

PHYSICS DEPARTMENT
IInd Semester: 2007-2008
PHL754: Optical Instruments and Metrology
MAJOR TEST

Duration: 2 Hour

Max. Marks: 50

There are two sections. Section A is **Compulsory**. Attempt any **two** questions from Section B.

Section A (20)

1. Draw the nature of Newton's fringes for plane and astigmatic surfaces with reference to a standard flat in the cases (a) without tilt and (b) with tilt. [2]
2. Plot the contrast as a function of the size of the source in the case of (a) fringes of equal thickness and (b) fringes of equal inclination [2]
3. Mention the limitations of multi-channel Fabry Perot spectrometer. [2]
4. Draw interferograms in a Fourier spectrometer when the source (a) is monochromatic and (b) has Gaussian spectral distribution. [2]
5. Plot the intensity distribution of fringe pattern in the case of three beam interferometer when the phase difference between the central beam and the outer beams are $0, \pi/2$ and π . [4]
6. In scanning probe microscopy a scanner utilizing a piezoelectric crystal is used to scan the surface. Draw the diagrams of the scanner for lateral and axial scanning showing the polarity of the supply. [4]
7. Draw a side view of a direct ophthalmoscope showing the light path from source to retina. [4]

Section B (15x2 = 30)

1. (a) Sketch the molecular arrangement of smectic, nematic and cholesteric liquid crystals. How can one use nematic liquid crystal for fabrication of a quarter wave plate and an intensity modulator? Discuss with diagrams. [8]
(b) Explain with the help of a diagram the working of an optical confocal scanning microscope for imaging of thick object. What are its limitations? Discuss briefly. [7]
2. (a) Discuss with the help of a diagram the basic principle of optical coherence tomography. [7]
(b) In an imaging of an object using OCT, a source of wavelength 600 nm with bandwidth 10 nm is used. The size of the beam incident on the objective lens is 1 cm and its focal length is 10 cm. Determine the axial and transverse resolutions of the instrument. [8]
3. (a) Draw a schematic diagram of a lateral shearing interferometer using a laser source and a plane parallel plate for testing of a lens. Discuss the method. What are its advantages over white light source lateral shearing interferometer? [8]
(b) A and B are two identical radiators of waves that are in phase and of the same wavelength λ . The radiators are separated by distance equal to 3λ . Find the largest distance from A along the x-axis for which fully destructive interference occurs. Express this distance in terms of λ . [7]

