**NATIONAL OPEN UNIVERSITY OF NIGERIA**
**Plot 91, Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja.**

**FACULTY OF SCIENCES**
**DEPARTMENT OF MATHEMATICS**
**October Examination 2019**

**Course Code:** **MTH 308**
**Course Title:** **Introduction to Mathematical Modeling**
**Credit Unit:** **3**
**Time allowed:** **3 Hours**
**Instruction:** **Answer Question Number One and Any Other Four Questions**

1. (a) (i) Define the term Mathematical Modeling? **(2.5 marks)**

   (ii) Using a suitable diagram, explain 1 (a) (i). **(4 marks)**

   (b) Enumerate and briefly discuss two (2) specific reasons (motivation) for Mathematical Modeling. **(5marks)**

   (c) Explain briefly with example the following types of Mathematical Modeling:

   (i) Deterministic Models **(3.5 marks)**

   (ii) Linear Models **(3.5 marks)**

   (iii) Stochastic Models **(3.5 marks)**

2. (a) Differentiate between Empirical models and Theoretical models. **(4 marks)**

   (b). A raindrop beginning at rest, falls from a cloud 705.6m above the ground. How long does it take to reach the ground? **(8 marks)**

3. (a) What is a Mathematical Model? **(3 marks)**

   (b) Water enters a cylindrical tank at a constant rate, a hole at the bottom of the tank allows water to escape at a rate proportional to $v^{\frac{2}{3}}$ where $v(t)$ is the volume of water at any time $t$. Write a differential equation describing this process and hence find the equilibrium volume. **(9 marks)**

4. (a) Mention and explain briefly three (3) general steps in developing Mathematical Modeling **(9 marks)**

(b) List two (2) factors that will help you decide the best if you are given three different models and briefly discuss any of the two factors. **(3 marks)**

5. (a).State two (2) limitations of Mathematical Model. **(5 mark)**

(b) Distinguish between a closed system and an open system. **(7 marks)**

6. (a) Define each of the following terms with examples;

(i) Dynamic Model **(3 marks)**

(ii) Static Model **(3 marks)**

(iii) Continuous Model **(3 marks)**

(b) Enumerate three (3) examples of real life problems that can be solved with Mathematical Modeling. **(3 marks)**