College of Engineering

Department of Civil Engineering

MATH 505 Numerical Linear Algebra

Credit and Contact hours	3/ 3 (Lectures), 0 (Tutorials), 0 (Laboratory)
Required, or Elective	Required for a MSCE degree
Course Description	Linear equations and matrix analysis approximation of functions, error analysis, special matrices, error analysis for linear systems, iterative methods, computation of Eigen values and Eigen vectors.
Prerequisites or Co-requisites	None
Course Learning Outcomes	Students completing this course successfully will be able to <table><tr><th>Course Learning Outcomes</th><th>Related Program Outcomes</th></tr><tr><td>**CLO1**: Recognize Basic concepts and types of linear systems</td><td>**K1**</td></tr><tr><td>**CLO2**: Formulate systems of linear equations</td><td>**K1**</td></tr><tr><td>**CLO3**: Use Direct and indirect numerical methods.</td><td>**K1**</td></tr><tr><td>**CLO4**: Apply Error estimate for system of linear equations.</td><td>**K1**</td></tr><tr><td>**CLO5**: Realize real-world problems that requires allowing for random effects.</td><td>**S1**</td></tr></table>
Student Outcomes related to this Course	**K1**. Recognize advanced engineering knowledge, concepts and techniques to identify, interpret and analyze complex and real-life engineering problems. **S1**. Provide solution for complex and real-life engineering problems through critical thinking and using modern engineering tools and identify its impact on social and ethical issues.

Topics Covered	List of Topics	Related CLOs
	1. Basic concepts of Numerical Methods solving system of linear equations.	CLO1
	2. Existence and uniqueness results. Special matrix approach.	CLO2
	3. Direct and iterative method for solving linear sytems	CLO3
	4. Error estimate and conditioning of system of linear equations. Applications	CLO4
	5. Solving eigenvalues problems using direct and iterative numerical methods	CLO5
	6. Approximation of the functions using least squares approximation	CLO5
Textbook(s) and Other Required Material	• Applied Linear Algebra using MATLAB, Pages: 518, Heldermann Verlag Press, (2008), by R. Butt. • Numerical Linear Algebra and Optimization using MATLAB, Pages: 1160, Mercury Learning and Information, (2011), by R. Butt. • An Introduction to Applied Numerical Linear Algebra Using MATLAB; Pages: 642, Alpha Science International Ltd., Oxford, United Kingdom, (2015), by R. Butt.	
Grading System	Homework and Tutorial Activities 10% First Midterm Exam 25% Second Midterm Exam 25% Final Exam 40%	
Instructors	To be set by College of Science	
Date of Review	February, 2021	