KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPH 121

COURSE TITLE: GEOMETRIC OPTICS

DURATION: 2 HOURS

DATE: 13/07/2021   **TIME: 2:00-4:00PM**

INSTRUCTIONS TO CANDIDATES
- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **3** printed pages. Please Turn Over

Question One (30 marks)

a) State the principle of reversibility of light. (1 mark)

b) What is a Polaroid material? Give an example. (2 marks)

c) Differentiate between white light and monochromatic light. (2 marks)

d) Differentiate between coherent and incoherent sources of light. (2 marks)

e) Explain the following terms as use in laser;

   I) Stimulated emission. (2 marks)

   II) Population inversion. (2 marks)

f) State the two laws of wave reflection. (2 marks)

g) Write down the conditions necessary for the formation of bright and dark fringes during interference of light. (2 marks)

h) Name the characteristics of an image formed by a diverging lens. (2 marks)

i) Name three conditions necessary for interference of light wave to occur. (3 marks)

k) What is laser? Name two application of laser in communication. (3 marks)

l) Write down the Brewster's law and state the meaning of all symbols used. (3 marks)

m) A mosquito is embedded in amber with refractive index of 1.6. One surface of the amber is spherically convex with a radius of curvature 3 cm. The mosquito head happens to be on the central axis of that surface, and when viewed along the axis appears to be buried 5 cm into the amber. How deep is it really? (4 marks)

Question Two (20 marks)

a) In a double slit interference experiment with blue light, the following measurements were obtained;

-Distance of the screen from the double slit=1.82 m

-Slit separation= 0.3 mm

- Distance between six fringes=12 mm.

Find the wavelength of blue light. (4 marks)

b) An object is placed 4 cm in front of two thin symmetrical coaxial lenses with focal length $f_1=+20$ cm and $f_2=+10$ cm with lens separation of 12 cm. Find the;

I) Image distance due to the first lens and state the characteristic of the image formed. (4 marks)

II) Image distance due to second lens and state the characteristic of the image formed. (4 marks)

c) Describe any four properties of light. (8 marks)

Question Three (20 marks)

a) Explain the following concepts as used in laser;

I)   Absorption.   (2 marks)

II) Spontaneous emission.   (2 marks)

b) What are the applications of laser?   (6 marks)

c) State Fermat's principle and use it to show that for a given pair of media, $\dfrac{n_1}{n_2} = \dfrac{Sin\theta_2}{Sin\theta_1}$

where symbols have their usual meanings.   (10 marks)

Question Four (20 marks)

a) What is Brewster angle?   (1 mark)

b) Write down the Brewster's law and state the meaning of all symbols used.   (3 marks)

c) Name any three applications of Brewster angle.   (3 marks)

d) State Fermat's principle and use it to derive the law of refraction.   (10 marks)

Question Five (20 marks)

a) Describe the polarization wave model.   (10 marks)

b) State Fermat's principle and use it to derive the law of reflection.   (10 marks)