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

INSTRUCTIONS
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) i) Determine the general solution of $x\frac{dy}{dx} = 2 - 4x^3$ ii) Determine the particular solution of $\frac{dy}{dx} - x + y = 0$ taking $x = 0$ and $y = 2$

(9 marks)

(b) i) Determine the general solution for the given differential equation

$$6\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$$

ii) Use Laplace transforms to solve the differential equation given that $x = y = y^0 = 0$

$$\frac{d^2y}{dx} - 3\frac{dy}{dx} = 9$$

(11 marks)

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

(10 marks)

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Question2

(a) Use Laplace transform to solve the differential equations $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 10y = e^{2x} + 20$ given that $x = 0$, $y = 0$ and $y' = \frac{-1}{3}$

(16 marks)

(b) Determine the Laplace transform of the equation $5e^{2t} - 3e^{-t}$

(4 marks)

Question3

(a) i) Use the Laplace transform of the first derivative to show that $\mathcal{L}(e^{-at}) = \frac{1}{s+a}$

ii) Determine the particular solution of $x\frac{dy}{dx} = \frac{x^2+y^2}{y}$ given that $y = 4$ when $x = 1$

(11 marks)

(b) i) Determine the inverse Laplace transform of $\frac{4s-5}{s^2-s-2}$

ii) The bending moment M of the beam is given by $\frac{dm}{dx} = -w(l-x)$ where w and x are constants. Determine M in terms of x given $m = \frac{1}{2}wl^2$ when *x* = 0

Question4

(a) Determine the

i) Laplace transforms of (1 + $2^{t - \frac{1}{3}t^4}$)

ii) Inverse Laplace transforms of $\frac{5}{3s-1}$

iii) Particular solution of $(y^2 - 1)\frac{dy}{dx} = 3y$ given that *y* = 1 and $x = 2\frac{1}{3}$

(10 marks)

(b) solve the following differential equation taking *y*(0) = 2 and $y^{0}(0) = 5$

$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 3e^x \cos 2x$

(10 marks)

Question5

(a) Solve the following equation $\frac{dx}{dt} - 6\frac{dx}{dt} + 8x$= 2 given that *x* = 0 and $\frac{dx}{dt} = 0.$

(10 marks)

(b) Using Laplace transform solve the following differential equation 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)