Physics 1C Chapter 36 HW

36.3) $\lambda = 585nm$, $a = 0.0666mm$

a) $\sin\theta = \frac{m\lambda}{a}$

$0 < \sin\theta \leq 1$

$1 = \frac{m\lambda}{a}$

$m = 113$

226 fringes

b) $m = 113$

$\sin\theta = \frac{m\lambda}{a}$

$\theta = 1.44 rads$

$|\theta| = 83.01°$

36.9) $f = 1250Hz$, $a = 1.05m$

$\lambda f = v_s$

$\lambda = \frac{v_s}{f}$

$\sin\theta = \frac{m\lambda}{a}$

$\sin\theta = \frac{mv_s}{af}$

$\theta = 15.19°$ @ $m = 1$

$\theta = 31.61°$ @ $m = 2$

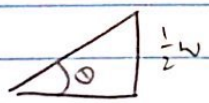
$\theta = 51.84°$ @ $m = 3$

36.11) $\lambda = 633nm$, $a = 0.400mm$

$D = 3.8m$

a) $\sin\theta = \frac{m\lambda}{a} \rightarrow m = 1$

$\theta = 0.09°$



$\tan\theta = \frac{w}{2D}$

$w = 0.012m$

b) $\sin\theta = \frac{m\lambda}{a} \rightarrow m = 2$

$\theta = 0.18°$

$\tan\theta = \frac{w_1 + \frac{1}{2}w}{D}$

$w_1 = 0.006m$

36.15) $f = 88.9MHz$, $a = 15m$

a) $\lambda f = c$

$\lambda = \frac{c}{f}$

$\sin\theta = \frac{m\lambda}{a}$

$\sin\theta = \frac{mc}{af}$

$\theta = 13°$ @ $m = 1$

$\theta = 26.74°$ @ $m = 2$

$\theta = 42.45°$ @ $m = 3$

$\theta = 64.14°$ @ $m = 4$

b) $I_0 = 3.4 W/m^2$, $\theta = 5.50°$

$$I = I_0\left[\frac{\sin(\pi a \frac{\sin\theta}{\lambda})}{\pi a \frac{\sin\theta}{\lambda}}\right]^2$$

$$I = I_0\left[\frac{\sin(\pi a \frac{f\sin\theta}{c})}{\pi a \frac{f\sin\theta}{c}}\right]^2$$

$\theta = 0.096 rads$

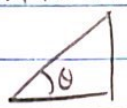
$I = 1.79 W/m^2$

36.42) $f = 135mm$, $D = \frac{f}{4}$, $d = 14m$, $\lambda = 550nm$

a) $\theta_{min} = 1.22\frac{\lambda}{D}$

$\theta_{min} = 1.22\frac{4\lambda}{f}$

$\theta_{min} = 1.99 \times 10^{-5} rads$



$\tan\theta_{min} = \frac{w}{d}$

$w = 0.28mm$

b) $D = \frac{f}{22}$

$\theta_{min} = 1.22\left(\frac{22\lambda}{f}\right)$

$\theta_{min} = 1.07 \times 10^{-4}$

$\tan\theta_{min} = \frac{w}{d}$

$w = 1.51mm$

36.43) $D_H = 2.4m$, $D_A = 305m$

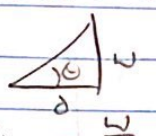
$\lambda_H = 400\text{-}700nm$, $\lambda_A = 75cm$

a) $\theta_{min} = 1.22\frac{\lambda}{D}$

$\lambda = 3.54 \times 10^{5} m$

$\theta_H = 2.03 \times 10^{-7}$ rads

$\theta_A = 0.003$ rads



$\tan\theta_{min} = \frac{w}{d}$

$w_H = 77.1m$

$w_A = 1.15 \times 10^{6} m$

b) $\theta_H = 2.03 \times 10^{-7}$ rads

$w = 30cm$

$\tan\theta_H = \frac{w}{s}$

$s = 1477.83km$

36.47) $\lambda = 632.8nm$, $a = 0.02mm$

$I_0 = 8.9 W/m^2$

a) $\sin\theta = \frac{m\lambda}{a}$

$\sin\theta < 1$

$1 = \frac{m\lambda}{a}$

$m = \frac{a}{\lambda}$

$m_{max} = 2m$

$m_{max} = 62$

b) $m = 31$

$\sin\theta = \frac{m\lambda}{a}$

$\theta = 78.77°$

c) $\theta_{31} = 78.77°$

$\theta_{30} = 71.66°$

$\theta = 75.21° = 1.31$ rads

$I = I_0 \left[\frac{\sin(\pi a \sin\theta/\lambda)}{\pi a \sin\theta/\lambda}\right]^2$

$I = 9.33 \times 10^{-4} W/m^2$