

Faculty	Natural Sciences
Home Department	Mathematics and Applied Mathematics
Module Topic	Differential Equations and Numerical Methods
Generic Module Name	Mathematics 212
Alpha-numeric Code	MAT212
NQF Level	6
NQF Credit Value	20
Duration	Year
Proposed semester to be offered	Both Semesters
Programmes in which the module will be offered	BSc (Mathematical and Statistical Sciences) (3227, 3031) BSc (Chemical Sciences) (3220, 3019) BSc (Physical Science) (3233, 3120) BSc (Computer Science) (3221, 3023)
Year level	2
Main outcomes:	On completion of this module students should be able to: <ul style="list-style-type: none"> • Formulate differential equations from given physical situations. • Solve linear ordinary differential equations. • Interpret the solutions in the given physical context. • Solve linear systems of differential equations. • Use Newton's method to solve systems of nonlinear equations. • Use different methods for polynomial interpolation. • Use different methods for numerical differentiation and numerical integration with error estimates.
Main content:	<p>Differential Equations:</p> <ul style="list-style-type: none"> • First order ordinary differential equations (general and particular solutions, velocity and acceleration, direction fields and solution curves, existence and uniqueness of solutions; linear equations, homogeneous equations, and applications) • Second order linear differential equations • Introduction to systems of differential equations (first order systems and their applications; the eigenvalue method for solving homogeneous linear systems) • Phase-plane analysis (population models, acceleration and velocity models) • Introduction to series solution of ordinary and partial differential equations • Some self-study/familiarity with the method of Laplace transforms for solution of ODEs is recommended. <p>Numerical Methods:</p> <ul style="list-style-type: none"> • Methods for solving nonlinear equations • Iterative methods solving linear systems of equations • Interpolation and polynomial approximation • Numerical differentiation • Numerical integration • Numerical methods for ordinary differential equations and their systems.
Pre-requisite modules	MAT105 or (MAT103 and MAT104) or (MAM151 and MAM152)
Co-requisite modules	MAT211
Prohibited module Combination	None

Breakdown of Learning Time	Hours	Timetable Requirement per week		Other teaching modes that does not require time-table
<i>Contact with lecturer / tutor:</i>	39	<i>Lectures p.w.</i>	2	
<i>Assignments & tasks:</i>	60	<i>Practicals p.w.</i>	1	
<i>Assessment</i>	0	<i>Tutorials p.w.</i>	0	
<i>Practicals:</i>	36			
<i>Selfstudy</i>	65			
<i>Other: Tutorials</i>	0			
Total Learning Time	200			
Methods of Student Assessment	Continuous Assessment (CA): 100% Final Assessment (FA): 0%			
Assessment Module type	Continuous Assessment (CA)			