Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

(*Empowered Autonomous*)

Three/Four Year Honours/Honours with Research B.Sc. (Comp. Sci.) Degree Program
(Faculty of Science)

CBCS Syllabus

T.Y.B.Sc. (Comp. Sci.) Mathematics

For Department of Mathematics

NEP-2.0

Choice Based Credit System Syllabus

(2024 Pattern)

(As Per NEP-2020)

To be implemented from Academic Year 2026-27

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AES's T. C. College (*Empowered* Autonomous), Baramati.   NEP-2.0   CBCS Syllabus 2024 Pattern as per NEP 2020

CBCS Syllabus as per NEP 2020 for T.Y.B.Sc. (Comp. Sci.) Mathematics (2024 Pattern)

Name of the Programme	**:** B.Sc. (Comp. Sci.) Mathematics
Program Code	**:** USCS
Class	**:** T.Y.B.Sc. (Comp. Sci.)
Semester	V
Course Type	**:** Minor
Course Name	**:** Linear Algebra
Course Code	**:** COS-310-MN(B)
No. of Teaching Hours	30
No. of Credits	2

Course Objectives:

1. To understand properties and operations on System of Linear Equations.
2. To understand basic concepts of Determinants.
3. Understanding of how to translate a linear equation into a matrix.
4. Identify and analyze properties of vector spaces.
5. Understand the concepts of basis and dimensions in vector spaces.
6. Construct orthogonal bases using the Gram-Schmidt process.
7. Understand the use of eigenvalues and eigenvectors with complex matrices.

Course Outcomes:

CO1: Student will apply the principles of Euclidean n-space, including geometric interpretations and applications.
CO2: Recognize and apply the concept of linear independence in vector spaces.
CO3: Analyze and understand the row space, column space, and null space of matrices, and relate them to linear transformations.
CO4: Apply techniques for determining eigenvalues and eigenvectors of matrices.
CO5: Apply the concept of inverse linear transformations and recognize their importance in various applications.
CO6: Analyze and calculate the kernel and range of linear transformations.
CO7: Apply inner products to analyze angles and Orthogonality in inner product spaces.

Topics and Learning Points

	Teaching Hours

Unit 1: Vector Spaces   **10**

    1.1 Vector Spaces and Subspaces
    1.2 Solving $Ax = 0$ and $Ax = b$
    1.3 Linearly Independence, Basis and Dimensions
    1.4 Linear Transformations

Unit 2: Orthogonality   **07**

    2.1 Orthogonal Vectors and subspaces
    2.2 Orthogonal Bases
    2.3 Gram-Schmidt

Unit 3: Eigen Values and Eigen Vectors   **07**

    3.1 Introduction
    3.2 Diagonalization of a Matrix
    3.3 Difference Equations and Powers $\square$k
    3.4 Complex Matrices

Unit 4: Symmetric Matrices   **06**

    4.1 Diagonalization of Symmetric Matrices
    4.2 Quadratic Forms

Text Books:

1. Gilbert Strang, *Linear Algebra and its applications*, Cengage Learning, 4th Edition.
   Unit 1: Section 2.1 to 2.4
   Unit 2: Section 3.1 and 3.4
   Unit 3: Section 5.1 to 5.3 and 5.5
2. David C. Lay, *Linear Algebra and its Applications*, MacDonald Pearson Publication, 4th Edition.
   Unit 4: Section 7.1, 7.2

Reference Books:

1. Kanti Bhushan Datta, *Matrix and Linear Algebra* (*aided with MATLAB*), Eastern Economic Edition.
2. Devi Prasad, *Elementary Linear Algebra*, Narosa, 3rd Edition.
3. Sheldon Axler, *Linear Algebra Done Right*, Springer, 2nd Edition.
4. S. Kumaresan, *Linear Algebra: A Geometric Approach*, Prentice Hall of India, New Delhi.
5. K. Hoffmann and R. Kunze, *Linear Algebra*, Prentice Hall of India.

CO-PO Mapping							

Weightage: 1 – weak or low relation, 2 – moderate or partial relation, 3 – strong or direct relation

Programme Outcomes	Course Outcomes						
	CO1	CO2	CO3	CO4	CO5	CO6	CO7
PO01	3	3	3	3	3	3	3
PO02	2	2	3	3	3	3	2
PO03	1	1	1	2	2	1	1
PO04	3	3	3	3	3	3	3
PO05	3	3	3	3	3	3	3
PO06	1	1	2	1	1	2	1
PO07	2	2	3	3	2	3	2
PO08	2	2	2	2	2	2	2
PO09	1	1	2	2	2	2	2
PO10	1	1	1	1	1	1	1
PO11	1	1	1	1	1	1	1
PO12	2	2	2	2	2	2	2
PO13	1	1	1	1	1	1	1

Justification for the mapping

PO1: Comprehensive Knowledge and Understanding

Strong (3) mapping with CO1–CO7, as all course outcomes develop deep theoretical understanding of vector spaces, matrices, eigenvalues, linear transformations, and inner product spaces.

PO2: Practical, Professional, and Procedural Knowledge

Strong (3) mapping with CO3–CO6 and Moderate (2) with CO1, CO2, CO7, as matrix operations, eigenvalue computation, and transformation analysis build procedural and applied competency.

PO3: Entrepreneurial Mindset and Knowledge

Moderate (2) mapping with CO4 and CO5 and Weak (1) with remaining COs, as eigenvalues and linear transformations support modelling, optimization, and innovative computational applications.

PO4: Specialized Skills and Competencies

Strong (3) mapping with CO1–CO7, as all outcomes develop advanced analytical, algebraic, and subject-specific competencies in Linear Algebra.

PO5: Application, Problem-Solving, and Analytical Reasoning

Strong (3) mapping with CO1–CO7, as each outcome enhances logical reasoning, structured problem solving, and analytical thinking.

PO6: Communication Skills and Collaboration

Moderate (2) mapping with CO3 and CO6 and Weak (1) with the remaining COs, as interpretation and explanation of matrix spaces, kernel, range, and transformations improve academic communication skills.

PO7: Research-Related Skills

Strong (3) mapping with CO3, CO4, CO6 and Moderate (2) with others, as abstract reasoning and eigenvalue analysis provide a strong foundation for research aptitude.

PO8: Learning How to Learn Skills

Moderate (2) mapping with CO1–CO7, as engagement with abstract mathematical concepts promotes independent learning and intellectual growth.

PO9: Digital and Technological Skills

Moderate (2) mapping with CO3–CO7 and Weak (1) with CO1, CO2, as computational aspects of matrices and transformations enhance technological proficiency.

PO10: Multicultural Competence, Inclusive Spirit, and Empathy

Weak (1) mapping with CO1–CO7, as the course indirectly promotes logical, unbiased reasoning with limited direct multicultural linkage.

PO11: Value Inculcation and Environmental Awareness

Weak (1) mapping with CO1–CO7, as ethical academic practice is encouraged though environmental connection is indirect.

PO12: Autonomy, Responsibility, and Accountability

Moderate (2) mapping with CO1–CO7, as independent analytical work and assignments foster responsibility and accountability.

PO13: Community Engagement and Service

Weak (1) mapping with CO1–CO7, as the course is primarily theoretical with indirect scope for societal application.