Physics ~~172~~ 173 SP
~~Winter~~ Quarter 1989
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George Williams

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THIRD MIDTERM

Name (print) HARYANTO Name (signed) 7 = 16.2

Discussion Instructor (circle one): Chen Emerson Iguchi Stoops

Discussion Section #_____

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) Calculate the polarizing angle for light reflected from glass (n = 1.55) under water (n = 1.33).

$\tan\theta_p = \frac{n_g}{n_w} \Rightarrow \boxed{\theta_p = 49.4^\circ}$

(b) There are 4 polarizing screens in a row. The polarizing direction of each is rotated 25.0° from the one before. Calculate the intensity, after D, as a fraction of I_o.

A B C D

$I_o \longrightarrow \frac{I_o}{2} \quad \frac{I_o}{2}\cos^2 25^\circ \quad \frac{I_o}{2}\cos^4 25^\circ \quad \frac{I_o}{2}\cos^6 25^\circ = \boxed{0.277\, I_o}$

(c) In a two-slit experiment, the 5th **minimum** from the center of the pattern is observed at 3.75 cm from the center on a screen 5.25 m away from the slits, using light of λ = 590 nm. Calculate the slit separation. The minimum described is not the single slit minimum, but is a minimum in the two-slit pattern.

$m = 4$ $\quad d\sin\theta = (m+\frac{1}{2})\lambda$ $\quad \sin\theta \doteq \frac{y}{L}$ $\Rightarrow \boxed{d = 3.72 \times 10^{-4}\,m}$

(d) Calculate the thickness of a quarter-wave plate for yellow light of wavelength 590 nm, if n_{fast} = 1.7500 and n_{slow} = 1.7520 for the material of the plate.

$\frac{\lambda}{4} = d\,|n_f - n_s| \Rightarrow \boxed{d = 7.38 \times 10^{-5}\,m}$

(e) In an optical rotation experiment the plane of polarization for a wavelength of 590 nm is rotated 235° in a cell 10.00 cm long. Calculate the quantity $(n_r - n_l)$.

$\angle_{rot} = \frac{\delta}{2} = \frac{1}{2}\,\frac{2\pi d(n_r - n_l)}{\lambda} \Rightarrow \boxed{(n_r - n_l) = 7.70 \times 10^{-6}}$