MURANG'A UNIVERSITY COLLEGE

A constituent college of Jomo Kenyatta University of Agriculture and Technology

University Examination 2015/2016

SUPPLEMENTARY EXAMINATION FOR THE DIPLOMA OF SCIENCE IN ENGINEERING –YEAR 2

SEE 1207: ENGINEERING MATHEMATICS IV

DATE: 27th JUNE 2016 **TIME: 2 HOURS**

Instructions: Attempt question **One** and any other **Two** questions

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Question One (30 Marks)

(a) Define and give an example of an ordinary differential equation (3 mks)

(b) Solve $\frac{dy}{dx} = \frac{2x^2}{y^3}$ (3 mks)

(c) (i) Show that $(3x^2 + 4xy)\,dx + (2x^2 + 2y)\,dy = 0$ is exact (3 mks)

(ii) Solve the differential equation in c(i) above (4 mks)

(d) Show that $y = e^{4t}$ is a solution to the differential equation $y^1 - 4y = 0$ (3 mks)

(e) Solve $x\frac{dy}{dx} + y = x^2$ (5 mks)

(f) Solve

$\frac{d^3y}{dx^3} + 10\frac{dy}{dx} + 25y = 0$ (3 mks)

Question two (20 marks)

(a) Define homogeneous equation of first order (3 mks)

(b) (i) Show that $\frac{xy}{x^2+y^2}$ is a homogeneous function in x and y (3 mks)

(ii) Using the method of separation of variables solve the equation in 2(b)(i) above (6mks)

(c)Suppose that a differential equation has a regular singular point $x_o = 0$ and has indicial roots r = -1 and r = 2 suppose further that the recurrence relation for the coefficients for the first solution y_1 is as follows $a_n = \frac{-(n+1)}{n(n+3)}a_n - 1$. Let $a_o = 1$ and find y_1 (8mks)

Question three (20 marks)

(a) Define Bernoulli equation (2 mks)

(b) Solve $\frac{dy}{dx} - y = 4y^5$ (8 mks)

(c) Solve the equation (10 mks)

$\frac{d^4y}{dx^4} + 2\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} = \sin 3x$

Question four (20 marks)

(a) The point xo = 0 is an ordinary point of the differential equation

$(1 - x^2)\, y^{11} - 2y^1 + 3y = 0$. Begin the process of finding a series solution for this differential equation. Find the recurrence relation for the coefficients a_n (10 mks)

Solve the initial value problem (10 mks)

$\frac{dy}{dx} = \frac{y^2+4x^2}{4xy}$, y(1) = 2

Question five (20 marks)

(a) Show that $y_1 = x^2$ is a solution to the differential equation.

$x^2y^{11} - (x^2 + 4x)y^1 + (2x + 6)y = 0$

Also find its second linearly independent solution in y_2 (10 mks)

b) Solve the following differential equation (10 mks)

$xy^1 + 4y = x^3y^2$