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

<u>Instructions to Candidates</u>
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) The current flowing in an electric circuit is given by the $Ri + L\frac{di}{dt} = E$ where R, L and E are constants. Using Laplace transform, solve for current given $t = i = 0$ (10 marks)

b) Solve the following differential equations
  i. $2y(1 - x) = -(x + xy)\frac{dy}{dx}$
  ii. $\frac{dy}{dx} = \frac{3}{x} - \frac{x}{y}$ (10 marks)

c) Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - 4y = 3\sin x$ given that $x = y = y' = 0$ (10 marks)

Question TWO

a) Determine the inverse Laplace transform of the following
  i. $\frac{3s^2 + 16s + 15}{(s+3)^3}$
  ii. $\frac{3 + 6s + 4s^2 - 2s^3}{s^2(s^2 + 3)}$ (10 marks)

b) Solve the following simultaneous equations using Laplace transform taking t = x = y = 0

$$\frac{dy}{dt} + x = 1$$

$$\frac{dx}{dt} - y + 4e^t = 0$$
(10 marks)

Question THREE

a) An inductor of 2H and a resistor of 200Ω are connected in series to an emf of 100 sin 150t. Determine the current in the circuit at any given time taking t = i = 0 (10 marks)

b) Solve the following equation using Laplace transform $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 3e^x \cos 2x$ taking $y(0) = 2$
(10 marks)

Question FOUR

Solve

a) $\frac{x+y}{y-x} = \frac{dy}{dx}$

b) $(y^2 + 2)\frac{dy}{dx} = 5y$

c) $\frac{dy}{dx} + x = 2y$

d) $(y^2e^{xy^2} + 4x^3)dx + (2xye^{xy^2} - 3y^2)dy = 0$ (10 marks)

Question FIVE

a) Solve $5\frac{d^2y}{dx^2} + 9\frac{dy}{dx} - 2y = 3e^x$ (10 marks)

b) Use Laplace transforms to solve $\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 8x = 0$ taking $x(0) = 4$ and $x'(0) = 8$
(10 marks)