



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**DIPLOMA IN ARCHITECTURE
DIPLOMA IN CIVIL ENGINEERING**

AMA 2207: ORDINARY DIFFERENTIAL EQUATIONS (ODE)

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Mathematical tables/Calculator*
- *Laplace Table*

This paper consists of **FIVE** questions in two sections **A & B**

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

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1

a) Determine Laplace transform of the following

$$L\{\cos(-2t)\}$$

(i)

$$L\{\frac{3}{4}t\}$$

(ii)

$$L\{e^{-t} \cos 3t\}$$

(iii)

$$L\{\frac{5}{3}e^{-2t} \sin 3t\}$$

(iv)

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

(10 marks)

b) Given the differential equation,

(i) Test for exactness,

$$y(0) = 3.$$

(ii) Solve the differential equation at

(10 marks)

$$y' + 2y + y = \tan x$$

c) Solve the differential equation,

(10 marks)

SECTION B (Answer any TWO questions from this section)

Question 2

$$y' + 3y - 10y = 5x^2$$

a) Find a particular solution to the differential equation

(10 marks)

$$\ddot{x} + 5\dot{x} + 6x = 4t$$

b) Use Laplace transform to solve,

given that $t = 0$, $x = 0$ and $\dot{x} = 0$.

(10 marks)

Question 3

$$(3x^2y - 1)dx + (x^3 + 6y - y^2)dy = 0$$

a) Solve the following initial value problem,

given $y(0) = 3$

(8 marks)

$$\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6x = 5$$

b) Solve,

(8 marks)

$$(3e^x y + x)dx + e^x dy = 0$$

c) Solve the initial value problem,

given $y(0) = 1$

(8 marks)

Question 4

a) Use Laplace transforms to determine the solution of the initial value problem,

$$y'' - 2y + 5y = 0, \quad \text{given, } y(0) = -1, y'(0) = 7 \quad (10 \text{ marks})$$

$$f(x) = x^3 - 4x + 2$$

b) Find the Laplace transform of the function, (5 marks)

$$y'' - y = 0$$

c) Give the general solution of the differential equation (5 marks)

Question 5

$$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} = 6e^{2x}$$

a) Solve, (8 marks)

$$\frac{d^2y}{dt^2} - 4x = 24 \cos 2t,$$

b) Using Laplace transform to solve the following differential equations, given

$$\frac{dx}{dt} = 4$$

that $t = 0, x = 3$ and

(8 marks)

$$L^{-1} \left\{ \frac{s+4}{s(s-2)} \right\}$$

c) Evaluate the following, (4 marks)