

BACHELOR OF INFORMATION TECHNOLOGY (BIT)

MATHEMATICS BRIDGING COURSE

SYLLABUS

1. **Sets, Number Systems and Notation.** The language of data, logical conditions and the states an algorithm searches.
2. **Equations, Inequalities and Constraints.** Solving for unknowns and expressing the constraints in scheduling and search problems.
3. **Exponents, Roots and Growth.** Growth and decay in algorithm running time, and the sigmoid function in classification.
4. **Logarithms and Scaling.** Entropy in decision trees, log-likelihood in machine learning, and the cost of binary search.
5. **Polynomials and Rational Functions.** Regression models, pricing and revenue curves, and efficient polynomial evaluation.
6. **Counting and Binomial Expansions.** Counting the configurations an algorithm must search, and curves in computer graphics.
7. **Vectors and Geometry in the Plane.** Feature vectors, distance in k-nearest neighbours and clustering, and linear decision boundaries.
8. **Trigonometric Functions.** Rotations in graphics and robotics, and periodic patterns in time-series data.
9. **Differentiation and the Chain Rule.** Gradients of a loss function, and the chain rule as backpropagation in neural networks.
10. **Rates of Change and Optimisation.** Gradient descent, least-squares fitting, and Newton's method.
11. **Integration.** Accumulating continuously varying quantities, and probability as area under a curve.
12. **Areas, Accumulation and Motion.** Motion models in tracking and simulation, and area under a curve as a performance measure.
13. **Mathematics in Computing.** Representing information numerically, optimising models, searching discrete choices, and deciding under uncertainty, with examples from AI, machine learning and neural networks.