Department of Chemical Engineering	
Engineering Numerical Analysis (64251)	
Total Credits	**3**
major compulsory	
Prerequisites	P1 : Computer Programming (61201) OR Programming Languages (65201) OR Computer Programming (66111) P2 : Differential Equations (21203) OR Engineering Mathematics (21202) OR Linear Algebra (21241)

Course Contents

This course will cover topics such as Taylor series, root finding, and optimization. Topics in function approximation, nonlinear equations, interpolation, numerical integration and differentiation, and numerical solution of ordinary differential equations will be similarly treated. The discussion of approximate arithmetic and error propagation will also arise in a natural way.

Intended Learning Outcomes (ILO's)		Student Outcomes (SO's)	Contribution
1	Use Taylor Series to approximate functions.	A	5 %
2	Use algorithms to locate the roots	A	23 %
3	Use algorithms to locate and optimize min and max of equations.	A	20 %
4	Learn how to smooth engineering collected data using least square method.	B	8 %
5	Use polynomials to interpolate engineering collected data or approximate a function.	B	8 %
6	Understand and use algorithms to evaluate the derivative or the integral of a given function.	A	8 %
7	Understand and use algorithms to solve Ordinary Differential Equations (ODE).	A	8 %
8	Understand relationships among methods, algorithms and errors.	A	10 %
9	Apply numerical and computer applications and programming languages to solve numerical common engineering problems.	K	10 %

Textbook and/ or Refrences

Numerical methods for engineering, Chapra S. C.andCanale R. P

Assessment Criteria	Percent (%)
First Exam	20 %
Second Exam	20 %
Homeworks	15 %
Final Exam	45 %

Course Plan

Week	Topic
1	1. Introduction - Significant Figures, 3.1 - Accuracy and Precision, 3.2 - Errors, 3.3, 3.4 - Taylors series, 4.1
2_5	2. Solving Nonlinear Equations - Graphical Methods, 5.1 - Bracketing Methods Bisection Method, 5.2 False-Position Method, 5.3 - Open Methods Simple Fixed-point Iteration, 6.1 Newton-Raphson Method, 6.2 Secant Method, 6.3 Multiple Roots, 6.4 - System of Nonlinear Equations, 6.5 - Case studies, 8.1 First Exam
6_8	3. Optimization - One Dimensional Unconstrained Optimization Golden Section Search,

	13.1 Quadratic Interpolation, 13.2 Newtons Method, 13.3 - Constrained Optimization Linear Programming, 15.1.1-2 - Case Studies, 16.1
9_11	4. Curve Fitting - Least Square Regression Linear Regression, 17.1 Polynomial Regression, 17.2 Multiple Linear Regression, 17.3 - Interpolation Linear, quadratic and nth order interpolating polynomial, 18.1.1 - 4 - Case studies, 20.1 Second Exam
12_14	5. Numerical Integrationand Differentiation - Newton Cotes Integration Formulas Trapezoidal Rule, 21.1 Simpsons Rules, 21.2 - Finite divided approximation formulas; low and high accurate formulas for first and higher derivatives (forward, backward and centered), 23.1 23.2 - Case studies, 24.1
15_16	6. Ordinary Differential Equations - First order O.D.E Eulers Method, 25.1 25.2 Rung-Kutta Methods, 25.3 - System of 1st order O.D.Es,25.4 - Case studies, 28.1