II Year II Semester **L T P C**

Code:20MA4712 **3 0 0 3**

MATHEMATICAL FOUNDATION FOR DATA SCIENCE (Minors)

Course Objectives:

At the end of semester the students able to understand the concepts of:

1. Recall the basics of sets, natural numbers, integers, rational numbers, and real numbers.
2. Learn to use the coordinate system, and plot straight lines.
3. Identify the properties and differences between linear, quadratic, polynomial, exponential, and logarithmic functions.
4. Find roots, maxima and minima of polynomials using algorithmic methods.
5. Learn to represent sets and relations between set elements as discrete graphs using nodes and edges.
6. Formulate some common real-life problems on graphs and solve them

Course Outcomes:

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

	OUTCOMES	BT
CO1	Determine whether or not particular subsets of a vector spaces are linearly independent.	1, 2, 3
CO2	Understand inner products and associated norms.	1, 2, 3
CO3	Understand the concepts of probability distributions.	1, 2, 3
CO4	Understand how to find nature as well as the amount of relationship between the given variables	1, 2, 3
CO5	Understanding of real life problems of graphs and solve them.	1, 2, 3

UNIT- I

Linear Algebra: Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings - affine spaces

UNIT-II

Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections.

UNIT-III

Probability and Distributions: Construction of a Probability space, Discrete and Continuous probabilities, sum rule, product rule and Bayes Theorem, Summary statistics and Independence, Gaussian Distribution.

UNIT-IV

Method of least squares – Straight line – Parabola – Exponential – Power curves. Regression - Regression coefficients and properties – Curvilinear Regression, Multiple Regression - Correlation – correlation coefficient – Rank correlation

UNIT-V

Graph Theory - Representation of graphs, Breadth-first search, Depth-first search, Applications of BFS and DFS

Directed Acyclic Graphs - Complexity of BFS and DFS, Topological sorting and longest path, Transitive closure, Matrix multiplication

Graph theory Algorithms - Single source shortest paths, Dijkstra's algorithm, Bellman-Ford algorithm, All-pairs shortest paths, Floyd–Warshall algorithm, Minimum cost spanning trees, Prim's algorithm, Kruskal's algorithm

Text Books:

1. https://mml-book.github.io/book/mml-book.pdf - c 2021 M. P. Deisenroth, A. A. Faisal, C. S. Ong. Published by Cambridge University Press (2020).
2. Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.

References:

1. Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists, 8th Edition, Pearson 2007.
2. Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.
3. Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.
4. Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical Scientists, 3rd Edition, Pearson, 2010.
5. Probability, Statistics and Random Processes, Murugesan, Anuradha Publishers, Chennai.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc17_ma17/preview
2. https://onlinecourses.nptel.ac.in/noc16_ma03/preview
3. https://www.youtube.com/watch?v=1VSZtNYMntM