



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MEDICAL ENGINEERING

AMA2251: ENGINEERING MATHEMATICS IV

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 9 May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

- a) An inductor, resistor and capacitor are connected all in series to a supply voltage E_0
- derive an equation involving current and time
 - solve for charge and current given that $E_0 = 40V$, $C = 250_F$, $L = 50mH$, and $R = 30$. take $i = 0$ and $q = 0$
 - iii) from the circuit calculate the voltage across the components involved.

(10 marks)

b) Use Laplace transform to solve $2 \frac{d^2x}{dt^2} + 3 \frac{dx}{dt} - 5x = 6 \sin 2t$

(10 marks)

c) Solve the following differential equation

i. $\frac{dy}{dx} = \frac{3}{x} - \frac{y}{x}$

ii. $2y(1-x) = -(x+xy) \frac{dy}{dt}$

(10 marks)

Question TWO

- a) Use Laplace transform to solve the following differential equation $\frac{d^2x}{dt^2} + 6 \frac{dx}{dt} + 8x = 0$ given that $x(0) = 4$ and $x'(0) = 8$

(10 marks)

b) A body executes damped forced vibrations defined by the equation

$\frac{d^2y}{dx^2} + 2k \frac{dy}{dx} + b^2y = e^{-kt} \sin \omega t$. Solve the differential equation for the following conditions

- i. $\omega^2 = b^2 - k^2$
- ii. $\omega^2 \neq b^2 - k^2$

(10 marks)

Question THREE

Using the substitution $x = e^t$

a. Express the differential equation $x^2 \frac{d^2y}{dx^2} - 2y = x + 1$ in the form

$$a \frac{d^2y}{dx^2} + b \frac{dy}{dx} + cy = f(t)$$

b. Solve the equation in (a) above taking $y = y$, $x = 1$ and $y' = 0.5$

(20 marks)

Question FOUR

a) Solve $\frac{d^2x}{dt^2} - 4 \frac{dx}{dt} + 3x = t^3$

(10 marks)

b) Solve the following simultaneous equation using Laplace transform given that $t = 0$, $x = 4$, $y = 2$
 $x' = y' = 0$

$$\frac{d^2x}{dt^2} + 2x = y$$

$$\frac{d^2y}{dt^2} + 2y = x$$

(10 marks)

Question FIVE

a) Solve the following differential equations

i. $x - y + x \frac{dy}{dx} = 0$

ii. $\frac{dy}{dx} + x = 2y$

(10 mark)

b) Determine the inverse Laplace transform for the following

i. $\frac{5s^2 - 2s - 19}{(s+3)(s-1)^2}$

ii. $\frac{2s^2 - 9s - 35}{(s+1)(s-2)(s+3)}$

(10 marks)