Northeastern University, EECE4646 Spring 2024
Marks: 100

Homework 4

Deadline - 03/11/2024

March 3, 2024

1 Problem I

Mirror M1 in figure 1 is moved through a displacement ΔL. During this displacement, 250 fringe reversals (formation of successive dark or bright bands) are counted. The light being used has a wavelength of 632.8 nm. Calculate the displacement ΔL. (**20 Marks**)

2 Problem II

Two glass plates 10.0 cm long are in contact at one end and separated at the other end by a thread with a diameter d = 0.050 mm (Fig. 2). Light containing the two wavelengths 400 nm and 600 nm is incident perpendicularly and viewed by reflection. At what distance from the contact point is the next dark fringe?(**20 Marks**)

3 Problem III

A beam of 580-nm light passes through two closely spaced glass plates at close to normal incidence as shown in Figure 3. For what minimum nonzero value of the plate separation "d" is the transmitted light bright?(**20 Marks**)

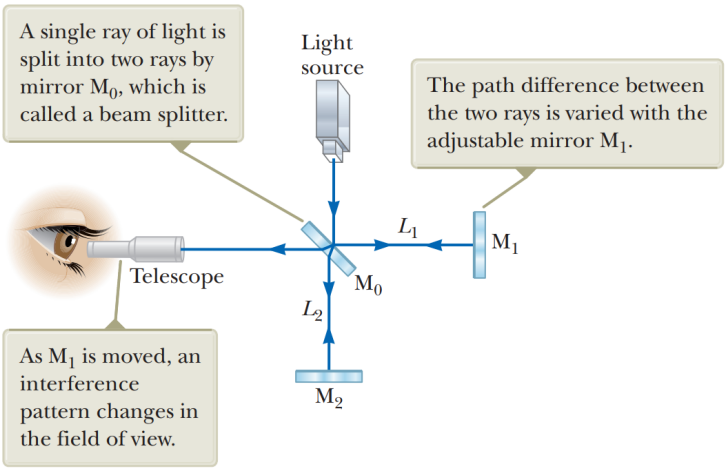

Figure 1: The Michelson Interferometer.

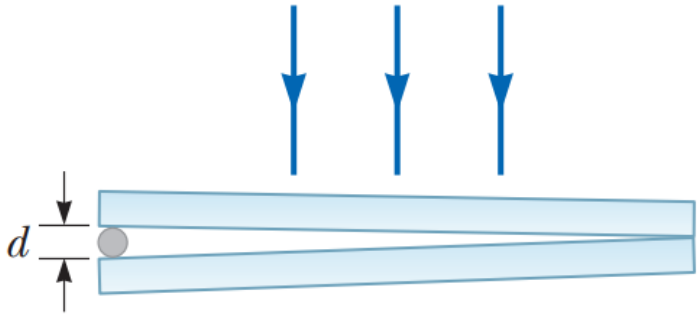

Figure 2: Two-glass plates system

4 Problem IV

In one arm of a Michelson Interferometer (Figure 4), a glass chamber is placed with attachments for evacuating the inside and putting gases in it. The space inside the container is 2 cm wide. Initially, the container is empty. As gas is slowly let into the chamber, you observe that dark fringes move past a reference line in the field of observation. By the time the chamber is filled to the desired pressure, you have counted 122 fringes move past the reference line. The wavelength of the light used is 632.8 nm. What is the refractive index of this gas?(**20 Marks**)

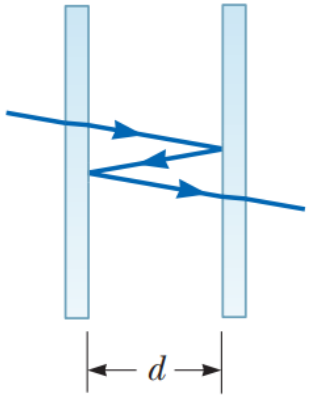

Figure 3: Problem III system

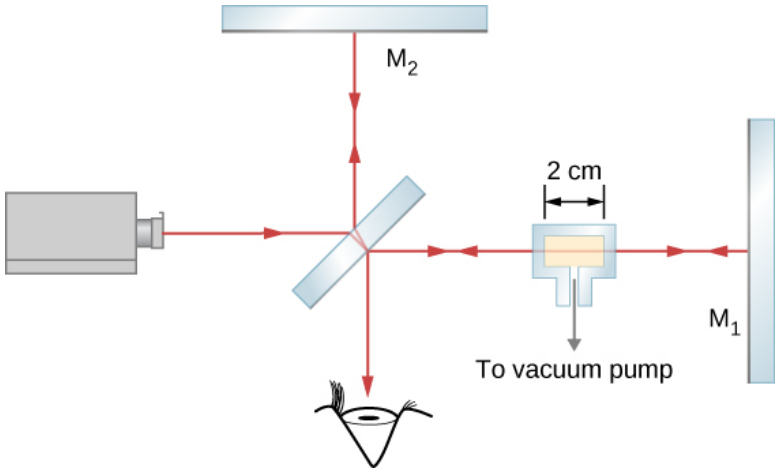

Figure 4: Problem IV system

5 Problem V

Explain the working principle Mach-Zehnder and Michelson Interferometer. (**20 Marks**)