Course Description and Outcome Form
Department of Computer Science and Engineering
School of Data and Sciences
Brac University

A. Course General Information:

Course Code:	CSE330
Course Title:	Numerical Methods
Credit Hours (Theory+Lab):	3+0
Contact Hours (Theory+Lab):	3+3
Category:	Program Core
Type:	Required
Prerequisites:	MAT216
Co-requisites:	None
Discord Server Link	https://discord.gg/Wm5n2DHqMG

B. Course Catalog Description (Content):

Fixed Point Arithmetic, Polynomial Interpolation, Differentiation, Nonlinear Equations, Linear Equations, Least-Squares Approximation, Numerical Integration

C. Course Objective:

The course will help students to recognize the need for numerical analysis, and the importance of error analysis. They will learn various methods to linearize a polynomial, differentiate and integrate different functions by using approximations, and finally how to solve the linearized equation by using the laws of linear algebra, like Gaussian elimination, QR decomposition, etc.

D. Faculty List:

Name	Initial	Section(s)
Mohammad Sayeem Sadat Hossain	MSDH	1, 10
Mushfique Nasir Probor	MNP	2, 3, 4
Md. Aquib Azmain	AQU	5
Abu Mohammad Khan	AMK	6, 7
Saadat Rafid Ahmed	SADF	8, 9
Niloy Farhan	NNFN	11
Majisha Jahan Disha	NMJD	12
Rifa Tasfiya	NRTA	13, 14
Anindita Labonno	ALB	15, 30
Ittehad Saleh Chowdhury	NISC	16
Fatema Tuj Johora	NFTJ	17
Bijoy Ahmed Saiem	NBAS	18, 31
Md. Zulkar Naim	NMZN	19, 20
Sajid Imam Mahir	SJM	21
Naima Tahsin Nodi	NTN	22

Abdullah Khondoker	AKDR	23
Sheikh Samiul Kadir	SMKD	24
Towshik Anam Taj	NTAT	25, 26
Md Nafiu Rahman	NMNR	27
Nazmus Sakib Touhid	NNST	28
Ayesha Siddika	ADD	29

E. Course Outcomes (COs):

Upon successful completion of this course, students will be able to

Sl.	CO Description	Weightage (%)
CO1	Demonstrate an understanding of the fundamental concept of numerical analysis for different mathematical problems and the need for error analysis.	10
CO2	Comprehend different numerical techniques and theorems of numerical methods for polynomial interpolation, derivatives, linear and non-linear equations, and integrations.	30
CO3	Apply the principles and/or techniques of numerical methods in different mathematical setups and solve the relevant mathematical problems.	60

F. Mapping of CO-PO-Taxonomy Domain & Level- Delivery-Assessment Tool:

Sl.	CO Description	POs	Bloom's taxonomy domain/level	Delivery methods and activities	Assessment tools
CO1	Demonstrate an understanding of the fundamental concept of numerical analysis for different mathematical problems and the need for error analysis.	**(b)**	Cognitive/Analyze	Lectures, Notes, Lab	Midterm, Final exams
CO2	Comprehend different numerical techniques and theorems of numerical methods for polynomial interpolation, derivatives, linear and non-linear equations, and integrations.	**(c)**	Cognitive/Evaluate	Lectures, Notes, Lab	Midterm, Final exams
CO3	Apply the principles and/or techniques of numerical methods in different mathematical setups. Solve the linear and overdetermined systems by different numerical methods. Also compute integration numerically using Newton-Cotes formula and estimate the error.	**(a)**	Cognitive/Analyze	Lectures, Notes, Lab	Midterm, Final exams

G. Course Materials:

i. Text and Reference Books:

Sl.	Title	Author(s)	Publication Year	Edition	Publisher	ISBN
1.	Numerical Analysis II – Lecture Notes. (Main Text)	Anthony Yeates.	2018		Durham University	
2.	Numerical Methods In Engineering With Python.	Jaan Kiusalaas.	2005	First Edition	Cambridge University Press	ISBN-13: 978-0-521-85287-6 ISBN-10:0-521-85287-0
3.	Numerical Analysis (Reference)	Richard L. Burden J. Douglas Faires	2011	Ninth Edition	BROOKS/COLE CENGAGE Learning	ISBN-13:978-0-538-73351-9 ISBN-10:0-538-73351-9

ii. Other materials (if any)

(a) Lecture Notes/Handouts

H. Attendance Policy:

Attendance in class is mandatory for all undergraduate students. Students are required to maintain the following threshold attendance to be eligible for final assessment/Examination: **90% attendance at laboratory and studio sessions and 70% attendance at other classes.** The Head of Department, in consultation with the Registrar, will make arrangements to consider exceptions for students unable to attend classes because of major circumstances beyond their control.

