



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
BACHELOR OF SCIENCE IN ELECTRICAL & ELECTRONIC ENGINEERING
BACHELOR OF TECHNOLOGY IN RENEWABLE ENERGY
BACHELOR OF TECHNOLOGY IN APPLIED PHYSICS

SMA 2278/AMA 4303: ORDINARY DIFFERENTIAL EQUATIONS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: AUGUST 2016

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Find the particular solution of the function and express the solution in its simplex form:

$$\frac{1+x^2}{1+y^2} = \frac{dy}{dx}$$

$$\text{if } y(0) = 3$$

(4 marks)

$$\frac{dy}{dx} - \frac{1}{2}y = \frac{3}{2}$$

b) Using separable functions, solve

$$\text{with } y(0) = 4$$

(3 marks)

$$f(xy), e^{y/x} + \tan \frac{y}{x}$$

c) Show that

is homogeneous

(3 marks)

$$y \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + y = 0 \quad y(0) = 1, \quad y'(0) = 0$$

d) Solve

(4 marks)

$$(D^2 + 5)(\sin 4x)$$

e) Evaluate (2 marks)

$$(x^4 - x^2)y'' + (2x + 1)y' + x^2(x + 1)y = 0$$

f) Locate the singular points of the differential equation (4 marks)

g) Using a system of linear differential equations, find a general solution of the system:

$$x' = y$$

$$y' = 2x + y$$

(5 marks)

h) Solve the following Bernoulli equation: (5 marks)

$$y' + y = exy^{-2}$$

Question Two

$$x^2 \frac{dy}{dx} - xy = 5x^6$$

a) Solve given that $y = -10$ when $x = 1$ (4 marks)

$$(3xy^4 + x)dx + (6x^2y^3 - 2y^2 + 7)dy$$

b) Show that is an exact differential and find its general solution (7 marks)

c) Solve the differential equation:

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$$

(4 marks)

d) Determine:

$$L^{-1} \left\{ \frac{15s + 1}{s^2 - s - 12} \right\}$$

(5 marks)

Question Three

$$y'' + y = 0 \quad y_1 = \cos x \quad y_2 = \sin x$$

a) Show that and are linearly independent solutions of the differential equation (3 marks)

b) Determine the singular points and determine the to the differential equation:

$$(1 - x^2)y'' + y' + y = 0$$

(10 marks)

$$x^2 + y^2 dx + 2xy dy = 0$$

c) Show that the differential equation if $y(1) = 1$ (7 marks)

Question Four

$$xy' = y + \sqrt{x}$$

a) Solve the equation (5 marks)

b) Using separable functions solve the equation:

$$y' = \frac{-2xy + 2x}{x^2 + 1}$$

(4 marks)

$$y'' + 4y' + 3y = 30e^{2x}$$

c) Use the method of undermined coefficient to find (7 marks)

$$y' = (x + y)^2$$

d) Solve the equation (4 marks)

Question Five

$$y'' - 16y' = 0$$

a) Find the general solution of (4 marks)

$$(D + 1)(D - 1)y = 16e^{3x}$$

b) Determine the general solution to (8 marks)

c) Find the particular solution of using assumed integral method of:

$$y'' + 5y' - y = x^2 - 3x - 35$$