Numerical Methods

Course Code	Credit Hours
MATH-355	3-1

Course Description

The course demonstrates the use of numerical analysis as a powerful problem solving tool in engineering. The course encompasses numerical analysis, numerical integration and solutions to ordinary differential equations, with applications to engineering problems through mathematics software MATLAB.

Text Book:

1. Numerical Analysis 9th Ed: by Burden and Faires.

Reference Book:

1. Calculus with Analytic Geometry by Thomas and Finny.
2. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra.

Prerequisites:

MATH-121 Linear Algebra & ODE

ASSESSMENT SYSTEM FOR THEORY

	Without Project (%)	With Project/Complex Engineering Problems (%)
Quizzes	15	10-15
Assignments	10	5-10
Mid Terms	25	25
Project	-	5-10
End Semester Exam	50	45-50

ASSESSMENT SYSTEM FOR LAB

Lab Work/ Psychomotor Assessment/ Lab Reports	70%
Lab Project/ Open Ended Lab Report/ Assignment/ Quiz	10%
Final Assesment/ Viva	20%

Teaching Plan

Week No	Topics/Learning Outcomes
1	Introduction to matrix algebra, direct method to solve system of linear equations.

2	Gaussian elimination method, Gauss Jordon method
3	Pivoting techniques: partial pivoting technique, Scaled partial pivoting technique
4	LU-factorization: Doolittle's method
5	Crout's method, Cheloski's method.
6	Solution to equations in one variable: Bisection method, Newton Raphson's Method
7	Secant method, False position method
8	Modified Newton method
9	**Mid Semester Exam**
10	Lagrange interpolation (1^{st} and 2^{nd} degree approximation)
11-12	Numerical integration: Trapezoidal rule, Simpson 1/3 rule.
13	Newton divided differences (1^{st} ,2^{nd} and 3^{rd} degree approximations)
14	Forward difference and back ward difference approximations,
15-16	Numerical solution of ODEs: Euler method, Modified Euler method. Runge-kutta method of order 4, Method of least squares
17-18	End Semester Exam

Practical:

Experiment No	**Description**
1	Introduction to MATLAB, Basic commands
2	Basics of Matrix algebra using MATLAB
3	Basics in build commands for polynomials
4	Basics commands for differentiation and integration
5	Plotting graphs for different expressions
6	Code for Bisection method
7	Code for secant method
8	Code for Newton Method and Modified Newton method
9	Code for secant Method
10	Code for Gaussian elimination method
11	Code for Gauss Jordan method
12	Pivoting technique
13	Curve fitting