** Bahria University Karachi Campus**

**SPRING-2018**

**Linear Algebra**

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**Instructor: Muhammad Imran Afridi**

**Email Address: Muhammadimran.bukc@Bahria.edu.pk**

**Course Code: GSC-121**

**Credit Hours : 3**

**Pre-requisite(s): Calculus**

**Faculty Contact Hours: Tuesday 09:00 am – 01 pm**

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**Course Objective:** Introduction to techniques of Linear Algebra for applications in Engineering.

**Contents**: Introduction to complex numbers, geometrical representation and simple mathematical operations; polar and exponential forms, DeMoivre’s theorem, powers and roots.

Introduction to matrices and determinants , simple mathematical operations and special matrices. Simple row operations; Gauss elimination , echelon form , rank, linear independence and system of linear equation ; Gauss-Jordan elimination , matrix inversion and Cramer rule. Vector spaces, basis and dimensions; ; eigen values and vectors, inner products, Gram- Schmidt process and orthogonalization, Least Square Problems.

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| **Mapping of CLOs and PLOs** | | | |
| **Sr. No.** | **Course Learning Outcomes (CLOs)** | **Program Learning Outcomes (PLOs)** | **Bloom’s Taxonomy** |
| CLO\_1 | Introduction to complex numbers, polar and exponential form, Demoivre’s theorem, Soloution of system of equation, Gauss Jordon method, Gauss Elemination method, Matrix inversion method, LU factorization method, Introduction to matrices and determinents, Matrix transformation,Linear transformation. | PLO\_1 | C3 (Applying) |
| CLO\_2 | Cramer’s Rule, Homogenous system of equation, rank, vectors, Span, linearly dependent and independent vectors, Vector spaces, Subspaces,Null Space , Column Space, Basis and dimension’ | PLO\_1 | C4 (Analyzing) |
| CLO\_3 | Eigenvalues and Eigenvectors, Inner products, Orthogonality,Orthogonal sets, Orthogonal Projections, Gram-schmidt process, Evaluate the problems related with engineering. | PLO\_1 | C5 (Evaluating) |

**CLO-PLO Mapping Matrix**

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| --- | --- | --- | --- | --- |
| **PLO** | | **CLO-1** | **CLO-2** | **CLO-3** |
| PLO-1 | Engineering knowledge | ✓ | ✓ | ✓ |
| PLO-2 | Problem Analysis |  |  |  |
| PLO-3 | Design/Development of solution |  |  |  |
| PLO-4 | Investigation |  |  |  |
| PLO-5 | Modern Tool usage |  |  |  |
| PLO-6 | The Engineer & society |  |  |  |
| PLO-7 | Environment & sustainability |  |  |  |
| PLO-8 | Ethics |  |  |  |
| PLO-9 | Individual and Team work |  |  |  |
| PLO-10 | Communication |  |  |  |
| PLO-11 | Project Management |  |  |  |
| PLO-12 | Lifelong Learning |  |  |  |

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| **Assessment tools** | **CLO\_1** | **CLO\_2** | **CLO\_3** |
| **Assignment** | **3% (1)** | **3% (1)** | **4%(1)** |
| **Quizzes** | **3% (1)** | **3% (1)** | **4%(1)** |
| **Midterm Exam** | **20%** | **10%** | **0%** |
| **Final Exam** | **15%** | **15%** | **20%** |

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| **Grading Policy** | |
| **Assessment Items** | **Percentage** |
| **Assignments** | **10%** |
| **Quizes** | **10%** |
| **Midterm Exam** | **30%** |
| **Final Exam** | **50%** |

Text:

“Linear Algebra and its Applications”

David C. Lay

Reference:

1. “Elementary Linear Algebra Application Version”

Anton & Rorrer

2. “Linear Algebra for Engineers and Scientists Using MATLAB”

Kenneth Hardy

3. “Advanced Engineering Mathematics”

Erwin Kreyszig

**Course Outline:**

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| --- | --- | --- |
| **Week** | **Session No** | **Contents** |
| **1** | 1 | Introduction Cartesian, Polar & Exp. Forms |
| 2 | Mathematical operations. |
| 3 | Simple problems |
| **2** | 4 | De-Moivre's Theorem Powers , roots and products |
| 5 | Graphical representation |
| 6 | Simple Examples |
| **3** | 7 | Introduction Mathematical operations |
| 8 | Special matrices |
| 9 | Introduction to System of linear equations |
| **4** | 10 | Introduction Echelon form(Gauss Elemination method) |
| 11 | Examples |
| 12 | Reduced echelon form(Gauss jordon method) |
| **5** | 13 | Simple examples |
| 14 | LU factorization method |
| 15 | Matrix Inversion method |
| **6** | 16 | Homogenous system of eqaution |
| 17 | Linearly dependent and independent vectors |
| 18 | Cramer’s Rule |
| **7** | 19 | Examples and applications. |
| 20 | Vector Spaces and their examples |
| 21 | Subspaces |
| **8** | 22 | Basic problems related to vector spaces and subspaces |
| 23 | Column Spaces and Null Spaces |
| 24 | Revision for Midterm Exam. |
| **MIDTERM EXAMINATION** | | |  | Analytical approach of PID Design |
| **9** | 25 | Introduction Basis & dimensions |
| 26 | Simple problems |
| 27 | Applications |
| **10** | 28 | Linearly independent set; Bases. |
| 29 | Coordinate Systems |
| 30 | Dimension of a vector Space, Rank |
| **11** | 31 | Introduction Basis & dimensions |
| 32 | Simple problems |
| 33 | Applications |
| **12** | 34 | Introduction to Eigen values |
| 35 | Evaluation of Eigen vectors and Eigen values |
| 36 | Application |
| **13** | 37 | Inner product, Length, Orthogonality |
| 38 | Orthogonal sets |
| 39 | Orthogonal projections |
| **14** | 40 | Examples |
| 41 | Applications |
| 42 | Gram- Schmidt process |
| **15** | 43 | Sample Examples |
| 44 | Least Square Problems |
| 45 | Inner Product Spaces |
| **16** | 46 | Sample Examples |
|  | 47 | Revision |
|  | 48 | Revision. |