Kasarani Campus
Off Thika Road
Tel. 2042692 / 3
P. O. Box 49274, 00100
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212
Fax: 4444175

KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION, 2020/2021 ACADEMIC YEAR
SECOND YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(MATHEMATICS)

Date: 16th December, 2020
Time: 8.30am – 10.30am

KMA 303 - INTRODUCTION TO ORDINARY DIFFERENTIAL EQUATIONS

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE (COMPULSORY)** AND **ANY OTHER TWO** QUESTIONS

QUESTION ONE (30 MARKS)

a) By eliminating the constants a and b find the differential equation whose solution is $y = ae^{2x} + be^{-3x}$, (5 Marks)

b) Using the variables separation method solve the differential equation
$\sin x \cos y dx + \cos x \sin y dy = 0$. (5 Marks)

c) Show that the following differential equation is exact and find its general solution.
$(3xy^4 + x)dx + (6x^2y^3 - 2y^2 + 7)dy = 0$ (5 Marks)

d) Solve the Bernoulli's differential equation $\frac{dy}{dx} + y = xy4$ (5 Marks)

e) The population of Kasarani constituency in 1964 and 1970 was 12,000and 18000 respectively. Find the year when the population was 513,000, given that the rate of growth of the population is directly proportional to the population. (5 Marks)

f) Solve the following differential equation
$(y + x^3)dx - xdy = 0$ (5 Marks)

QUESTION TWO (20 MARKS)

a) Solve the inhomogeneous differential equation $(x + 2y + 1)dx + (3x + 6y + 5)dy = 0$. (10 Marks)

b) Apply the method of variation of parameters to solve the equation

$$\frac{d^2y}{dx^2} + y = \sec x$$ (10 Marks)

QUESTION THREE (20 MARKS)

a) Solve the equation $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 12\frac{dy}{dx} - 8y = e^x + e^{3x}$ (10 Marks)

b) Solve the following system of differential Equations

$$2\frac{dy}{dt} - y + x + \frac{dx}{dt} = 0$$

$$3\frac{dy}{dt} + x - y + \frac{dx}{dt} = e^t$$ (10 Marks)

QUESTION FOUR (20 MARKS)

a) A company is using Newspaper advertising to introduce a new product to a community of 50,000 people. It was assumed that the rate at which people learn about the new product is proportional to the product of the number of people who have heard about it and the number of people who have not heard about it. If 100 individuals were aware of the product initially and 500 people were aware about it after 10 days of the campaign. Find the number of people who will be aware of product after 20 days

(10 Marks)

b) Find the power series solution of the equations $y''-2xy'+y=0$ in powers of x

(10 Marks)

QUESTION FIVE (20 MARKS)

a) By finding a suitable integrating factor , solve the equation $(3xy-y^2)dx+x(x-y)dy=0$

(10 Marks)

b) i) Define orthogonal trajectories

(1 Mark)

ii) Find and sketch the orthogonal trajectories of the family of curves represented by . . the differential equation $ydx - xdy = 0$

(9 Marks)