MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
SECOND YEAR SECOND SEMESTER

SCHOOL OF SCIENCES
BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION (SCIENCE)
COURSE CODE: PHY 1208
COURSE TITLE: GEOMETRIC OPTICS

DATE: 29TH APRIL, 2019 **TIME: 2.30- 4.30PM**

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions
2. *Question one carries 30 marks while each of the others carries 20 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

*This paper consists of **4** printed pages. Please turn over.*

QUESTION ONE

a) Explain the duality nature of light (2marks)
b) Explain why it is difficult to see while driving on a rainy night (2marks)
c) State two conditions for total internal reflection to occur. (2marks)
d) Two mirrors make an angle of 120^0 with each other. A ray is incident on mirror M_1 at an angle of 65^0 to the normal. Find the direction of the ray after it is reflected from mirror M_2. (4marks)
e) Two thin converging lenses of focal lengths f_1=10.0cm, and f_2=20.0cm are separated by 20.0cm. An object is placed 30.0cmto the left of lens 1 (of f1=10.0cm). Find the position and the magnification of the final image. (5marks)
f) Distinguish between chromatic aberration and spherical aberration in lenses. (4marks)
g) Construct a ray diagram to correct a person with farsightedness (4marks)
h) A small fish at a depth d below the surface of a pond. what is the apparent depth of the fish as viewed from directly overhead (3marks)
i) A converging glass lens (n=1.52) has a focal length of 40.0 cm in air. Find its focal length when it is immersed in water. (4marks)

QUESTION TWO

a) Use diagrams to illustrate the diffraction effects of light waves that meet a barrier with a circular opening:
   i. Whose diameter is much larger than the light wavelength (2marks)
   ii. Whose diameter is much smaller than the light wavelength (2marks)
b) Distinguish between a real image and a virtual image (2marks)
c) By calculation, locate and describe the image form by an object placed at 5.00cm from a spherical mirror whose focal length is +10.0 cm. (5marks)
d) Explain the working of a compound microscope (5marks)
e) With aid of diagram explain the light dispersion on a prism (4marks)

QUESTION THREE

a) State the Snell's law of refraction of light (2marks)
b) State any three characteristics of image formed by a plane mirror (3marks)
c) 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 toward the normal (2marks)
d) A light of wavelength 589nm travels through air is incident on a smooth flat slab of crown glass at an angle of 30.0^0 to the normal. Find the angle of refraction. (3marks)
e) I. State Fermat's principle (2marks)
ii. Use Fermat's principle to derive the Snell's law of refraction (8marks)

QUESTION FOUR

a) State two laws of reflection of light (2marks)
b) With the aid of ray diagram explain how to correct a person with nearsightedness(myopia) (5marks)
c) Construct a ray diagram to find the image distance and its description for and object placed 30.0 cm in front of a converging lens of focal length 10.0 cm (5marks)
d) Explain how a telescope works (5marks)
e) Find the critical angle for an air-water interface (3marks)

//END