B.Tech. Mathematics & Computing

COURSE PLAN: THEORY COURSE

Department/School	**Mathematics**				
Course Name	Computational Linear Algebra				
Course Code	**Mat 2135**	**Semester**		**Core / PE / OE**	**Core**
Name of the faculty	**Dr Kedukodi Babushri Srinivas**				
No of contact hours/week:	**L**	**T**	**P**	**C**	
	3	**1**	**0**	**4**	

Lesson Plan

L No	Topics	CO Addressed
0	*To address OBE philosophy towards NBA and IET accreditation followed by a discussion on Course Plan, Course Outcomes, CO-PO Mapping and Blooms Taxonomy, with prerequisites for the course, if any.*	
1	Eigenvalues and Eigenvectors of a Matrix, Diagonalization, Power of a Matrix	CO1
2	Linear Transformations, Matrix of linear transformation, nth composition of linear transformation	CO1
3	Elementary linear transformations: Scaling, Shear, Projection, Reflection, Rotation	CO1
4	Vectorization concept with the use of python (Lab/ Tutorial)	CO1
5	Elementary decomposition of matrix, LU decomposition of a matrix	CO1
6	Computational examples on LU, PLU decomposition	CO1
7	Solving system of equations using PLU decomposition, Inverse of Matrix using PLU Decomposition	CO1
8	Scaling, Shear, Projection, Reflection, Rotation, Linear Transformations (Lab/Tutorial)	CO1
9	Orthogonal maps characterization in 2D, 3D Rotations, Ker T and ImT as subspaces	CO1
10	The rank-nullity theorem with proof, Verification examples	CO1
11	Vector space of polynomials P_n, Derivatives, Integrals on P_n as linear transformations, Results on Ker T with respect to one-one property, Characterizations	CO1
12	Gauss-Jordan vs PLU decomposition Matrix inversion, personalized page ranking (Lab/Tutorial)	CO1
13	Image T with respect to one-one, onto properties	CO2
14	Elementary decomposition of matrix	CO2
15	Derivation of Cosine Similarity formula	CO2
16	Implementation of Recommender System using Cosine Similarity (Lab/Tutorial)	CO2
17	Results on Im T with respect to onto property, Characterization, Isomorphic Vector spaces	CO2
18	Projections, Idea of least squares method, Solution to system of equations by least squares, Error Computation	CO2
19	Least squares proof for solution of Ax=b, Computing right inverse from left inverse and vice versa, Regression using least squares	CO2
20	Right inverse of a matrix, left inverse of a matrix, regression (Lab/Tutorial)	CO2
21	More problems on regression using least squares	CO2
22	Projection Matrix, Algorithm for constructing projection matrix	CO2
23	Eigenvalues of Projection Matrix , Grahm-Schmidt Process on P_n	CO2
24	Implementations of Regression (Lab/Tutorial)	CO3
25	QR decomposition of a matrix, Computational Examples	CO3
26	Orthogonal complement of a subspace, Direct Sum, its properties	CO3
27	Four fundamental subspaces of a matrix	CO3
28	Gradient Decent Algorithm and regression (Lab/Tutorial)	CO3
29	Symmetric matrices and orthogonality of eigen vectors	CO3
30	Spectral decomposition of a matrix	CO3
31	Quadratic forms	CO3
32	Application of Grahm-Schmidt Process on P_n (Lab/Tutorial)	CO3
33	Change of variables in a quadratic form	CO3
34	Classifying quadratic forms	CO3
35	Miscellaneous examples	CO3
36	Quadratic forms (Lab/Tutorial)	CO3

37	Positive definite matrices	CO4
38	Constrained Optimization	CO4
39	Matrix norms, Condition number of a matrix	CO4
40	Computing Matrix norms, Condition number (Lab/Tutorial)	CO4
41	Singular Value Decomposion (SVD) of a matrix	CO4
42	Examples on SVD	CO4
43	Principal Component Analysis (PCA)	CO4
44	Applications of SVD, PCA (Lab/Tutorial)	CO4
45	Difference equations and powers A^k	CO4
46	Game Theory, Zero-Sum games	CO4
47	Nash equilibrium using Matrices	CO4
48	Spectral Clustering (Lab/Tutorial)	CO4

Faculty members teaching the course (if multiple sections exist):

Faculty	Section	Signature	Faculty	Section	Signature
Dr Kedukodi Babushri Srinivas					
Dr Aishwarya S					

References:

Textbooks	• **S. Kumaresan, Linear Algebra, Geometric approach, PHI, 2017** • **R. Rao and P. Bhimsankaram: Linear Algebra, Hindusthan book agency, 2000** • **S. H. Friedberg, A. J. Insel and L. E. Spence: Linear algebra, Pearson, 2015** • **D. C. Lay: Linear algebra and its applications, Pearson, 2014.**
Self-Directed Learning	**L36, L46, L47, L48**
Research Literature/ Case Studies	• •
NPTEL/Coursera/any MOOC-based material	• •
Virtual Labs	•

Submitted by: Dr Kedukodi Babushri Srinivas