

IIT DELHI
PHL 756 - Major Test

3 May 2007
3.30PM – 5.30PM
Total Marks = 50

- Q.1 Show that, for a diffraction limited optical imaging system, the image is a two-dimensional convolution of object and the impulse response of the system (4)
- Q.2. Derive Whittaker-Shannon sampling theorem (6)
- Q.3. Show that exact FT of an object illuminated by coherent parallel beam can be obtained if the object is at the front focal plane of an FT lens. (6)
- Q.4. Explain the effect of aberrations on ATF and OTF (5)
- Q.5. Consider two objects (A & B) with amplitude transmittances; $A(x,y) = \cos(2\pi fx)$ and $B(x,y) = |\cos(2\pi fx)|$. Whether incoherent or coherent illumination is better for imaging these objects, when $f_o/2 < f < f_o$? (f_o is the cutoff frequency of ATF) (6)
- Q.6. Explain Matched Filter and its optical interpretation. (5)
- Q.7. It is required to record a Vanderlugt filter for obtaining auto-correlation of an object of width 1cm, using a lens of focal length 10cm. If the laser used is of wavelength 500nm, what should be the minimum angle at which the reference beam should be used? (Explain the formula used) (5)
- Q.8. Consider an object which has perfect periodicity of amplitude transmittance in both x and y directions. On this object, there exists a small opaque defect. Using a spatial filtering experiment,
(a) is it possible to remove the defect and get the periodic object?
(b) is it possible to remove the periodic object and visualize the defect?
Describe briefly about the filter(s) to be used. (5)
- Q.9. Write short notes on ANY TWO of the following. (2x4 = 8)
- (a) Define similarity, shift, Rayleigh's and convolution theorems of Fourier transforms.
 - (b) Working of OASLM
 - (c) Photographic process and H-D curve