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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE AND APPLIED SCIENCE**

**APRIL/MAY2019 EXAMINATIONS**

**COURSE CODE: PHY 312**

**COURSE TITLE: MATHEMATICAL METHODS FOR PHYSICS II**

**CREDIT UNIT 3**

**TIME ALLOWED (2½ HRS)**

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

**QUESTION 1**

1. Give a general expression for a second order linear partial differential equation with two

independent variables x and y. [2 marks]

(b). Eliminate A and P from the function *Z* *Ae pt* sin *px*. [4 marks]

(c). Find the Fourier coefficients of the periodic function.

f(x) = - k when - π< x< 0 and f(x) = k when 0< x< π. Also f (x +2π) = f(x) [4 marks]



(d) (i) Write the Bessel differential equation. [2 marks]

(ii) Write the Associated Laguerre equation and associated Laguerre Polynomials. [2 marks]

(iii) Give integral representation of the Hermite polynomial. [1 mark]

(e) Define the periodic function. Give four examples. [3 marks]

(f) Evaluate the integral  in terms of J0(x) and J1(x). [4 marks]

**QUESTION 2**

(a). Find the Fourier series of the sine function represented by f (x) = 0 for x ≤ 2 and f (x) = 2 for x > 2 the points ( 0, 3). **[9 marks]**

(b) Solve the equation this equation:

 [**3 marks]**

**QUESTION 3**

**a).** *Obtain the solution of the equation *

which represents the forced vibrations of a damped oscillator with representing the damping constant, F(t) the external force and m and k representing the mass of the particle and the force constant respectively. **[6 marks]**

**(b)** Write the Laplacian operator **[2 marks]**

(c) Write the first three polynomials of the associated Laguerre Polynomials **[4 marks]**

**QUESTION 4**

(a) Write down the expression for the Neumann function **[3 marks]**

(b) Solve the radial part of the Schrodinger equation **[9 marks]**

**QUESTION 5**

(a) Find the period of tan x. **[3 marks]**

(b) Find the Fourier series for the for f(x) = ex on (0, π) **[4 marks]**

(c) Find the Fourier integral of f(x) = x2 for – π ≤ x ≤ π **[5 marks]**

**QUESTION 6**

**(a).** Write the formula for the generating function for Laguerre polynomials **[ 3 marks]**

**(b)** . Derive the **Rodrigues formula** for the Laguerre polynomials **[9 marks]**