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: 2HOURS

DATE: 9May2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attemptquestion 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 Eo
   i. derive an equation involving current and time
   ii. solve for charge and current given that Eo = 40V , C = 250_F, L = 50mH, and R = 30. take i = 0 and q = 0
   iii. iii) form 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)