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