Module 1: Introduction to Numerical Methods

Knowledge (K):

* Define numerical methods and explain their importance.

Comprehension (C):

* Discuss different types of numerical methods and provide examples of their applications.

* Identify a real-world problem where numerical methods could be used to find a solution.

Application (A):

* Use the Newton-Raphson method to find the root of the equation $x^3 - 2x - 5 = 0$.

Module 2: Numerical Integration

Knowledge (K):

* Define the concept of a definite integral and numerical integration.

Comprehension (C):

* Explain the difference between the trapezoidal and Simpson's rules for numerical integration.

Application (A):

* Use the trapezoidal rule to approximate the integral of the function $f(x) = x^2 + 1$ from $x = 0$ to $x = 1$ with $n = 4$ subintervals.

Module 3: Numerical Differentiation

Knowledge (K):

* Describe the forward difference method for numerical differentiation.

Comprehension (C):

* Explain how the central difference method is more accurate than the forward or backward difference methods.

Application (A):

* Use the central difference method to approximate the derivative of the function $f(x) = x^3$ at $x = 1$.

Module 4: Differential Equations

Knowledge (K):

* Explain the concept of a differential equation and its order.

Comprehension (C):

* Describe how Euler's method can be used to approximate the solution to a first-order differential equation.

Application (A):

* Use Euler's method to approximate the solution to the differential equation $y' = x + y$ with initial condition $y(0) = 1$ from $x = 0$ to $x = 1$ with $h = 0.2$.

Module 5: Interpolation and Curve Fitting

Knowledge (K):

* Define polynomial interpolation and explain its applications.

Comprehension (C):

* Compare the accuracy of linear and quadratic interpolations.

Application (A):

* Use Lagrange interpolation to construct a polynomial that passes through the points (0, 2), (1, 3), and (2, 6).