



## MASTER COURSE OUTLINE

A. MATH 2400 Linear Algebra

B. COURSE DESCRIPTION:

An introduction to the topics in linear algebra. Topics include: systems of linear equations, matrix algebra, determinants, vectors and vector spaces, linear transformations, eigenvalues and eigenvectors. Prerequisite: Math 1220 with a grade of C or better.

**MnTC (Goals 4/MA and Goal 2/CT); (4 Cr - 4 lect, 0 lab)**

C. \*MnTC Discipline: Mathematical/Logical Reasoning \*\*Core Theme: Critical Thinking

D. RIVERLAND INSTITUTIONAL LEARNING OUTCOMES:

This course addresses the following Riverland Institutional Learning Outcome(s):

- ILO 1: critical thinking (*Core Theme Goal 2*)
- ILO 2: awareness of the larger global community (*Core Theme Goal 7 or 8*)
- ILO 3: ethical, engaged citizenship (*Core Theme Goal 9 or Goal 10*)
- ILO 4: communication and collaboration (*Discipline Goal 1 and by any learning outcome(s) involving communication or collaboration*)

E. MAJOR CONTENT AREAS:

- Systems of linear equations
- Matrix algebra
- Determinants
- Vectors and vector spaces
- Eigenvalues and Eigenvectors

F. GOAL TYPES, OBJECTIVES, AND OUTCOMES:

<u>GOAL</u>	<u>OBJECTIVES</u>	<u>OUTCOMES</u>
<u>MnTC Goal 4b</u>	Students will be able to clearly express mathematical ideas in writing.	The student will successfully <ol style="list-style-type: none"> <li>1. compute, explain, and apply key properties and definitions related to eigenvalues and eigenvectors of a matrix.</li> <li>2. identify symmetric, skew-symmetric, lower triangular, upper triangular, triangular, scalar, and diagonal matrices and apply their basic properties.</li> </ol>

<u>MnTC Goal 4c</u>	explain what constitutes a valid mathematical/logical argument (proof).	<ol style="list-style-type: none"> <li>1. prove or disprove that a given finite set of vectors is linearly independent.</li> <li>2. identify a vector space from the axioms and prove that a non-empty subset of a vector space is a subspace.</li> </ol>
<u>MnTC Goal 4d</u>	apply higher-order problem-solving and/or modeling strategies.	<ol style="list-style-type: none"> <li>1. interpret the determinant of a matrix and its properties and apply them to linear independence, areas, volumes, orientation, invertibility, Cramer's Rule, and the adjoint of a matrix.</li> </ol>
<u>MnTC Goal 2a</u>	gather factual information and apply it to a given problem in a manner that is relevant, clear, comprehensive, and conscious of possible bias in the information selected.	<ol style="list-style-type: none"> <li>1. create a basis for a nonzero finite dimensional vector space and find its dimension.</li> </ol>
<u>MnTC Goal 2b</u>	imagine and seek out a variety of possible goals, assumptions, interpretations, of perspectives which can give alternative meanings or solutions to given situations or problems.	<ol style="list-style-type: none"> <li>1. solve systems of equations using matrix methods.</li> <li>2. perform operations on matrices, including addition, subtraction, multiplication, transposition, and inversion.</li> </ol>
<u>MnTC Goal 2c</u>	analyze the logical connections among the facts, goals, and implicit assumptions relevant to a problem or claim; generate and evaluate implications that follow from them.	<ol style="list-style-type: none"> <li>1. construct bases for the row, column and null space of a matrix and relate their dimensions to one another and to the rank and nullity of the matrix.</li> </ol>
<u>CS</u>	understand and use properties of matrices and identify types of matrices.	<ol style="list-style-type: none"> <li>1. create and recognize row equivalent matrices and equal matrices.</li> <li>2. write LU and elementary matrix factorizations of square matrices where defined.</li> </ol>
<u>CS</u>	analyze and discuss concepts related to vector spaces.	<ol style="list-style-type: none"> <li>1. determine whether a vector is in the span of a finite collection of vectors.</li> <li>2. compute the coordinate vector of a vector relative to a finite basis.</li> <li>3. express the solution to <math>Ax = b</math> as a translation of the null space of <math>A</math> when <math>Ax = b</math> is consistent.</li> </ol>
<u>CS</u>	demonstrate knowledge of linear transformations and change of basis matrices.	<ol style="list-style-type: none"> <li>1. construct matrix representations for linear transformations relative to various bases when the domain and codomain are finite dimensional over the same field.</li> <li>2. create change of basis matrices.</li> </ol>
<u>CS</u>	apply principles of orthogonality and least-squares to find approximate solutions to inconsistent systems of equations.	<ol style="list-style-type: none"> <li>1. evaluate inner products.</li> <li>2. construct and identify orthogonal sets of vectors and orthogonal matrices.</li> <li>3. illustrate the Gram-Schmidt process.</li> </ol>

#### G. SPECIAL INFORMATION:

This course may require use of the Internet, the submission of electronically prepared documents and the use of a course management software program. Students who have a disability and need accommodations should contact Accessibility Services at the beginning of the semester. This information will be made available in alternative format, such as Braille, large print, or current media, upon request. A graphing calculator is required.

H. COURSE CODING INFORMATION: Course Code A/Class Maximum 48; Letter Grade

Revision date: 10/10/17; 09/29/22

AASC Approval date: 11/21/17; 10/18/22

<b>*Riverland Community College Disciplines</b>	<b>MnTC Goal Number</b>
Communication (CM)	<b>1</b>
Natural Sciences (NS)	<b>3</b>
Mathematics/Logical Reasoning (MA)	<b>4</b>
History and the Social & Behavioral Sciences (SS)	<b>5</b>
Humanities and Fine Arts (HU)	<b>6</b>

<b>**Riverland Community College Core Themes</b>	<b>MnTC Goal Number</b>
Critical Thinking (CT)	<b>2</b>
Human Diversity (HD)	<b>7</b>
Global Perspective (GP)	<b>8</b>
Ethical and Civic Responsibility (EC)	<b>9</b>
People and the Environment (PE)	<b>10</b>

\*These five MnTC Goals have been identified as Riverland Community College Disciplines.

\*\* These five MnTC Goals have been identified as Riverland Community College Core Themes.

NOTE: The Minnesota Transfer Curriculum “10 Goal Areas of Emphasis” are reflected in the five required discipline areas and five core themes noted in the Riverland Community College program of study guide and/or college catalog.