

University of Rwanda



College of Science and Technology

School of Science

Department of Mathematics

Option: Applied Mathematics

Summary of Undergraduate Courses

From Nov-2019 to Apr-2023

K.Olivier

Reg.no: 220000950

This document enumerates all the courses undertaken during the undergraduate program in Applied Mathematics, spanning from November 2019 to April 2023. It details the course code, lecturer, and some of the topics covered.



Olivier KANAMUGIRE

¹This document was prepared by Olivier KANAMUGIRE, a former student at the University of Rwanda, Department of Rwanda (Applied Mathematics).

LEVEL I

Academic Year: 2019–2020

Trimester I

PHY1161: General Physics I Lecturer: Dr. Jean Claude Uwamahoro

Topics: Measurements and Units, Kinematics in 1D and 2D, Newton's laws and applications, Work, Energy and Power, Momentum and collision, Rotational motion and gravitational force.

MAT1161: Calculus I Lecturer: Mr. Mugisho Jerome

Topics: Functions, Limits, Derivatives, Integrals and applications, Infinite sequences and Series.

MAT1162: Linear Algebra I Lecturer: Dr. Celestin Kurujyibwami

Topics: Introduction to abstract algebra, Vector spaces, Matrices and determinants, system of Linear equations, Linear transformation

MAT1163: Analytical Geometry I Lecturer: Mr. Solange Mukeshimana

Topics: Points, lines, and planes, Coordinate systems, Ellipse, Parabolas, Hyperbolas, Conic sections

CSC1163: ICT Skills

Topics: Microsoft Word, Microsoft Excel, PowerPoint, Advanced computer skills

Trimester II

MAT1261: Calculus II

Lecturer: Mr. Mugisho Jerome

Topics: Vector-valued functions, Partial derivatives, Multiple integrals, Vector calculus

PHY1261: General Physics II

Lecturer: Dr. Mushinzimana Xavier

Topics: Electric fields, Gauss's law, Electric potential, Currents and resistance, circuits, Magnetic fields, Faraday's law, Inductance

MAT1262: Linear Algebra II

Lecturer: Dr. Celestin Kurujiyibwami

Topics: Eigenvalues and Eigenvectors, Inner product, Jordan normal form, Unitary and Hermitian Operators, Quadratic Forms

ENT1231: Entrepreneurship and Innovation

Topics: Eigenvalues and Eigenvectors, Inner product, Jordan normal form, Unitary and Hermitian Operators, Quadratic Forms

MAT1263: Introduction to Statistical Computing

Lecturer: Dr. Japhet

Niyobuhungiro

Topics: Eigenvalues and Eigenvectors, Inner product, Jordan normal form, Unitary and Hermitian Operators, Quadratic Forms

MAT1265: Analytical Mechanics

Lecturer: Dr. Ruganzu Leon Fidele

Topics: Lagrangian mechanics, Hamiltonian mechanics, Symmetry and conservation laws, Noether theorem and application

CTE1111: Citizenship and Transformative Education

Lecturer: Kaberuka Dan

Trimester III

MAT1361: Ordinary Differential Equation Lecturer: Dr. Ndengo Marcel

Topics: First Order and Second Order Differential Equation, higher order differential equations. (Methods of solving equations)

MAT1362: Analytical geometry II Lecturer: Dr. Solange Mukeshimana

Topics: Introduction to differential geometry, Curvilinear Coordinates, Quadrics

MAT1363: Complex Analysis Lecturer: Dr. Ruganzu Leon Fidele

Topics: All topics in the book "A First Course in Complex Analysis with Applications, Dennis G. Zill.

MAT1364: Special Functions Lecturer: Mr. Maniraguha Jean de Dieux

Topics: Tchebychef polynomials, Gamma & Beta Functions, Bezzel functions, Legendre functions

EGP1111: English for General Purposes Lecturer: Mr. Kaberuka Dan

This course was studied during the whole year!

LEVEL II

Academic Year: 2020–2021

Trimester I

MAT2161: General topology and its Applications Lecturer: Dr. Minani
Froduald

Topics: Basic concepts and definitions, Topological Spaces, Continuous functions, Connectedness and compactness, Convergence

MAT2162: Probability Theory Lecturer: Dr. Ndengo Marcel

Topics: Introduction to Probability, Random Variables and Probability Distributions, Jointly Distributed Random Variables, Functions of Random Variables, Law of large numbers and Central Limit theorem

MAT2163: Numerical Analysis and Programming Lecturer: Prof. Jean Marie Ntaganda

Topics: Errors in Numerical Calculations, Solving Nonlinear Equations, Linear Algebraic Equations, Interpolation and Polynomial Approximation, Numerical Differentiation and Integration, Initial Value Problems for Ordinary Differential Equations.

