



### Course Outlines of BSCS Degree Program

<b>Course Instructor</b>	Mr.Mohammad Jamil	<b>Semester</b>	Spring
<b>Batch/Section(s)</b>	Batch 2023 / Sections	<b>Year</b>	2026
<b>Course Title</b>	CS 2008 NUMERICAL COMPUTING	<b>Credit Hours</b>	3
<b>Prerequisite(s)</b>		<b>Course TA</b>	

#### **Text Book(s)**

Title of book	Numerical Analysis , 9 <sup>th</sup> Edition
Author(s)	Burden and Faires

#### **Reference Book(s)**

1) Numerical Methods using MATLAB , 3rd Edition
John H.Mathews
2) Applied Numerical Methods with Matlab for Engineers and Scientist, 3 <sup>rd</sup> Edition
Steven C,Chapra

#### **Course Objective:**

- To introduce the students to the mostly used computing methods in the different fields of engineering and sciences.
- The emphasis will be on understanding the algorithem of the various methods for computing and on applying these to obtain the approximate solutions for various mathematical problems.
- Python , MATLAB ,Excel will be used as tool for implementation and application of these computing methods.

#### **Course Description:**

The Numerical computing includes: Error concept and analysis , Roots of nonlinear algebraic equations of one variable ,Direct and iterative method for system of linear equations, Linear interpolation with 2nd and 3<sup>rd</sup> dimensional , Interpolating polynomials , Differences , Operators and their relation , Numerical differentiation and integration , Numerical solution of differential equation .Iteration for non linear system of equation

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<b>Department</b>	Computer Science		<b>Dept. Code</b>	CS
<b>Course Title</b>	Numerical Computing		<b>Course Code</b>	CS 2008
<b>Instructors</b>	Mr. Jamilusmani		<b>Sections</b>	A-I
<b>Pre-requisite(s)</b>	MT-119 Calculus with analytical Geometry		<b>Credit Hrs.</b>	03

<b>Course Objectives</b>	This course introduces as fundamental concepts and methods of basic numerical analysis tools to the computer science and engineering students. The objectives of this course are: To introduce the students to the mostly used computing methods in the different fields of engineering and sciences. The emphasis will be understanding the algorithm of the various methods for computing and on applying these to obtain the approximate solutions for various mathematical problems. Excel, Matlab or C++ can be used as tool for implementation and application of these computing methods.
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PLO	Assigned Program Learning Outcome (PLO)			
02	<b>Knowledge for Solving Computing Problems:</b>	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.		

CLO	Course Learning Outcome (CLO) Statements	Domain	Taxonomy level	PLO	Tools
01	<i>Analyze Error and difference operators of numerical methods and compute the roots of algebraic and transcendental function of nonlinear equations of single variable.</i>	Cognitive	4	02	A1,Q1 M1,F
02	<i>Apply numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations.</i>	Cognitive	3	02	A2,Q2 M2,F
03	<i>Demonstrate the capability of using numerical analysis library or software for solving related problems of interpolation, differentiation, integration, the solution of linear and nonlinear equations related to the program domain</i>	Cognitive	2	02	A1,A2,A3
<i>Tools: A = Assignment(A1,A2,A3), M = Midterm (M1,M2), F=Final, Q=Quiz(Q1,Q2,Q3)</i>					

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**Tentative Weekly Lectures Schedule:** Numerical Analysis , Burden and Faires , 9<sup>th</sup> Ed

