

1. Course Name: NUMERICAL ANALYSIS	
2. Course Code:	
3. Semester / Year: 1 st semester/ 2 nd Year	
4. Description Preparation Date: 25-11-2025	
5. Available Attendance Forms:	
6. Number of Credit Hours (Total) / Number of Units (Total) : 5 / 125	
7. Course administrator's name (mention all, if more than one name)	
Assist. Prof. Dr. Ammar Adel Hasan	
8. Course Objectives	
Course Objectives	1. Explain and apply various numerical methods for mathematical problem solving. 2. Implement numerical algorithms using MATLAB for solving mathematical problems. 3. Analyze and quantify errors associated with numerical methods. 4. Apply numerical techniques to solve real-world engineering and scientific problems. 5. Communicate results effectively, both orally and in writing.
9. Teaching and Learning Strategies	
Strategy	The learning outcomes for a Numerical Analysis course include: 1. Understanding and implementing numerical methods for solving mathematical problems, such as root finding, interpolation, and approximation of functions. 2. Analyzing the properties of numerical algorithms including convergence, stability, and accuracy. 3. Applying numerical techniques to solve practical engineering and scientific problems, such as differential equations, optimization, and linear algebraic equations. 4. Developing proficiency in programming and utilizing computational tools like MATLAB, Python, or numerical computation software to implement algorithms and analyze numerical solutions. 5. Critically evaluating the results obtained from numerical methods, including error analysis and comparing with analytical solutions where possible. 6. Exploring advanced topics in numerical analysis, such as finite element methods, numerical integration, and solving eigenvalue problems.
1. Course Structure	

Week	Hours	Required Learning Outcomes	Weekly Lecture Plan Unit or subject name	Learning method	Evaluation method
1	2	LO1	Introduction & Types of Partial Differential Equations (PDEs)	Lecture	Quiz
2	2	LO1	Formation of PDEs & First-Order Linear PDE Solutions	Lecture	Quiz
3	2	LO1	Variable Separation Method with Boundary Conditions	Lecture	Quiz
4	2	LO1	Types of PDEs – Heat Equation Solution	Lecture	Quiz
5	2	LO1	Solving PDEs – Wave Equation	Lecture	Quiz
6	2	LO1	Problems on PDE Classifications	Lecture	Quiz
7	2	LO1, LO2	Introduction to Numerical Analysis + Newton–Raphson Method & Lagrange Approximation	Lecture	Midterm Preparation
8	2	LO1, LO3	Numerical Differentiation & Integration Integral Equations, Trapezoidal + Simpson's Methods	Lecture	Formative Assessment
9	2	LO1, LO3	Simpson's 3/8 Rule	Lecture	Formative Assessment
10	2	LO1, LO3	Numerical Differentiation, Euler Method	Lecture	Formative Assessment
11	2	LO1, LO3	Modified Euler, Runge–Kutta, Runge–Kutta–Merson Methods	Lecture	Formative Assessment
12	2	LO1, LO3	Systems of Linear Equations, Inverse Matrices, Gauss Elimination	Lecture	Practical Problem
13	2	LO1–LO4	Iterative Methods & Least-Squares Approximation	Lecture	Practical Problem
14	2	LO1	Fourier Series (Odd/Even), Half-Range Interval Change	Lecture	Midterm Review
15	–	–	Midterm Exam & Preparatory Week	Exam	Midterm (15%)

2. Course Evaluation

Assessment Type	Number/Duration	Weight (Marks)	Week Due	Learning Outcomes Assessed
Quiz	1	10% (10 marks)	Week 5	LO1, LO3
Practical / Lab Assessment	2 (continuous)	15% (15 marks)	Continuous during the semester	LO2, LO4, LO5
Midterm Exam	1 hour	15% (15 marks)	Week 14	LO1–LO5
Final Exam	3 hours	60% (60 marks)	Week 15	All LOs
Total	—	100% (100 marks)	—	—

3. Learning and Teaching Resources

Required textbooks (curricular books any)	Thomas, G. – "Calculus and Analytic Geometry", 5th Edition, Addison-Wesley (1999) Link: https://www.mathworks.com/help/matlab/
Main references (sources)	MATLAB Programming Language Documentation
Recommended books and references (scientific journals, reports...)	1- Burden & Faires – <i>Numerical Analysis</i> , 10th Edition 2- Chapra & Canale – <i>Numerical Methods for Engineers</i> 3- Quarteroni, Saleri – <i>Numerical Mathematics</i>

Electronic References, Websites	MathWorld – Numerical Methods Topics https://mathworld.wolfram.com Numerical Analysis Notes – MIT OpenCourseWare https://ocw.mit.edu/courses/18-335j-numerical-methods-spring-2004/ MATLAB Numerical Examples https://www.mathworks.com/examples/numerical-analysis.html
---------------------------------	---

Week	Hours	Required Learning Outcomes	Weekly Lab Plan Unit or subject name	Learning method	Evaluation method
1	2	LO2	Introduction to MATLAB for Numerical Computations	Lab	Practical Assessment
2	2	LO2	Solving Linear Systems in MATLAB	Lab	Practical
3	2	LO2, LO3	Numerical Differentiation & Integration in MATLAB	Lab	Practical
4	2	LO2	Nonlinear Equation Solutions in MATLAB	Lab	Practical
5	2	LO2	Numerical Solutions of ODEs	Lab	Practical
6	2	LO2, LO4	Finite Difference Methods	Lab	Practical
7	2	LO2, LO4	Numerical Solutions of PDEs	Lab	Practical
8	2	LO2	Applied Programming of PDEs	Lab	Practical
9	2	LO2	MATLAB Programming for Numerical Analysis	Lab	Practical
10	2	LO2	Vectors & Matrices in MATLAB	Lab	Practical
11	2	LO1–LO3	Numerical Methods: Newton–Raphson + Lagrange (MATLAB)	Lab	Practical
12	2	LO1–LO3	Numerical Integration: Trapezoidal + Simpson Methods (MATLAB)	Lab	Practical
13	2	LO2–LO4	Numerical Differentiation, Euler & Modified Euler	Lab	Practical
14	2	LO2–LO4	Runge–Kutta & Runge–Kutta–Merson (MATLAB)	Lab	Practical
15	–	–	Final Exam	Exam	Lab Final

Course Description Form