**4152**

**University of Central Punjab**

**Faculty of Information Technology**



**BSCS, BSSE, BSDS, BSAI**

**PROGRAM (S)TO BE**

**EVALUATED**

1. **Course Description**

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| --- | --- | --- | --- | --- |
| **Course Code** | CSSS 2753, SESSS2743, AIMS1023 | | | |
| **Course Title** | Linear Algebra | | | |
| **Credit Hours** | 3 | | | |
| **Prerequisites** | Calculus. | | | |
| **Assessment Instruments with Weights** (homework, quizzes, midterms, final, etc.) | |  |  | | --- | --- | | Class Participation | 10% | | Quizzes | 15% | | Assignments | 10% | | Midterm | 20% | | Final | 45% | | | | |
| **Semester** | Fall 2024 | | | |
| **Course Instructor** | Sadaf Ijaz | | | |
| **Course Coordinator** | Dr. Maria Naseem | | | |
| **Office Hours** | None. I am a visiting teacher. | | | |
| **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 provides an in-depth introduction to the fundamental concepts of linear algebra with a focus on applications in computer science. Students will explore vector spaces, matrices, linear transformations, eigenvalues, and eigenvectors and learn how these concepts underpin key areas in computing such as computer graphics, machine learning, cryptography and data science. | | | |
| **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. | | | |
| **Textbook** | 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 Topic** (assume 15-week instruction and one-hour lectures) | Attached | | | |
| **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. | | | |

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| **CLO#** | **Course Learning Outcome (CLO)** | **Taxonomy Level** | **Mapping to PLO** |
| CLO 1 | Students will be able to **apply** linear equations to model real-world problems and solve them using appropriate methods and derive matrices representing linear transformation. | C3 | PLO – 02 |
| CLO 2 | Students will be able to **review** the concepts of a vector space and subspace and grasp the concepts of rank and nullity for any vector space. | C1 | PLO – 02 |
| CLO 3 | Students will be able to **grasp** the concepts and methods of calculating Eigenvalues and Eigenvectors. | C2 | PLO - 02 |

**WEEKLY PLAN**

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| --- | --- | --- | --- | --- |
| **Week#** | **Lec#** | **Topics Covered** | **CLO Achieved** | **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. | 1 |  |
| **2** | **Types of solutions:** Algebraic solution and Geometric solution.  Homogenous and non-homogenous linear system | 1 |
| **2** | **3** | Solving the system of linear equations by Gauss Elimination and Gauss Jorden method | 1 |  |
| **4** | Gauss Jorden method Continued. | 1 |
| **3** | **5** | Applications to the system of linear equations. | 1 | Assignment 1 |
| **6** | More on Applications to the system of linear equations | 1 | Quiz 1 |
| **4** | **7** | Matrices and Matrix Operations | 1 | Assignment 2 |
| **8** | Inverse of a Matrix | 1 |
| **5** | **9** | Cryptography: Encryption | 1 | Quiz 2 |
| **10** | Cryptography: Decryption | 1 |
| **6** | **11** | Matrix Transformation | 1 | Quiz 3 |
| **12** | Euclidean Transformation | 1 |
| **7** | **13** | Affine Transformation | 1 |  |
| **14** |
| **8** | **15** | Revision |  |  |
| **16** |
| **9** | **Mid Term Exam** | | | |
| **10** | **19** | Vector Spaces | 2 |  |
| **20** | 2 |
| **11** | **21** | Vector Spaces Continued | 2 | Assignment 3 |
| **22** | Subspaces | 2 |
| **12** | **23** | Linear combination of vectors. Linear independence/dependence | 2 | Quiz4 |
| **24** | Spanning | 2 |
| **13** | **25** | Basis and Dimension | 2 | Assignment 4 |
| **26** | Introduction to Eigenvalues and Eigenvectors | 1 |
| **14** | **27** | Eigenvalues and Eigenvectors of 3 by 3 matrices | 1 | Quiz 5 |
| **28** | PCA: Application of Machine Learning | 3 |
| **15** | **29** | Eigen space, basis of Eigen Space. | 3 |  |
| **30** | Digonalization | 3 |
| **16** | **31** | Revision |  |  |
| **32** |
| **17** | **Final Term Exam** | | | |