



ALOPE UNIVERSITY
COLLEGE
Bastion of Knowledge...

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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2021 /2020 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF
EDUCATION SCIENCE/ARTS

COURSE CODE: MAT 205

COURSE TITLE: ORDINARY DIFFERENTIAL
EQUATIONS I

DATE: 22nd JULY, 2021

TIME: 1:00PM- 4:00PM

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVER

REGULAR –MAIN EXAM

MAT 205: ORDINARY DIFFERENTIAL EQUATIONS I

STREAM: BED

DURATION: 3 Hours

INSTRUCTION TO CANDIDATES

- i. Answer **ALL** questions from **section A** and any **THREE** from **section B**
- ii. Do not write on the question paper.

SECTION A [31 MARKS] ANSWER ALL QUESTIONS

QUESTION ONE [16 MARKS]

- a) Define the terms
 - i. Ordinary differential equation [1mk]
 - ii. Partial differential equation [1mk]
- b) Find a differential equation to represent the family of the curves $y = Ae^x + Be^{-x} + C$ [4mks]
- c) Solve the differential equation $e^x(1+x^2)\frac{dy}{dx} - 2x(1+e^y) = 0$ [4mks]
- d) Use the integrating factor method to solve $(x^2 + 1)\frac{dy}{dx} + 2xy = x^2$ [6mks]

QUESTION TWO [15 MARKS]

- a) Show that $(12x + 5y - 9)dx + (5x + 2y - 4)dy = 0$ is exact. Hence solve it [4mks]
- b) Solve the differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 29y = 0$, given that at $x = 0$, $y = 0$, $\frac{dy}{dx} = 15$ [6mks]
- c) Find the general solution of $(D^2 + 9)y = \cos 3x$ [5mks]

SECTION B: 39 MARKS [ATTEMPT ANY THREE QUESTIONS]

QUESTION THREE [13 MARKS]

- a) The displacement x of a particle moving in a straight line at time t is given by the relation $x = A \sin(\mu t + k)$, obtain the differential equation to represent the phenomenon. [2mks]
- b) Show that $x dy - y dx = \sqrt{x^2 + y^2}$ is homogeneous hence solve it. [11mks]

QUESTION FOUR [13 MARKS]

- a) Solve $(1 + xy)y dx + (1 - xy)x dy = 0$ by transforming it first into exact form. [6mks]
- b) Solve $\left(\frac{dy}{dx}\right)^2 - 2\frac{dy}{dx} \sinh(x) - 1 = 0$ [7mks]

QUESTION FIVE [13 MARKS]

- a) Find a particular integral for the differential and hence find its general solution $(D^2 - 4D + 3)y = e^{4x}$ [7mks]
- b) Solve the following homogeneous linear differential equation $x^3 \frac{d^3 y}{dx^3} + 3x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} = 24x^2$ [6mks]

QUESTION SIX [13 MARKS]

Solve the simultaneous differential equations

$$\begin{aligned} \frac{dx}{dt} + 4x + 3y &= t \\ \frac{dy}{dt} + 2x + 5y &= e^t \end{aligned} \quad [13mks]$$

QUESTION SEVEN [13 MARKS]

Solve $(D^2 - 3D + 2)y = 0$ by the method of undetermined coefficients (Find a power series solution) [13mks]