University of Central Punjab
Faculty of Information Technology

PROGRAM (S)TO BE EVALUATED | **BSCS, BSSE**

A. Course Description

Course Code	CSSS 2753, SESSS2743
Course Title	Linear Algebra
Credit Hours	3
Prerequisites	Calculus.
Assessment Instruments with Weights (homework, quizzes, midterms, final, etc.)	Class Participation 5% Quizzes 10% Assignments 10% Presentation 10% Midterm 20% Final 45%
Semester	Spring 2023
Course Instructor	Rushda Habib
Course Coordinator	M. Asim Farooq
Office Hours	
Plagiarism Policy	All the parties involved in the first cheating case will be awarded zero for that evaluation. Repeat of the same offense will result in (F) grade.
Course Description	This course includes the study of vectors in the plane and space, systems of linear equations, matrices, determinants, vectors, real vector spaces, linear transformations, inner products, Eigen values and Eigen vectors, linear programming.
Course Objectives	The objective of this course is to enable students, 1. Creating awareness to become proficient in the language of linear Algebra and be able to use its connections to real life problems. 2. Applying the variety of the codes that computers use relies on the concepts of linear algebra to operate. 3. Matrices are simply an easy way to represent large amounts of information, which is extremely appealing for data storage and retrieval. Most sophisticated programs are being designed to work by using matrices for this reason. 4. In this course, students will understand the concepts and methods of linear algebra and how to use them to think about problems arising in computer science. Online tools will be used to implement basic matrix and vector functionality which in

	turn will be used to solve real world problems that fall in the domain of linear models.	
Course Learning Outcomes	**Outcomes**	**Relation with PLO**
	1. Model a problem using linear equations.	1, 3 ,11
	2. Determine if a modeled system of equations is consistent or inconsistent.	2, 3, 4, 5
	3. Consistency of homogeneous system vs. non-homogeneous system. Relation of both systems with same transformation matrix.	1, 6, 11
	4. Perform vector operations and interpret the results geometrically.	1, 3, 4, 11
	5. Derive matrix of linear transformation. To Implement linear Transformation on 2D figures to translate, Scale, Rotate stretch, shear and reflect them.	1, 3, 4, 6, 11
	6. Understand definition of a vector space. To verify whether a given set, with given operations, is a vector space. Given a subset of a vector space, be able to determine if it is a subspace or not. To write a vector as a linear combination. To determine whether a set of vectors is a spanning set.	1, 4, 5, 6, 11
	7. Understand the concept of rank and nullity and the insight it gives about the matrix of transformation.	1, 2, 4, 6
	8. Understand the concept and methods of calculations of Eigen values and Eigen vector, Eigen space and its basis.	1, 2, 3, 4, 5, 6, 8
	9. Use Eigen values and Eigen vectors on models like population growth, a Stable Age Distribution Vector etc.	3, 4, 5, 6, 10
Textbook (or **Laboratory Manual** for Laboratory Courses)	Linear Algebra with supplemented Applications by Howard Anton/ Chris Rorres, 10th Edition.	
Reference Material	1. Introductory Linear Algebra with Applications by Bernard Kolman, David R. Hill. 2. Linear Algebra with applications by Otto Bretscher, 4th edition. 3. Linear Algebra with Applications by Steven J. Leon.	
Topics Covered in the Course, with Number of Lectures on Each	Attached	

Topic (assume 15-week instruction and one-hour lectures)				
Programming Assignments Done in the Course	Yes (Design Patterns)			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	1.0	0.6	1.0	0.4
Oral and Written Communications	At least 4 assignments will be submitted by each student.			

Week#	**Lecture#**	**Topics Covered**	**Evaluation Instrument used**
1	**1**	Introduction to Linear Algebra concepts and their use with respect to daily life. Linear equation, System of linear equations, Consistent and inconsistent systems.	
	2	Homogenous and non-homogenous solution Algebraic solution and Geometric solution.	
2	**3**	Applications to the system of linear equations.	Assignment 1
	4	Solving the system of linear equations by Elimination Method.	Quiz 1
3	**5**	More on Applications to the system of linear equations	
	6	Solving the system of linear equations by Gaussian Elimination Method	
4	**7**	More on Linear Systems and Gauss Jordan reduction,	Quiz2
	8	Introduction to Cryptography.	
5	**9**	Continue Cryptography	
	10	Introduction to Matrix Transformations from R^n to R^m Including Euclidean and Affine Transformations	
6	**11**	Types of Euclidean Transformations: Translation, Reflection	Assignment 2
	12	Rotation, Types of Affine Transformation.	Quiz 3
7	**13**	Stretching, Shearing	
	14		
8	**15**	Revision	
	16		
9	**Mid Term Exam**		
10	**19**	Introduction to real Vector Spaces,	
	20	Real Vector Spaces,	
11	**21**	Subspaces	Assignment 3
	22	Linear combination of vectors.	
12	**23**	Linear independence/dependence	Quiz4

	24	Spanning	
13	**25**	Basis and Dimension	
	26	Relationship between homogeneous and non- homogeneous linear systems	
14	**27**	Basis for the solution Space of homogeneous linear systems	Assignment 4 Quiz 5
	28	Introduction to Eigenvalues and Eigenvectors	
15	**29**	Eigenvalues and Eigenvectors of 2 by 2 and 3 by 3 matrices	
	30	Eigen space, basis of Eigen Space.	
16	**31**	Revision	
	32		
17	**Final Term Exam**		