Phys 132 2022

Final Review

Final: * Weds 18 May at 10am - noon

* In lecture classroom

Exam covers: Entire semester

Bring: Calculator

Four single side 3"x5" cards

Review: Previous finals

2017 All questions

2018 All questions

This review covers only material from Ch 33, 34, 35 and standing waves

Chapter 33.1 -> 33.4, 33.6, 33.8

Constructive interference: $\Delta r = 0, \pm\lambda, \pm 2\lambda, \pm 3\lambda, \ldots$

Destructive interference: $\Delta r = \pm \lambda/2, \pm 3\lambda/2, \pm 5\lambda/2$

Double slit // grating ~~dark~~ bright $m\lambda = d\sin\theta_m$ $y_m = m\frac{\lambda L}{d}$

Single slit dark $a\sin\theta_p = p\lambda$ $p = \pm 1, \pm 2 \ldots$

Circular $w = 2.44\,\lambda L/D$

Standing waves (fixed ends) $\lambda_n = \frac{2L}{n}$ $f_n = n\frac{v}{2L}$

Quiz 1 70% -> 0

Additional Optics Exercises

262 Diffraction grating: number of fringes

A diffraction grating has slits that are 2500 nm apart.

a) Light with wavelength 650 nm is incident on the grating. How many bright fringes will be observed?

b) What adjustment to the wavelength of the light incident on the grating would add two more bright fringes? Explain your answer.

Answer: a) $d\sin\theta_m = m\lambda$ $\quad m = 0, \pm 1, \pm 2 \ldots$

$$\sin\theta_m = m\frac{\lambda}{d}$$

$$= m\,\frac{650}{2500} = 0.26m$$

We need $|\sin\theta_m| \leq 1$ $\Rightarrow$ $m = 0, \pm 1, \pm 2, \pm 3$

So there are seven possibilities.

b) We would need $m = 4$ to be possible

So

$$|\sin\theta_m| = 4\frac{\lambda}{d} \leq 1 \Rightarrow \lambda \leq \frac{d}{4} = 625\text{nm}$$

So the wavelength would need to drop below 625nm

Quiz 2 80% → 100%

263 Standing waves on a string with fixed ends

A string with both ends fixed is stretched so that the speed of waves on the string is 300 m/s. The frequency of the fundamental ($n = 1$) is 500 Hz.

a) Determine the length of the string.

b) Sketch the second harmonic ($n = 2$) and use this to determine its wavelength and frequency.

Answer a)

$\lambda = 2L \qquad v = \lambda f \Rightarrow v = 2Lf$

$\Rightarrow L = \frac{v}{2f}$

$\Rightarrow L = \frac{300\,m/s}{2 \times 500\,Hz} = 0.30\,m$

b)

$\lambda = L$

$\lambda = 0.30\,m$

$v = \lambda f \Rightarrow f = \frac{v}{\lambda} = \frac{300\,m/s}{0.30\,m} = 1000\,Hz$

Ch 34

Law of reflection

Snell's Law $n_1 \sin\theta_1 = n_2 \sin\theta_2$

Ray tracing

Meaning of focal point

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \qquad m = \frac{h'}{h} \qquad m = -\frac{s'}{s}$$

$$\frac{1}{f} = \left(\frac{n_2}{n_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Quiz 3 75%

264 Converging lens: upright image

An object is placed left of a converging lens with focal length f. How far from the lens (in terms of f) must the object be placed so that the lens produces an upright image which is three times as large as the object?

$$m = 3 = -\frac{s'}{s} \quad \Rightarrow \quad s' = -3s$$

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \quad \Rightarrow \quad \frac{1}{s} + \frac{1}{-3s} = \frac{1}{f}$$

$$\Rightarrow \quad \frac{3-1}{3s} = \frac{1}{f}$$

$$\Rightarrow \quad \frac{2}{3s} = \frac{1}{f} \quad \Rightarrow \quad s = \frac{2}{3}f$$