TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCE

DEPARTMENT OF MATHEMATICS AND PHYSICS

UNIVERSITY EXAMINATION FOR:

THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED PHYSICS, RENEWABLE ENERGY AND ENVIROMENTAL PHYSICS, BACHELOR SCIENCE IN STATISTICS AND COMPUTER SCIENCE , MECHANICAL, CIVIL, ELECTRICAL AND ELECTRONICS ENGINEERING

SMA2278/ SMA 2271 / AMA 4204: ORDINARY DIFFERENTIAL EQUATIONS

SPECIAL SUPPLEMENTARY EXAMINATION

SERIES: SEPT 2017

TIME: 2 HOURS

Instructions to Candidates

You should have the following to do this examination:

-Answer Booklet, examination pass and student ID

Do not write on the question paper.

Answer question One and any other two

Question ONE (30 marks) compulsory.

a) Find the laplace transform of $e^{-3t}(2\cos 5t - 3\sin 3t)$ (4 marks)

b) Determine a general solution of an equation $\frac{d^2y}{dx^2} + 14\frac{dy}{dx} + 49y = 4e^{5x}$. (5 marks)

c) Solve the differential equation $\frac{dy}{dx} + y = xy^3$ (6 marks)

d) Find the singular points of the differential equation $x^2(1-x)\frac{d^2y}{dx^2}+(1-x)\frac{dy}{dx}+y=0$ and determine whether they are regular or ordinary points. (4 marks)

e) An electric circuit has a constant electromotive force E=40v, a resister of 10Ω and an inductance of 0.2 Henry, with initial current $i=0$ at t=0 and a differential equation $L\frac{di}{dt}+Ri=E.$ Determine the steady current after a long time. (6 marks)

f) Solve the 2nd order differential equation $y\frac{d^2y}{dx^2}=2\left[\frac{dy}{dx}\right]^2-2\left[\frac{dy}{dx}\right]$. (5 marks)

Question TWO (20 marks)

a) b) Solve the differential equation $(x-4)y^4dx-(y^2-3)x^3dy=0$ (3 marks)

b) Find the inverse laplace transform of $F(s)=\frac{3s+7}{s^2-4}$ (4 marks)

b) Solve the equation $(3x^2+4xy)dx+(2x^2+2y)dy=0$ (5 marks)

c) Determine complementary function of $\frac{d^2y}{dx^2}+2\frac{dy}{dx}=3x$ then use reduction of order method to find the particular solution. (8 marks)

Question THREE (20 marks)

a) Solve the differential equation $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^2=1.$

(4 marks)

b) Solve $\frac{dy}{dx}+y\cot x=\cos x$ to obtain the particular solution given that at $x=\frac{\pi}{2}$, then $y=\frac{5}{2}$.

(4 marks)

c) Obtain a general solution of the equation $(x^2-xy+y^2)dx-xydy=0$. (6 marks)

d) Using Laplace transform solve $\frac{dx}{dt}+2x=4e^{3t}$ at t=0 when x=1. (6 marks)

Question FOUR (20 marks)

a) By separation of variables solve $y \tan x \frac{dy}{dx} = \left(4 + y^2\right)\sec^2 x$. (4 marks)

b) Obtain the particular solution for the differential equation $(x^2 + y^2)dx + 2xydy = 0$ if $y(1) = 1$.

(7 marks)

c) Find the general solution of $\frac{dy}{dx} + y = e^x$. (3 marks)

d) Using the D-operator method, find the particular solution for the differential equation

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 0 \text{ if } y(0)=0 \text{ and } y'(0) = -4.$$ (6 marks)

<u>Question Five (20 marks)</u>

a) Use the Bernoulli's method to solve $\frac{dy}{dx} - \frac{1}{2}\left(1 + \frac{1}{x}\right)y = \frac{3y^3}{x}$. (5 marks)

b) Solve the linear fractional differential equation $(3y + 2x + 4)dx - (4x + 6y + 5)dy = 0$ (8 marks)

c) A particle of mass 2kg moves along the x-axis attracted towards the origin O by a force whose magnitude is numerically equal to 8x. if it is initially at rest at x=20 and has also a damping force whose magnitude is numerically equal to 8 times the instantaneous speed. Find the equations of displacement and velocity of the particle at any time t. (7 marks)

THE END