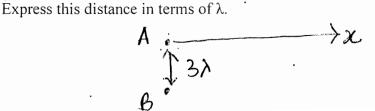
## PHYSICS DEPARTMENT

## **Hnd 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. 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 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. 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  $\pi$ . 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. 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? (b) A and B are two identical radiators of waves that are in phase and of the same wavelength  $\lambda$ . The radiators are separated by distance equal to  $3\lambda$ . Find the largest



distance from A along the x-axis for which fully destructive interference occurs.

[7]