AJAYI CROWTHER UNIVERSITY, OYO

FACULTY OF NATURAL SCIENCES,

DEPARTMENT OF PHYSICS

COURSE CODE: PHY 3210. COURSE TITLE: CLASSICAL MECHANICS II 2 CREDITS

SEMESTER: SECOND SEMESTER EXAMINATION. SESSION: 2021/2022

EXAMINER'S NAME: Dr. C. O. OGUNKOYA DATE: DURATION: 3HRS

INSTRUCTION: ANSWER ANY **FOUR** QUESTIONS

QUESTION 1

a. Define the term "Frame of Reference" (5 marks)
b. Highlight the postulates of special theory of relativity (5 marks)
c. Find the equation of motion of a simple harmonic oscillator using Lagrange's method if a force $F_o \sin wt$ is acting on it. (7.5 marks)

QUESTION 2

a. What is Galilean Transformation? (4 marks)
b. Consider a bulb of mass M attached with an inextensible and massless string. The length of the pendulum is l. assuming the effect of air is negligible on the motion of the pendulum. Find the equation of motion of the simple pendulum using Lagrangian method (13.5 marks)

QUESTION 3

a. Define the term "Degree of Freedom" (5 marks)
b. Determine the Degree of Freedom for the following:
i. A double pendulum (3 marks)
ii. A dumbbell in 2-dimensional plane (3 marks)
iii. 2 free particle in 3-D plane (3.5 marks)
iv. Simple pendulum (3 marks)

QUESTION 4

a. Explain what you understand by Hamiltonian (5 marks)
b. Solve the one dimensional harmonic oscillator by Hamiltonian method. Hence determine the Hamiltonian of the system (12.5marks)

QUESTION 5

a. Define the term 'Generalized Coordinate' (5 marks)
b. What is Constraint? (5 marks)

c. A certain particle has a life time of $2 \times 10^{-6}\ sec$. What is the mean life time when the particle is travelling with speed of $3 \times 10^{8}\ m/s$? How far does it go during one mean life? (7.5 marks)

QUESTION 6

a. Highlight five (5) properties of generalized coordinate (5 marks)
b. A certain process required 10^{-6} sec to occur in an atom at rest in Laboratory. How much time will this process require to an observer in the Laboratory, when the atom is moving with the speed of $5 \times 10^{7}\ m/s$ (4.5 marks)
c. With appropriate examples, distinguish between the types of reference frame(8 marks)

1.014×10^{-6}