KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF B.SC (PHYSICS)

COURSE CODE: SPC 122

COURSE TITLE: WAVES AND GEOMETRICAL OPTICS

DATE: 12/2/21 **TIME:** 11 – 1 Pm

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

QUESTION ONE (30 MARKS)

a) Define a wave (1 Marks)

b) Differentiate between transverse wave and longitudinal wave giving one example each. (2 Marks)

c) Define the following terms and give their relation formulas.

i. Frequency (1 Mark)
ii. Period (1 Mark)
iii. Wavelength (1 Mark)
iv. Wave speed (1 Mark)

d) Calculate the wavelength of a sound wave with a frequency of 1324Hz at *STP*. The speed of sound waves at *STP condition* is 331m/s. (2 Marks)

e) State the law of reflection. (2 Marks)

f) State Huygens's principle (2 Marks)

g) State four possible things that can happen to the incident light on an interface between two transparent optical media. (4 Marks)

h) In a handheld optical instrument used under water, light is incident from water onto the plane surface of flint glass at an angle of incidence of 45°.

i. What is the angle of reflection of light off the flint glass? (2 Marks)
ii. What is the angle of refraction in the flint glass? (3 Marks)

i) Differentiate between a converging thin lens and a diverting thin lens. (2 Marks)

j) What is resolving power of microscope? (1 Mark)

k) A refracting telescope has a length of 1.20 m from object to ocular. What is the angular magnification if the ocular has a focal length of 2.2 cm? (2 Marks)

l) Give the abbreviation of LASER and give two applications of lasers (2 Marks)

m Define Brewster's angle. (1 Mark)

QUESTION TWO (20 MARKS)

a) Define a travelling wave (1 Marks)

b) Explain the three types of waves giving two examples each (3 Marks)

c) Calculate the velocity of a pulse in a rope of mass per unit length μ = 3.0 kg/m when the tension is 25 N. (3 Marks)

d) A transverse wave in a cord of length L = 3.0 m and mass M = 12.0 g is a travelling at 6000 cm/s. Find the tension in the cord. (3 Marks)

e) Derive the one-dimensional wave equation (10 Marks)

$$\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2}\frac{\partial^2 y}{\partial t^2}$$

QUESTION THREE (20 MARKS)

a) Define simple harmonic motion giving two examples. (2 Marks)

b) A SHM travelling wave of period of T = 3.0 s and wavelength λ= 30 m moves to the right in a long cord. The maximum transverse velocity in the cord is v_{max} = 2.5 cm/s, and the power transmitted by the wave is 0.60 W.

i. Find the velocity of propagation of the wave, v_p (2 Marks)
ii. Find the amplitude of the wave. (2 Marks)
iii. Find the mass per unit length of the cord, μ. (2 Marks)
iv. (d) Find the tension in the cord, S. (2 Marks)

c) A 0.500-kg cart connected to a light spring for which the force constant is 20.0 N/m oscillates on a frictionless, horizontal air track.

i. Calculate the maximum speed of the cart if the amplitude of the motion is 3.00 cm (3 Marks)
ii. What is the velocity of the cart when the position is 2.00 cm? (3 Marks)
iii. Compute the kinetic and potential energies of the system when the position of the cart is 2.00 cm. (4Marks)