Course Outline: Differential Equations and Dynamics (MTH 102)

PAU Undergraduate Programme

School of Science and Technology

Year I, Semester II

This course is a foundational course that will focus on the study of differential equations and the application in dynamics and classical mechanics. The concept will help to derive concepts in physics from first principles.

Leaning outcomes

At the end of the course, students should be able to:

1. define the following: order and degree of a differential equation

2. describe some techniques for solving first and second order ordinary differential equations

3. solve some problems relating to physics

4 solve some differential equations and graph the solution with SAGEMath

Course Content

Week	Session	Session type	Session content
1	2	Class	Classification of Ordinary Differential Equations (ODEs). Order, Degree, Formation of ODEs. Initial Value Problems (IVP, Boundary Value Problems (BVP). First Order Ordinary Differential Equations. Variable Separable.
2	2	Class	Homogeneous Equations
3	2	Class	Exact Equations. Integrating Factor.
4	2	Class	Linear / Bernoulli Equations
5	2	Class	Applications of First Order Equations. Growth and Decay. Mechanics. Heat Conduction. Newton's law of motion. Motion under a constant force. Free Fall under gravity.
6	1	Class	Test.
7	2	Class	Solution to Test Questions.

8	2	Class	Second Order ODE. Method of Undetermined Coefficients
9	2	Class	Method of Undetermined Coefficients.
10	2	Class	Kinematics of a Particle. Newton's law of motion. Force of friction. Motion of a body on a rough inclined plane. Application of Second Order ODEs.
11	2	Class	Simple Harmonic Motion. Potential and Kinetic energy in Simple Harmonic motion.
12	2	Class	Test. Scientific computing of ODEs and application to dynamics with SAGE
13	2	Class	Scientific computing of ODEs and application to dynamics with SAGE
14	2	Class	Presentation
15	1		Revision

Learning assessment:

Learning will be evaluated through continuous assessment:

Class engagement	5%
Class tests, online test, assignments and project	30%
End-of-semester examination	65%

Lecturers:

Dr. Julius Ehigie (jehigie@unilag.edu.ng)

Useful Text:

1. Differential Equations.
2. Classical Mechanics