LAIKIPIA UNIVERSITY

UNIVERSITY EXAMINATIONS

1ST SEMESTER 2022/2023 ACADEMIC YEAR

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION (SCIENCE)

PHYS 212: WAVES AND OSILLATIONS

STREAM: R ***TIME: 2 HRS***

DAY: WED [11.30AM – 13.30] ***DATE: 21/12/2022***

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.

SECTION A: (Compulsory) TOTAL MARKS FOR THIS SECTION IS 40 MARKS.

QUESTION ONE

(a) Distinguish between oscillations and vibrations. Give one example. (1 mark)

(b) Define periodic motion. (1 mark)

(c) State three characteristics of simple harmonic motion. (3 marks)

(d) State the principle of superposition in waves and give its importance. (1 mark)

(e) Give two conditions for superposition. (2 marks)

(f) Two sounds notes of frequencies 338Hz and 340Hz are sounded together. Find the beat period of the sound note produced (3 marks)

(g) A pipe open at one end of length 1.2m long has sound wave of speed 330m/s incident on to it. Find the frequency of the second harmonics. (3 marks)

(h) State two differences between constructive interference and destructive interference. (2 marks)

(i) What do you understand by beat frequency? (1 marks)

(j) Write down an equation that relates path difference and phase difference. define all the symbols used. (2 marks)

(k) Explain four characteristic of a wave? (8 marks)

(l) What is damped simple harmonic motion. Give one example. (2 marks)

(m) Distinguish between transverse and longitudinal waves. (2 mark)

(n) The frequency of a car horn is measured by a stationery observer as 200Hz when the car is at rest. Find the measured frequency if the car is approaching the observer at aspeed of 30m/s. take the speed of sound in air to be 330m/s. (3 marks)

(o) Show that the amplitude of a standing wave is given by A=2Acoskx. (3 marks)

(p) Define Doppler effect? (1 mark)

(q) Consider a simple harmonic motion whose displacement is defined by the equation

$$x = A\sin(\omega t - \varphi)$$

Show that its linear acceleration is given by $a = -\omega^2 x$ (2 marks)

QUESTION TWO

(a) Distinguish between free and forced vibrations. Give one example of each. (4 marks)

(b) Show that for non – dissipative system executing simple harmonic motion, the total mechanical energy of the system is conserved. (3 marks)

(c) Give three examples of simple harmonic oscillators. (3 marks)

(d) What do you understand by wave motion? (1 mark)

(e) Name two characteristics of wave motion. (3 marks)

(f) Define the following terms as used in the study of waves

(i) Amplitude. (1 mark)
(ii) Time period. (1 mark)

QUESTION THREE

(a) Illustrate the existence and nature of normal modes using relevant example. (10 marks)

(b) Derive the characteristic impedance of a transmission line. (10 marks)

QUESTION FOUR

(a) consider the given progressive wave equationwith units in SI

$y=2\sin 2\Pi(t/0.01 - x/30)$ (10 marks)

(i) The direction of the wave
(ii) Amplitude
(iii) Period
(iv) Wavelength
(v) Speed

(b) Show that the wave equation given as $y=a\sin kx-wt$ may be written in the alternative form of $y=a\sin \omega(xv- t)$. Hence or otherwise, write the equation for a wave travelling in the negative x direction and having amplitude of 0.01 m, a frequency of 550 Hz and speed of 330 m/s. (5 marks)

QUESTION FIVE

(a) When a simple harmonic wave is propagated through a medium, the displacement of a particle (in cm) at any instant of time is given by
$y=10\sin 2\Pi 100(36000t - 20)$.

Calculate the amplitude of the vibrating particle, wave velocity, wavelength, and time period. (10 marks)

(b) Two wave motion travelling in opposite direction may be represented as
$y_1= A\sin k (vt-x)$ and $y_2=A\sin k (vt+ x)$

Find an expression for their resultant. (5 marks)