



## MME 526 Linear Models I

Fall 2022

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Stratton 201A

zoom: <https://wpi.zoom.us/j/3833386232>

course objectives:

- a) review/learn basic linear **algebra**: matrix algebra, vectors and vector spaces, eigenvalues and diagonalization
- b) solutions of **systems**
- c) **linear transformations**
- d) work with modern models that may be analyzed with that linear algebra: market share, regression, populations, quadratic forms, graphs

note: the course continues on with *Linear Models II* (MME 527) with additional applications including binomial graphs, Google searches, linear programming, and project management.)

materials needed:

*Linear Algebra and It's Applications* Lay, Lay and McDonald **5<sup>th</sup>** edition Pearson

Maple, Matlab or Octave software. Something that does matrix computations.

**grade** based upon:

weekly homework 50%

exam 25%

project 25%

**Topics** to be addressed:

**Linear systems of equations** - vector form of solutions, nature of solutions, algorithms. *Linearity*.

**Matrix arithmetic and algebra**

inverses, powers, notation

stochastic matrices

**Markov Chains and Market Share**

stochastic matrices and distributions

Markov Chains, esp regular

attainment and prediction of equilibrium

Covid 19 growth as a Markov Chain

### **Population Models**

development of Leslie matrix

asymptotic behavior of solutions

intro to dominant eigenvalue concept

software considerations

### **Diagonalization**

eigenvalues, eigenvectors

Principal Axis Theorem

### **Dynamical Systems $\mathbf{x}(k+1) = \mathbf{A} \mathbf{x}(k)$**

Perron-Frobenius Theorem and Dominant Eigenvalue Analysis