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)