WINONA STATE UNIVERSITY

COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

**Proposed Course Outline-MATH 314**

**Course Title:** Linear Algebra for Differential Equations

**Number of Credits:** 1

**Catalog Description:** Methods of linear algebra are studied as they apply to the solutions of differential equations. Topics include systems of linear equations and eigenvalue analysis. Prerequisite: Concurrent enrollment in instructor’s section of MATH 313 - Differential Equations or instructor’s permission.

**Possible Textbooks:**

* *Differential Equations & Linear Algebra, Sixth Edition* by Edwards & Penny, Prentice-Hall, 2006, ISBN: 978-0132397308
* *Differential Equations: Matrices and Models* by Bugl, Prentice-Hall, 1994, ISBN: 978-0023165405
* *Differential Equations & Linear Algebra* by Greenberg, Prentice-Hall, 2000, ISBN: 978-0130111180
* *Linear Algebra and its Applications, Third Edition* by David Lay, Addison Wesley, 2005, ISBN: 978-0321287137

**Topics Covered:**

1. Solving Simultaneous Linear Equations
   1. Substitution Method
   2. Linear Combination Method
   3. RREF
   4. Vector Form of Solutions
   5. Applications
2. Matrix Arithmetic
   1. Matrix Inversion
   2. Determinants
   3. Cramer’s Rule
3. Vector Spaces
   1. Linear Independence
   2. Spanning
   3. Bases
   4. Change of Basis Matrices
4. Linear Transformations
   1. Basic Forms
      1. Node
      2. Saddle
      3. Center
      4. Spiral
   2. Creating Linear Transformations
5. Elementary Spectral Theory
   1. Eigenvalues
   2. Eigenvectors
   3. Jordan-Canonical Form

**Listing of Sections to be Covered:** Not applicable to this course, since there is no standard textbook. Chosen sections of any text should correspond to the topics outlined above.

**Remarks:** None.

**Method of Instruction:** Lecture-presentation, discussion, question-answer sessions,

use of calculators/computers, group work.

**Evaluation Procedure:** Homework, quizzes, midterm exams, and a final exam.

**Minnesota Transfer Curriculum:** Not Applicable

**MnSCU Learning Outcomes:**

* Students will be able to solve systems of equations using matrix methods, including RREF, inverses, and Cramer’s Rule.
* Students will be able to determine whether a given set of vectors is a basis and convert coordinates between bases.
* Students will correctly analyze and classify linear transformations using eigenvalue analysis.
* Students will use linearization to analyze the behavior of non-linear transformations.

**Last Revised:** Spring 2013 by the Mathematics Subgroup (Double-checked Spring 2016)