Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
200 level 2nd Semester Examination – Dec./Jan. 2017/18
SCT 253-1 Physical Optics (Repeat)

Instructions to candidates
Duration: One (01) hour
Number of questions: Two (02)
Answer **all** questions
Mark allocation: 60 marks

1.

a. Using a schematic diagram explain the phenomenon, "Total Internal Reflection".
(08 marks)

b. Derive an equation for the critical angle θ_c associated with total internal reflection using Snell's Law, if the medium which has a lower refractive index has a value of n_1 and the medium which has a higher refractive has a value of n_2.
(06 marks)

c. Modify the equation derived in part "b" above, if the medium of lower refractive index is air.
(04 marks)

d. An optical fiber is shown in Figure 01 below. It consists of a plastic core ($n_1 = 1.64$) which is surrounded by a plastic sheath ($n_2 = 1.59$). A light ray from air is incident on one end of the fiber at an angle θ. The ray is to undergo total internal reflection at point A, where it encounters the core–sheath boundary. Thus there is no loss of light through that boundary. What is the maximum value of θ that allows total internal reflection at A?
(12 marks)

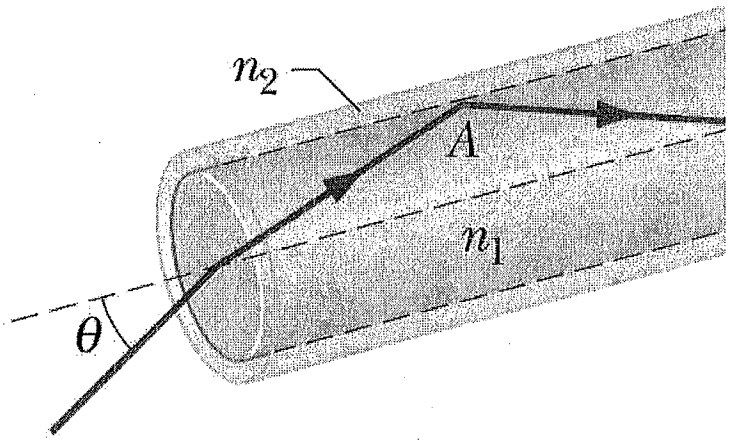

Figure 01

(44)

2.

a. With the aid of diagrams explain what you mean by "Polarization of Light"

(08 marks)

b. How do you transform unpolarized visible light into polarized light ?

(03 marks)

c. Write down equations for one-half rule and cosine-squared rule associated with polarization of light.

(04 marks)

d. Figure 02 below, shows a system of three polarizing sheets in the path of initially un-polarized light. The polarizing direction of the first sheet is parallel to the y-axis, that of the second sheet is at an angle of 30° counter clockwise from the y axis, and that of the third sheet is parallel to the x-axis.

I. What fraction of the initial intensity I_0 of the light emerges from the three-sheet system, and in which direction is that emerging light polarized ?

(10 marks)

II. What fraction of the initial intensity emerges from the system, If the second sheet is removed.

(05 marks)

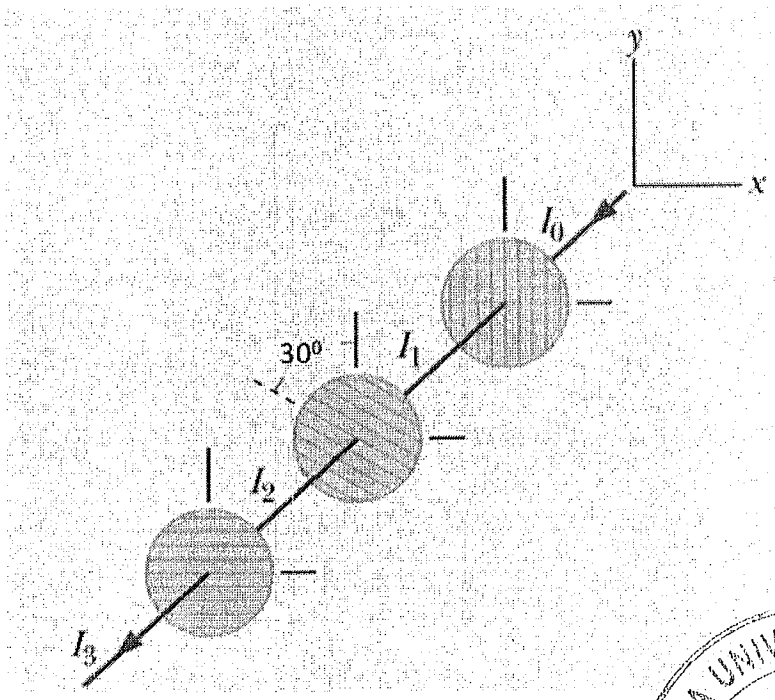

Figure 02