RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B.Sc. (General) Degree in Applied Sciences
Second Year – Semester II Examination – March / April 2015

PHY 2204 - PHYSICAL OPTICS

Answer **FOUR** questions only Time allowed: **2 Hours**

The permeability of vacuum, $\mu_o = 1.25\times10^{-6}$ N A^{-2}

The permittivity of vacuum, $\varepsilon_o = 8.85\times 10^{-12}$ F m^{-1}

The use of a non-programmable electronic calculator is permitted.

1)

a. On what factors does the refractive index of a medium depend?

(15 marks)

b. Calculate the speed of light in a medium having the relative permittivity and relative permeability of 1.77 and 0.999992 respectively.

(15 marks)

c. Calculate refractive index of the medium.

(15 marks)

d. Derive equation, $n_2\frac{1}{V}-n_1\frac{1}{U}=(n_2-n_1)\frac{1}{R}$ for the refraction at a spherical surface.All the symbols have their usual meanings.

(30 marks)

e. Show that the first and the second focal lengths ofthe spherical surfacesare given by,

$f_1=-\frac{Rn_1}{(n_2-n_1)}$ and $f_2=\frac{Rn_2}{(n_2-n_1)}$ respectivly.

(25 marks)

2)

a. Prove that the equivalent focal length of a two lens system is given by $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$ where f_1 and f_2 are focal lengths of the 1st and 2nd lenses respectively and d is the distance between two lenses.

(40 marks)

b. Derive Newton's relationship for the two lens combination.

(20 marks)

c. Two thin converging lenses of focal lengths f_1 = 15.0 cm and f_2 = 20.0 cm are placed coaxially 5.0 cm apart.

(i) Calculate the equivalent focal length of the system.

(ii) Locate the image of an object placed 15 cm away from the 1st lens.

(iii) Find position of the image if the distance betweenlenses is increased by x.

(40 marks)

3) Consider the superposition of following two waves. $y_1 = ASin(Kx - \omega t)$ and $y_2 = BSin(Kx - \omega t + \theta)$.

a. Show thatthe amplitude of the resultant wave is given by; $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

(25 marks)

b. Two coherent monochromatic light beams of intensities I and $4I$ are superimposed. Calculate the maximum and minimum possible intensities of the resultant beam.

(25 marks)

c. Derive equations for the distance to bright and dark fringes from central fringe ofa double slit interference experiment.

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d. In Young's double-slit experimentabeamelectron is used. What are the possible changed you expect, if the velocity of the electrons is increased? Explain you answer.

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