# SCMA 259 Linear Algebra

**First Semester Academic Year 2023-2024**

**Faculty of Science, Mahidol University**

**Student Groups** Materials Science and Nano Engineering, Bioresources and Environmental Biology, and Industrial Mathematics

**Class Schedule** Thursday at 9:00-12:00

**Instructors** Dr. Piyanan Pasom

Department of Mathematics, Faculty of Science, Mahidol University

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**Course Description**

Vector spaces, Linear transformations, Inner product spaces, projections on to subspaces, Least squares, Eigenvalues and eigenvectors, Diagonalization and Jordan forms, Complex vector spaces, Singular value decomposition and the pseudoinverse, Systems of linear differential equations.

**Grading Policy**

Student evaluation is in accordance with the rules and regulations of the Faculty of Science, Mahidol University. Letter grades of A, B+, B, C+, C, D+, D, and F will be evaluated according to the student's score.

| Score consists of: | Class Attendance | 5% | Midterm Exam | 35% | Quiz | 10% |
|---|---|---|---|---|---|---|
| | Assignments | 15% | Final Exam | 35% | | |

**All students are required**

- To come to class on-time and have an attendance record of 80% for the whole course. Otherwise students will not be allowed to take the examination.
- To dress properly. Otherwise students will not be allowed to sit in the class.

## Course Timetable

| Week | Topic/Details | Number of hours | | Teaching activities/ media | Instructors |
|---|---|---|---|---|---|
| | | Classroom sessions | Practice sessions | | |
| 1 | System of linear equations,<br>Gauss-Jordan elimination | 3 | 0 | **Teaching method**:<br>Interactive lecture, effective questioning, formative assessment, problem solving, problem based activities<br><br>**Media**:<br>lecture notes, individual assignments | Dr. Piyanan Pasom |
| 2 | Vector spaces and Subspaces,<br>Linear Independence, | 3 | 0 | | |
| 3 | Span, Basis and Dimension | 3 | 0 | | |
| 4 | Fundamental subspaces of matrices | 3 | 0 | | |
| 5 | Fundamental subspaces of matrices (continued)<br>**********<br>Linear Transformations<br>- Basic Definition and examples | 3 | 0 | | |
| 6 | - Matrices Representation for Linear Transformations<br>Scalar Product and Orthogonality in the Euclidean space $\mathbb{R}^n$ | 3 | 0 | | |
| 7 | - Orthogonal subspaces | 3 | 0 | | |
| 8 | - Projections onto subspaces,<br>- Least Squares Problems | 3 | 0 | | |
| 9 | **Midterm examination** | | | | |
| 10 | Inner product spaces<br>- Basic definitions and its properties | 3 | 0 | | |
| 11 | - Orthogonal and orthonormal bases | 3 | 0 | | |

| Week | Topic/Details | Number of hours | | Teaching activities/ media | Instructors |
|---|---|---|---|---|---|
| | | Classroom sessions | Practice sessions | | |
| | Eigenvalues and eigenvectors | | | **Teaching method**: Interactive lecture, effective questioning, formative assessment, problem solving, problem based activities **Media**: lecture notes, individual assignments | Dr. Piyanan Pasom |
| 12 | Diagonalization Jordan forms | 3 | | | |
| 13 | Complex vector spaces, Complex eigenvalues and eigenvectors | 3 | 0 | | |
| 14 | Hermitian matrices, Unitary matrices and unitarily diagonalization | 3 | 0 | | |
| 15 | The Singular value decomposition and pseudoinverse of matrices | 3 | 0 | | |
| 16 | Systems of linear differential equations | 3 | 0 | | |
| 17 | **Final examination** | | | | |
| | **Total** | **45** | **0** | | |

**Textbooks**

1. Howard Anton and Chris Rorres. **Elementary Linear Algebra with Applications**. 10th Ed. New York: Wiley. 2010.

2. Steve Leon, **Linear Algebra with Applications**, 8th Ed., Pearson, 2009