Week	Contents / Topics	Exercise	Questions	Exam
1	<b>Error analysis:</b> Introduction of Numerical Computing ,Chopping Roundoff and truncation error ,Absolute ,relative and percentage error ,Taylor polynomial,.Significant figures, Nested arithmetic, loss of significance.	1.1  1.2	1,2,11,13  1,4,5-8,13	A1/M1 /Q1/F
2	<b>Solution(Root) of equations in one variable:</b> The Bisection or Binary-search method. Fixed Point iteration. ( $x=g(x)$ )	2.1  2.2	1-6,12,13  1-6,9- 11,14	CLO1
3	Newton's Raphson and Secant Method.	2.3	1-10	
4	Method of False position (Regula falsi).			
5	<b>Interpolation and Polynomial approximation:</b> Lagrange interpolation polynomial of degree one,two and three with error term	3.1	1,2,5,6	CLO2
6	<b>Mid 1 Exam</b>			
7	Divided difference table and interpolating polynomial. Newton Forward and Backward difference formula	3.3	1-6,9	
8	Newton centered difference (stirling) formula.			
9	<b>Numerical differentiation :</b> Differentiation using Forward and Backward differences 3-point Endpoint and Midpoint formula & error bound 5-point Endpoint and Midpoint formula & error bound	4.1	1,2,5,6,18, 25,26	CLO2
10	<b>Numerical Integration:</b> Trapezoidal and Simpson's rule with error term. Closed & open Newton-Cotes formulas with error term Composite Numerical Integration: Trapezoidal , Simpson's and Midpoint formula with bound error	4.3  4.4	1,2,5- 10,22  1-4,7,8,11	
11	<b>Mid 2 Exam</b>			
12	<b>Differential Equations:</b> Euler's method with bound error, 2-RK method , Mid Point formula Modify Euler and Huen's method , 4-RK method	5.2  5.4	1,2,5 1-4 5-8 , 9-12 13-16	Q3/A3 /F
13	<b>Direct Method for solving linear system:</b> LU decomposition (Dolittle and Crout) and positive definite matrices $LDL^t$ Factorization , cholesky method	6.5  6.6	1,2,3-6 1- 3,5,11,12	
14	<b>Iterative Techniques:</b> Iterative methods for solving linear system Gauss-Siedel and Jacobi's methods.	7.3	1,2,3,4	CLO2
15	<b>Approximating Eigenvalues :</b> The Power method	9.3	1,2,3	
16	<b>One-Dimensional Optimization:</b> Golden-Section Search and Parabolic Interpolation	7 (Steven Chapra)	1-10	

Course Teacher : Jamilusmani

**Grading Criteria:****Marks Distribution:**

<b>Particulars</b>	<b>% Marks</b>
1. Class participation/Attendance	00
2. Quizzes/ Assignments	05
3. Project /Programme	15
4. First Mid Exam	15
5. Second Mid Exam	15
6. Final Exam	50
<b>Total:-</b>	<b>100</b>

**Important Instructions to be followed for this Course**

- Be in classroom on time. Any student who arrives more than 5 minutes late in the class would be marked LATE. Anybody coming to class more than 15 minutes late will be marked ABSENT.
- Turn off your cell phones or any other electronic devices before entering the class.
- Maintain the decorum of the class room all the time.
- Avoid a conversation with your classmates while lecture is in progress.
- Submit your assignments on time, no assignment will be accepted after the deadline.

**Instructions / Suggestions for satisfactory progress in this course:**

- On average, most students find at least three hours outside of class for each class hour necessary for satisfactory learning.
- Chapters should be read and homework should be attempted before class.
- Do not get behind. You are encouraged to work with other students. Plus, I am always available during office hours to help you.
- The homework assigned is a minimum. You may always work extra hours on your own.
- Use the few minutes you usually have before the start of each class to review the prior meetings' notes and homework. This will save us valuable in-class time to work on new material.
- Develop a learning habit rather than memorizing. Work in groups, whenever appropriate.
- Apply the learned principles and gained knowledge.
- Be creative in thinking, but stick to the topic assigned for discussions, assignments and presentations.
- Always bring your **Work Book** and **Calculator** with you in the class.

**Note:** Students are welcome all the time in office to get help from the Teacher.



Signature: \_\_\_\_\_

01-02-2026

Date: \_\_\_\_\_