אורט בראודה
המכללה האקדמית להנדסה
ORT Braude College

The Department of Physics and Optical Engineering

Course Name:	Interferometry and microscopic interferometry
Course Number:	391540
Course Extent	Lectures 3, Exercises 1, Laboratory 2 weekly hours
Course Demerits	3.5
Pre-requisites	39140 Optical Physics

Course Goals:

The course intends to provide a basic understanding in interferometric concepts, phenomena, and interferometric measurements as well as a hands-on experience with building interferometers and their applications.

Course structure and requirements:

The course comprises frontal lectures, laboratory work, exercises and home assignments.

Course grade: home assignments comprise 30% and final exam 70% of the course grade.

Course Topics:

1. **Review of pre-requisite topics:**
   Maxwell equations; the scalar wave equation; plane waves and the ray model; Pointing vector, intensity and power, time averaging in the detector; Gaussian waves; the Fresnel-Huygens integral.

2. **Young's experiment:**
   Diffraction as a basis of interferometry; the underlying contributors to interferometric resolution: wavelength resolution and signal-to-noise limitations.

3. **Two-beam interference:**
   Interferometric fringes of two-beams: path-length, angle and wavefront differences; effects of polarization, intensity differences and coherence.

4. **Two-beam and coherence interferometers:**
   Michelson, Mach-Zehnder, Jamin, Twyman- Green, Linnik, Michelson stellar, and Hanbury-Brown-Twiss interferometers.

5. **Methods for phase shift and interferometric measurement algorithms:**
   Reference-mirror displacement, acousto-optic modulator, elecro-optic modulators; three measurement points, LSE, Schwider, error sources.

6. **The interferometer as nature's most accurate measurement instrument:**
   The Michelson-Morley experiment; LIGO: detection of gravitational waves.

7. **Interferometers with overlapping beam paths:**
   Fizeau: measurement of the speed of light in flowing water; Sagnac and the optical gyroscope.

8. **Multi-reflection interferometer – thin films:**
   Interference filters, wavelength filtering, interference mirrors and their manufacturing methods.

9. **Multi-reflection interferometer – Fabry-Pérot:**
   Construction and alignment of the Fabry-Pérot interferometer, finesse, resolution, application in optical systems.

10. **Surface quality and phase reconstruction:**
    Definition and measurement of surface quality; methods for phase reconstruction (error minimization, input-output).