NATIONAL OPEN UNIVERSITY OF NIGERIA

University Village, Plot 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi, Abuja

FACULTY OF SCIENCES

2023_1 POP EXAMINATION

Course Code: MTH308

Course Title: Introduction to Mathematical Modeling

Credit Unit: 3

Time Allowed: 3 Hours

Total: 70 Marks

Instruction: Answer Question One (1) and Any Other 3 Questions

1.   **a.** Define the term Mathematical Modeling.   **(5 marks)**

     b. Differentiate between the following:

        i.   Static and dynamic model   **(6 marks)**

        ii.   Discrete and continuous model   **(7 marks)**

     c. State and discuss two limitations of mathematical modeling.   **(7 marks)**

2.   **a.** Why is it necessary to formulate a mathematical model?   **(7 marks)**

     b. A raindrop beginning at rest, falls from a cloud 700.3m above the ground. How long does it

     take to reach the ground?   **(8 marks)**

3   **a.** Show that the solution of $\frac{dQ}{dt} = -kQ \; is \; Q(t) = Q_0 e^{-kt}$, where $Q(0) = Q_0$ (**7 marks**)

     b List and discuss two specific reasons for Mathematical Modeling.   **(8 marks)**

4   **a.** Distinguish between a closed system and open system.   **(6marks)**

     b. Define the following:

        i.   Supply of a commodity   **(3 marks)**

      ii.   Production lag   **(3 marks)**

      iii.   The demand for a commodity   **(3 marks)**

5.   **a.** Mention and discuss two limitations of mathematical model.   **(5 marks)**

      b. Differentiate between Empirical and Theoretical model.   **(10 marks)**

6.   **a.** Define the following:

      i.   Dynamic model   **(4 marks)**

      ii.   Theoretical model   **(4 marks)**

      iii.   Empirical model   **(3 marks)**

b Using Elliptic Integral, find T_0 if $\theta_0 = 20^0$, given that $l = 20cm$ and $g = 980cm/\sec^2$.

    (4 marks)