

TRIBHUVAN UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF MATHEMATICAL SCIENCES
Bachelor in Mathematical Sciences (B.Math.Sc.)

Course of Study

Code No: MSCS 102

Full Marks: 75

Paper: **Mathematics Software (MATLAB)**

Pass Marks: 30

Nature: Theory

Credit: 3

Course Description:

This course introduces MATLAB and its tools and contains a discussion of looping and logical structures within MATLAB, Creating matrices and vectors, numerical methods for solving system of linear equations, numerical methods for solving Basic Algebra equations, some classical numerical root finding, the numerical analysis associated with integration and differentiation, Interpolation and Extrapolation

Course Objective:

To acquaint students with Mathematical Software and use the software to solve, observe and analysis mathematical and computational problems.

Unit 1 Familiarization with MATLAB

5 hrs

Overview, Understanding the MATLAB Environment, MATLAB Basic Syntax, Variables and Data Types, Commands, Operators

Unit 2 Loops and conditional statements

5 hrs

Decision making Statements: if...end statement, if...else...end statement, if...elseif...elseif...else...end statement, Nested if statement, Switch statement, Nested switch statement, Loop statements: for loop, while loop, nested loops, Break and continue statements

Unit 3 Writing scripts and functions

4 hrs

Writing scripts files, Creating functions, Calling functions, inline functions
MATLAB Plotting, 3D plotting, Graph representation (Bar, Pie, box-plot, counters, etc)
Statistics: Central Tendency, Measure of dispersion

Unit 4 MATLAB - Algebra

16 hrs

Vectors: Creating Row and column vectors, referencing elements of vectors, delete insert and modify elements of vector, Vector operations: Addition, scalar multiplication, transpose of vector, appending vectors, magnitude of vectors, dot product, Creating uniformly spaced vectors (linspace, logspace)

Matrix: Creating matrices, Special matrix generation, referencing elements of matrices, editing and deleting row and column in matrices,

Matrix operations: Addition, scalar operations on matrices, transpose of matrix, concatenating matrices, matrix multiplication, determinant, Inverse, rank

Complex Number: Complex numbers representation, modulus of complex numbers, conversion between coordinate system

Polynomial: Solving Basic Algebra equations, Factorization and Simplifications of Algebraic Equations, Solving quadratic equations, Solving Higher order equations, Solving Systems of Equations (Gauss Elimination method, Jacobi's, Gauss-Siedel method, LU factorization method) Polynomials representation, finding roots of polynomials, polynomial curve fitting

Unit 5 MATLAB – Calculus

4 hrs

Computation of Limits, Verification of basic properties of limits, Verification of basic rules of differentiation, derivative of function (linear, non-linear), computing Higher order derivatives, finding the maxima and minima of a curve, Solving simple Differential equations Computation of integrals, Verification of basic properties of integrals

Unit 6 Numerical Approximation

11 hrs

Root Finding: Finding Solution of nonlinear equations: Bisection Method, Regula-Falsi Method, Secant Method, Newton Raphson Method

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Gaussian Integration (Gaussian-Legendre Formula 2-point and 3-point)

Interpolation and Extrapolation: Newton's Interpolation (forward, backward), Lagrange Interpolation, Cubic Spline Interpolation Linear Interpolation

References:

1. S.R. Otto and J.P Denier: An Introduction to Programming and Numerical Methods in MATLAB, Springer-Verlag London Limited 2005.
2. Stormy Attaway: MATLAB A Practical Introduction to Programming and Problem Solving, Second Edition, 2012 Elsevier Inc.
3. http://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf