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

(a) 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 $\int x^4 J_1(x)dx$ in terms of $J_0(x)$ and $J_1(x)$.   [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:

$$\frac{\partial^2 u}{\partial x^2} - 7\frac{\partial^2 u}{\partial x \partial y} + 6\frac{\partial^2 u}{\partial y^2} = 0$$

     [**3 marks**]

QUESTION 3

a). *Obtain the solution of the equation* $m\frac{d^2 x}{dt^2} + \Gamma \frac{dx}{dt} + kx(t) = f(t)$

which represents the forced vibrations of a damped oscillator with Γ 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 $f(x) = e^x$ on $(0, \pi)$ **[4 marks]**

(c) Find the Fourier integral of $f(x) = x^2$ for $-\pi \leq x \leq \pi$ **[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]**