

Fall 2022: OSE-5115 Interference, Diffraction, and Coherence

Tue & Thu 1:30 – 2:45

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- 1- Brief review
 - a. Integral transforms, FT properties and theorems, 2D and 3D transforms and applications
- 2- Wave interference
 - a. Wavefront - angular spectrum of plane waves
 - b. Optical path difference
 - c. Spherical waves interference
 - d. Three/multiple waves interference
- 3- Diffraction
 - a. Rayleigh-Sommerfeld integral
 - b. Huyghens principle
 - c. Fresnel diffraction
 - d. Babinet's, Poisson's spot, Talbot
 - e. Fraunhofer diffraction
 - f. Asymptotic transforms and singularities
- 4- Interferometry
 - a. Division of amplitude, division of wavefront
 - b. Fizeau, Newton, Loyd, Michelson, Mach-Zehnder, Sagnac
 - c. Multiple beams interferometers, Fabry-Perot, gratings
 - d. Extended incoherent sources
 - e. Optical testing
 - f. Interferometric imaging
 - g. Phase shifting, heterodyning, time delay, laser-ranging
- 5- Elements of coherence
 - a. White light phenomena, Michelson
 - b. Temporal and spatial coherence, Michelson & Young interferometers
 - c. Coherence propagation, VanCittert Zernike
 - d. Space-frequency representation, stationarity, Wiener Khinchin
 - e. Fourier transform spectroscopy

Supplementary reading (recommended chapters):

Papoulis, *Systems & Transforms with Applications in Optics* (1)

Goodman, *Introduction to Fourier Optics* (2,3)

Gaskill, *Linear Systems, Fourier Transforms, and Optics* (2,3)

Goodman, *Statistical Optics* (5)

Mandel and Wolf, *Optical Coherence* (3,5)

Hecht, *Optics* (2,3,4,5)

Hariharan, *Optical Interferometry* (4,5)

Grading:

25% Exam 1 and Exam 2

10% Homework

40% Final (Comprehensive)