I. Lesson Plan:

Date	: Topics
Week # 1	: Introduction. Overview of the whole course.
	: Floating Point Arithmetic. (Ch:1.1-1.3)
Week # 2	: Rounding error, loss of significance. (Ch:1.4-1.5)
	: Polynomial Interpolation. Vandermonde method. (Ch:2.1-2.2)
Week # 3	: Lagrange form. (Ch:2.3). Quiz # 1. Assignment # 1 due in class.
	: Newton divided/difference form. Interpolation error. (Ch:2.4-2.5)
Week # 4	: Chebyshev Nodes. Hermite Interpolation method. (Ch:2.6-2.7)
	: Differentiation: higher order finite difference. (Ch:3.1.) Quiz # 2. Assignment # 2 due in class.
Week # 5	: Rounding error, Richardson extrapolation. (Ch:3.2-3.3)
	: Nonlinear equations: Bisection method. (Ch:4.1)
Week # 6	: Fixed Point method. (Ch: 4.2)
	: Newton's method. (Ch:4.4). Quiz # 3. Assignment # 3 due in class.

Midterm Exam : July 30, 2025. From 11:00am-1:00pm

Week # 7 : Aitken acceleration. (Ch:4.6)
: Quasi-Newton method (Secant form). (Ch:4.7)

Week # 8 : Linear equations. Triangular forms. (Ch:5.1)
: Gaussian Elimination method. (Ch:5.2). Quiz -4. Assignment-4 due in class.

Week # 9 : LU decomposition method, pivoting. (Ch:5.3-5.4).
: Least Square Approximation: norms, Orthogonality, Gram-Schmidt Process. (Ch:6.1)

Week # 10 : Discrete least squares. (Ch:6.2)
: QR-decomposition method. (Ch:6.3). Quiz -5. Assignment-5 due in class.

Week # 11 : Newton-Cotes Formulae. Trapezium rule. (Ch: 7.1)
: Composite Newton-Cotes formulae. (Ch: 7.2)

Week # 12 : Simpson's rule. Exactness. (Ch: 7.3)
: Reviews. Quiz # 6. Assignment # 6 due in class.

Final Exam : September 18, 2025. From 11:00am-1:00pm.

I. Lab

No	Topic	Week/Lecture	Related CO
1	Floating Point and Basic Python	Week 1	C01
2	Polynomial [Class design] and application of VanderMonde Matrix	Week 2	C02
3.	Lagrange	Week 3	C02
4.	Hermite and Newton's Divided Difference	Week 4	C02
MID-WEEK			
5.	Differentiation and Richardson extrapolation	Week 5	C03
6.	Coding MID-Exam	Week 6	
7.	Root finding using Bisection method and Fixed point iteration	Week 7	C03
8.	Equation Solving	Week 8	C03
9.	Integration	Week 9	C03
10.	Review Class	Week 10	

11.	Final Viva/Coding Exam	Week 11	

J. Assessment Tools:

Assessment Tools	Weightage (%)
Attendance	5
Quiz	10
Assignment	15
Midterm	20
The mandatory final exam	30
Lab	20

K. CO Assessment Plan:

Assessment Tools	Course Outcomes		
	CO1	CO2	CO3
Mid Term	√	√	√
Final	√	√	√

L. Makeup Exam Policy:

The university policy for makeup exams for the midterm and final exams are the following: "If a student misses a scheduled exam due to unforeseen circumstances, they must apply for a makeup exam within 10 days from the day of the exam. Within these 10 days, the student must collect the necessary approvals, including medical clearances, and submit the makeup form to the Office of the Controller of Examinations. **Students unable to appear in the final exams may sit for the final makeup exams on the dates decided by the department/school which will be within 4 weeks of the following semester.** Students failing to appear in the makeup final exams shall be awarded an 'F' Grade and shall have to retake the course". For further details, visit the university webpage at https://www.bracu.ac.bd/academics/office-registrar/policies-and-procedures/examinations

M. CO Attainment Policy:

As per BRAC University Policy.

N. Grading policy:

As per BRAC University Policy.

O. Course Coordinators:

Abu Mohammad Khan (AMK) and Aquib Azmain (AQU) for theory.
Mushfique Nasir Probor (MNP) for laboratory.