



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2010/2011
INSTITUTE OF OPEN LEARNING

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE, ARTS
AND BACHELOR OF EDUCATION**

SMA 335: ORDINARY DIFFERENTIAL EQUATIONS I

DATE: THURSDAY 3RD FEBRUARY 2011

TIME: 8.00 A.M- 10.00 A.M

INSTRUCTIONS: Answer Question ONE and any other TWO

QUESTION ONE (30 MARKS)

- Q1. a) i) Differentiate between a Primitive equation and a differential equation. [3 marks]
- ii) Form the differential equation from the equation $y = c_1 \cos bx + c_2 \sin bx$. by eliminating the arbitrary constants. c_1 and c_2 where b is a parameter. [5 marks]
- b) Solve the differential equation
- i) $y^1 = y^2 + 1$ [4 marks]
- ii) $(2y^4 + x^4)dx - xy^3dy = 0$ [4 marks]
- c) Use the method of undetermined co-efficient to solve the equation.
 $y'' + 9y = e^{-x}$ [4 marks]
- d) Find a series solution about the point $x = 0$ of the d.e $y'' - 4y = 0$.
Using the power series method. [5 marks]
- e) Determine orthogonal trajectory obtained from the family of curves
 $cy^2 + x^2 = 4$. [5 marks]

QUESTION TWO (20 MARKS)

- Q2. a) Explain each of the following terms
- i) Degree and order of a differential equation. [3 marks]
 - ii) The general solution of a differential equation of order n.
- b) Show that the transformation $y = vx$ reduces the equation given below into a separable equation and hence solve it.
- $$2x^3 + y^2 dx - 3xy^2 dy = 0. \quad [10 \text{ marks}]$$
- c) Test for exactness and hence solve it.
- $$(y^3 + 2x)dx + (3xy^2 + 1)dy = 0 \quad [7 \text{ marks}]$$

QUESTION THREE (20 MARKS)

- Q3. a) Solve the differential equation
- $$(D^4 - 6D^3 + 7D^2 + 16D + 60)y = 0 \text{ given that one root is of the form } (4 - 2i) \quad [6 \text{ marks}]$$
- b) Solve the initial value problem $y''' - 2y'' - 5y' + 6y = 0$ subject to the condition $y(0) = 4$, $y'(0) = 11$ and $y''(0) = 17$ [6 marks]
- c) A certain radioactive material is known to decay at a rate proportional to the amount present. If initially 500mg of the material is present and after 3 years, 20% of the original mass has decayed, find
- i) an expression of the amount present at any time t. [4 marks]
 - ii) the amount remaining after 25 years. [2 marks]
 - iii) the half life of the material [2 marks]

QUESTION FOUR (20 MARKS)

- Q4. (a) Use the method of undermined co-efficient to solve the differential equation $y'' + 9y = 81x^2 + 18x + 45$. [8 marks]
- b) Use the variation of parameters method to solve the differential equation $y'' + 4y' + 4y = 4x^2 e^{2x}$ [7 marks]
- c) Solve the Bernoulli's equation $xy' + y = xy^3$ [7 marks]

QUESTION FIVE (20 MARKS)

- Q5. (a) Determine whether $y = \frac{1}{x}$ is a solution of the differential equation
$$y' + y^2 = 0.$$
 [3 marks]
- (b) The solution to the differential equation $y'' - 2xy' - 2y = 0$ is of the form
 $y = c_1y_1 + c_2y_2$ where y_1 and y_2 are the two linearly independent solutions. Use the power series method to solve the differential equation at $X_0 = 0$. Give the first terms in y_1 and y_2 .
- (c) Solve the *d.e*
- i) $4y'' - 12y' + 9y = 0$ [5 marks]
- ii) $y'' - 2y' + 3y = 0$ [5 marks]