



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER
SCIENCE

BACHELOR OF SCIENCE IN STATISTICS & PROGRAMMING.

BACHELOR OF SCIENCE IN MATHEMATICS

BACHELOR OF EDUCATION (SCIENCE)

BACHELOR OF EDUCATION ARTS

SMA 335/300: ORDINARY DIFFERENTIAL EQUATION I

DATE: 9/8/2016

TIME: 8:30 – 10:30 AM

INSTRUCTION TO CANDIDATES

ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS

QUESTION ONE COMPULSORY (30 MARKS)

a) Give the order of the given differential equation

i) $xy\left(\frac{d^2y}{dx^2}\right)^3 - y^2 \sin x = 0$ (2 marks)

ii) $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dx^2}$ (2 marks)

b) Solve $x\frac{dy}{dx} = 5x^4 + 4x^2 + 2x$ by direct integration (4 marks)

c) Find the general solution to $(D^3 - 3D + 2)y = 0$ (4 marks)

d) Find the general and singular solution of $y = px + \frac{a}{p}$ (4 marks)

e) Test for exactness and hence solve the following differential equation
 $(4x + 3y + 1)dx + (3x + 2y + 1)dy = 0$ (4 marks)

f) Reduce the given differential equation to homogenous form and solve it
 $(2x + 3y - 5)\frac{dy}{dx} + (3x + 2y - 5) = 0$ (10 marks)

QUESTION TWO (20 MARKS)

a) Form the differential equation associated with $ay^2 = x^2$ (3 marks)

b) Use the method of undetermined coefficient to solve
 $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 4x^2$ (7 marks)

c) Find the orthogonal trajectories of the family $x^2 + 3y^2 = cy$. Find that member of the orthogonal trajectories which passes through the point (1,2). (10 marks)

QUESTION THREE (20 MARKS)

a) Find the general solution corresponding to the equation $(D^2 + 4)y = \sin^2 x$ (6 marks)

b) Find a suitable integrating factor and solve the equation
 $xydx - (x^2 + 2y^2)dy = 0$ (7 marks)

c) Apply the method of separation of variables to solve
 $\frac{dy}{dx} + xy = xy^3$ (7 marks)

QUESTION FOUR (20 MARKS)

a) Verify that $Ax^2 + By^2 = 1$ is the solution to $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ (10 marks)

- b) If the population of a country doubles in 50 years. In how many years will it triple under the assumption that the rate of increase is proportional to the number of inhabitants? (10 marks)

QUESTION FIVE (20 MARKS)

- a) Find the differential equation of the family $y = Ae^{2x} + Be^{-2x}$ (4 marks)
- b) Define and solve the given first order differential equation.

$$x^2(x^2 - 1)\frac{dy}{dx} + x(x^2 + 1)y = x^2 - 1 \quad (16 \text{ marks})$$