**What you need to know:**

Wave Model:
Wave properties needed to explain:
- •refraction
- •diffraction
- •interference

Particle Model:
Modern Physics: Particle properties needed to explain
- Photoelectric effect
- Compton effect

Dispersion:
Colour related to wavelength, λ. Refractive index, n = c/v , depends on λ
eg glass
$n_{red}$ = 1.520
$n_{violet}$ = 1.538
⇒ red light refracted less ⇒ Dispersion

Dispersion
- •Limits speed of optical fibre communications
- •Chromatic aberration: position of focus depends on wavelength
- •Colours from prisms
- •Rainbows

Interference:

Interference patterns of double slits and diffraction gratings: (constructive: dsinθ = m λ),

Single slits and circular apertures: (Nodes a sin θ = p λ, p = 1, 2, 3 …)

Interferometers: Distance moved is N λ/2, N = number of fringes counted.

Diffraction crossover:

$$\Rightarrow D_c = \sqrt{2.44\lambda L}$$

For the Exam:

- You may be asked to find the fringe spacing for single or double slits or diffraction gratings.
- You may be asked to explain how a Michelson interferometer works.

Training:

Homework Problems and Problem Class Sheets.

And then try an exam question:

**What you need to know:**

**Question 10 (parts b and c)** **[ 3 + 2 + 2 marks]**

(b) In the centre of the shadow of a disk or sphere there is a small bright spot, called the Poisson spot, as shown in the figure below. Briefly explain how this bright spot arises.

(c) Two sources of light illuminate a double slit simultaneously. One has wavelength 580 nm and the second has an unknown wavelength. The m = 5 bright fringe of the unknown wavelength overlaps the m = 4 bright fringe of the light of 580 nm wavelength.

(i) Find the unknown wavelength.

(ii) For the 580 nm light, if the m = 4 bright fringes is 0.5 cm from the central maximum on a screen that is 2.0 m from the slits, what is the slit spacing?

Optics Formulae from exam paper:

| | | |
|---|---|---|
| $d\sin\theta = m\lambda$ | $\Delta\theta = \frac{1.22}{D}\lambda$ | $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ |
| $n = \frac{c}{v}, \quad n_i \sin\theta_i = n_f \sin\theta_f$ | $\frac{1}{f} = \frac{1}{s} + \frac{1}{s'}$ | $m = -\frac{s'}{s}$ |
| $f_{\#} = \frac{f}{D}$ | $P = \frac{1}{f}$ | $NA = n\sin\theta$ |

Answers to exam question:

(b) (i) 464 nm, (ii) 0.9 mm