ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name: Mathematics for Computing (Theory) **B.Sc. (Hons.) Computer Science**						
Semester	**Course Code**	**Course Title**	**Lecture (L)**	**Tutorial (T)**	**Practical (P)**	**Credit (C)**
I	32341103	Core Course-DSC-3 (BHCS03)- Mathematics for Computing	3 Credit-3	0	1 Credit-1	4
Teacher/Instructor(s)		Uma Ojha, Parul Jain and Lokesh Kumar				
Session		2022-23				

Course Objective:

This course introduces the students to the fundamental concepts and topics of linear algebra and vector calculus, whose knowledge is important in other computer science courses. The course aims to build the foundation for some of the core courses in later semester.

Course Learning Outcomes:

On successful completion of the course, students will be able to:

- Perform operations on matrices and sparse matrices
- Compute the determinant, rank and eigenvalues of a matrix
- Perform diagonalization
- Perform operations on vectors, the dot product and cross product
- Represent vectors geometrically and calculate the gradient, divergence, curl
- Apply linear algebra and vector calculus to solve problems in sub-disciplines of computer science.

Lesson Plan

Unit No.	Learning Objective	Week No.	Topics to be covered
I	Introduction to Matrix Algebra	1	Echelon form of a Matrix, Rank of a Matrix, Determinant and Inverse of a matrix
		2	Solution of System of Homogeneous & Non-Homogeneous Equations: Gauss elimination and Gauss Jordan Method.
II	Vector Space and Linear Transformation	3	Vector Space, Sub-spaces, Linear Combinations, Linear Span, Convex Sets, Linear Independence/ Dependence, Basis & Dimension.
		4-5	Linear Span, Convex Sets, Linear Independence/ Dependence, Basis & Dimension.
III	Linear Transformation	6	Linear transformation on finite dimensional vector spaces
		7	Inner Product Space, Schwarz Inequality,
		8	Orthonormal Basis, Gram-Schmidt Orthogonalization Process.
IV	Eigenvalue and Eigenvector	9	Characteristic Polynomial, Cayley Hamilton Theorem
		10	Eigen Value and Eigen Vector of a matrix, Eigenspaces, Diagonalization
		11	Positive Definite Matrices, Applications to Markov Matrices
V	Vector Calculus	12	Vector Algebra, Laws of Vector Algebra, Dot Product, Cross Product, Vector and Scalar Fields
		13	Ordinary Derivative of Vectors, Space Curves, Partial Derivatives, Del Operator, Gradient of a Scalar Field,
		14	Directional Derivative, Gradient of Matrices, Divergence of a Vector Field, Laplacian Operator, Curl of a Vector Field.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		30
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		
2.	End Semester Examination	3 hrs. (tentative)	90

Details of the Course		
Unit	**Contents**	**Contact Hours**
I	Introduction to Matrix Algebra: Echelon form of a Matrix, Rank of a Matrix, Determinant and Inverse of a matrix, Solution of System of Homogeneous & Non-Homogeneous Equations: Gauss elimination and Gauss Jordan Method.	6
II	Vector Space and Linear Transformation: Vector Space, Sub-spaces, Linear Combinations, Linear Span, Convex Sets, Linear Independence/ Dependence, Basis & Dimension.	9
III	Linear transformation on finite dimensional vector spaces, Inner Product Space, Schwarz Inequality, Orthonormal Basis, Gram-Schmidt Orthogonalization Process.	9
IV	Eigenvalue and Eigenvector: Characteristic Polynomial, Cayley Hamilton Theorem, Eigen Value and Eigen Vector of a matrix, Eigenspaces, Diagonalization, Positive Definite Matrices, Applications to Markov Matrices	9
V	Vector Calculus: Vector Algebra, Laws of Vector Algebra, Dot Product, Cross Product, Vector and Scalar Fields, Ordinary Derivative of Vectors, Space Curves, Partial Derivatives, Del Operator, Gradient of a Scalar Field, Directional Derivative, Gradient of Matrices, Divergence of a Vector Field, Laplacian Operator, Curl of a Vector Field.	9
	Total	**42**

S. No.	Name of Authors/Books/Publishers	Year of Publication /Reprint
1.	Strang Gilbert. *Introduction to Linear Algebra*, 5th Edition, Wellesley-Cambridge Press	2021
2.	Strang Gilbert. *Linear Algebra and Learning from Data*, 1st Edition, Wellesley-CambridgePress.	2019
3.	Jain R. K., Iyengar S.R. K. *Advanced Engineering Mathematics*, 5th Edition, Narosa, 2016.	2016
4.	Jain R. K., Iyengar S.R. K. *Advanced Engineering Mathematics*, 5th Edition, Narosa,	2016
Mode of Evaluation: Internal Assessment / End Semester Exam		