****

**NATIONAL OPEN UNIVERSITY OF NIGERIA**

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

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE AND APPLIED SCIENCE**

 **JULY 2018 EXAMINATIONS**

**COURSE CODE: PHY 312**

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

**CREDIT UNIT 3**

**TIME ALLOWED (21/2 HRS)**

**INSTRUCTION: *Answer question one (1) and any other four (4) questions***

**QUESTION 1**

1. ai) Give the general form of a second order linear partial differential equation with two independent variables $x$ and $y$. [2marks]

aii) State when this equation is said to be

1. Homogeneous [2marks]
2. Elliptic [2marks]
3. Hyperbolic [2marks]
4. Parabolic [2marks]

b) Define the term ‘periodic function’ and give three examples each of periodic function and phenomena. [4 marks]

c) Find the Fourier coefficients of the periodic function having the period of $2π$

$f\left(x\right)=\left\{\begin{matrix}-k, -π<x<0\\k, 0<x<π\end{matrix}\right.$ [4 marks]

d )Given the values of $J\_{0}\left(2\right)=0.22389$and $J\_{1}\left(2\right)=0.57672$, find the value of $J\_{4}\left(2\right)$. [4 marks]

**QUESTION 2**

2. a) Solve the partial differential equation

$\frac{∂^{2}u}{∂x^{2}}-5\frac{∂^{2}u}{∂x∂y}+6\frac{∂^{2}u}{∂y^{2}}=0 $[5 marks]

b) Use the Laplace transform to solve the problem

 $\frac{ ∂u}{∂t}=3\frac{∂^{2}u}{∂x^{2}}$ [7 marks]

With the boundary conditions $ u\left(0,t\right)=u\left(3,t\right)=0$, $u\left(x,0\right)=10\sin(2πx)-6\sin(4πx)$

**QUESTION 3**

3. a) Prove that $y\left(x,t\right)=A\left(2x+3t\right)+B(2x-3t)$ is a general solution of

$9\frac{∂^{2}y}{∂x^{2}}=4\frac{∂^{2}y}{∂t^{2}}$ [6 marks]

b) Find the Fourier sine series for

$f\left(x\right)=\left\{\begin{matrix}\begin{matrix}0, x\leq 2\\2, x>2\end{matrix}&on (0,3)\end{matrix}\right.$ [6 marks]

**QUESTION 4**

4.a) Prove that the period of $\tan(x)=π$ [6 marks]

b) Define the half-range Fourier series for a $f\left(x\right)$ and give the respective functions representing the even and odd periodic functions of period$ T=2l$. [6 marks]

**QUESTION 5**

5. Given the periodic function $f\left(x\right)=a\_{0}+\sum\_{n=1}^{\infty }(a\_{n}\cos(nx)+b\_{n}\sin(nx))$, assuming $f\left(x\right)$ has a

 period of $2π$

1. Find the coefficient $a\_{0}$ [6 marks]
2. Find the coefficient $a\_{n}$ [6 marks]

**QUESTION 6**

1. a)State Fourier theorem [3 marks]

b) Find the Fourier series for $f\left(x\right)=x^{2}$, $0<x<2π$ [9 marks]