LESSON PLAN 1

Course Title:			Advanced Linear Algebra					
Course Code:								
Course Coordinator				Dr. Surender Singh				
Credits				4-1-0=5				
Evaluation Scheme Total 100 Marks								
Quiz (Total 20 Marks)			Assignment/Project (Total 20 marks) (Minimum Two Assignments or one Project)		Mid-Term	Major Examination	Total	
Quiz I (5 marks	Quiz II (5 marks)	Quiz III (5 marks)	Quiz IV (5 marks)			20 marks) (1 <sup>1/2</sup> Hour Duration)	(40 marks) (3 Hour Duration	100 Marks
WEEKS			TOPICS TO BE COVERED					
Week 1				Review of Basics of Linear Algebra: Vector Spaces, Linear Span, Linear dependence, Linear Independence, Basis and dimensions, Linear Transformations				
Week 2				Definition and examples of Linear functionals and dual spaces.				
Week 3				Dual Basis and related theorems, second dual space, Examples and problems on dual basis.				
Week 4			Annihilators, Dimensions of Annihilator, some analytical results based on annihilators.					
Week 5				Inner product spaces and examples, Norm in Inner product spaces, Cauchy-Schwarz inequality				
Week 6				orthogonality, orthonormal sets, Gram-Schmidt orthogonalization process, Characteristic and minimum polynomials of linear operators				
Week 7				Hermitian, Unitary, Normal Transformations, Similar linear transformations and related algebraic and characterization theorems.				
Week 8			Invariant subspaces of vector spaces. Reduction of a linear transformation to triangular form. Nilpotent transformations. Index of nilpotency of a nilpotent transformation.					
Week 9			Cyclic subspace with respect to a nilpotent transformation and their applications					
Week 10			Uniqueness of the invariants of a nilpotent transformation and related properties.					
Week 11 (17 <sup>th</sup> -21 <sup>st</sup> March, 2025)				Mid-Term				

2 <sup>nd</sup> April, 2025	Showing of Mid-Term Answer Sheets
Week 13	Algebraic and Geometric multiplicity with their properties and applications in problem solving.
Week 14	Diagonalizability, Necessary & Sufficient condition of diagonalizability, Spectral Theorem, Canonical forms
Week 15	Jordan blocks and Jordan canonical forms. Companion matrix of a polynomial f(x)
Week 16	Definition and examples based on Trace and transpose, properties and problems based on trace and transpose
Week 17 (5 <sup>th</sup> -9 <sup>th</sup> May, 2025)	Revision Week
Week 18 (13 <sup>th</sup> – 22 <sup>nd</sup> May, 2025)	Major Examinations
29 <sup>th</sup> May, 2025	Showing of Major Exams Answer Sheets

Course Outcomes: After successful completion of this course, students shall be able to;

**CO1:** Understand the concept of dual spaces and inner product spaces.

CO2: Know the concepts of triangular & nilpotent transformation, and invariance.

CO3: Understand the concepts of canonical forms, and trace & transpose.

**CO4:** Apply the above concepts to solve problems in other branches of science.

## **Recommended Books:**

1. Roman, Steven. Advanced Linear Algebra. 3rd Edition. Springer

2. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi

3. Hoffman & Kunze, Linear Algebra, Prentice Hall PTR, 3rd revised ed

https://archive.nptel.ac.in/courses/111/107/111107164/

Calendar of Quizzes/Assignment etc. to be provided as per below details and exact dates to be fixed in consultation with other course coordinators to avoid overlap of Quizzes of different courses.

Component	Date
Quiz-I	27 <sup>th</sup> -31 <sup>st</sup> , January 2025
Quiz-II	24 <sup>th</sup> -28 <sup>th</sup> February, 2025
Assignment-I	10 <sup>th</sup> -12 <sup>th</sup> February, 2025
Mid-Term	17-21 <sup>st</sup> March, 2025

Assignment-II/	21 <sup>st</sup> – 24 <sup>th</sup> April, 2025
Project Submission	
Quiz-III	7 <sup>th</sup> – 11 <sup>th</sup> April, 2025
Quiz-IV	28 <sup>th</sup> April-2nd, May, 2025
Major Exam	13 <sup>th</sup> – 22 <sup>nd</sup> May, 2025

Note:

- 1. One surprise Quiz may be fixed out of Quiz-II, Quiz-III or Quiz-IV.
- 2. In case of any deviation in evaluation methodology for courses such as AEC/VAC/SEC shall be mentioned accordingly. Thus, same shall be approved by the next BOS of school if not done earlier.

Signature of Course Coordinator : 5-5-3