NATIONAL OPEN UNIVERSITY OF NIGERIA
14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS
SCHOOL OF SCIENCE AND TECHNOLOGY
JUNE/JULY EXAMINATION

COURSE CODE: MTH421
COURSE TITLE: Ordinary Differential Equation
TIME ALLOWED:3HOURS
INSTRUCTION: ANSWER EQUATION ONE AND ANY OTHER FOUR. (TOTAL 5 QUESTIONS)

1.
Test for Exactness and solve

$$x\frac{dy}{dx}+3x+y=0=0$$ 7marks

b. Solve the differential equation

$$\frac{dy}{dx}+y\tan x=\sin(2x)$$
$$y(0)=1$$
7marks

2 a) When will a set of points A of the xy plane said to be **CONNECTED**? 3marks

b) When is a set of points A of the xy plane said to be **OPEN?** 3marks

c) What do you call an **OPEN** and **CONNECTED** set in the xy plane? 2.5marks

d) When is a point P said to be a **BOUNDARY POINT** of a domain D? 3marks

e) What will you call a **DOMAIN PLUS** its **BOUNDARY POINTS**? 2.5marks

3.a Solve the differential equation. $2xy\frac{dy}{dx}=y^2-x^2.$ 7marks

$$\frac{d^2y}{dx^2}+\frac{dy}{dx}+9.04\,y=0,\ y(0)=0,\frac{dy(0)}{dx}=3$$

b. Solve the initial valued problem

7marks

4a. $$\frac{d^2y}{dx^2}+\frac{dy}{dx}-20\,y=0,,,,,,,,,,,,,,,\ y(0)=4,\ldots\frac{dy(0)}{dx}=-5$$

7marks

$$\frac{d^2y}{dx^2}-6\frac{dy}{dx}+25\,y=0,\ y(0)=-3,\frac{dy(0)}{dx}=-1$$

4b. Solve the initial value problem

7marks

$$\frac{d^3y}{dx^3}-2\frac{d^2y}{dx^2}-\frac{dy}{dx}+2\,y=0$$

5a. .Solve the equation

10marks

5b. Show that the solution to question [4a] are linearly independent.

4marks

6 Solve the initial value problem

$$\frac{d^2y}{dx^2}+2\frac{dy}{dx}+5\,y=e^{5x}+10\cos 10x-120\sin 10x.$$

$$,\ y(0)=0.10,\frac{dy(0)}{dx}=30.10$$

14marks

7a. find the non-trivial solution of the sturm-Liouville problem.

$$\frac{d^2y}{dx^2}+\lambda y=0$$
$$y(0)=0=y(\pi)$$ 7marks

7b. Find the characteristics value and the characteristics function of the Sturm-Liouville problem.

$$\frac{d}{dx}\left[x\frac{dy}{dx}\right]+\frac{\lambda}{x}y=0$$
$$y'(0)=0, y'(e^{2x})=0$$ 7marks

λ is non-negative i.e λ $=0$

Where it is assumed that the parameter

and λ >0.