MURANG'A UNIVERSITY COLLEGE

(A constituent College of Jomo Kenyatta university of Agriculture and Technology)

UNIVERSITY EXAMINATION 2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

SPECIAL/ SUPPLEMENTARY EXAMINATION FOR THE DIPLOMA IN MECHANICAL ENGINEERING

SEM 1321 : ENGINEERING MATHEMATICS VI

DATE: 27TH **2 HOURS**

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) Define the terms as used in differential equations

i. Differential equation (2mks)

ii. Ordinary differential equation (1mk)

iii. Partial differential equation (1mks)

iv. General and particular solution (2mks)

b) state the order and degree of the following differential equations

i. $9\frac{d^6y}{dx^6} - 8\frac{dy}{dx} + y = sinx$ (2mks)

ii. $2\left(\frac{d^2y}{dx^2}\right)^4 - \left(\frac{d^3y}{dx^3}\right)^3 - y = tanx$ (2mks)

c) By separation of variables solve

i. $(y-2) = (1+x)\frac{dy}{dx}$ (3mks)

ii. $\frac{dy}{dx} = 3ytanx$ (3mks)

d) Solve the differential equation using integrating factor method

$\frac{dy}{dx} + 2y = 4e^{2x}$ (4mks)

e) Find the Laplace transform of

i. $L(e^{2t})$ (3mks)

i. Find the inverse Laplace transform of $L^{-1}\left(\frac{3s^2+2s-6}{s^2}\right)$ (4mks)

ii. $L^{-1}\left(\frac{3s-5}{(s+1)^2(s-2)}\right)$ (4mks)

QUESTION TWO (20MARKS)

a) solve the initial value problem using Laplace transform $\frac{dy}{dt} - y = 12e^{3t}\ , y(0) = 1$

(10mks)

b) Solve the homogeneous differential equation

$(-2xy - x^2)dy + (2xy + 3y^2)dx = 0\ \ when\ y(2) = 4$ (10mks)

QUESTION THREE (20MARKS)

a) Use Laplace transform method to solve $4\frac{d^2y}{dt^2} + 8\frac{dy}{dt} + 8y = 4e^{-t}\ \ y(0) = 0,\ y'(0) = 0$

(10mks)

b) Decompose into partial fractions the find the inverse Laplace transform of $L^{-1}\left(\frac{-3s^2+20s-24}{(s+1)^2(s+1)}\right)$

(5mks)

c) Find the Laplace transform of $cosh2t$ (5mks)

QUESTION FOUR (20MARKS)

a) Determine the particular solution using method of un- determined coefficient of

$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2e^{3x}\ \ y(0) = 0, y'(0) = 0$ (10mks)

b) Use Laplace transform method to solve $\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + y = e^t \quad y(0) = 2,\ y'(0) = -1$

(10mks)

QUESTION FIVE (20 MARKS)

a) By first checking if the following differential equation is homogenous, solve the initial value ordinary differential equation

$(-x^2 + y^2)dx - 2xydy = 0 \quad y = 1\ when\ x = 0$ (10mks)

b) Find the general solution of $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ (5mks)

c) The current in an electric circuit is given by the equation $Ri + L\frac{di}{dt}$=0 where L and R are constants. Show that $i = Ie^{-\frac{Rt}{L}}$ given $i = I\ when\ t = 0$ (5mks)