ELIZADE UNIVERSITY, ILARA-MOKIN

FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE
2nd SEMESTER EXAMINATION
2017 / 2018 ACADEMIC SESSION

COURSE CODE: MTH 202

COURSE TITLE: Ordinary Differential Equation

COURSE LEADER: Dr. T. Akinwumi

DURATION: 2 Hours

HOD's SIGNATURE

INSTRUCTION:

Candidates should answer **THREE** questions

1a.) Indicate which of the following differential equations is (are) linear or non-linear and State the order.

(i) $\left(\frac{d^3y}{dx^3}\right)^7 + \left(\frac{d^2y}{dx^2}\right)^3 - y^2\frac{dy}{dx} = \cos x$ (ii) $x^2dy + y^2dx = 0$

(iii) $\frac{\partial^2 y}{\partial x^2} - 4\frac{\partial^2 y}{\partial t^2} = 0$ (iv) $\frac{dy}{dx} + x^2y = ye^x$

(v) $\frac{d^3y}{dx^3} + (\sin x)\frac{d^2y}{dx^2} + 5xy = 0$ (2 Marks each)

b.) Solve the first Order differential equation

$\frac{dy}{dx} = \frac{xy}{x^2+1}$ (5Marks)

c.) Solve the differential equation $y'' + 6y' + 13y = 0$ (5 Marks)

2a.i) When is an equation of the form $M(x,y)dx + N(x,y)dy = 0$ said to be exact. (4 Marks)

Show whether the differential equation $(3x + 2y)dx + (2x + 2y)dy$ is exact. (4 Marks)

b.) Solve the differential equation $(3x + 2y)dx + (2x + 2y)dy = 0$ (8 Marks)

c.) A particle of mass m moves along a straight line (the x-axis while subject to):

(1.) A force proportional to its displacement x from point O in its path and directed toward O and (2.) a resisting force proportional to its velocity. Express the force as a differential equation. (4 Marks)

3a.) Given that the differential equation $M(x,y)dx + N(x,y)dy = 0$ is not exact, determine the integrating factor I which makes the differential equation exact. (8marks)

b.) Find an integrating factor for the equation $(3xy + y^2)dx + (x^2 + xy)dy = 0$ and solve (7Marks)

c.) Solve the differential equation $x\frac{dy}{dx} - y = 2x^2y$ (5 Marks)

4a.i) Show that the Bernoulli equation $\frac{dy}{dx} + yp(x) = y^n q(x)$ reduces to linear ordinary Differential equation with the substitution $Z = y^{1-n}$ (7 Marks)

b.) Hence or otherwise solve the equation $\frac{dy}{dx} + y = xy^3$ (8 Marks)

c.) Determine the Laplace Inverse transform of $L^{-1}\left\{\frac{7s-6}{s^2-2s}\right\}$ (5marks)

5a.) Find the general solution for the differential equation

$y'' - 4y' - 12y = 3e^{4x}$ (7 Marks)

b.) Using the Laplace technique, find the solution of

$\frac{dx}{dt} + 2x = 12e^{3t}$, $x(0) = 3$ (8Marks)

c.) Obtain the differential equation associated with the primitive

$y = Ae^{-2x} + Be^{3x} + C$ and show that $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 6y = 0$ (5Marks)