I YEAR I SEMESTER PAPER– I MATHS FOR DATA SCIENCE

Objective

The course is a brief overview of the basic tools from Linear Algebra and Multivariable Calculus that will be needed in subsequent course of the program.

Outcome

By completing the course the students will have been reminded of the basic tools of Linear Algebra and Multivariable Calculus needed in subsequent courses in the program notably:

- Fundamental properties of matrices, their norms, and their applications.
- Differentiating/Integrating multiple variable functions and the role of the gradient and the hessian matrix.
- Basic properties of optimization problems involving matrices and functions of multiple variables.

Unit-I

Matrices and Basic Operations, Special structures Matrices and Basic Operations, Interpretation of matrices as linear mappings and some examples.

Square Matrices, Determinants, Properties of determinants, singular and non-singular matrices, examples, finding an inverse matrix.

Unit-II

Eigen values and Eigenvectors Characteristic Polynomial, Definition of Left/Right Eigen values and Eigenvectors, Caley – Hamilton theorem, singular value Decomposition, Interpretation of Eigen values/vectors.

Unit-III

Linear Systems Definition, applications, solving linear systems, linear inequalities, linear programming.

Unit-IV

Real-valued functions of two or more variables. Definition, examples, simple demos, applications.

Unit-V

Analysis elements Distance, Limits, Continuity, Differentiability, the gradient and the Gaussian.

Optimization problems Simple examples, motivation, the role of the Hessian maxima and minima and related extreme conditions.

Integration Double integrals, Fubini's theorem, properties, applications.

References

1. Gilbert Strang, *Linear Algebra and its Applications*. Thomson /Brooks Cole (Available in a Greek Translation).
2. Thomas M. Apostol, Calculus, Wiley, 2nd Edition, 1991 ISBN 960-07-0067-2.
3. Michael Spivak. *Calculus,* publish or Perish, 2008, ISBN 978-0914098911.
4. Ross L. Finney, Maurice D.Weir . and Frank R. Giordano. Thomas's Calculus, Pearson
   12th Edition 2009.
5. David C. Lay, Linear Algebra and Its Applications, 4th Editoin.
6. Yourself saad, Iterative Methods for spare Linear Systems.

Student Activity:

1. Find the Eigenvectors of A = { 1 1 1 1,2 3 4 5,3 4 5 6}
2. Find orthogonal S =Spam{(1 1 1 1),(1 4 4 0),(-1 4 4 0),(-4 2 2 0)}

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Tutorial

1. Study various applications of Matrices.

2. Study different polynomial functions and their uses.

3. Take one real world example and apply the Linear System solution.

4. Study some real valued functions and its applications.

5. Study and solve one optimization problem.