MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF APPLIED SCIENCES

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

THIRD YEAR **FIRST** SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE
BACHELOR OF SCIENCE IN MATHEMATICS AND ECONOMICS

AMM 304 – ORDINARY DIFFERENTIAL EQUATIONS I

DURATION: 2 HOURS

DATE: 6TH DECEMBER, 2017

TIME: 2.00 – 4.00 P.M.

Instructions to Candidates:

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION ONE - COMPULSORY

QUESTION ONE (30 marks)

(a) Classify the differential equations below

i) $\frac{d^2y}{dx^2} + 2y\frac{dy}{dx} + 2y = x^2 + 4x$

ii) $3y\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 2y = 0$ (1 mark)

(b) Set up a differential equation whose general solution is $y = cx^2 - 3x$ where c is an arbitrary constant (3 marks)

(c) Use the D-Operator method to find the solution to the indefinite integral

$\int e^{3x} cosx dx$ (5marks)

(d) Find the general solution to the first order differential equations below

i) $(y - xy)dx - 2xy^2dy = 0$ (3 marks)

ii) $x\frac{dy}{dx} + y = x^5y^3$ (6 marks)

(e) The number of bacteria in a liquid culture is observed to grow at a rate proportional to the number of cells present. At the beginning of the experiment, there are 5,000 cells and after two hours, there are 100,000 cells. Assuming that this growth rate continues

i) Set-up the differential equation and the initial conditions describing this growth (2 marks)

ii) Solve the differential equation in part (i) above to find the number of cells present at any later time (5 marks)

(f) Find the general solution to the second order differential equation

$\frac{d^2y}{dx^2} - \frac{2dy}{dx} + 10y = 0$ (4 marks)

SECTION TWO – ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 marks)

(a) Find the general solution to the differential equation

$\frac{dy}{dx} = \frac{2xy+3y^2}{x^2+2xy}$ (6 marks)

(b) Find the series solution to the differential equation

$\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - y = 0$ (14 marks)

QUESTION THREE (20 marks)

(a) Find the general solution to the differential equation

$\frac{dy}{dx} + \frac{2y}{x} = \frac{sinx}{x^2}$ (5 marks)

(b) Find the particular solution to the differential equation

$(2xy^3 + 8x)dx + (3x^2y^2 - 6y^2 + 1)dy = 0$ given the y(1) = 1 (6 marks)

(c) Use the D-Operator method to find the general solution to the differential equation

$3\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 8y = e^{5x}$ (9 marks)

QUESTION FOUR (20 marks)

(a) Use the method of variation of parameters to find the general solution to the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 5y = 2x$ (10 marks)

(b) Use the method of undetermined coefficients to find the general solution to the differential equation $2\frac{d^2y}{dx^2} + \frac{dy}{dx} - 10y = Sin\ x$ (10 marks)

QUESTION FIVE

(a) Find the general solution to the equi-dimensional equation $x^2y^{"} - 3xy^{'} + 4y = x^2$ (10 marks)

(b) Find the general solution to the system of first order ordinary differential equations below

i) $\frac{dx}{dt} = 6x - 3y$

ii) $\frac{dy}{dt} = 2x + y$ (10 marks)