

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2015/2016**

**FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE**

**DEGREE OF MASTER OF SCIENCE IN PHYSICS**

 **SPH 3102: QUANTUM MECHANICS**

**DATE: APRIL, 2016 TIME: 3 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE (COMPULSORY, 30 MARKS) AND ANY OTHER TWO QUESTION (20 MARKS EACH)**

1. a) i) Distinguish between classical mechanics and quantum

 mechanics in terms of the state of a system. [3 marks]

 ii) State the properties of a linear operator [3 marks]

b) Obtain the commutation brackets. [6 marks]

 ;  ; 

c) Show that  = 0. Hence  =  = 0 [6 marks]

d) i) Prove that  = 0 [4 marks]

 ii) State any two Hermitian operators that give real

 eigenvalues. [2 marks]

e) Prove whether orbital angular momentum operator  is

 Hermitian or not. [6 marks]

1. Write down the orbital angular momentum operators

   in spherical polar coordinates and use the results

to determine =   in spherical polar coordinates. [20 marks]

1. By considering a hydrogen like atom with only a single electron

remaining. Calculate the lowest order and the energy splitting

in the presence of a uniform electric field. [20 marks]

1. a) Explain six properties of a wave function. [12 marks]

b) Discuss application of quantum mechanics to

 the science community. [8 marks]