



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS**

**2023/2024 ACADEMIC YEAR**

***FIRST YEAR SECOND SEMESTER***

**SCHOOL OF PURE APPLIED AND HEALTH  
SCIENCES**

**BACHELOR OF SCIENCE AND BACHELOR OF  
EDUCATION (SCIENCE)**

**COURSE CODE: PHY 1208-1**

**COURSE TITLE: GEOMETRIC OPTICS**

**DATE: 16/5/ 2024**

**TIME: 1100-1300 HRS**

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**INSTRUCTIONS TO CANDIDATES**

1. Answer Question **ONE** and any other **TWO** questions
2. *Question one carries 20 marks while each of the others carries 15 marks.*
3. *Credit will be awarded for clear explanations and illustrations.*

*Speed of light in vacuum =  $3.0 \times 10^8$  m/s*

*Index of refraction of air = 1.00*

*Index of refraction of crown glass = 1.52*

*Index of refraction of water = 1.33*

### **QUESTION ONE**

- a) Explain the dual nature of light (2marks)
- b) State two conditions for total internal reflection to occur. (2marks)
- c) Two thin converging lenses of focal lengths  $f_1=10.0\text{cm}$ , and  $f_2=20.0\text{cm}$  are separated by  $20.0\text{cm}$ . An object is placed  $30.0\text{cm}$  to the left of lens 1 (of  $f_1=10.0\text{cm}$ ). Find the position and the magnification of the final image. (5marks)
- d) Construct a ray diagram to correct a person with farsightedness (4marks)
- e) A small fish is at a depth  $d$  below the surface of a pond. what is the apparent depth of the fish as viewed directly overhead from the surface of a pond (3marks)
- f) A converging glass lens of index of refraction  $n=1.52$ , has a focal length of  $40.0\text{ cm}$  in air. Find its focal length when it is immersed in water. (4marks)

### **QUESTION TWO**

- a) State two laws of reflection of light (2marks)
- b) Two mirrors make an angle of  $120^\circ$  with each other. A ray is incident on mirror  $M_1$  at an angle of  $65^\circ$  to the normal. Find the direction of the ray after it is reflected from mirror  $M_2$ . (4marks)
- c) Construct a ray diagram to find the image distance and its description for an object placed  $30.0\text{ cm}$  in front of a converging lens of focal length  $10.0\text{ cm}$  (5marks)
- d) Distinguish between chromatic aberration and spherical aberration in lenses. (4marks)

### **QUESTION THREE**

- a) State the Snell's laws of refraction of light. (2marks)
- b) State any three characteristics of image formed by a plane mirror (3marks)
- c) A light of wavelength  $589\text{nm}$  travels through air is incident on a smooth flat slab of crown glass at an angle of  $30.0^\circ$  to the normal. Find the angle of refraction. (3marks)
- d) i. State Fermat's principle (1mark)  
ii. Use Fermat's principle to derive the Snell's law of refraction (6marks)

### **QUESTION FOUR**

- a) Distinguish between a real image and a virtual image (2marks)
- b) Explain the observation that when light passes from a material with index of refraction  $1.3$  into one with index of refraction  $1.2$  bends away the normal (2marks)
- c) By calculation, determine the location and describe the image form by an object placed at  $5.00\text{cm}$  from a spherical mirror whose focal length is  $+10.0\text{ cm}$ . (5marks)
- d) Explain why it is difficult to see while driving on a rainy night (2marks)
- e) With aid of diagram explain the light dispersion on a prism (4marks)

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