NLT 52 -2 8-10:30 20/4/18

**REDEEMER'S UNIVERSITY**
**P.O.BOX 230, Ede, Osun State**
**COLLEGE OF NATURAL SCIENCES**
**DEPARTMENT OF MATHEMATICAL SCIENCES**

**SECOND SEMESTER DEGREE EXAMINATIONS** **2017/2018 SESSION**

**COURSE CODE:** MAT 202

**COURSE TITLE**: Elementary Differential Equations I

**INSTRUCTIONS**: Answer any Four (4) questions. **TIME ALLOWED**: 2½ Hours

**Question One**

a). Define and briefly discuss what a Differential Equation (DE) is, its classification, order and degree. You may which to use a simple diagram to further your discussion.

b). A stone weighing $4kg$ falls from rest toward the earth from a great height. As it falls, it is acted upon by a resistance which numerically equal to $\frac{1}{2}v(in\ kg)$ where $v$ is the velocity in $m/s$.

i). Find the velocity and the distance at time $t$

ii). Find the velocity and distance falling at the end of 5 $seconds$ ($g = 10\ m/s^2$)

**Question Two**

a). Discuss briefly what constitute as a solution to a given differential equation

b). Find the Orthogonal trajectories of the family

i). $y = e^{\lambda x}$ ii). $y = Cx^3$

**Question Three**

a). State the Basic Existence and Uniqueness Theorem

b). What is an exact differential equation? List the procedures for testing for an exact DE.

c) A radioactive substance decays at the rate proportional to the amount present at any time $t$. A certain substance loses $\frac{1}{3}$ of its mass in 11.7 days. Find the half life of the substance.

**Question Four**

Determine the type and solve, using appropreate method, the following differential equations:

a). Solve

$$(x-4)y^4dx - x^3(y^2-3)dy = 0$$

b) Solve

$$(x^2 - y^2)dx + xydy = 0$$

c) Solve

$$x\frac{dy}{dx} + 3y = 6x^3$$

**Question Five**

Determine the type and solve, using appropreate method, the following differential equations:

a).

$$\frac{d^2y}{dx^2} - 8\frac{d^1y}{dx^1} + 16y = 0$$

b). $(5x + 2y + 1)dx + (2x + y + 1)dy = 0$

c). $x^3 \frac{d^3y}{dx^3} - 3x^2 \frac{d^2y}{dx^2} + 6x\frac{dy}{dx} - 6y = 0$

**Question Six**

a). Given that $x, x^2, \& x^4$ are solutions of the DE

$$x^3\frac{d^3y}{dx^3} - 4x^2\frac{d^2y}{dx^2} + 8x\frac{d^1y}{dx^1} - 8y = 0$$

show that they are generally independent on the interval $0 \leq x \leq \infty$ and write the general solution.

b).Find the Laplace Transforms of $\cosh at$ and $\sinh at$ where $a$ is any real constant. Given that

$$\cosh t = \frac{e^t + e^{-t}}{2}, \quad \sinh t = \frac{e^t - e^{-t}}{2}.$$

c). Solve the equation

$$\frac{d^2y}{dt^2} + 4y = 0$$

with the following initial value conditions

$y(0) = 3, y'(0) = 2$

using Laplace Transform method.