Tutorial 3, Optics: Interference

Q1. Define following: (a) Interference of light, (b) phase, (c) Wavefront (3 x 1 = 3 marks)

Q2. Describe the conditions to observe stationary interference pattern of light. (2 marks)

Q3. Explain techniques of the Division of wavefront and the Division of amplitude to get a fixed phase relationship to observe light interference. (3 marks)

Q4) Explain Young's (double hole) interference experiment and derive the expression of fringe position and fringe width. (5 marks)

Q5.

A viewing screen is separated from a double-slit source by 1.2 m. The distance between the two slits is 0.030 mm. The second-order bright fringe ($m = 2$) is 4.5 cm from the center line.

(A) Determine the wavelength of the light.

(B) Calculate the distance between adjacent bright fringes. (3 marks)

Q6.

A light source emits visible light of two wavelengths: $\lambda = 430$ nm and $\lambda' = 510$ nm. The source is used in a double-slit interference experiment in which $L = 1.50$ m and $d = 0.025\,0$ mm. Find the separation distance between the third-order bright fringes.

(3 marks)

Q7. A thin film of 4 x 10-5cm thickness is illuminated by white light normal to its surface (r = 0˚). Its refractive index is 1.5. Of what colour will the thin film appear in reflected light? (3 marks)

Q8. Describe Michelson Interferometer and write the conditions for constructive and destructive interference. (3 marks)

Q9. Circular fringes are observed in a Michelson interferometer illuminated with light of wavelength 5896 A. When the path difference between the mirrors M1 and M2 is 0.3 cm, the central fringe is bright. Calculate the angular diameter of the 7th bright fringe. (3 marks)

Q 10.

A gas-filled cell of length 5 cm is inserted in one arm of a Michelson interferometer as shown in the figure. The interferometer is illuminated by light of wavelength 500 nanometers. As the gas is evacuated from the cell, 40 fringes cross a point in the field of view. The refractive index of this gas is most nearly?

A. 1.02
B. 1.002
C. 1.0002
D. 1.00002
E. 0.98

(3 marks)

Reference:

Chapter 14, Two Beam Interference by division of wavefront
14.1 Introduction
14.4 Interference of Light waves
14.5 The interference pattern
14.6 The intensity distribution
Chapter 15: Interference by Division of Amplitude
15.1 Introduction
15.2 Interference by Plane parallel Film
15.11 The Michelson Interferometer

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