WINONA STATE UNIVERSITY
PROPOSAL FOR NEW COURSES

Department: Mathematics & Statistics ____________________________ Date: March, 2010

Refer to Regulation 3-4, Policy for Changing the Curriculum, for complete information on submitting proposals for curricular changes.

MATH 205 __________________ Linear Algebra ________________________________ 4 Credits
Course No. __________________ Course Title ________________________________

This proposal is for a(n) __X__ Undergraduate Course __________ Graduate Course
Applies to: __X__ Major __X__ Minor __________ University Studies* __________ Not for USP
____ Required ______ Elective ______ Elective

Prerequisites: MATH 160 or Mathematics Placement Exam Score ______________

Grading method __X__ Grade only ______ P/NC only ______ Grade and P/NC Option

Frequency of offering __X__ Once per semester __________________________

*For University Studies Program course approval, the form Proposal for University Studies Courses must also be completed and submitted according to the instructions on that form.

Provide the following information:

A. Course Description

1. Catalog 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.

2. Course outline of the major topics and subtopics (minimum of two-level outline).

I. Systems of Linear Equations
   a. Gaussian Elimination
   b. Matrix Operations and Arithmetic
   c. Matrix Inverses
   d. Elementary Matrices
   e. Diagonal Matrices

II. Determinants
   a. Properties of the determinant
   b. Cofactor expansion

III. Vectors
   a. Geometric Vectors
   b. Vector Arithmetic
   c. Norm, Dot Product
   d. Projections
   e. Orthogonality

IV. Vector Spaces
   a. R^n
   b. Properties of Linear Transformations
   c. Subspaces
   d. Linear Independence
   e. Bases and Dimension
   f. Gram-Schmidt Process

V. Linear Transformations
   a. General Linear Transformations
   b. Change of Bases
   c. Rank, Range and Kernel

VI. Eigenvalues and Eigenvectors
   a. Computing eigenvalues and eigenvectors
   b. Characteristic Equations
   c. Diagonalization
3.a  Instructional delivery methods utilized: (Please check all that apply).

<table>
<thead>
<tr>
<th>Lecture: Auditorium</th>
<th>ITV</th>
<th>Online</th>
<th>Web Enhanced</th>
<th>Web Supplemented</th>
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<td>Lecture: Classroom X</td>
<td>Service Learning</td>
<td>Travel Study</td>
<td>Laboratory</td>
<td>Internship/Practicum</td>
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<td>Other: (Please indicate)</td>
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3.b  MnSCU Course media codes: (Please check all that apply).

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<th>None:</th>
<th>Internet</th>
<th>Independent Study</th>
<th>Satellite</th>
<th>Taped</th>
<th>Web Enhanced</th>
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4.  Course requirements (papers, lab work, projects, etc.) and means of evaluation.
   - Requirements: Homework, quizzes, exams
   - Means of evaluation: Homework, quizzes and exams evaluated by instructor

5.  Course materials (textbook(s), articles, etc.).
   - Or
   - Howard Anton, *Elementary Linear Algebra with Applications*, Wiley, 2005

6.  Assessment of Outcomes
   - By examination

7.  List of references.

B. Rationale

1.  Statement of the major focus and objectives of the course.
   - The major focus of this course will be introductory topics in Linear Algebra. The objective is to introduce mathematics, math-ed, and statistics majors to these concepts, which will be used and reinforced in subsequent courses in their respective majors. In addition, a secondary objective of the class is to begin exposing students to proof techniques and proof-style writing. Again, this is in preparation for upper level courses which use and develop these skills more fully.

2.  Specify how this new course contributes to the departmental curriculum.
   - The Guidelines of the Mathematical Association of America explicitly state that an undergraduate mathematics program should contain a “Linear Algebra” course. Currently, the more basic topics of the proposed course are taught in Math130 while the more advanced topics in the proposed course are spread out over the curriculum. This class would pull together these topics in a more coherent fashion.
   - In addition, the proposed course will serve as a needed additional stepping-stone toward upper-level proof-based mathematics courses.

3.  Indicate any course(s) which may be dropped if this course is approved.
   - No courses would be dropped, however Math130, which is currently offered every semester, would be reduced to being offered only as needed for the new Middle School Math minor program (approximately once every two or three semesters).

C. Impact of this Course on other Departments, Programs, Majors, or Minors

1.  Does this course increase or decrease the total credits required by a major or minor of any other department? If so, which department(s)?
   - This course will result in an additional credit being required for the MTED major within our own department. However, this additional credit will be offset by the reduction of one credit in Math440 and hence will cause no net change in required credits.
   - It does not affect any major programs outside our department.

2.  Attach letter(s) of understanding from impacted department(s).

Attach a *Financial and Staffing Data Sheet*.

Attach an *Approval Form* with appropriate signatures.

Department Contact Person for this Proposal:

<table>
<thead>
<tr>
<th>Name (please print)</th>
<th>Phone</th>
<th>e-mail address</th>
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</thead>
<tbody>
<tr>
<td>Eric Erthum</td>
<td>474-5775</td>
<td><a href="mailto:eerthum@winona.edu">eerthum@winona.edu</a></td>
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[Revised 7/5/07]
WINONA STATE UNIVERSITY
FINANCIAL AND STAFFING DATA SHEET

Course or Program: Math 205

Include a Financial and Staffing Data Sheet with any proposal for a new course, new program, or revised program.

Please answer the following questions completely. Provide supporting data.

1. Would this course or program be taught with existing staff or with new or additional staff? If this course would be taught by adjunct faculty, include a rationale.

This course would be taught with existing staff.

2. What impact would approval of this course/program have on current course offerings? Please discuss number of sections of current offerings, dropping of courses, etc.

Currently Math130 is offered every semester. If this course is approved, Math 205 will be offered every semester instead. However Math 130 will still be offered as needed (approximately once every two or three semesters) by the new Middle School Math minor program which requires Math130.

3. What effect would approval of this course/program have on the department supplies? Include data to support expenditures for staffing, equipment, supplies, instructional resources, etc.

None.

[Revised 9-05]
WINONA STATE UNIVERSITY
NEW AND REVISED COURSE AND PROGRAM APPROVAL FORM

Routing form for new and revised courses and programs. Course or Program: MATH205

<table>
<thead>
<tr>
<th>Department Recommendation</th>
<th>3/31/10</th>
<th><a href="mailto:bdeppa@winona.edu">bdeppa@winona.edu</a></th>
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<td>Department Chair</td>
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Please forward to Registrar.

Registrar: Date entered

Please notify department chair via e-mail that curricular change has been recorded.

[Revised 7-5-07]