

School of Computational and Mathematical Sciences (Programme of Mathematics and Applied Mathematics)

Undergraduate Programmes

Modules

First year



SAPM011: Mechanics	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics
Content: Vectors and Scalar quantities; Newton's laws of motion, Falling bodies and Projectiles; Harmonic Oscillators, Central force and Planetary motion; System of Particles, Plane motion of Rigid bodies, Space motion of rigid bodies. Simple interest, simple discount, compound interest, annuities and amortisation.		

CFNA001: Foundation Basic Numeracy A	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Numerical Calculations. Number systems, basic calculations, rounding and significant figures, calculations that needs various kinds of numbers, fractions, decimal numbers, powers large and small numbers, scientific notation, orders of magnitude. Ways of comparing numbers, Ratios, conversions, percentages, percentages of percentages, mathematical functions, introduction to functions, linear functions, quadratic functions, exponential functions.		

MOPM011: Mathematics for Pharmacy	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Limits; Derivatives; integration; Application of integration; Application of differentiation; Solution of single non-linear and non-quadratic equations by Newton iteration; Solutions of simultaneous equations by matrices; Elementary Probability Theory.		

SMAT011: Intermediate Calculus	Credits: 15	Co-requisite / Prerequisite: Grade 12 ECP Mathematics
Content: Changing the Subject of the formula; Simplifications and equations; Exponents; Decimal fractions; Metric systems; derivatives; Tangent lines and gradients to curves; maximum and minimum value problems; integration of simple algebraic functions; techniques of integration; Area between curves; Volume of solid revolution; Simpson's rule		

SFNB001: Foundation Basic Numeracy I	Credits: 12	Co-requisite / Prerequisite: Grade 12
Content: Properties of logs, natural logs, common logs, logs as a function. Limits: Limit of a function, formal definition, and properties of limits, one-sided limits, infinite limits, methods and application. Differentiations: Notations, finding derivatives, derivatives of power, derivatives as a function, implicit differentiation, and differentiation of logs and exponential.		

Integral: Terminology and notations, properties of integration, inequalities for integral, multiple integral and methods and application.

SMAH011: Mathematics for Health Sciences	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics
Content: Limits; Derivatives; integration; Application of integration; Application of differentiation; Solution of single non-linear and Solutions of simultaneous equations by matrices; Elementary Probability Theory.		

SSMA011: Elementary Calculus	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics
Content: Functions, Limits, Continuity, Derivatives, Integration. Application of differentiation and integration e.g. gradient of a curve, equation of tangent and normal to a curve, curves simple differential equations and arc length		

SMTH011: Differential and Integral Calculus	Credits: 12	Co-requisite / Prerequisite: Grade 12 or EDP Mathematics
Content: Limits, Continuity, Derivatives and Integration		

SSTA011: Elementary Mathematics	Credits: 12	Co-requisite / Prerequisite:
Content: Sets and sets operation, Elementary logic, Elementary number theory, Equations and inequalities with applications, Functions and graphs with applications, Differential and integration with applications, Matrices and their applications, Financial Mathematics		

SAPM012: Computational Mathematics and Mathematical Modelling	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics
Content: Computational Mathematics: Introduction to Maple software; Algebraic computation and computer programming and errors; Numerical solution of linear systems; Roots of non-linear equations; Curve fitting. Mathematical Modelling: Ideal of modelling; Some straight forward examples; Translating models into mathematics; modelling linear systems; Study of typical behaviours, i.e. exponential, sinusoidal, etc.; Discrete models; First order difference equations; Cobweb diagrams; First order differential equations models		

SMTH012: Elementary Set Theory, Linear and Abstract Algebra	Credits: 12	Co-requisite / Prerequisite: Grade 12 or EDP Mathematics
Content: Elementary Set Theory, Relations and Inequalities, Mathematical Induction, Complex Numbers, Symbolic Logic, Binomial Theorem, Boolean Algebra, Matrix Algebra and Systems of Linear Equation		

