Soran University
Faculty of Science
Department of Mathematics

- **Module Title:** **Numerical Analysis**
- **Module Level:** **Undergraduate**

- **Module Leader:** Tahsin I. Rasul

- **Teaching Semester :** 1^{st} **&** 2^{sec}

Aims

To introduce student to the topic of Numerical Analysis and some of the major issues involved, including accuracy and convergence. Developing simple programs to implement the numerical methods. Though the study of some simple numerical algorithms.

Module Description

This course analyzed the basic techniques for the efficient numerical solution of problems in science and engineering. Topics spanned root finding, direct and iterative methods in linear algebra, interpolation, approximation of functions, integration and differential equations.

Learning Session Structure

First Semester

The format of the class each week will be as follows

Lectures: 3 hour / per week
Tutorial: 1 hour / per week
Computer Lab session: 2 hour / per week

Summary description of assessment items

Assessment Type	Description of Item	% Weighting	Week Due
Quick Quiz	An exam of one or two questions with 20 minutes time to answer.	%5	Every week
Midterm Exam	An Exam of 4 to 6 questions with 1.5 hour time to answer.	%25	Every 5 week
Midterm practical Exam	An Exam of 2 to 4 questions with 1hour time to answer by using the computer.	%10	Every 5 week
Final Exam	One exam at the end of the Semester; 6 to 8 questions with time of 3 hours to answer.	% 40	End of the Semester
Final practical Exam	An Exam of 2 to 4 questions with 1hour time to answer by using the computer.	% 20	End of the Semester

Learning and Teaching Methods

For Lecture, three hours lecture per week; each lecture will cover part of the course; lecture notes will be given to students before class; sometimes slide shows will be used to describe subjects that need some pictures for a better understanding.

For tutorials, every week, I will set the class tutorial questions to be attempted. Solutions should be handed to me one day before the tutorial class. The tutorial class is an opportunity for you to test your knowledge of the lecture material and also allows you to raise any question about the lecture material you have.

For computer lab sessions, student should be come to Laboratory and we will try to write some MATLAB code to solve some mathematical problems.

Syllabus

First Semester

Chapter One

- Introduction.
- Numerical Analysis: What is it?
- Floating point numbers and Round-off Errors.
- The Representation of Integers.
- The representation of Fractions.
- Round-off Errors.
- Absolute and Relative Errors.
- Finite-Digit Arithmetic.
- Stability and Convergence.

Chapter Two.

Solution of equation in one variable.

- Bisection Method
- False-Position Method (Regula Falsi Method).
- Secant Method.
- Newton-Raphson Method.
- Fixed-Point Iteration.

Chapter Three.

Direct Methods for Solving Linear system

- Standard Gaussian Elimination
- The LU Factorization
- Cholesky Factorization
- Norms of Vectors and Matrices
- Vector Norms
- Iteration Methods
- Jacobi Iterative Method
- Gauss-Seidel Iterative Method

- Power Method

Chapter Four.

INTERPOLATION POLYNOMIAL

- **FINITE DIFFERENCES.**
- **FORWARD DIFFERENCE OPERATOR**
- **BACKWARD DIFFERENCES**
- **CENTRAL DIFFERENCES**
- **INTERPOLATION POLYNOMIAL**
- **LAGRANGE INTERPOLATION POLYNOMIAL (L I P) .**

Bibliography

1- G. SHANKER RAO. (1997), "*Numerical Analysis* ".

2- Richard L. Burden and J. Douglas Faires , "*Numerical Analysis"* , Ninth Edition ,*Youngstown State University.*

3- M.K. JAN , S.R.K. Iyengar and R.K. Jain. (2007) *"Numerical methods for scientific and engineering computation*", Fifth edition.

4- Kincaid, D. and Cheney, W. (2002), "Numerical Analysis: mathematics of scientific computing ", third edition , Brooks / Cole publishing Company.

5- Atkinson, K. (1985) *"Elementary Numerical Analysis", New York: Wiley.*

Authored by

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