DEPARTMENT OF PHYSICS
PHL 754: OPTICAL SYSTEM AND METROLOGY

Majors
Duration: 2hrs

Max. Marks 40
May 3, 2015

Answer all questions.
Good Luck !!!

1) Explain the basic principle of the lateral shearing interferometery. Explain with the help of diagrams how primary astigmatism can be correctly ascertained using lateral shearing interferometry. [5]

2) Derive an expression for the Moire fringe spacing and Moire fringe orientation for two gratings with different frequencies but making an equal angle "β" with the Y-axis. What happens in the special case (1) when the gratings frequencies are equal (2) the angle "β"=0. [5]

3) Find the Jones matrix of a linear polarizer with a transmission axis making an angle "θ" with the x-axis. What are the advantages and disadvantages of a liquid crystal display? [5]

4) How can the deviation in the radius of curvature between spherical surfaces be determined using a Newton Interferometer? [5]

5) Explain the working of the optically addressed spatial light modulator with the help of a diagram. What are advantages of using an OASLM? [5]

6) A diffraction grating of width 5cm, slits of width 0.0001cm separated by a distance of 0.0002cm. Calculate the width of the principal maxima, the missing orders and maximum order for a wavelength = 5.5×10^{-5} cm. Explain the working of a twisted nematic display with the help of a diagram. [5]

7) In the Young's double slit experiment, the fringes are formed predominantly by λ_1 = 5890A and λ_2 = 5896A. Obtain the region closest to the screen when the fringe pattern disappears. Assume that the distance between the slits is 5mm and the distance between the slit and screen is 20 cms.
Explain the basic principle behind any two of the term papers discussed in class other than yours. [5]

8) With the help of Jones matrices, find the output polarization vectors in a surface stabilized half wave plate ferroelectric crystal from first principles. The incident light is linearly polarized with the vector making an angle "θ" with the y-axis. [5]

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MINOR 2 **Max. Marks 20**
Duration: 1hr **March 19, 2015**

Answer all questions.
Good Luck !!!

1) Explain with the help of the diagram: (i) How the Michelson Interferometer is modified to obtain the Twyman and Green interferometer.(ii) How is this interferometer so useful for optical testing? **[5]**

2) Derive an expression for chromatic resolving power in a Fabry-Perot instrument from first principles. **[5]**

3) In the Michelson interferometer, calculate the first three of values of θ' (corresponding to bright fringes) for $d = 5\times10^{(-3)}$ cm. Show that if d is decreased to $4.997\times10^{(-3)}$ cm, the fringe corresponding to m=200 disappears. What will be the corresponding values of θ' be for $\lambda = 5\times10^{(-5)}$ cm? **[5]**

4) A monochromatic beam of wavelength 6000A is incident normally on a Fabry-Perot interferometer with n=1 and F=400. The distance between the mirrors is written as

$$l = l_0 + x \qquad (1)$$

with l_0 =10cm, calculate
(a) The first three values of x for which unit transmittivity is obtained and also find the corresponding values of m.
(b) Calculate the FWHM.
(c) What would be the value of FWHM if F was 200? **[5]**