Study Guide for EXAM 1 – 505R SPRING 2007

Chapter 1 –

Understand basic F.T. properties and F.T. pairs of common functions.

Definition
Linearity
Similarity
Shifting property
Convolution
Fourier integral thm
F.T. of separable functions
Euler's identity
F.T. pairs, including -
rect
sinc
tri
gaus
delta
shifted delta
comb
circ
somb
sin
cos

Chapter 2 –

Free-space wave equation
Helmholtz equation
Absorption – Beer's Law
Frequency dependence of refractive index and absorption
Power flow
Poynting vector
Irradiance

Chapter 3 –

Part A
Beats
HF/modulation terms
Modulation envelope
Irradiance

Nondispersive/dispersive media
Standing waves

Part B
Plane-wave solution of the wave equation
Plane wave characteristics
Scalar spherical waves
Linearity
Polarization (p.w. traveling in *z* direction)–
- General solution
- Linear
- Left and right circular
- Elliptical
- Ellipticity
- Jones Calculus
- Jones Matrices
- Uniaxial crystals
- Wave plates
- Rotated elements
- Reflection – *ps* notation and Fresnel's coefficients
- Cascaded components
- General description of Stokes parameters and Mueller matrices (don't memorize matrices)
- Degree of polarization

Chapter 4 –

Part A
Two vector plane waves, nondispersive medium
Modulation and HF terms
Case of equal wavelengths –
- Constructive/destructive interference
- Vector diagram to determine fringe plane orientation
- Power flow
- Irradiance
- Angle of observation plane
- Visibility
- Polarization
- Weiner experiment

Part B
Hyperboloidal sheets generated from two point sources
Effect of varying separation of the source points
y-axis (symmetry line) properties
Maximum OPD_0
$m = 0$ fringe properties

yz planar intercept
Small-angle approximation for straight-line, equally spaced fringes
xz planar intercepts
Plane wave + spherical wave
Plane wave + cylindrical wave

Part C
Appreciate that there are many useful ways to generate two-beam interference.

Chapters 5 and 6
Eq. (5.8)
Power spectrum
Eqs. (5.44) through (5.51)
Coherence length in OPD_0 units and physical distance in the observation space
Coherence time
Twyman-Green interferometer
Small-angle approximation for OPD_s in Eq. (5.67)
Eqs. (5.74) through (5.79)
van Cittert-Zernike thm
Coherence area
Fringe localization terms (give examples)–
- Localized everywhere, non-localized, unlocalized
- Localized
- Localized at infinity, Haidinger's fringes, fringes of equal inclination
- Fringes of equal thickness

Fringe localization with a PPP
Thin films and Fizeau interferometers
- Where are fringes localized?
- Properties of fringe position versus thickness of film
- Properties of fringe shift versus bump/hole defect

Michelson interferometer
- Where are fringes localized?
- Case of parallel mirrors
- Case of tilted, but not displaced, mirrors
- Case of tilted and displaced mirrors
- White-light fringes
- Why is a compensator necessary?
- Understand Figure 5.49

Appreciate that source properties affect visibility differently in different interferometers
Newton's rings
Mach-Zhender interferometer
Lateral shearing interferometry