

693.

**Problem 48.7 (RHK)**

*A beam of unpolarized light is incident on a stack of four polarizing sheets that are lined up so that characteristic direction of each is rotated by  $30^\circ$  clockwise with respect to the preceding sheet. We have to find the fraction of the incident intensity that is transmitted.*

**Solution:**



Let the intensity of the unpolarized incident beam be  $I_0$ .

The incident of the beam after it emerges from the first polarizing sheet will become

$$I_1 = \frac{1}{2} I_0.$$

As the characteristic directions of each successive three polarizing sheets are rotated by  $30^\circ$  with respect to the preceding sheet, the intensity of the transmitted light as it emerges from the fourth polarizing sheet will be given by

$$I_4 = I_1 (\cos 30^\circ)^6 = \frac{1}{2} I_0 \times \left( \frac{\sqrt{3}}{2} \right)^6 = \frac{27}{128} I_0,$$

or

$$\frac{I_4}{I_0} = \frac{27}{128}.$$

