

Module	Foundations of Computing
Credits	10 ECTS / 5 U.S. semester credits
Important notes	Available for academic year students only
Allocation of marks	60% Continuous assessment 40% Final examination

Intended Module Learning Outcomes

On successful completion of this module learners be able to:

1. Perform numerical calculations involving integers and real numbers that involve indices, logs and modulo arithmetic.
2. Solve algebraic equations
3. Work with Boolean algebra and quantified expressions.
4. Solve problems in linear programming
5. Work with sequences and series.

6. Explain the principle of induction and carry out simple inductive proofs over the natural numbers;
7. Use general formulas for the equations of lines, circles, parabolas and ellipses;
8. Solve trigonometric problems
9. Do differentiation and integration.

Module Objectives

The main objective of this course is to introduce learners to the concepts, notations and operations of mathematics that provide a basis for working in the field of computing. The material covered extends the knowledge of learners who have completed courses in mathematics at secondary level.

Module Curriculum

Discrete Mathematics

- **Number sets:** naturals, cardinals, integers, rationals, reals, complex; basic laws of arithmetic: commutativity, associativity, distribution; indices; logs; modulo arithmetic.
- **Algebra:** algebraic expressions and simplification rules; solving polynomials – quadratic and cubic ; inequalities; solving simultaneous equations in two unknowns.
- **Boolean Algebra:** constants, expressions, operators (and, or, not, implication, equivalence), evaluating expressions, truth-tables; predicate calculus: predicates, quantifiers – forall, exists, +, *, #(counting), writing assertions over sequences.
- **Linear Programming:** linear inequalities; graphing regions of the plane; simultaneous inequalities; maximising and minimizing constraints; using linear programming to calculate optimizations for given problems.
- **Sequences and Series:** sequences as lists of numbers formed by rules; arithmetic sequences; geometric sequences; arithmetic series; geometric series; infinite geometric series.
- **Induction:** principle of induction; inductive proofs.

Continuous Mathematics

- **Co-ordinate Geometry:** line, circle, hyperbola, ellipse

- **Trigonometry:** angle measurements: radian, degrees; trigonometric ratios, functions & identities; sine and cosine rules; compound angles and associated formulae.
- **Differentiation:** limits; differentiation from first principle; differentiation by rule: product, quotient and chain; implicit and parametric differentiation; higher derivatives; exponential functions; logarithm functions; max/min problems.
- **Integration:** indefinite and definite integral; integration by substitution; integration of rational and trigonometric functions; calculations of areas and volumes by integration.