College of Arts and Sciences **Fall 2017**
MATH 305-001 Linear Algebra (3,0) **3 Credits**

Prerequisites: A grade of "C" or better in MATH 112 or MATH 151.

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Office Hours:

Monday	Tuesday	Wednesday	Thursday	Friday
10:00-10:50	10:00-10:50	10:00-10:50	10:00-10:50	10:00-10:50

Required Texts: Linear Algebra and its Applications 3rd Edition, by David C. Lay, 2006 Pearson Education, Inc. Addison-Wesley. ISBN-10: 0321287134, ISBN-13: 978-0321287137 or ISBN-10: 0201709708, ISBN-13: 978-0201709704

Recommended: None

Course Description: This course provides an introduction to matrix algebra, vector spaces, and linear transformation, including applications. Focus is on computation and theory.

Course Objectives: Upon completion of MATH 305, students will be able to:

1. Define, develop illustrative examples of, manipulate, prove features of, and make practical use of the concepts associated with ***systems of linear equations***, including consistent, inconsistent, solution set, elementary row operations, row reduction, and linear transformation.
2. Define, develop illustrative examples of, manipulate, prove features of, and make practical use of the concepts associated with ***matrix algebra***, including vector, matrix, singular, invertible, determinant, inverse, matrix factorization.
3. State, develop illustrative examples of, and prove the ***Invertible Matrix Theorem***, which consists of equivalent conditions for a square matrix to have an inverse.
4. Define, develop illustrative examples of, manipulate, prove features of, and make practical use of the concepts associated with ***vector spaces***, including span, subspace, linear transformation, linear independence, basis, null space, row space, kernel, rank, and dimension.
5. Compute, develop illustrative examples of, manipulate, prove features of, and make practical use of the concepts associated with ***eigenvalues and eigenvectors of a matrix***.
6. Compute, develop illustrative examples of, manipulate, prove features of, and make practical use of the concepts associated with ***orthogonality,*** including inner product, length, norm, orthogonal vectors, orthogonal compliments, orthogonal basis, orthonormal sets, orthogonal projection, and least-squares problems.

Grading Scale and Policies:

Point Values:

Exams	200 points
Final exam	100 points
Quizzes	100 points
	Total 400 points

Grading Scale%:

94-100	A	70-74	C
90-93	A-	65-69	C-
87-89	B+	60-64	D+
84-86	B	55-59	D
80-83	B-	50-54	D-
75-79	C+	0-49	F

Grading Policies: You will be graded on correct methodology, i.e., if you provide an answer but show no work or your work is incorrect, you will receive no credit. Your solutions must be written in a connected, step-by-step logical fashion and all variables should be clearly defined. If your solution is not written clearly, you will not receive full credit. In many cases, setting up the correct mathematical model and using this model to solve a problem will be just as important as computing a numerical answer.

The homework exercises for each section covered are on the last pages of this handout. You should spend a lot of your math study time doing homework. If you are struggling with your homework seek help from your instructor or the tutors in the Learning Center.

The course outline on the next-to-last page is a projection of the general structure and content of the course. It is tentative and will be loosely followed.

***Ground Rules*:**

1. **Calculator: We will not be using a calculator.** All electronic devices, including computers, PDAs and cell phones, must be turned off for all class lecture sessions.
2. **Purpose of Lecture:** Lectures are an opportunity for students to ask questions and seek clarification on material. This implies student preparation has been accomplished prior to class. Lecture is also the opportunity for the instructor to coordinate coverage of the material and present material that is historically or potentially difficult. It does not negate student preparation or study.
3. **Attendance Policy:** Attendance is strongly encouraged. If you miss a class, or are late, you are still responsible for class notes and assignments. Moreover, **you will be assigned a 0 score should a quiz take place during that missed lecture**.
4. **Make-up Policy:** Each exam should be taken at the designated time. An exam may be taken prior to or after the scheduled date, by agreement with the instructor, provided that the student provides a request with a **documented valid excuse well in advance of the scheduled date**. **If an absence is unexcused, no make-up will be provided, either for exams or for quizzes**.
5. **Academic Integrity:** Students are expected to perform all assigned work themselves. Any form of cheating or plagiarism will be handled in accordance with the Academic Integrity Procedures. Violations of the University Academic Integrity Policy may result in an F course grade.
6. **Testing:** Use of head phones, cell phones and hats during exams is prohibited.

University Policies

Online and Blended Course Attendance Policy
Students in online or blended classes are required to log in to the Course Management System (Blackboard, Wimba, TaskStream, etc.) and complete at least one "Academic Related Activity" within the Add/Drop period.

The Americans with Disabilities Act & Accommodations
In compliance with Lake Superior State University policies and equal access laws, disability-related accommodations or services are available to students with documented disabilities.

