Lecture 11 – Exercises

Exercise 11.1

A diffraction grating is illuminated at 45°. Its period is $L = 1.25\lambda$. The refractive indices of the reflection and transmission regions are $n_{\text{ref}} = 1$ and $n_{\text{trn}} = 2$, respectively. Compute the total number of diffraction orders that exist in both regions.

Exercise 11.2

A diffraction grating has a period of 600 nm and is illuminated by a wave with a wavelength of 1100 nm. The refractive indices of the reflection and transmission regions are $n_{\text{ref}} = 1$ and $n_{\text{trn}} = 1.5$, respectively. The wave is initially impinging on the grating at normal incidence. The angle of incidence of the wave is then progressively increased, at which angle and in which medium does the first diffraction order appears ?

Exercise 11.3

An hexagonal grating of side $a = 500$ nm is illuminated with a wavelength of 600 nm. The top medium is air with $n = 1$. The bottom medium is glass with $n = 1.5$. The incident wave comes from the air and impinges the grating at $\theta = 50°$ and $\phi = 15°$. Compute the reflection and transmission angles for all diffraction orders.

Exercise 11.4

Design a square-lattice diffraction grating that lies between air ($n = 1$) and glass ($n = 1.5$) and that achieves retro-reflection for an incidence angle of $\theta = 45°$ from the air for the first diffraction order. The wavelength of the light is 632 nm. What is the corresponding retro-reflection angle if the light comes from glass?