SSMA012: Elementary Linear Algebra and Statistics	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Algebraic expression, Partial Fractions, Binomial Theorem. Linear Algebra: Solving systems of linear equations by elimination, substitution and using matrices. Complex Analysis, Sequences and Series: Arithmetic progressions and Geometric Series. Set Theory, Inequalities and Absolute Values, Linear Programming, Elementary Probability Theory and Elementary Statistics		

SFNB002: Foundation Basic Numeracy II	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Elementary set theory, elementary combinatorics, elementary probability, dependent and independent events, expectation and variation, the normal distribution, system of linear equations, matrices and introduction to linear programming.		

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CFNA002: Foundation Basic Numeracy B	Credits: 12	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Sequence and series: Arithmetic sequence and series; Geometric sequence and series; How quantities change: Simple and compound interest, Effective interest rates, Inflation. Statistics and Probability: Measure of central tendency (mean, median, mode), Measure of spread (range, variance and standard deviation) Permutations and Combinations, Probability distributions; Binomial distribution; Poisson distribution, Linear regression.		

SMTH000: Pre- Calculus and Differential Calculus	Credits: 24	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Limits, Continuity, Derivatives and Integration		

SMTB000: Introductory Algebra and Integral Calculus	Credits: 24	Co-requisite / Prerequisite: Grade 12 Mathematics or EDP Mathematics
Content: Elementary Set Theory, Relations and Inequalities, Mathematical Induction, Complex Numbers, Symbolic Logic, Binomial Theorem, Boolean Algebra, Matrix Algebra and Systems of Linear Equation		

Second Year

SAPA021: Ordinary Differential Equations and partial Differential Equations	Credits: 20	Co-requisite / Prerequisite: SAPM011 SAPM012 SMTH011 SMTH012
Content: General introduction to differential equations; Classification of ODE's: first, second and higher order linear ODE's; Methods of solutions; Power series method; Laplace transforms and applications; Classification of Partial differential equations into elliptic, hyperbolic and parabolic equations and their methods of solutions and application in science and engineering.		

SMTA021: Advanced Calculus	Credits: 20	Co-requisite / Prerequisite: SMTH011
Content: Improper Integrals and L'Hôpital's Rules; Definitions and Properties of Infinite Sequences; Infinite Series; Tests for Convergence and Divergence for Series with Positive terms; Alternating Series; Absolute Convergence; Power Series; Convergence of Power Series; Taylor and Maclaurin series; Differential Calculus of Functions of several variables; Distance between two points in R_n ; Partial Derivatives; Limits and Continuity; Multiple Integrals; Definition of Double Integral; Evaluation of Double Integral as an Iterated		

Integral; Fubini's Theorem; Change of Variables; Jacobian of the transformation; Double Integrals in Polar Form; Triple Integrals; Line Integrals; The Fundamental Theorem for Line Integrals; Green's Theorem; Stokes's Theorem; Hyperbolic Functions; Definitions and Identities; Derivatives and Integrals; Inverse Hyperbolic Functions; Ordinary Differential Equations; First Order Differential Equations; Linear (higher order) homogeneous and non-homogeneous differential equations with constant coefficients; Use of the variation of parameters.

SAPA022: Numerical Analysis	Credits: 20	Co-requisite / Prerequisite: SAPM011 SAPM012 SMTH011 SMTH012
Content: Numbers and errors; Root finding for single non-linear equations; Interpolation and approximation; Limitation of polynomial interpolation; Numerical integration and differentiation; Numerical solution of systems of linear equations; Numerical solution of initial value problems and boundary value problems.; Eigenvalue problems, the largest eigenvalue in magnitude by power method; Eigenvalues and eigenvectors of symmetric matrices; The LR- and QR-algorithms; Errors in computed eigenvalues and eigenvectors, etc.		

