Forman Christian College, Lahore
(A Chartered University)
Department of Mathematics

Numerical Analysis (MATH 310)
Spring 2022
Nazish Shahid, Associate Prof.
Room No. S-352
Office hrs. Mon, Wed, Fri 1:00 PM-1:55 PM
Tues, Thur: 1:50 PM- 02:50 PM
Note: For other than office hours get an appointment.
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Course Details:

Course Timings: MWF 2:00 PM-2:50 PM
Class Room: S-416
Credits: 3hrs
Prerequisite: MATH 102 or MATH 103
Section **A**

Recommended Books & Lecture Notes:

- **Numerical Methods by Dr. V. N. Vedamurthy and Dr. N. Ch. S. N. Iyengar (will be followed in class)**
- Numerical Methods for Mathematics, Science and Engineering by John H. Methews (3rd Edition)
- Lecture Notes (available on Moodle)
- Links of youtube video lectures posted on Moodle

Goals:

- To be able to solve higher order equations using numerical methods.
- To be able to find solution of systems of linear equations by exact and iterative methods.
- To be able to understand the concepts and working of numerical differentiation and numerical integration.
- To be able to reduce errors to its minimum while finding numerical solutions of higher order equations.
- To be able to apply methods and techniques of numerical analysis to other areas of mathematics like ordinary differential equations and linear algebra, etc.

Course Requirements

- **Every student must bring his\her calculator in the class.**
- **There will be absolute grading for evaluation of the course.**
- Students are expected to attend all classes. **University's attendance policy** will be followed and the student whose attendance is less than 70% won't be allowed to take the final exam.
- Students must arrive in the class at time and should remain there for the entire period.
- All electronic devices including **Mobile phones should be switched off** during classes, quizzes and midterm.
- **All quizzes and exams shall be held on-campus.**
- There is no make up for missed quizzes and assignments. Make up for midterm and final exam is possible only under extremes cases if the student provides strong documentary evidence. In case of makeup exam there will be a 0-20% deduction in marks depending upon case-to-case basis. Medical Certificate will be acceptable if the medical officer of FCC verifies it.
- For other "Expectations" and "Breaches of Academic Integrity" please visit
  https://www.fccollege.edu.pk/policy-on-academic-integrity/

Course Contents

This is a core course of Mathematics. Course contents include solution of system of linear equations, solution of non-linear equations, error analysis, interpolation by polynomials, Lagrangian interpolation, numerical differentiation, numerical integration, and computer programming (MATLAB, subject to availability of software).

Course Evaluation
Course assessment will be done through the following steps:

Attendance, Behavior, Class Participation	5%
Assignments (2)	5%
Quizzes (3)	20%
Midterm	30%
Final Exam	40%

Contents Distribution

Week	Topics	Assessment
1	**Course Plan:** Course Introduction, Policies and Grading Criteria. **Solution of System of Linear Equations (Exact Methods)** Gauss Elimination Method, Gauss Jordan Method, Method of Triangularization	
2	**Solution of System of Linear Equations (Iterative Methods)** Gauss Jacobi Method, Gauss Seidel Iteration Method	
3	**Solution of Non Linear Equations (Iterative Methods)** Bisection Method, Method of Successive Approximation	
4	**Solution of Non Linear Equations (Iterative Methods)** (**Continued**) Method of False Position, Newton's Iteration Method, Rate of Convergence of Newton Raphson Method	**Assignment 1**
5	**Errors** Error Analysis, Truncation Error, Round off Error, Propagated Error	**Quiz-1**
6	**Difference operators and Interpolation** Forward Differences, Backward Differences, Gregory Newton Forward Interpolation	
7	**Interpolation (Continued)** Gregory Newton Backward Interpolation, Divided Differences, Newton's Divided Difference Formula	
8	**Mid-Term Course:** Topics covered in first 7 Weeks Lectures **Lagrange's Interpolation** Equidistant Terms with One or More Missing Values, Lagrange's Interpolation	**Midterm**
	Computer Programming (subject to availability of software)	

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10	**Inverse Interpolation** Lagrange's method and iterative method	**Quiz-2**
11	**Numerical Differentiation** Introduction of Numerical Differentiation, Derivatives by Newton's Forward Difference Formula, Derivatives by Newton's Backward Difference Formula	
12	**Numerical Integration** Introduction of Numerical Integration, General Quadrature Formula,	**Assignment 2**
13	**Numerical Integration (Continued)** Trapezoidal Rule, Simpson's $\frac{1}{3}$ rule	
14	**Numerical Integration (Continued)** Simpson's $\frac{3}{8}$ rule	
15	**Errors in Quadrature Formulae**	**Quiz-3**
16	**Errors in Quadrature Formulae (continued)**	
	Final Exam (from whole course)	