

SHRI GNANAMBICA DEGREE COLLEGE: MADANAPALLE



(AUTONOMOUS)

COURSE 2: MATHEMATICAL FOUNDATION FOR AI
SEMESTER I

(W.E.F.2025-26)

Program: BSC (AI)



Hours per week: 4

Credits: 3

Course Objectives:

1. Develop a strong foundation in linear algebra, set theory, and functions essential for AI.
2. Understand and solve systems of linear equations using matrix methods.
3. Gain knowledge of eigenvalues, eigenvectors, and matrix diagonalization.
4. Learn fundamental concepts of probability and statistics for data analysis.
5. Explore functions and their applications relevant to AI problem-solving.

Course Outcomes:

1. Solve complex linear algebra problems including matrix properties.
2. Apply set theory rigorously and compute eigenvalues/eigenvectors for intermediate examples.
3. Understand differentiation rules and solve constrained optimization problems.
4. Calculate probabilities in varied scenarios and explore discrete random variables.
5. Analyze data using comprehensive statistical measures and interpret visualizations.

Unit I

Matrices, Basic Linear Algebra and Systems of Linear Equations: Basics and operations of matrices (addition, multiplication, transpose, inverse). Elementary row operations: row swapping, scalar multiplication, row addition. Row Echelon Form (REF). Rank of a matrix using echelon form. System of linear equations: coefficient and augmented matrix representation. Types of solutions: unique, infinite, no solution. Gaussian elimination method using REF.

Unit II

Set Theory and Eigen Concepts : Sets, subsets, set operations (union, intersection, difference, complement). Venn diagrams. Cartesian products. Eigenvalues, eigenvectors, characteristic polynomial. Statement of Cayley–Hamilton Theorem and related problems.

Unit III

Functions and their Properties: Definition and types of functions (polynomial, rational, exponential, logarithmic). Domain and range. Inverse of functions. Composition of functions. Limits and continuity. Graphical representation of functions. Maxima and minima of linear and quadratic functions.

Unit IV

Vector Differentiation: Vector differentiation – ordinary derivatives of vectors. Differentiability. Gradient. Divergence. Curl operators. Directional derivatives of functions.



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Unit 5

Basic Statistics:

Definition, Importance and Limitations of statistics. Classification and Tabulation of Data. Construction of Frequency distribution tables. Data representation: Histograms and Bar charts.

Measures of central tendency: Mean, Median, Mode.

Measures of dispersion: Range, inter quartile range, variance, standard deviation.

Textbooks and References

1. Mathematics for Machine Learning, M. P. Deisenroth, A. A. Faisal, C. S. Ong, Cambridge University Press, 2020.
2. Introductory Linear Algebra, Howard Anton, Wiley.
3. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, Wiley.
4. Discrete Mathematics and its Applications, Kenneth H. Rosen, McGraw Hill.
5. Online Resources: Khan Academy, MIT Open Course Ware (Linear Algebra, Probability, Statistics, Functions).

Activities:

Unit 1 Activity:

Solve advanced linear equation systems using elementary row operations; explore matrix rank with concrete examples; interpret solutions graphically.

Evaluation Method: Assess problem-solving accuracy, clarity of solution process, and ability to classify solution types.

Unit 2 Activity:

Practice set theory problems including Venn diagrams, unions, intersections; compute eigenvalues/eigenvectors for 3x3 matrices; perform matrix diagonalization exercises.

Evaluation Method: Evaluate completeness of set operations, correctness of eigen computations, and accuracy in diagonalization.

Unit 3 Activity:

Plot and analyse various types of functions (polynomial, exponential, logarithmic); solve problems on function composition and inverses; perform simple graphical interpretations.

Evaluation Method: Assess quality of function plots, conceptual clarity of compositions and inverses, and accuracy of graphical analyses.

Unit 4 Activity:

Calculate conditional probabilities; simulate discrete probability distributions; apply Bayes' theorem in practical scenarios (e.g., medical testing, reliability analysis).

Evaluation Method: Evaluate correct application of probability laws and rules, and logical use of Bayesian inference.

Unit 5 Activity:

Analyse sample datasets to calculate central tendency measures and dispersion; compute correlation coefficients; create histograms and scatter plots; interpret data insights. Evaluation Method: Assess accuracy of statistical calculations, clarity and correctness of visual data representation, and quality of interpretation.



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SHRI GNANAMBICA DEGREE COLLEGE: MADANAPALLE



(AUTONOMOUS)
COURSE 2: MATHEMATICAL FOUNDATION FOR AI -
PRATICALS
SEMESTER I
(W.E.F.2025-2026)
Program: BSC (AI)



Hours per week: 2

Credits: 1

List of Experiments:

1. To compute the transpose and inverse of a given matrix and verify the results using matrix properties.
2. To determine the rank of a given matrix by reducing it to Row Echelon Form (REF).
3. To solve a system of linear equations using the Gaussian Elimination method through conversion into Row Echelon Form (REF).
4. To verify the Cayley–Hamilton theorem for a given square matrix and apply it to determine the inverse or higher powers of the matrix.
5. To determine the domain, range, and inverse of a given function.
6. To find the maximum and minimum values of a given linear or quadratic function.
7. To evaluate the gradient, divergence, and curl of a given scalar or vector field and interpret their significance.
8. To compute the directional derivative of a given function at a specified point in a given direction.
9. To determine the median and mode of a given data set and analyze the central tendency.
10. To compute the interquartile range and standard deviation of a given data set and analyze data dispersion.



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Program: BSC (AI)

SEMESTER I

COURSE 2: MATHEMATICAL FOUNDATION FOR AI

(W.E.F. AY 2025-26)

Question Paper Blue Print

Time: 3hrs

Max. Marks: 70

PART-A

Answer any 4 of the following. Each Question Carries 5 marks.

(4 x 5 =20)

1. Unit-1
2. Unit-1
3. Unit-2
4. Unit-2
5. Unit-3
6. Unit-4
7. Unit-5
8. Unit-5

PART-B

Answer one from each unit. Each Question Carries 10 marks.

(5X10=50)

UNIT 1

9. Question A

OR

Question B

UNIT 2

10. Question A

OR

Question B

UNIT 3

11. Question A

OR

Question B

UNIT 4

12. Question A

OR

Question B

UNIT 5

13. Question A

OR

Question B



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