OSE6115 Interference, Diffraction, and Coherence

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The grade in this class will be divided as follows:

Homeworks: 30%; Midterm1: 20%; Midterm2: 20%; Final: 30%

Class Day & Time: Mondays, Wednesdays 4:30 AM to 5:45 AM, **Room:** 102

Syllabus:

1- Review of the Fourier transform

2- Review of electromagnetic wave propagation, and the plane-wave angular spectrum

3- Two-beam interference: Mach-Zehnder interferometer, Michelson interferometer, Sagnac interferometer

4- Double slit-interference

5- Multiple-beam interference

6- Rayleigh-Sommerfield diffraction

7- Fresnel and Fraunhofer diffraction

8- Introduction to Fourier optics

9- Diffraction limited optical imaging

10- Diffraction Gratings

11- Introduction to coherence theory

12- Second-order spatial and temporal coherence

13- Effect of coherence on optical imaging

Textbooks:

B. E. A. Saleh and M. C. Teich, “Fundamentals of Photonics”

J. W. Goodman, “Introduction to Fourier Optics”

A. Papoulis, “Systems and Transforms with Applications in Optics”

G. O. Reynolds, J. B. Develis, G. B. Parrent, B. Thompson, “The New Physical Optics Notebook: Tutorials in Fourier Optics”

J. W. Goodman, “Statistical Optics”

J. D. Gaskill, “Linear Systems, Fourier Transforms, and Optics”

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Week 1: Review of 1D and 2D Fourier transforms; plane-wave spectrum

Week 2: Review of 1D and 2D Fourier transforms; plane-wave spectrum

Week 3: Temporal interference, Mach-Zehnder interferometer, optical pulses

Week 4: Michelson interferometer, optical coherence tomography with pulsed light, effect of dispersion, Fabry-Perot interferometer, Sagnac interferometer

Week 5: Interference of two plane waves, interference of an infinite number of waves (x-ray diffraction), double-slit interference

Week 6: Scalar diffraction theory

Week 7: Fresnel and Fraunhofer diffraction, effect of a lens

Week 8: Fourier optics, spatial filtering

Week 9: Diffraction-limited imaging, introduction to optical microscopy I

Week 10: Diffraction-limited imaging, introduction to optical microscopy II

Week 11: Review of random variables and stochastic processes, introduction to coherence theory

Week 12: Temporal coherence theory, Weiner-Khintchine theorem, temporal coherence of an optical pulse

Week 13: Spatial coherence, the double slit revisited, Schmidt (modal) decomposition

Week 14: Propagation of coherence functions, can Cittert-Zernike theorem, higher-order coherence functions, Hanbury-Brown and Twiss interferometry