Physics 471 - Study guide for exam 3
Dr Colton, Winter 2024

- Chapter 8 – Temporal Coherence (i.e. sections 8.1-8.4 only)
    - How a Michelson interferometer works, what signal you get for monochromatic beam
    - How to determine the signal you get for a beam containing multiple frequency components
        - Note this could be it because it's either pulsed or just not very monochromatic
    - Understanding the gamma function (degree of coherence function)
        - Real part gives oscillations to signal
        - Magnitude gives visibility
        - Integrating magnitude squared gives coherence time
    - Fourier spectroscopy - how to use an interferometer to determine the spectrum of the light
- Chapter 9 – Rays
    - What the eikonal equation means
    - How to use Fermat's principle, finding path of minimum time
    - How to represent rays as vectors: (height, angle)
    - How to derive ABCD matrices of common optical elements
    - How to use ABCD matrices to determine final rays after passing through optical elements
    - What is the image formation condition and how to use it (and what the magnification is, if an image gets formed)
    - How to use principal planes to simplify an optical system
    - How to determine/enforce the stability of laser cavities
    - Understand what causes the main types of optical aberrations and what steps you can take to improve them
- Chapter 10 – Diffraction
    - The four main integral formulas
        - Given an aperture function, how to calculate diffraction pattern using each of the four formulas
        - Know where/when each of the four formulas applies
        - One example: how to calculate the on-axis intensity after a circular hole or obstruction
    - Fraunhofer, more details
        - How/why the Fraunhofer formula relates to Fourier transforms
        - How to calculate Fraunhofer pattern for any aperture function
        - Know/understand the details of the 1D single slit, 1D double slit, 2D rectangular, and 2D circular patterns
- Chapter 11 – Diffraction Applications (only sections 11.3-11.5 for this exam: Array Theorem, Gratings, Spectrometers)
    - Understand the convolution theorem and how to/why/when it applies to Fraunhofer diffraction patterns
    - Know how a grating pattern arises, and relevant details about it (e.g. from FT of comb function)
    - Spectrometers
        - Which wavelengths get selected
        - What the resolution is
        - How to use