MAT2164: Measure theory and Integration Lecturer: Dr. Venuste Nyagahakwa

Topics: Introduction to Measure Theory, Construction of Measures, Measurable Functions, Integration with Respect to a Measure, Fubini's Theorem.

Trimester II

MAT2261: Functional analysis Lecturer: Dr.Minani Froduald

Topics: Vector Spaces, Metric spaces, Normed Spaces and Banach Spaces, Inner product spaces and Hilbert Spaces, Linear Operators and Functionals

MAT2262: Partial Differential Equations Lecturer: Prof. Banzi Wellars

Topics: Classification of PDEs, First-Order PDEs, Second-Order Linear PDEs, Boundary and Initial Value Problems, Method of Characteristics

MAT2264: Operational research and Optimization Lecturer: Dr.Marcel Ndengo

Topics: Introduction to Operational Research, Linear Programming (LP), Integer Programming

MAT2269: Inferential Statistics Lecturer: Prof. Joseph Nzabanita

Topics: Discrete and continuous distributions, Sampling Distributions, Point and Interval Estimation, Hypothesis testing, Analysis of Variance (ANOVA)

MAT2265: Mathematical Modelling Lecturer: Dr.Jean Pierre Muhirwa

Topics: Types of models, Linear Models, Differential Equations models and applications

Trimester III

MAT2361: Stochastic Processes Lecturer: Dr.Ndengo Marcel

Topics: Stationarity, Ergodicity, Gaussian and Markovian processes, Markov Chains, Queueing Theory

MAT2362: Nonlinear analysis Lecturer: Prof. Denis Ndanguza

Topics: Fundamental Concepts of Nonlinear Systems, Banach fixed-point theorem, Bifurcation Theory, Phase Plane Analysis

MAT2363: Fluid dynamics Lecturer: Dr. Ruganzu Leon Fidele

Topics: Introduction to basic concepts, Properties of fluids, Lagrangian and Eulerian description of fluid flow, Continuity equation, Bernoulli's Equation, Navier-Stokes equations

MAT2364: Multivariate Statistical analysis Lecturer: Prof. Joseph Nzabanita

Topics: Characterizing and Displaying Multivariate Data, Multivariate Normal Distribution, Tests on One or Two Mean Vectors, Multivariate Analysis of Variance, Tests on Covariance Matrices, Principal Component Analysis

ESP2112: English for Specific Purposes Lecturer: Mrs. Marie Louise

LEVEL III

Academic Year: 2021–2022

Trimester I

MAT3161: Optimal control Lecturer: Dr. Jean Pierre Muhirwa

Topics: State variables and control variables, Objective functions and constraints, Calculus of Variation, Pontryagin's Maximum Principle.

MAT3162: Differential geometry Lecturer: Dr. Mahara Isidore

Topics: Curves and Surfaces, Manifolds, Tangent Spaces and Vectors, Differential Forms, Riemannian geometry, Connections and Covariant Derivatives, Lie Groups and Lie Algebras

MAT3163: Dynamical Systems Lecturer: Prof. Ndanguza Denis

Topics: Trajectories or Orbits, Fixed Points and Equilibria, Chaotic Behavior, Bifurcations, Phase Portrait Analysis

MAT3164: Mathematical biology Lecturer: Prof. Jean Marie Ntaganda

Topics: Population Dynamics, Deterministic ODEs Models and stability, SI Model, SIS Model, SIR Model, SIRS Model, Chemical Kinetics

MAT3165: Research Methodology Lecturer: Prof. Banzi Wellars

Topics: Literature Review and Formulation of the problem, Developing Hypotheses or Conjectures, Proving or Disproving the Conjectures, Generalizations and Extensions, Project.

Trimester II

MAT3263: Financial Mathematics Lecturer: Dr. Hakizimana Jean Bosco

Topics: Concepts of Interest rates, Investment Appraisal and Investment Performance, Present value and Annuities, European and American options, Portfolio theory

MAT3264: Actuarial mathematics Lecturer: Dr. Hakizimana Jean Bosco

Topics: Survival time and Actuarial Functions of Mortality, Life insurance and Annuities, Premium, Reserves

EAP3113: English for Academic Purposes Lecturer: Mrs. MUKASIBO

Trimester III

MAT3361: Industrial Attachment

This module required to complete a two-month academic internship, followed by the preparation and submission of a detailed report. The purpose is to integrate practical skills with theoretical knowledge

Final Year Project.

Upon completing all the coursework, students are required to select a specific research topic and a supervisor to conduct an in-depth study over three months. This research project, which carries the highest credit value of all courses, culminates in a comprehensive report detailing the findings. After a report is accepted, you are required to defend what you did.

Method of Evaluation

Quizzes

Two quizzes on 10 marks each

Percentage share: 20% of total marks

Assignments

Two Assignments on 15 marks each

Percentage share: 30% of total marks

Final Exam

One on 50 marks.

Percentage share: 50% of total marks

Pass mark = 50%