



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR
THIRD YEAR FIRST SEMESTER
SPECIAL/ SUPPLEMENTARY EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MA1314

COURSE TITLE: ORDINARY DIFFERENTIAL EQUATION

DATE: 03/02/2021

TIME: 11 AM -1 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

- a) The slope at any point of a curve is $2x + 3y$. If the curve passes through the origin, determine its equation. (5 Marks)
- b) Given that $y = x$ is a solution of $x \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = 0$ at $x \neq 0$. Find the general solution of $x \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = x$ (4 Marks)
- c) Prove that $L[\text{Sin}(at)] = \frac{a}{s^2 - a^2}$ (4 Marks)
- d) By use of separable variables, solve first order differential equation $(1-x)dy + (1-y)dx = 0$ (4 Marks)
- e) Solve a homogeneous equation $xdy - ydx = \sqrt{x^2 + y^2} dx$. (4 Marks)
- f) Solve a differential equation below which is reducible homogeneous form .
 $\frac{dy}{dx} = \frac{x - y + 3}{2x - 2y + 5}$ (6 Marks)
- g) Define the following terms as used in ordinary differential equations. (3 Marks)
- (i) Operator
 - (ii) Partial Differential Equation
 - (iii) Linear Differential Equation.

QUESTION TWO (20 MARKS)

- a) Solve $(D^3 - D^2 - 6D)y = x^2 + 1$ (7 Marks)
- b) Apply partial differential method to solve $z^2(p^2x^2 + x^2) = 1$ (8 Marks)
- c) Evaluate the functional $I = \int_0^1 \left[y^2 + \left(\frac{dy}{dx} \right)^2 \right] dx$ by calculus variations along the paths (i) $y = x^2$ (ii) $y = (e^x - 1)(e - 1)$ (5 Marks)

QUESTION THREE (20 MARKS)

- a) Find the Laplace transforms of the following functions.
- (i) $f(x) = e^{ax}$ (5 Marks)
 - (ii) $f(x) = \text{Sinh}(ax)$ (7 Marks)
- b) Solve the function $y = yp^2 + 2px$ given that the function is solvable for y only and
 $y = f(x, p), f(x, p, c) = 0, f(x, y, p) = 0, p = \frac{dy}{dx} = Q\left(x, p \frac{dp}{dx}\right)$ (5 Marks)
- c) How long does it take for a given amount of money to double at 6% interest rate per annum compounded
- (i) Annually. (1 Marks)
 - (ii) Continuously. (2 Marks)

QUESTION FOUR (20 MARKS)

- a) Solve a homogeneous differential equation $(D^3 + 1)y = \text{Cos}2x$ when $Q(x) = b\text{Sin}(ax)\dots\text{or}\dots b\text{Cos}(nx)$ (10 Marks)
- b) Using Multiplier method, solve $\frac{dx}{x(y^2 - z^2)} = \frac{dy}{-y(z^2 + x^2)} = \frac{dz}{z(x^2 + y^2)}$ (10 Marks)

QUESTION FIVE (20 MARKS)

- a) Compound Z is formed when two chemicals X and Y are combined. The resulting reaction between the two chemicals is such that each gram of X , $4g$ of Y is used. It is observed that 30grams of compound Z is formed in 10Minutes . Determine the amount of Z at any time if the rate of reaction is proportional to the amount of X and Y remaining when initially there were 50grams of X and 32grams of Y . How much compound Z is present after 15Minutes . Interpret the solution as $t \rightarrow \infty$ (10 Marks)
- b) Find the Inverse transforms of $\frac{5s + 2}{(s - 2)^2 + 13}$ (4 Marks)
- c) In each of the following types of equation write two examples. (6 Marks)
- (i) First Order Differential Equations
 - (ii) Second Degree Differential Equations
 - (iii) Ordinary Differential Equations