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:

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	OUTCOMES	BT
CO1	Determine whether or not particular subsets of a vector spaces are linearly	1, 2, 3
	independent.	
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	1, 2, 3
	the given variables	
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 1. 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