THIRD MIDTERM

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Discussion Section # 

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

A film of oil is set up on the surface of water as shown. Light is incident perpendicular to the surface from the air side. The film is $1.45 \times 10^{-6}$ m thick.

(4) Calculate all of the wavelengths in visible light ($400$ - $700$ nm) that show constructive interference maxima in reflection.

(4) Calculate all of the wavelengths of visible light that show constructive interference maxima in transmission.

\[ \text{air} \quad n = 1 \quad \text{oil} \quad n = 1.25 \quad \text{water} \quad n = 1.33 \]

a) Since both the reflected rays are different from the incident by a phase shift of $\pi$, they are in phase when they interfere constructively.

\[ \lambda = \frac{2nt}{m} \]

\[ n = 1.25 \]

\[ \lambda_1 = 2 \times 1.25 \times 1.45 \times 10^{-6} \text{ m} \]

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3. \( m = 6 \) \( \lambda_1 = 604 \text{ nm} \) 605
3. \( m = 7 \) \( \lambda_2 = 518 \text{ nm} \) 518.6
3. \( m = 8 \) \( \lambda_3 = 453 \text{ nm} \) 453.8
3. \( m = 9 \) \( \lambda_4 = 403 \text{ nm} \) 403.0

b) 

Since the phase difference is $\pi$, constructive interference occurs.

\[ 2nt = (m + 1/2) \lambda \]
\[ \alpha t = (m + y_z) \lambda \]

\[ \lambda = \frac{\alpha t}{(m + y_z)} \]

\[ \eta = 1.25 \]
\[ t = 1.45 \times 10^{-6} \]

\[ \lambda_m = \frac{2 \times 1.25 \times 1.45 \times 10^{-6}}{(m + y_z)} \]

\[ m = 5 \]

\[ \begin{align*}
\lambda_5 &= 659 \text{ nm} \\
\lambda_6 &= 558 \text{ nm} \\
\lambda_7 &= 483 \text{ nm} \\
\lambda_8 &= 426 \text{ nm}
\end{align*} \]