TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

DEPARTMENT OF MEDICAL ENGINEERING

DIPLOMA IN MEDICAL ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING
DME/March 2018/J-FT & DMEN/March 2018/J-FT

AMA 2251

ENGINEERING MATHEMATICS IV

END SEMESTER EXAMINATION
SERIES: AUGUST 2019 TIME: 2
HOURS

<u>INSTRUCTIONS</u>
You should have the following for this examination

- Answer booklet

- Scientific calculator

- SMP tables

- Examination pass

- Student ID

This paper consists of *FIVE* questions
Answer Question **ONE (compulsory)** and any other **TWO** questions
The paper consists of **3 PRINTED** pages

Question1

(a) 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)

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

$dv\,dt =$
3ω.

(10 marks)

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

(10 marks)

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Question2

(a) Use Laplace transform to solve the following differential equation
$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 3e^x \cos 2x$$

given that $x = 0$, $dx\_dy = 3, y = 2$

(10 marks)

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

(10 marks)

Question3
The differential equation for a circuit is given by
$$\frac{di}{dt} + \frac{1}{LC}\int i\,dt = \frac{E_o}{L}\cos\omega t$$

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

(b) given that $q = q_o$, $t = 0$ and $n^2 = \frac{1}{LC} \neq \omega^2$ use laplace tansforms 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

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Question4

(a) Solve the following differential equation
$2\frac{d^2x}{dt^2} + 3\frac{dx}{dt} - 5x = 6\sin 2t$

(10 marks)

(b) Solve the following differential equations

i) $7x(x - y)dy = 2(x^2 + 6xy - 5y^2)dx$ ii)
$(x - 2)\frac{dy}{dx} + \frac{3(x-1)}{(x+1)}y = 1$

(10 marks)

Question5

(a) Use Laplace transforms to solve the following equation $x'' - 6x' + 8x = 2$ taking $x(0) = x'(0) = 0$.

(10 marks)

(b) Solve the following differential equation $x^2 - 3y^2 + 2xy\frac{dy}{dx} = 0$ given that $y = 3$ when $x = 1$

(10 marks)