Tutorial 3

Interference:

- Interference of light-Young's experiment,
- Newton's rings,
- interference by thin films,
- Michelson interferometer;
- Multiple beam interference and
- Fabry-Perot interferometer.

Q1:

In Michelson interferometer, 100 fringes cross the field of view when the movable mirror is displaced through 0·029 mm. Calculate the wavelength of the light source used. 5

2016

Q2:

Obtain the conditions for constructive interference and destructive interference in a thin film due to reflected light. 15

2016

Q3:

Explain with proper example the interferences due to 'division of wavefront' and 'division of amplitude'. 10

2017

Q4:

What is multiple-beam interference? Discuss the advantages of multiple-beam interferometry over two-beam interferometry. Explain the fringes formed by Fabry-Perot interferometer. 15

2017

Q5:

Describe how Michelson Interferometer can be used to determine refractive index of a gas.

In a Michelson Interference experiment, a tube of length 25 cm containing a gas of refractive index μ is introduced between the upper mirror and the beam splitter. 150 fringes cross the centre of the field of view when the wavelength of light used is 5890 Å. Find the value of μ. 20

2018

Q6:

What are the fringes of equal thickness and fringes of equal inclination ?

In a Newton's ring arrangement with a source emitting two wavelengths $\lambda_1 = 6 \times 10^{-7}$ m and $\lambda_2 = 5{\cdot}9 \times 10^{-7}$ m, it is found that the m^{th} dark ring due to one wavelength coincides with the $(m + 1)^{th}$ dark ring due to the other. Find the diameter of the m^{th} dark ring, if the radius of curvature of the lens is 90 cm. *10*

2019

Q7:

Discuss the conditions for interference. Describe Young's double-slit experiment and derive an expression for the estimation of fringe width. Discuss its dependency on various parameters.

Green light of wavelength 5100 Å from a narrow slit is incident on a double-slit. If the overall separation of 10 fringes on a screen 200 cm away is 2 cm, find the slit separation. *20*

2020

Q8:

A thin film of petrol of thickness 9×10^{-6} cm is viewed at an angle 30° to the normal. Find the wavelength(s) of light in visible spectrum which can be viewed in the reflected light. The refractive index of the film $\mu = 1{\cdot}35$. *10*

2021

Q9:

Newton's rings are observed between a spherical surface of radius of curvature 100 cm and a plane glass plate. The diameters of 4th and 15th bright rings are 0·314 cm and 0·574 cm, respectively. Calculate the diameters of 24th and 36th bright rings and also the wavelength of light used. 15

2022

Q10:

(i) What are the requisite conditions for observation of interference pattern on a screen ? *5*

(ii) Derive the expression for fringe width and intensity at a point on the screen in a double slit experiment. *10*

2023

Q11:

In a Young double slit experiment, the first bright maximum is displaced by y = 2 cm from the central maximum. If the spacing between slits and distance from the screen are 0·1 mm and 1 m respectively, find the wavelength of light. *10*

(Asked in Section B) 2013

Q12.

The intensity at the central maximum observed on a screen in a double-slit experiment is 2×10^{-3} W/m^2. If the path difference between interfering waves reaching a point on the screen is $\frac{\lambda}{6}$, where λ is the wavelength of the light used in the experiment, determine the intensity at that point. 10

2024

Q13.

Consider multiple reflections from a plane parallel film of thickness h and refractive index n_2 and derive an expression for the total reflectivity from the surface of the film. *20*

2025