



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR
SECOND YEAR SECOND SEMESTER
MAIN EXAMINATION
FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE

COURSE CODE: MAA 224

COURSE TITLE: ORDINARY DIFFERENTIAL EQUATIONS I

DATE: 7/10/201

TIME: 2:00 PM - 4:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

- a) Classify each of the following ordinary differential equations by stating their order, degree and linearity.

i. $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{d^3y}{dx^3}\right)^{10} + 5y = 5x^2$

ii. $\frac{d^3y}{dx^3} + 4\frac{dy}{dx} = x^2 y$ (4 marks)

b) Solve $\frac{d^2y}{dx^2} + 25y = 0$ (2 marks)

- c) Form a differential equation whose general solution is given by the equation

$$y = A e^{-4x} + Bx + C \quad (3 \text{ marks})$$

- d) Find particular solution of

$$\frac{d^2y}{dx^2} = \cos x; \text{ when } x = 0, y = 1 \text{ and } \frac{dy}{dx} = 1 \quad (5 \text{ marks})$$

- e) Prove that the following ordinary differential equations is homogeneous and find its solution.

$$x^2 dy - (x^2 + xy + y^2) dx = 0 \quad (5 \text{ marks})$$

f) Solve the linear differential equation $\frac{dy}{dx} + y \cot x = \sec x$ (5 marks)

g) Solve $(x^3 + 2y)dx + (3x^2y - 6x)dy = 0$ (6 marks)

QUESTION TWO (20 MARKS)

- a) Solve the following ordinary differential equation using the method of integrating factors;

i. $\frac{dy}{dx} + \frac{3x+1}{x}y = e^{-3x}$ (5 marks)

ii. $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ (7 marks)

- b) Use the method of variation of parameters to solve

$$\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = e^{3x} \quad (8 \text{ marks})$$

QUESTION THREE (20 MARKS)

- a) Solve the Bernoulli's equation $\frac{dy}{dx} - \frac{1}{x}y = xy^2$ (6 marks)
- b) Use the method of undetermined coefficients to solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - 4y = 3xe^{2x}$ (7 marks)
- c) Use operator method to solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} - 10y = \sin 2x$ (7 marks)

QUESTION FOUR (20 MARKS)

- a) Test for exactness and solve the following ordinary differential equation
 $(ye^{xy} - 2y^3)dx + (xe^{xy} - 6xy^2 - 2y)dy = 0$ (7 marks)
- b) Solve the following Bernoulli's equation
 $4x^2 \frac{d^2y}{dx^2} + 8x \frac{dy}{dx} + y = 0$ (4 marks)
- c) A metal bar at a temperature of 100°C is placed in a room at a constant temperature of 0°C . If after 20 minutes, the temperature of the bar is 50°C , find the time it will take the bar to reach a temperature of 25°C . (7 marks)
- d) Find orthogonal trajectories to the circle $x^2 + y^2 = 25$. (2 marks)

QUESTION FIVE (20 MARKS)

- a) Test for homogeneity and solve the following ordinary differential equations
- i. $(x^3 + y^3)dx - 3xy^2dy = 0$ (7 marks)
- ii. $(x + 2y - 1)dx + (3x + 6y)dy = 0$ (6 marks)
- b) Solve $\frac{d^3y}{dx^3} - 4\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 18y = 0$ (5 marks)
- c) Define the term Wronskian of functions. (2 marks)

END