THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING
(HD A08)

MATHEMATICS (O.D.E)

SEMESTER III EXAMINATION

SERIES: APRIL/MAY 2010

TIME : 2 HOURS

Instructions to candidates:

You must have the following for this examination:
- Answer booklet
- Scientific Calculator / S.M. P table

This paper consists of **FIVE** questions
Answer question **ONE** from section **A** and any other **TWO** questions from section **B**.
Attached find the abridged Laplace Transform table.

Question One

a) Solve completely for q2 leaving your answer with arbitrary constants.

$$\frac{dq^1}{dt} + q_1 + q_2 = 4Cos\,4t$$

$$\frac{dq_2}{dt} + q_2 = q_1$$ (10marks)

b) Determine the laplace transfer of : $f(t) = e\lambda^2 t$ from first principles. (5marks)

c) Determine the laplace transform of :

$$\frac{e^{8t} - 1}{t}$$ (7marks)

d) Solve the following differential equation using D- operator method or method of undetermined coefficient.

$\frac{d^2x}{dt^2} + 400x = 10Cos\,20t$ given that $t = 0, x = 0, \dot{x} = 100$. (8marks)

Question TWO

a) Determine the inverse la place transform of :

i) $$\frac{7s^2 - 6s - 64}{(s - 2)(s + 4)(s - 4)}$$

ii) $$\frac{26 - s^2}{s(s^2 + 4s + 13)}$$ (12marks)

b) Solve the following by la place transform method.

$\frac{d^2x}{dt^2} - 4x = Cosst$ given that t= 0, x =2, $\frac{dx}{dt}$ = 3 (8marks)

Question THREE

a) Use D-operator method to solve the following differential equations leaving the answer with answer with arbitrary constants

$\frac{d^2y}{dx^2}$ + 2$\frac{dy}{dx}$ + 2y = 5 sin x . (7marks)

b) Solve completely by D- operator method

$(D^2 - 4D + 3)y = x^2 + e^{2x}$ given that $x = 0,\ y = -1,\ \dot{y} = 0$ (13marks)

Question FOUR

a) State the Cauchy linear equation. (1mark)

b) Given that x= e^z, express the differential equation

$x^2 \frac{d^2y}{dx^2} + \frac{dy}{dx} + y = Sin\,(Inx)$ in the form $a^2 \frac{d^2y}{dz^2} +\ b\frac{dy}{dz}$ + cy = $f(z)$ where a, b, and c are constants. (7marks)

c) Solve the differential equation $x^2 \frac{d^2y}{dx^2} +\ x\frac{dy}{dx}$ + y = Sin ($l$nx)

given that when x = 1, y= 10, $\frac{dy}{dx} = \frac{19}{2}$ (12marks)

Question FIVE

a) State the lagendre linear equation. (1mark)

b) Given that $ax + b = e^z$., show that

(ax +b) $\frac{dy}{dx}$ = (ax +b) Dy = $a\frac{dy}{dz}$ and

(ax + b)^2 $\frac{d^2y}{dx^2}$ = (ax+b)^2 D^{2}y = a^2 $\left(\frac{d^2y}{dz} - \frac{dy}{dz} \right)$ (8marks)

c) Using b above , solve the differential equation

(3x + 2)^2 $\frac{d^2y}{dx^2}$ + 3 (3x +2) $\frac{dy}{dx}$ -36y = 3x^2 + 4x + 1 (13marks)