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:DECEMBER2016

TIME:2HOURS

DATE:9Dec2016

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) A constant emf of $20V$ is applied across a circuit of resistance 600Ω, inductance $20H$, and capacitance of $250\mu F$.

i) derive an equation for charge across the circuit

ii) given that $q = 0$, $i = 0$ use **Laplace transforms** to solve for charge hence deduce the current I

(10 marks)

(b) Solve the following differential equations

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

ii) $\frac{dy}{dx} = \frac{y^2(1+x)}{x^2(y-1)}$

(10 marks)

(c) Solve the following differential equation

$$2\frac{dx^2}{dt^2} + 3\frac{dx}{dt} - 5x = 6\sin 2t$$

Question TWO

(a) Use Laplace transform to solve the following differential equation $\frac{dx^2}{dt^2} + \frac{dx}{dt} - 2x = 5e^{-t}\sin 2t$

Given that x=1 $\frac{dx}{dt} = t = 0$ (10 marks)

(b) The current in an electric circuit containing resistance and inductance is given by the equation, $E - L\frac{di}{dt} = Ri$ Solve for i using separating the variables method given that $t = 0$ and $i = 0$

(10 marks)

Question THREE

The differential equation for a circuit is given by $\frac{di}{dt} + \frac{1}{LC}\int idt = \frac{E_o}{L}\cos\omega t$

(a) express the above equation as a second order differential equation in terms of q

(b) given that $q = q_O,\ t = 0$ and use Laplace transforms to determine q as a function of time

(c) taking $n = 2\omega$, use the results in (b) above to deduce for current as a function of t and ω only

(20 marks)

Question FOUR

(a) A voltage Ee^{-at} is applied at t=0 to a circuit containing inductance and resistance. Determine the expression for current at any given time (10 marks)

(b) Determine the inverse Laplace transform for the following equation.

(i) $\frac{3s^3+s^2+12s+2}{(s-3)(s+1)^3}$

(ii) $\frac{7s+13}{s(s^2+4s+13)}$

(10 marks)

Question FIVE

(a) Use Laplace transform to solve $2\frac{d^2t}{dt^2} + 5\frac{dx}{dt} - 3x = 0$ given that t=0, x=4 and $\frac{dx}{dt} = 9$

(b) Given the differential equation $\frac{d^2v}{dt^2} = \omega^2 v$ where ω is a constant, show that the solution can be expressed as $v = 7cosh\omega t + 3sinh\omega t$ taking t=0, v=7 and $\frac{dv}{dt} = 3\omega$. (10 marks)