p^2}{(w^2 - w_c^2)}}{(1 - rac{w_p^2}{(w^2 - w_c^2)})^2 - rac{w_p^4 w_c^2}{w^2 (w^2 - w_c^2)^2}} \ & = rac{1}{\epsilon_0} \cdot rac{(w^2 - w_c^2)(w^2 - w_c^2 - w_p^2)}{(w^2 - w_c^2 - w_p^2)^2 - rac{w_p^4 w_c^2}{w^2}} \ k_g & = rac{1}{\epsilon_0} \cdot rac{- rac{w_p^2 w_c}{w(w^2 - w_c^2)}}{(1 - rac{w_p^2}{(w^2 - w_c^2)})^2 - rac{w_p^4 w_c^2}{w^2 (w^2 - w_c^2)^2}} \ & = rac{1}{\epsilon_0} \cdot rac{- rac{w_p^2 w_c}{w} \cdot (w^2 - w_c^2)}{(w^2 - w_c^2 - w_p^2)^2 - rac{w_p^4 w_c^2}{w^2}} \ k_z & = rac{1}{\epsilon_z} & = rac{1}{\epsilon_0 [1 - rac{w_p^2}{w^2}]} & = rac{w^2}{\epsilon (w^2 - w_p^2)} \end{aligned}$$