CHUKA UNIVERSITY

COLLEGE

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE / BACHELOR OF EDUCATION SCIENCE

PHYS 314: MATHEMATICAL PHYSICS 1

STREAM: BSC. B.ED SICE Y3S1 **TIME: 2 HOURS**

DAY/DATE: TUESDAY 18/12/2012 **8.30 A.M. – 10.30 A.M**

INSTRUCTIONS:

Answer question ONE and any other TWO questions
Use of calculative & SMP tables are allowed.

1. (a) Define a differential equation and give an example using a physical phenomenon. [3 Marks]

   (b) State the three main coordinate systems and give the relationship between the candidates in the three systems. [6 Marks]

   (c) Define the legendre of polynomial,the Bessel functions the gamma and give examples of their applications in physics. [6 Marks]

   (d) Differentiate between eigenvalues and eigerfunction. [4 Marks]

   (e) Write the sturn – liosville equation. [2 Marks]

   (f) State the cauchys theorem. [2 Marks]

   (g) List the six main techniques of integrations. [3 Marks]

   (h) Differentiate between a complex number and a complex variable. [3 Marks]

   (i) What is a parametric equation? [1 Mark]

2. (a) Evaluate $\int_0^{'} 2x\, e^{3x} dx$ [8 Marks]

(b) An electrical circuit contains inductance L and resistance R connected to a constant voltage source E. the current is given by the differential equation.

$$E - L\,\frac{di}{dl} = Ri$$

Where L and R are constants. Find the current in terms of time t given that when

t=0, i=0. [12 Marks]

3. (a) A particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $\mathbb{Z} = 3t - 5$. where t is the time. Find the components of velocity and acceleration at the time t=1 in the direction. $\boldsymbol{j}$= 3$\boldsymbol{j}$ + 2**k**. [10 Marks]

(b) Show that for all values of θ, real or complex

$\cos\theta = \frac{e^{i\theta} + e^{-1\theta}}{2}$ and $\sin\theta = \frac{e^{i\theta} - e^{-i\theta}}{2i}$. [10 Marks]

4. (a) Use logarithmic differentiations to differentiate :

$$y = \frac{4\epsilon^{-2x}\ \sec x}{\left(x^2 + \frac{1}{2}\right)^{3/2}}$$ [10 Marks]

(b) If $\mathbb{Z}$= f (x , y) and $\mathbb{Z} = x\ \cos(x + y)$

Find: $\frac{\partial^2 \mathbb{Z}}{\partial\, x^2}$ *and* $\frac{\partial^2 \mathbb{Z}}{\partial y^2}$

Hence show that:

$$\frac{\partial^2 \mathbb{Z}}{\partial x \partial y} = \frac{\partial^2 \mathbb{Z}}{\partial y\ \partial x}$$ [10 Marks]

5. Show that the Laplace equation is given by:

$\nabla^2 \emptyset = \frac{1}{p}\frac{\partial}{\partial p}\left(p\,\frac{\partial \emptyset}{\partial p}\right)' + \frac{1}{p^2}\frac{\partial^2 \emptyset}{\partial \emptyset^2} + \frac{\partial^{2} \emptyset}{\partial \mathbb{Z}^2} = 0$ in cylindrical coordinates. [20 Marks]
