Course Title: Linear Algebra
Document date: Fall 2015
Course Number: 56-3740
Section Number: 01
Credits: 4
Designation: MA
Meeting Days and Times: Tues/Thurs 10:30 – 12:20
Meeting Location: 623 S. Wabash, room 600J

Instructor Name: Christopher Shaw
Office location: 623 South Wabash, room 500M
Office phone: 312-369-7732
Email address: cshaw@colum.edu
Mail delivery: Mail may be brought to room 500 of the 623 South Wabash building and given to the student worker for delivery to my mailbox.
Departmental office: 623 South Wabash, room 500
Departmental phone: 312-369-7368
Departmental fax: 312-369-8075
Availability: Tues/Thurs 1 – 3, or by appointment

Required Text(s): Linear Algebra with Applications
8th edition, Gareth Williams

Instructional Resource Fees: $40.00

Course Description: Linear algebra is the study of vector spaces and transformations on them. This course emphasizes techniques of computation and applications. Topics include systems of linear equations, matrix algebra, eigenvalues and eigenspaces, and inner product spaces. Applications typically include polynomial interpolation, electrical networks, cryptography, computer graphics, Markov chains, and approximation of functions including Fourier methods.

Course Rationale: Linear Algebra is a mathematical topic that bridges the pure and applied aspects of mathematics. On the one hand, the theory is characterized by an elegant simplicity. On the other hand, its applications range from business to science to computer graphics. This course respects the dichotomy of the subject by pairing discussions of the theory of linear algebra with applications that require students to put the mathematics in action.
This course can be used to satisfy the requirements of: the Liberal Arts and Sciences Core Curriculum; the Game Programming major; the Acoustics major; and/or the Mathematics minor. Please speak to your advisor if you have questions about how this course can and cannot fit into your particular program of study.

**Prerequisites:** Calculus I

**Liberal Arts and Sciences Core Objectives:**
This course satisfies the Mathematics requirement of the Liberal Arts and Sciences Core Curriculum. Students will be able to:

- understand and use basic mathematical concepts and skills.
- utilize various tools of analysis to enable critical thinking.

**General Mathematics Objective:**
Upon successful completion of mathematics courses:

- students will be competent in a system of symbolic reasoning.
- students will be able to apply symbolic reasoning to analyze and draw meaningful conclusions using information, which may be presented in a variety of ways, including visually, symbolically, or in ordinary language.

**Course Learning Outcomes:**
Upon successful completion of this course, students should be able to:

- Solve systems of linear equations using Gauss-Jordan elimination.
- Understand vector spaces and subspaces and the concepts of linear independence, basis, and dimension.
- Use the dot product and cross product to determine properties of vectors.
- Perform basic operations on matrices, including addition, scalar and matrix multiplication, and transposition.
- Compute the inverse of matrices and understand when and why an inverse does not exist.
- Understand the effect of linear transformations on vectors and the connection to matrix operations.
- Compute the determinant of a matrix.
- Compute eigenvalues and eigenvectors and interpret them in the context of a linear transformation.

**Grading and Evaluation:** Your final grade will be assigned using the scale below:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-</td>
<td>90 – 92</td>
</tr>
<tr>
<td>A</td>
<td>93 – 100</td>
</tr>
<tr>
<td>B-</td>
<td>80 – 82</td>
</tr>
<tr>
<td>B</td>
<td>83 – 86</td>
</tr>
<tr>
<td>B+</td>
<td>87 – 89</td>
</tr>
<tr>
<td>C-</td>
<td>70 – 72</td>
</tr>
<tr>
<td>C</td>
<td>73 – 76</td>
</tr>
<tr>
<td>C+</td>
<td>77 – 79</td>
</tr>
<tr>
<td>D</td>
<td>60 – 69</td>
</tr>
<tr>
<td>F</td>
<td>0 – 59</td>
</tr>
</tbody>
</table>

Your grade will be broken down as follows:

- Homework .................30%
- Quizzes.....................10%
- Three Exams .............60%
1. Written homework will be assigned at least once per week. Homework problems will consist of a hybrid of assigned questions from the textbook and problems written by the instructor.

2. Quizzes will be announced in advance or given as take-home assignments. While it is expected that students may work together and use outside resources to solve homework problems, you may not work collaboratively on material assigned as a quiz unless explicitly told otherwise.

3. There will be three in-class exams (see schedule for dates). The total weight of the exams is to form 60% of the final grade, however, the exams will be weighted as follows: 25 points for the highest exam score, 20 points for the second-highest exam score, and 15 points for the lowest exam score.

**Attendance Policy:** Missing class will have an adverse effect on the learning process and on your course grade.

**Late Work and Makeup Policy:**

1. Homework submitted beyond the due date will be penalized by 50%, and will not be accepted for credit after one week has passed. Your lowest homework score will be dropped.

