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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS**

**SEPTEMBER/OCTOBER 2015 EXAMINATION**

**SCHOOL OF SCIENCE AND TECHNOLOGY**

**COURSE CODE: PHY 309**

**COURSE TITLE: QUANTUM MECHANICS I**

Time: 2hrs

**Instructions:** Answer any five questions

1. (a) Check if the set is linearly independent. (b) Show that the set is a linearly independent.

2. Find the inner product of the following vectors:

(a) (b) ix2+2 and 2x - 3i, 0 x 2.

3. Find the norm of the followings (a) (b) ix2 + 2, 0 x 1 (c) normalize each vector in the set .

4. (a) Write the function h(*x*) = as a sum of odd and even functions. (b) Show that sin*mx* and sin *nx* are orthogonal, m (c) If the matrix is Hermitian, find the value of *y*.

5. (a) Given the matrix , find the corresponding eigenvectors and eigenvalues. (b) Find the expectation value of a matrix operator, in state . (c) Calculate

6. (a) Find the maximum kinetic energy with which an electron is emitted from a photometal of work function 3.2 *x*10-39 J when a radiation of energy *E* = 3.313 *x*10-39 J falls on it, given that the work function is 3.2 *x*10-39 J. (b) What value does Rayleigh-jeans formula predict for the radiation f frequency 6*x*1013Hz emitted by a blackbody per unit time, per unit area at 2500K. Compare ths value with that predicted by Planck.

7. (a) By solving the time-dependent Schroedinger equation for a free particle (V = 0), find the condition imposed on the angular frequency and the wavenumber. (b) By applying the method of separation of variables, solve the differential equation