SMTA022: Linear Algebra	Credits: 20	Co-requisite / Prerequisite: SMTH012
Content:		

General Vector Spaces; Examples of Concrete vector spaces; Vector Space Properties; Linear independence, Spanning sets and Bases; Sub Spaces; Inner Product Spaces and Orthogonal Bases; Linear transformations: Matrix representations; Properties of linear transformations; Change of basis; Linear problems; The Eigenvalue Problem; The Characteristic Polynomial and Eigenvalues; The Hamilton-Cayley Theorem; Eigenvectors and Eigenspaces; Similarity Transformations and Diagonalization; Symmetric Matrices, Bilinear and Quadratic Forms; Linear Functionals; Dual Spaces; Bases for dual spaces; Annihilators..

Third Year

SAPA031: Fluid Mechanics	Credits: 32	Co-requisite / Prerequisite: SAPA021 SAPA022
Content: Part 1: Fluid motion description; Streaklines; Eulerian and Lagrangian descriptions; Hydrodynamic and Euler's equations; Bernoulli's equations and their application; Stream function; some elementary flows; Potential flows; Vortex dynamics; Kelvin theorem, etc Part 2: Constitutive equations; Continuity equations; Navier-Stokes equations; Vorticity Transport equations; Energy equation, etc; Couette flow; Poiseuille flow; Flow between two rotating cylinders etc; Boundary layer equations; Von-Karman equations, etc		

SMTA031: Mathematical Analysis I	Credits: 16	Co-requisite / Prerequisite: SMTA021
Content: Series and sequences of functions; The Riemann-Stieltjes integrals; Metric Spaces (introduction and examples); Normed and Inner Product Spaces; Complete Spaces		

SMTB031: Abstract Algebra	Credits: 16	Co-requisite / Prerequisite: SMTA022
Content: Groups; Definition and properties of Groups; Subgroups; Cyclic and permutation groups; Cosets and Lagrange's Theorem; External and Internal Direct Products; Isomorphisms and homomorphisms; Normal subgroups and Factor groups; Rings and Fields; Definitions and examples; integral Domains; ideals and Factor rings; Ring Homomorphisms; Definition, properties and examples; Factorization of polynomial over a field; Unique Factorization and Euclidean Domains; Extension Fields; Algebraic and Transcendental elements; Geometric Constructions.		

SAPA032: Mathematical Theory of Electromagnetism and Special Relativity	Credits: 32	Co-requisite / Prerequisite: SAPA021 SAPA022
Content: Mathematical Theory of Electromagnetism: Newton's laws of motion; Lorentz transformation; Minkowski space-time , Length contraction, Time dilatation; Spacelike and timelike intervals; Light cones, Velocity, acceleration and momentum and energy. Special Relativity: Classical electrodynamics; Maxwell's equations; Continuity equations, Gauge invariance of electromagnetic field; Variations principles in field theory; Euler-Lagrange's equations; Maxwell's equation in 4-dimensional Minkowski space; Equations of motion; Lagrangian for a charged field and Equations of motion derived from variational methods.		

SMTA032: Complex Analysis II	Credits: 16	Co-requisite / Prerequisite: SMTA021
Content: Complex numbers; Some topology of the set of complex numbers; Analytic and harmonic functions; Complex power series and elementary complex functions; Complex integrals; Curves and contours; Fundamental Theorem of Calculus; Estimation Theorem; Theory of holomorphic functions; Cauchy's Integral Formula; Liouville's and Morera's Theorem; Cauchy's Integral Formula for Derivatives; Representation of holomorphic functions by power series; Maximum Principle; Laurent's series; Residue Theory; Classification of singularities; Cauchy's Residue Theorem; Summation of series; Conformal mappings.		

SMTB032: Mathematical Analysis II	Credits: 16	Co-requisite / Prerequisite: SMTA021 SMTA022 SMTA031
Content: Continuity and homeomorphisms in metric spaces; Compactness in metric spaces; Connectedness in metric spaces; Differentiation in normed spaces		