ANSWER MIDTERM PHYSICS 4
(04/2021)

Q.1 (25 pts)

(a) $f' = \frac{v + v_0}{v - v_s} f = \frac{344 - 15}{344 + 0} \cdot 392 = 375\ Hz$ (15 pts)

(b) $f'' = \frac{v + v_0}{v - v_s} f = \frac{344 + 15}{344 - (-35)} \cdot 392 = 371\ Hz$ (10 pts)

Q 2 (25 pts)

(a) *Open: $(n+1) f_1 - n f_1 = 1764 - 1732$; $n = 3.5 \rightarrow$ NO!

*Stopped: $(n+2) f_1 - n f_1 = 1764 - 1732$; $n = 7 \rightarrow$ OK (10 pts)

(b) $n = 7$; $n + 2 = 9$ (5 pts)

$L = \frac{v}{4 f_1} = 0.439\ m$ (10 pts)

Q.3 (25 pts)

(a) $d \sin\theta = (m + \frac{1}{2}) \lambda \Rightarrow \sin\theta_1 = \frac{\lambda}{2d}$; $\theta_1 = 8.79°$

$\sin\theta_2 = \frac{3\lambda}{2d}$; $\theta_2 = 27.28°$; $\Delta\theta = 18.49°$ (15 pts)

(b) $y_1 = L \tan\theta_1 = 0.0541\ m$

$y_2 = L \tan\theta_2 = 0.1805\ m$ } $\Delta L = 12.6\ cm$ (10 pts)

Q. 4 (25 pts)

(a) $d = \frac{m\lambda}{\sin\theta} = \frac{3 \times 681\ nm}{\sin 78.4°} = 2.086 \times 10^{-4}\ cm$ (5 pts)

$N = \frac{1}{d} = 4790\ slits/cm$ (5 pts)

(b) $\sin\theta_1 = \frac{\lambda}{d}$; $\theta_1 = 19.1°$

$\sin\theta_2 = \frac{2\lambda}{d}$; $\theta_2 = 40.8°$ } $\Delta\theta = 21.7°$ (10 pts)

(c) $\sin\theta = \frac{4\lambda}{d} > 1$. (5 pts)