



SRI VENKATESWARA UNIVERSITY - TIRUPATI
Syllabus for 4-Year UG Honors in B.Sc. (Mathematics) as Major
in consonance with Curriculum framework
(W.E.F. AY-2026-27)

COURSE STRUCTURE (for Semester III)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	5	Ring Theory	5	4
		6	Advanced Real Analysis	5	4
		7	Theory of Matrices	5	4

SEMESTER – III

COURSE 7: THEORY OF MATRICES

Credits: 4 5 hrs/week

Course Objectives

1. Develop an understanding of special matrices such as symmetric, Hermitian, orthogonal, and unitary matrices and their properties.
2. Explain the computation and properties of determinants and how they are used in matrix operations.
3. Teach methods to find the rank and inverse of matrices using elementary transformations.
4. Provide techniques to analyze and solve systems of linear equations using matrix methods.
5. Introduce the concepts of eigenvalues and eigenvectors, and highlight their significance in linear algebra and applications.

Course Outcomes

6. Compute the determinant of a matrix using expansion and apply various properties for simplification.
7. Perform elementary row and column operations to simplify determinants and matrix expressions.
8. Determine the rank of a matrix using echelon and normal forms, and compute matrix inverses via transformations.
9. Analyze systems of linear equations (homogeneous and non-homogeneous) for consistency, and solve them using methods such as matrix inversion, Cramer's Rule, Gauss elimination, and LU decomposition.
10. Define and compute eigenvalues and eigenvectors of square matrices, and use characteristic equations in applications.

Course Content

Unit – 1

Matrix – Algebra of Matrices – Matrix Multiplication – Transpose and trace of a matrix – Symmetric and Skew symmetric matrices – Hermitian and Skew Hermitian matrices – Orthogonal and Unitary matrices – Idempotent matrix – Nilpotent matrix – Involutory Matrix – examples and related problems – Every square matrix can be expressed as a sum of a symmetric and a skew symmetric matrix – (countable and uncountable sets – If $AB = A$ and $BA = B$, then A and B are idempotent.)

Unit – 2

Determinant of a square matrix (of order 3) – Minors and Cofactors – Properties of determinants – Product of two determinants of the same order – Adjoint and Inverse of a matrix – Orthogonal matrix – Problems.

Unit – 3

Rank of a matrix – Elementary row and column operations on a matrix – Properties of elementary matrices – Reduction to Echelon form and Normal form – Inverse of a non-singular matrix by elementary transformations – Related problems – (The rank of product of matrices cannot exceed the rank of either.)

Unit – 4

System of homogeneous linear equations – Conditions for trivial and non-trivial solutions – Solving methods of homogeneous linear equations system – System of non-homogeneous linear equations – Conditions for consistency and inconsistency – Matrix Inversion method – Cramer's Rule – Gauss method – LU decomposition method.

Unit – 5

Characteristic (Eigen) Values and Characteristic vectors of a square matrix – Characteristic polynomial and Characteristic equation of a matrix – Finding eigenvalues and eigenvectors of a square matrix.

Activities

The activities include quizzes, assignments, seminars, and student presentations. Additional tasks involve mini projects, concept flowcharts, open board work, peer teaching, LMS-based quizzes, board work challenges, poster presentations, and visual aids like chalk talks to enhance learning and engagement.

Text Book

Matrices, by A.R. Vasishtha and A.K. Vasishtha, published by Krishna Prakashan Media (P) Ltd.

Reference Books

1. S.H. Friedberg, A.L. Insel, and L.E. Spence, Linear Algebra, Prentice Hall of India (P) Ltd., New Delhi, 2004.
2. R.D. Sharma and Umash Kumar, Basic Applied Mathematics for Physical Sciences, Pearson Education India (P) Ltd.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

SRI VENKATESHWARA UNIVERSITY -TIRUPATI

B.Sc(Honors)-Mathematics (Major)

SEMESTER – III

COURSE 7: THEORY OF MATRICES

Time: 3 Hours

Maximum Marks: 75

SECTION – A

(Answer any FIVE questions. Each question carries 3 marks)

(10 questions – Two from each unit)

(5×3=15 Marks)

1. Define symmetric and skew-symmetric matrices with examples.
2. Write the properties of Hermitian and skew-Hermitian matrices.
3. Define minors and cofactors of a determinant.
4. State any three properties of determinants.
5. Define the rank of a matrix.
6. What are elementary row operations? Give examples.
7. What is a homogeneous system of linear equations?
8. State the condition for consistency of a system of linear equations.
9. Define eigenvalues and eigenvectors of a square matrix.
10. Write the characteristic equation of a matrix.

SECTION – B

(Answer ALL questions. Each question carries 12 marks)

(One question from each unit with internal choice)

(5×12=60 Marks)

11. (a) Explain and prove that every square matrix can be expressed as a sum of a symmetric and a skew-symmetric matrix.

(OR)

(b) Explain the properties of orthogonal and unitary matrices with suitable examples.

12. (a) Find the determinant of a 3×3 matrix using cofactor expansion and verify the properties of determinants.

(OR)

(b) Find the adjoint and inverse of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 2 & 1 \\ 3 & 0 & 2 \end{bmatrix}$.

13. (a) Find the rank of the matrix $A = \begin{bmatrix} 2 & 3 & 5 \\ 4 & 6 & 10 \\ 1 & 2 & 3 \end{bmatrix}$ using elementary transformations.

(OR)

(b) Explain Echelon and Normal forms of a matrix with suitable examples.

14. (a) Solve the system of equations using Cramer's Rule:

$$x + y + z = 6, \quad 2x - y + 3z = 14, \quad 3x + 4y - 2z = 2$$

(OR)

(b) Explain the Gauss elimination and LU decomposition methods for solving linear systems.

15. (a) Find the eigenvalues and eigenvectors of the matrix $A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$.

(OR)

(b) Define and explain the characteristic polynomial and characteristic equation of a matrix. Show how they are used to find eigenvalues.

4- Year UG Honours, Major
Syllabus
(2026-27)
Semester-III

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V