Course Syllabus
Gyanmanjari Science College
Semester-2 (M.Sc.)

Subject: Linear Algebra (MSCMA12508)

Type of course: Major

Prerequisite: Set theory, Binary operations, Algebraic structures, Vectors and scalars, Matrix.

Rationale: After successful completion of the course, students shall be able to construct a vector space, linear transformation, inner product space.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	-	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weightage
1	**CHAPTER 1:** Vector spaces over fields, subspaces, bases and dimension, Systems of linear equations, rank of matrices.	15	25
2.	**CHAPTER 2:** Linear transformations, representation of linear transformations by matrices, rank-nullity theorem, duality and transpose, Determinants, cofactors, adjoint, Cramer's Rule.	15	25
3	**CHAPTER 3:** Eigen values and eigenvectors, characteristic polynomials, minimal polynomials, Cayley-Hamilton Theorem, triangulation, diagonalization, rational canonical form, Jordan canonical form, Inner product spaces.	15	25
4	**CHAPTER 4:** Gram-Schmidt Orthonormalization, linear functionals and adjoints, Hermitian, self-adjoint, unitary and normal operators, Spectral Theorem for normal operators.	15	25

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1.	**Paper Reviews :** Faculty will provide a particular portion of the research paper and a group of students will review it and prepare a conclusion in 100 words and upload it to the GMIU web portal	10
2.	**Research Activity:** Faculty will assign Topic of Linear algebra and Students will analyze and prepare chart and upload to the GMIU web portal.	10
3.	**Puzzle :** Develop puzzles that span the entire course, challenging students to apply theoretical knowledge from vector spaces, linear transformations, Eigen values, and spectral theorems to solve complex problems via GMIU web portal	10
4.	**Analysis :** Conduct analysis workshops that connect the theoretical concepts across chapters, emphasizing the relationships between vector spaces, linear transformations, Eigen values, and spectral theorems and prepare a report in 100 words and upload it to the GMIU web portal.	10
5.	**Concept mapping :** Faculty will assign real time project / problem that Students map their Idea, Solution for real time project / problem and upload it to the GMIU web portal.	10
Total		**50**

Course Outcome:

After learning the course the students should be able to:	
CO1	Analyze the effects of a change of basis on vector representations.
CO2	Apply the Rank-Nullity Theorem to problems in data analysis, including the analysis of linear systems and solutions.
CO3	Understand its role in determining eigen values.
CO4	Apply Gram-Schmidt orthonormalization to solve problems related to vector spaces, linear transformations, and Eigen value problems.

Suggested Specification table with Marks (Theory) : 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	10%	40%	20%	10%	20%	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MCQ etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

Reference Books:

1. M. Artin, Algebra, Prentice Hall of India, 1994.

2. K. Hoffman and R. Kunze, Linear Algebra, Pearson Education (India), 2003. Prentice-Hall of India, 1991.

3. Vivek Sahai, Vikas Bist, Linear Algebra (Narosa Publishing House).

4. S. Kumaresan, Linear Algebra-A Geometric Approach,PrenticeHall, New Delhi, 2003.

5. K. B. Dutta, Matrix and Linear Algebra, ,PrenticeHall, New Delhi.