

**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja.**

**FACULTY OF SCIENCES**

**OCTOBER/NOVEMBER EXAMINATION 2016**

**Course Code**: MTH 308

**Course Title:** Mathematical Modeling

**Credit Unit**: 2

**Time Allowed**: 3 HOURS

**Instruction: ATTEMPT ANY FOUR (4) QUESTIONS**

1. (a) Define Mathematical Modeling and give 6 examples (5 ½ marks)

b) Mention and discuss processes involve in mathematical modeling (6 marks)

c) Mention and discuss with examples types of modeling (6 marks)

1. a) Differentiate between Mathematical Model and Mathematical modeling (2 marks)

b) If the force F exacted within a system can be represented by a relation of the form

 where p is the pressure (mass per volume), A is the area and v the Velocity,

What powers of p, A, and v would combine to make F be a force?, denoting mass by M, length by L, and time by T (K is constant and dimensionless) (15 ½ marks)

1. a) A pendulum executing small vibrations has period P and length 1, and m is the mass of the

bob. Can P depend only on l and m? If we assume P depends on l and the acceleration g due to gravity, then show that T , where C is constant. 7 marks)

b) The law governing the distance x an object falls in time t in a field of constant gravitational acceleration g with no air resistance is . How many independent dimensionless quantities can be formed from t, x, and g? Rewrite the physical law in terms of dimensionless quantities (10½ marks)

4. At time t = 0 an amount of heat energy e, concentrated at a point in space, is allowed to diffuse outward into a region with temperature zero. If r denotes the radial distance from the source and t is time,

a). Find the dimensionless quantity that can be formed (10 ½ marks)

b). Determine the temperature u as a function of r and t (7 marks)

5. (a) Formulate the model for the dynamic stability of market equilibrium. (10 Marks)

(b) Find the extremals of the functional

 y(0) = 0, y(1) = 1. (7 ½ marks)