The Open University of Sri Lanka
B.Sc. Degree Programme - Level 05
Final Examination - 2008/2009
PHU 3144: Practical Physics

021

Duration: Two and a Half Hours (2½ Hrs.)

Date: 16.07.2009 **Time: 01.30 pm *to* 04.30 pm**

ANSWER FOUR QUESTIONS ONLY.

1. You are asked to find the wavelength of a monochromatic light by the method of Newton rings.
   (a) Explain the theory of Newton rings.
   (b) Derive the equations required to determine the wavelength of a monochromatic light by the method of Newton rings.
   (c) List the apparatus and accessories required to carry out this experiment.
   (d) Describe briefly the experimental setup with the help of labelled diagrams.
   (e) Describe the experimental procedure and describe how you would obtain the required physical quantities for the determination of the wavelength.

2. A student uses two optically flat glass slides, a travelling microscope and a sodium-lamp along with other necessary apparatus to determine the thickness of a thin wire. In the process, the student has recorded following observations.

   Wavelength of the Sodium Light, $\lambda = 5893$ Å. Length of the Slide, L = 7.00 cm.

Fringe Order	Microscope Reading (cm)
m	5.074
m + 5	5.019
m + 10	4.964
m + 15	4.904
m + 20	4.843
m + 25	4.784
m + 30	4.719
m + 35	4.656
m + 40	4.594

(a) Name the experiment and sketch the experimental setup.

(b) Describe the theory involved in finding the thickness of the thin wire.

(c) Plot an appropriate graph using the given data.

(d) Hence determine the diameter of the wire used by the student.

(e) Discuss the precautions you would take and the methods you would implement to minimize any errors that might occur during the process.

3. You are provided with a sodium lamp and a double slit, and asked to determine the wavelength of sodium light.

(a) List the additional apparatus and accessories required to carry out this experiment.

(b) Discuss briefly the optical phenomenon that happens at the slit and the physical theory that describe the above phenomenon, providing suitable diagrams.

(c) Describe the experimental procedure and list the observations you would make during the process.

(d) Show how you will determine the wavelength of sodium light from the above observations.

(e) Discuss the precautions you would take and the methods you would implement to minimize any errors that might occur during the process.

4. You are provided with a spectrometer, which is set with all preliminary adjustments, and you are asked to determine the wavelengths of the visible spectral lines in the hydrogen spectrum using a diffraction grating.

(a) Describe a method by which a diffraction grating mounted on the levelled prism table could be set normal to the incoming parallel rays.

(b) Derive the equation you would use in this experiment to determine the wavelengths of the spectral lines.

(c) A student recorded following data in a similar experiment.

Spectral Lines	**First Order Diffraction Angle (± 30")**
Blue-green	8^0 23'
Red	11^0 20'

d - spacing = (1/300) mm

Using the given data calculate the wavelengths of both spectral lines.

(d) Estimate the error in your result.

5. You are requested to analyse the state of polarisation of a given light beam.

   (a) What are the apparatus needed to carry out this task?

   (b) Draw a clear labelled diagram of the experimental arrangement.

   (c) What are the possible states of polarisation of light?

   (d) In a similar experiment one student observes that when the light beam passes through the analyser its intensity varies with the orientation of the analyser but never falls to zero. Explain how you would continue this experiment to find the state of polarisation of the incident beam.

   (e) Explain qualitatively what would happen when a beam of plane polarized light passes normally through a quarter-wave plate, in situations where the angle between the plane of polarization and the optical axis of the quarter-wave plate is (i) 0^0 (ii) 45^0 (iii) 90^0.

6. (a) Explain why it is necessary, to set the telescope and collimator of the spectrometer for parallel rays, and to level the prism table of the spectrometer before using it for any measurement.

   (b) Explain, with the help of clear diagrams, how the levelling of a prism table is done.

   (c) Describe the Schuster method to set the telescope and collimator of a spectrometer for parallel rays. Specify a situation where this method is very useful.

   (d) Discuss briefly the types of errors.

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