2. No makeup quizzes. Your lowest quiz score will be dropped.

3. No makeup exams, unless there is a documented emergency.

**Academic Integrity:** Students at Columbia College enjoy significant freedom of artistic expression and are encouraged to stretch their scholarly and artistic boundaries. However, the college prohibits all forms of academic dishonesty. For present purposes, "academic dishonesty" is understood as the appropriation and representation of another's work as one's own, whether such appropriation includes all or part of the other's work or whether it comprises all or part of what is represented as one's own work (plagiarism). Appropriate citation avoids this form of dishonesty. In addition, "academic dishonesty" includes cheating in any form, the falsification of academic documents, or the falsification of works or references for use in class or other academic circumstances. When such dishonesty is discovered, the consequences to the student can be severe. (Taken from the Columbia College Chicago Student Handbook.)

**Services for Students with Disabilities:** Columbia College Chicago seeks to maintain a supportive academic environment for students with disabilities. Students who self-identify as having a disability should present their documentation to the Services for Students with Disabilities (SSD) office. After the documentation has been reviewed by the SSD office, a Columbia College accommodation letter will be provided to the student. Students are encouraged to present their Columbia accommodation letters to each instructor at the beginning of the semester so that accommodations can be arranged in a timely manner by the College, the department, or the faculty member, as appropriate. Accommodations will begin at the time the letter is presented. Students with disabilities who do not have accommodation letters should visit the office of Services for Students with Disabilities, Room 304 of the 623 S. Wabash building (312-369-8296).

**Science Visualization Lab:** The Science and Mathematics Department maintains a computer lab on the 6th floor of 623 S. Wabash, Room 600-P. When not reserved for
class sessions, this lab is open to students currently enrolled in Science and Mathematics classes for work on Science and Math related projects, available M – F from 9am to 7pm.

**Learning Studio:** The Learning Studio, located at 618 S. Michigan Avenue, first floor, is a relaxed, open, and personal environment. Tutors can help you with a wide range of subjects at all levels. The environment of the learning studio is non-judgmental when working with a tutor. Using the Learning Studio is a good idea for working in a number of disciplines, including Accounting, Math, Science, and with writing assignments. You can make an appointment through Oasis (using the “Make Appointments” tab) or call the Learning Studio at 312-369-8130. Please visit the website at [www.colum.edu/learningstudio](http://www.colum.edu/learningstudio). It’s super helpful and free!

**Course Calendar:**

| Week 1 | 9/8/15 & 9/10/15 | Course introduction  
1.1: Matrices and Systems of linear equations  
1.2: Gauss-Jordan elimination  
1.3: Vector space $\mathbb{R}^n$ | Monday, September 14 is the last day to add a class |
|--------|-----------------|-------------------------------------------------|-------------------------------------------------|
| Week 2 | 9/15/15 & 9/17/15 | 1.4: Subspaces of $\mathbb{R}^n$  
1.5: Basis and Dimension  
1.6: Dot product, norm, angle, and distance | Monday, September 21 is the last day to drop a class |
| Week 3 | 9/22/15 & 9/24/15 | 1.7: Curve fitting  
2.1: Arithmetic on matrices  
2.2: Properties of operations | |
| Week 4 | 9/29/15 & 10/1/15 | 2.3: Symmetric Matrices  
2.4: Inverse  
2.5: Matrix transformations  
2.6: Linear transformations | |
| Week 5 | 10/6/15 & 10/8/15 | Review and **Exam 1** | |
| Week 6 | 10/13/15 & 10/15/15 | 2.8: Markov Chains  
3.1: Determinants  
Appendix A: Cross Product  
3.2: Properties of determinants | |
| Week 7 | 10/20/15 & 10/22/15 | 3.3: Determinants & inverses  
3.4: Eigenvalues & eigenvectors | |
| Week 8 | 10/27/15 & 10/29/15 | 3.5: Applications  
4.1: General vector spaces | Monday, November 2 is the last day to withdraw from a class |
| Week 9 | 11/3/15 & 11/5/15 | 4.2: Linear combinations  
4.3: Linear independence  
4.4: Bases  
4.5: Rank | |
<table>
<thead>
<tr>
<th>Week 10</th>
<th>Review &amp; Exam 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/10/15 &amp; 11/12/15</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 11</th>
<th>4.6: Orthonormal vectors/projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/17/15 &amp; 11/19/15</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 12</th>
<th>4.7: The orthogonal complement</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/24/15</td>
<td>4.8: Kernel, Range, and Rank/Nullity</td>
</tr>
<tr>
<td></td>
<td>4.9: One-to-One and Inverses</td>
</tr>
<tr>
<td></td>
<td>No class on Thanksgiving (Thursday, 11/26/15)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 13</th>
<th>5.1: Coordinate vectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/1/15 &amp; 12/3/15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.2: Matrix of linear transformations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 14</th>
<th>6.1: Inner product spaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/8/15 &amp; 12/10/15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.2: Non-Euclidean geometry</td>
</tr>
<tr>
<td></td>
<td>6.3: Approximation of functions</td>
</tr>
<tr>
<td></td>
<td>6.4: Least-squares curves</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Week 15</th>
<th>Review &amp; Final Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/15/15 &amp; 12/17/15</td>
<td></td>
</tr>
</tbody>
</table>

**Disclaimer Statement:** This syllabus may be amended as the course proceeds. You will be notified of all changes.