MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS 2021/2022

FIRST YEAR, SECOND SEMESTER EXAMINATION FOR DEGREE OF BACHELOR
OF SCIENCE IN PHYSICS, BACHELOR OF SCIENCE IN PHYSICS AND MATHS,
BACHELOR OF SCIENCE IN PHYSICAL SCIENCE, BACHELOR OF EDUCATION
SCIENCE, BACHELOR OF PHYSICS/MATHS, BACHELOR OF PHYSICS/CHEMISTRY
AND BACHELOR OF PHYSICS/COMPUTER
AND
SECOND YEAR, SECOND SEMESTER EXAMINATION FOR DEGREE OF
BACHELOR OF EDUCATION SCIENCE

SPS 3153: WAVES AND VIBRATIONS

DATE: MAY 2022   **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

a) State any two properties of simple Harmonic motion   (2 Marks)

b) Define amplitude as applied in simple harmonic motion   (1 Mark)

c) The frequency of a body undergoing SHM is 2Hz and the amplitude is 0.2 m. Find

    i.   Maximum angular velocity   (3 Marks)

    ii.   Maximum acceleration   (2 Marks)

d) State the factors required for superposition of any two progressive waves to produce beats

(3 Marks)

e) State any 4 characteristics of a progressive wave   (4 Marks)

f) A spring carrying a mass of 100 g is oscillating with a periodic time 0.1 second. Find the

spring constant   (4 Marks)

g) The equation of a progressive wave is given by $y = 2sin2\pi(\frac{t}{0.02} - \frac{x}{24})cm$. Find the velocity

of the wave   (5 Marks)

h) A wave has a wavelength of 1.6 m, find the phase angle between two particles that are 0.4 m apart (3 Marks)

i) Sound waves travelling in air in the same direction meet at a point. The first loud note is heard when the path difference is 12 cm and 16 cm respectively. If the frequency of the source was 1200 Hz. Find the velocity of sound in air (3 Marks)

QUESTION TWO (20 MARKS)

a) The equation of a progressive wave is given by $y = 0.4 \sin 200\pi(t - \frac{x}{24})m$. Find

    i.   Amplitude (2 Marks)

    ii.   Velocity (1 Mark)

    iii.   Wavelength (5 Marks)

    iv.   Maximum Particle velocity (5 Marks)

b) Suppose that the wave in part (a) is travelling through water of density 1000 Kg/m^3, find

    i.   Energy density of the wave (3 Marks)

    ii.   Kinetic energy per cycle (2 Marks)

    iii.   Potential energy per cycle (2 Marks)

QUESTION THREE (20 MARKS)

A particle of mass 2.0 Kg exhibiting Simple Harmonic Motion has its displacement along x direction represented by the equation $x = 5cos(1.8t + \frac{\pi}{4})m$. Find

    i.   Amplitude (2 Marks)

    ii.   Angular Frequency (1 Mark)

    iii.   Frequency (2 Marks)

    iv.   Period (2 Marks)

    v.   Phase angle (1 Marks)

    vi.   Equation of the velocity of the body (3 Marks)

    vii.   Equation of the acceleration of the body (3 Marks)

    viii. Spring constant (3 Marks)

    ix.   Total energy of the system (3 Marks)

QUESTION FOUR (20 MARKS)

a) A tuning fork sends a sound wave through a medium of density 0.8 Kg/m^3. The wave propagation is represented by the equation $y = 3.2sin100\pi(t - \frac{x}{20})m$. Find the intensity of the wave. (7 Marks)

b) The frequencies of three tuning forks are 400, 401 and 402 Hz. The forks are sounded together producing waves of the same amplitude. Find the frequency of the beats produced (13 Marks)