NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCE

2020_2 EXAMINATIONS

COURSE CODE: PHY 301
COURSE TITLE: CLASSICAL MECHANICS II
CREDIT UNIT: 3
TIME ALLOWED: (2½ HRS)

INSTRUCTION: *Answer question 1 and any other four questions*

QUESTION 1

(a) Differentiate between holonomic and non-holonomic constraints   (4marks)
(b) What is constraint?   (2marks)
(c) Write a Lagrangian equation of one dimensional harmonic oscillator   (5marks)
(d) What is Legendre transform?   (2marks)
(e) What is non-inertial reference frame?   (2marks)
(f) Use the Kepler's first law in polar coordinates to describe the space for
    p>1, p = 0 and p< 1   (7marks)

QUESTION 2

(a) Differentiate between fixed and rotating reference frame.   (4marks)
(b) For the elliptical wire, write the constraint equation in x and y with
        and without the displacements and differentiating the two.   (6marks)
(c) Write a constraint equation for elliptical wire.   (2marks)

QUESTION 3

(a) Use the Lagrangian to construct the Hamiltonian for the system.   (3marks)
(b) Write a Lagrangian equation in Cartesian coordinate.   (3marks)
(c) Mention three (3) criteria that satisfy virtual displacement.   (6marks)

QUESTION 4

(a) Differentiate between virtual displacement and virtual work.   (4marks)
(b) Use the generalized equation of motion prove the Euler-Lagrangian equation(6marks)
(c) What is Classical Hamiltonian?   (2marks)

QUESTION 5

    (a) Draw a diagram of Atwood machine. (3marks)

    (b) Differentiate between rheonomic and scleronomic constraints. (4marks)

    (c) Use Kepler's second law expression for angular momentum and prove the Kepler's third law (5marks)

QUESTION 6

    (a) State D' Alembert's Principle. (2marks)

    (b) Differentiate between Hamiltonian and Lagrangian methods. (4marks)

    (c) Generate the Hamiltonian's equation of motion using the classical Hamiltonian. (6marks)