

Institute of Computer Science/Information Technology (ICS&IT)  
Faculty of Management Sciences & CS/IT (FMCS)  
The University of Agricultural Peshawar

Programme: BS(CS)-V  
Course Name: Numerical Computing  
Course Code: CSS-502  
Course Hours: 03  
Total Weeks: 16  
Total Hours: 48

Course Objectives

The process of obtaining solution by analytical means is to reduce original problem to a repetition of the same steps or series of steps so that the computation becomes automatic. Such a process is called a numerical method and the derivation and analysis of such method lie within the description of numerical analysis. A major objective of the course is to introduce the students to numerical analysis so that the students are able to solve complex numerical problems. The minimum prerequisite for effectively following this course is elementary calculus, Fortran 77 and differential equation.

Week-1

Introduction to Numerical Analysis

- The concepts of efficiency
- Reliability and accuracy of a method
- Minimizing computational errors

Week-2

Theory of Differences

- Difference Table,
- Detection and Correction of Errors in a Difference Table

Week-3

- Forward Difference Operator, Backward Difference Operator, Central Difference Operator

Week-4

- Shift Operator, Mean Operator Relationship b/w Operators.

Week-5

- Interpolation, Meaning of Interpolation
- Linear, Quadratic Interpolation.

Week-6

- Type of Interpolation Formulas for Equally Spaced Data Points.
- Type of Interpolation Formulas for Unequally Spaced Data Points.

Week-7

- Newton's Forward Difference Interpolation Formulas
- Newton's Backward Difference Interpolation Formulas

Week-8

- Interpolation with Central Difference Formulas.
- Stirling's Interpolation Formulas.
- Bessel's Interpolation Formulas.

Week-9

- Lagrange's Interpolation Formula.
- Everett's Interpolation Formula.
- Gaussian Interpolation Formula.

Week-10

Numerical Differentiation

- Derivation of Differentiation Formulas R/S b/w Operator E and D
- Derivatives Using Newton's Forward Difference Formula.

Week-11

- Derivatives Using Newton's Backward Difference Formula.
- Derivatives Using Central Difference Formulas.

Week-12

NUMERICAL INTEGRATION

- Derivation of Interpolation Formula.
- The Newton Cotes Formulas
- Trapezoidal Rule.

Week-13

- Simpson's  $1/3^{\text{rd}}$  Rule.
- Simpson's  $3/8^{\text{th}}$  Rule.

Week-14

- Iteration Method
- False- Position Method
- Bisection Method.

Week-15

- Estimation of Errors in Some Newton Cotes Formulas.
- Error in Trapezoidal Rule.
- Error in Simpson's  $1/3^{\text{rd}}$  Rule

Week-16

- Linear System of Equation
- Cramer's Rule.
- Gaussian Elimination Method

Total Marks: 100

Recommended Books:

1. A 1<sup>st</sup> Course in Numerical Analysis with C++ 4<sup>th</sup> Edition by Dr. Saeed Akhtar Bahtti  
Mr. Naeem Akhtar Bhatti