MATH 406   Linear Algebra III

1. Catalog Description

   MATH 406   Linear Algebra III (4)

   Rigorous development of real and complex inner product spaces. Orthogonal bases and
direct sums of subspaces. Linear transformations on inner product spaces. Properties of
self-adjoint and normal operators. Additional topics such as the Jordan Decomposition
Theorem and the Spectral Theorem. 4 lectures. Prerequisite: MATH 306 or consent of
instructor.

2. Required Background or Experience

   Math 306.

3. Learning Objectives

   The student should learn the language and methods of linear algebra and some of the most
important applications. The methods include computations with pencil and paper and with
computers.

4. Text and References

   In addition to using the book selected for Math 306 (see course outline for Math 306) the
instructor may also choose an advanced book or use notes depending on the topics to be covered
after finishing the material in the text. However, the book for Math 306 is very likely to contain
sufficient material for both courses.

   Possible texts include:
   - Strang, Gilbert, Introduction to Applied Mathematics.
   - Trefethen, Lloyd N. and David Bau, Numerical Linear Algebra
   - Watkins, David S., Fundamentals of Matrix Computations

   Supplemental computer software:
   - Matlab™, Mathematica™, Maple™, True BASIC™, Theorist™, HP-48 calculators

5. Minimum Student Materials

   Paper, pencils, and notebook.

6. Minimum University Facilities

   Classroom with ample chalkboard space for class use.

7. Content and Method

   • Inner product spaces
   • Spectral Theorem for symmetric and self-adjoint matrices
   • Cayley-Hamilton Theorem and the minimal polynomial
   • Jordan and rational canonical forms
   • Applications, including Fourier series

   Some suggested chapter outlines to follow for Math 406: Using Axler, cover Chapters 7-
10. Using Friedberg, Insel, and Spence, cover Sections 6.3-6.6, Chapter 7, plus Fourier
series and some optional sections.

   Additional topics chosen at the discretion of the instructor in consultation with the course
supervisor.
Possible topics include more on canonical forms, numerical linear algebra, introductory functional analysis, operations research, linear programming, linear codes.

8. Methods of Assessment

Assigned problem sets, scheduled examinations, and computer projects.