If you are a student with a disability and you think you may require accommodations you must register with Disability Services (DS), which is located in the KJS Library, Room 149, (906) 635-2355 or x2355 on campus. DS will provide you with a letter of confirmation of your verified disability and authorize recommended accommodations. This authorization must be presented to your instructor before any accommodations can be made.

Students who desire such services should meet with instructors in a timely manner, preferably during the first week of class, to discuss individual disability related needs. Any student who feels that an accommodation is needed – based on the impact of a disability – should meet with instructors privately to discuss specific needs.

IPASS (Individual Plan for Academic Student Success)
If at mid-term your grades reflect that you are at risk for failing some or all of your classes, you will be contacted by a representative of IPASS. The IPASS program is designed to help you gain control over your learning through pro-active communication and goal-setting, the development of intentional learning skills and study habits, and personal accountability. You may contact 635-2887 or email ipass@lssu.edu if you would like to sign up early in the semester or if you have any questions or concerns.

Tentative Course Outline:

Week	Dates	Monday	Wednesday	Friday
1	08/28	1.1	1.2	1.3
2	09/04	BREAK	1.4	1.5
3	09/11	1.7	1.8	1.9
4	09/18	Review	Review	Exam 1
5	09/25	2.1	2.2	2.3
6	10/02	2.4	2.5	Review
7	10/09	3.1	3.2	3.3
8	10/16	Review	4.1	Exam 2
9	10/23	4.2	4.3	4.4
10	10/30	4.5	4.6	4.7
11	11/06	Review	Review	5.1
12	11/13	5.2	5.3	Exam 3
13	11/20	5.4	BREAK	BREAK
14	11/27	Review	6.1	6.2
15	12/04	6.3	Review	Exam 4

Homework Practice:

Section	*Section Title*	*Assigned exercises*
1.1	Systems of Linear Equations	1, 5, 7, 11, 15, 19, 23, 25, 26, 33
1.2	Row Reduction and Echelon Forms	1, 2, 3, 7, 13, 15, 17, 21, 26
1,3	Vector Equations	1, 3, 5, 7, 9, 11, 13, 15, 17, 23, 25, 28
1.4	The Matrix Equation Ax = b	1, 5, 7, 9, 11, 13, 15, 17, 18, 19, 20, 23
1.5	Solution Sets of Linear Systems	1, 5, 7, 11, 15, 19, 23
1.7	Linear Independence	1, 3, 5, 7, 9, 11, 15, 17, 19, 21, 31, 33, 37
1.8	Introduction to Linear Transformations	1, 5, 7, 9, 11, 17, 19, 21
1.9	The Matrix of a Linear Transformation	1, 3, 5, 13, 19, 23, 37, 39
2.1	Matrix Operations	1, 3, 5, 9, 13, 15, 19, 21, 27
2.2	The Inverse of a Matrix	1, 5, 7, 9, 21, 26, 31, 35, 39
2.3	Characterizations of Invertible Matrices	1, 3, 5, 7, 9, 11, 13, 15, 33
2.4	Partitioned Matrices	1, 3, 5, 7, 9
2.5	Matrix Factorizations	2, 4, 10, 31
3.1	Introduction to Determinants	1, 5, 9, 19, 21, 23, 39, 43, 44
3.2	Properties of Determinants	1, 2, 3, 4, 5, 9, 15, 17, 19, 21, 23, 25, 27, 29, 34*
3.3	Crame, Volume, and Linear Transformations	1, 3, 5, 7, 9, 11, 18, 19, 21, 23, 27, 31
4.1	Vector Spaces and Subspaces	1, 3, 5, 7, 9, 11, 13, 15, 17, 23, 37*
4.2	Null and Column Spaces and Linear Transformations	1, 3, 5, 7, 9, 13, 15, 17, 21, 23, 31
4.3	Linearly Independent Sets; Bases	1, 3, 5, 7, 9, 11, 13, 15, 21, 31*, 33, 37*
4.4	Coordinate Systems	3, 7, 9, 11, 13, 15, 27
4.5	The Dimension of a Vector Space	1, 3, 5, 7, 9, 11, 13, 17, 19, 21, 23
4.6	Rank	1, 3, 5, 7, 9, 11, 13, 15, 17, 25
4.7	Change of Basis	1, 5, 7, 11, 13
5.1	Eigenvectors and Eigenvalues	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 24
5.2	The Characteristic Equation	1, 3, 5, 9, 11, 15, 17, 21
5.3	Diagonalization	1, 3, 5, 7, 9, 11, 13
5.4	Eigenvectors and Linear Transformations	1, 3, 5, 7, 9, 11, 13, 15, 17
6.1	Inner Product, Length, and Orthogonality	1, 3, 5, 7, 15, 17, 19
6.2	Orthogonal Sets	1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21
6.3	Orthogonal Projections	3, 9, 11, 13