



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**FIRST YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS
FOR THE DEGREE OF BSC (PHYSICS)**

COURSE CODE: SPH 121

COURSE TITLE: GEOMETRIC OPTICS

DURATION: 2 HOURS

DATE: 27/09/2021

TIME: 11:00-1:00PM

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 **4** printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

Question One (30 marks)

- a) What is the difference between mechanical and electromagnetic waves? (2 marks)
- b) What is a matter wave? (1 mark)
- c) Name and explain two ways in which waves are classified. (4 marks)
- d) What is reflection of a wave? (1 mark)
- e) State the two laws of wave reflection. (2 marks)
- f) Explain the following terms as used in waves;
- I) Dispersion. (1 mark)
- II) Dissipation. (1 mark)
- III) Interference. (1 mark)
- IV) Diffraction. (1 mark)
- V) Refraction. (1 mark)
- g) 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)
- h) Name three differences between incandescent and laser light. (3 marks)
- i) What is laser? Name two application of laser in communication. (3 marks)
- j) Write down the Brewster's law and state the meaning of all symbols used. (3 marks)
- k) Explain the term 'spherical aberration'. (2 marks)

Question Two (20 marks)

- a) What is a thin lens? (1 mark)
- b) Name the characteristics of an image formed by a diverging lens. (2 marks)
- c) State one condition that will lead to formation of;
- I) Image at infinity. (1 mark)
- II) Real image. (1 mark)
- d) Name three conditions necessary for interference of light wave to occur. (3 marks)

e) 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)

f) 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)

Question Three (20 marks)

a) An object is placed 8 cm in front of a diverging lens of focal length 20 cm. Find its magnification and state two characteristics of the image formed. (5 marks)

b) Using a diagram, explain how a prism deviate a ray of light through 90° . What is the practical application of such an arrangement? (5 marks)

c) Explain the following concepts as used in laser;

I) Absorption. (2 marks)

II) Spontaneous emission. (2 marks)

d) What are the applications of laser in;

I) Industry. (2 marks)

II) Military. (2 marks)

III) Science and technology. (2 marks)

Question Four (20 marks)

a) What is laser? Name any two medical application of laser. (3 marks)

b) What is Brewster angle? (1 mark)

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

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

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

Question Five (20 marks)

a) State a condition that leads to formation of a virtual image in a converging lens. (1 mark)

- b) Explain the following terms as use in laser;
- I) Stimulated emission. (2 marks)
 - II) Population inversion. (2 marks)
- c) Using a diagram, explain how a prism can deviate a ray of light through 180° . What is the practical application of such an arrangement? (5 marks)
- d) State Fermat's principle and use it to derive the law of reflection. (10 marks)