**LINEAR ALGEBRA**

Credit hours 3+0

Course code MS223

**Course Learning Objectives**

Students will be able to:

1. Perform calculation with concept understanding and mathematical literacy to deal with system of linear equations and matrices.
2. Deal with fundamental concepts of linear algebra culminating in Euclidean, general vector spaces, inner product spaces and linear transformations.
3. Evaluate mathematical expressions to compute quantities that deal eigenvalue, Eigen vectors problems, and diagonalization and quadratic forms.
4. Apply linear algebra concepts to model, solve, and analyze real-world situations.

**Course Learning Outcome:**

Upon completion of this course, the students will be able to:

**[CLO: 1]** Work with matrices, determinants and know their properties. They will be able to solve systems of linear equations

**[CLO: 2]** Understand the basic ideas of vector spaces.

**[CLO: 3]** Work with linear transformations.

**[CLO: 4]** Find the eigenvalues and eigenvectors and will know how to do diagonalization.and apply linear algebra concepts to analyze real-world situations.

**Assessment/Evaluation**

Assignments+Class Quizzes+Presentations+Class Activities 20%

Mid-term examination 20%

Final examination 60%

**Assignments**

Assignments would be assigned at least one week before the due date and must be submitted on or before due date.no late assignment will be accepted.at least 2 assignments would be assigned during the semester. You have to be very careful while you are solving your assignment. Please do not try copy from someone else in order to avoid any problem at the end of the semester.

**Class Quizzes**

To check the class performance, sudden test or class quizzes would be taken in class throughout the semester.at least 5 quizzes would be taken during the semester. These quizzes have to be solved in the class and they would be of short duration. There would be no LATE submission or MAKEUP for these quizzes.

**Recommended Books**

**Text Books:**

1. Howard Anton,Chhris Rorrer,” Elementry Linear Algebra”, Latest edition.

**Reference Books:**

1. Gilbert Strang, “Linear Algebra and Its Applications”, 4th Edition, Thomson Brooks/ Cole, (latest edition).
2. Otto Bretscher,”Linear Algebra with Applications”, 3rd Edition, Prentice Hall,( latest edition)
3. David Poole, “ Linear Algebra- A Modren Introduction”, Brooks/ Cole, (latest edition).
4. James M Ortega, “ Matrix Theory- A Second Course”, Plenum, (latest edition).

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| **Week(s)** | **Topic(s) to be covered** | **PLO** | **Quizzes**  **&**  **Assignments** | **remarks** | **signature** |
| 1 | **Chapter 1(system of linear equations and matrices)**  Introduction to system of linear equations. Gaussian elimination | PLO 1  PLO 2  PLO 3 |  |  |  |
| 2 | Gauss Jordan. Diagonal, triangular and symmetric matrices. | PLO 1  PLO 2  PLO 3 | Quiz no 1 |  |  |
| 3 | **Chapter 4( general vector spaces)**  Real vector spaces and subspaces, Spanning, | PLO 1  PLO 2  PLO 3 |  |  |  |
| 4 | Linear independent and dependent. Basis and dimensions | PLO 1  PLO 2  PLO 3 | Quiz no 2 |  |  |
| 5 | Row space, column spaces and null spaces. Rank and nullity | PLO 1  PLO 2  PLO 3 |  |  |  |
| 6 | matrix transformations form to . | PLO 1  PLO 2  PLO 3 | Assignment no 1 |  |  |
| 7 | **Chapter 8(linear transformation)**  General linear transformation | PLO 1  PLO 2  PLO 3 |  |  |  |
| 8 | isomorphism | PLO 1  PLO 2  PLO 3 | Submission of assignment 1 Quiz no 3 |  |  |
| **Mid-Term Examination** | | | | | |
| 9 | Compositions and inverse transformations. | PLO 1  PLO 2  PLO 3 |  |  |  |
| 10 | **Chapter 3 (Euclidean vector spaces)**  Vectors in 2-spaces, 3-spaces and n-spaces. Norm, dot product and distances in .orthogonality | PLO 1  PLO 2  PLO 3 | Assignment no 2 |  |  |
| 11 | **Chapter 6( inner product spaces)**  Inner products. Angle and orthogonality.gram-schmidt process | PLO 1  PLO 2  PLO 3 |  |  |  |
| 12 | **Chapter 5 (Eigen values and Eigen vectors)**  Eigen vectors and Eigen values. Diagonalizations. Power of a matrix. | PLO 1  PLO 2  PLO 3 | Quiz no 4 |  |  |
| **Week(s)** | **Topic(s) to be covered** | **PLO** | **Quizzes**  **&**  **Assignments** | **remarks** | **signature** |
| 13 | **Chapter 7 (diagonalization)**  Orthogonal diagonalization. | PLO 1  PLO 2  PLO 3 | Quiz no 5 |  |  |
| 14 | **Presentations:**  Applications of linear algebra | PLO 1  PLO 2  PLO 3 | Submission of assignment 2 |  |  |
| 15 | **Presentations:**  Applications of linear algebra | PLO 1  PLO 2  PLO 3 | Submission of assignment 2 |  |  |
| 16 | Applications of linear algebra. | PLO 1  PLO 2  PLO 3 |  |  |  |
| **Final Term Examination** | | | | | |

**Course Instructor** **Head of the Department**

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(WAJEEHA MATLOOB) (M.IFTHIKHAR MUBBASHIR)

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(AHMED FARID)

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(ALISHBA TARIQ)