**UNIVERSITY OF MARY**

**MAT 312**

**Linear Algebra**

**Fall 2019**

**Credit Hours:** 4

**Location:** HMC 203

**Instructor:**  Bob Willenbring, Ph.D. **Course Format:** Classroom Instruction~16 weeks

**Schedule:**  MWF 9:00am-9:50am  
 Thurs 8:30am-9:20am

**Major Requirement and Liberal Arts Core Elective**

**Office Hours:** 1-2:50pm MTWHF  **Email:** [rtwillenbring@umary.edu](mailto:rtwillenbring@umary.edu)

**Office Location:** HMC 221  **Phone:** 701-355-8191

**Course Description:**

Vector spaces, their general properties, and linear transformations; systems of linear equations, matrices, determinants.

**Relationship of the Course to the Program of Study:**

This course is required for all Math, Engineering, Comp Sci, and Math Ed Majors, and for most math minors too. We suggest first completing MAT 209, Calculus I. All upper level math courses depend implicitly on concepts introduced in Linear… a common utterance among math professors is “don’t you remember this from Linear?”

**Servant Leadership and the Benedictine Values:**

This course does not have a specific Servant Leadership component, beyond working with others to succeed.

Of the six Benedictine Values that underlay the university, it is my intention you will encounter hospitality every time you enter my classroom or office, community through discussing and studying math with your peers, and respect for persons in your interactions with others resulting from studying math at the University of Mary.

**Course Outcomes:**

Critical Thinking:

- Solve systems of equations; row reduce a matrix; understand pivot positions, free variables, span, and linear independence; calculate determinants, eigenvalues, and eigenvectors

- Find the matrix of a linear transformation; find the inverse of an invertible matrix; determine bases for various vector spaces

- Apply linear algebra techniques to solve problems in chemistry, physics, economics, and a variety of other areas

- Understand the characteristics of a formal proof, and use basic theorems and definitions to prove related results

Communication:

- Interpret results, especially those involving matrices and linear transformations, and explain them both verbally and written, using correct terminology and notation

- Carefully define concepts and explain definitions

- Write mathematical proofs that are clear, correct, and concise

-Check solutions for accuracy, relevance, and reasonableness

**Major Assignments:**

*Homework*: Solving problems is a crucial part of this course. Homework will be assigned from each section, and will be turned in once a week. These assignments provide the instructor an important assessment tool, and provide the student essential practice. Some assignments may be worked on in class!

*Chapter Exams*: There will be an exam upon the conclusion of most chapters for the purpose of assessing the critical thinking and communications outcomes of this course. Students will be provided with a list of topics to be tested and/or a list of example problems that illustrate the content of the exam.

Final Exam: The final exam is a two hour comprehensive examination, covering all material for the semester. The time can be found on the final exam schedule, or the course calendar. Also, the instructor reserves the right to take strong final performance into consideration when calculating grades (for example, possibly by replacing a student’s lowest chapter exam score with a score corresponding to the percentage on the final.)

**Methods and Policies for Evaluation and Grading of Student Work:**

There will be approximately 13 Homework assignments graded out of 25 (30% of grade, combined with any in class work), 3 exams graded out of 50 (50% of grade), and 1 final exam graded out of 100 (20% of grade). A student’s weighted percentage is then assigned a course grade. Grades will be no worse than the following:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 92-100% | A |  | 90-91% | A- |  | 88-89% | B+ |
| 82-87% | B |  | 80-81% | B- |  | 78-79% | C+ |
| 72-77% | C |  | 70-71% | C- |  | 68-89% | D+ |
| 62-67% | D |  | 60-61% | D- |  | 0-59% | F |

All exams are graded page by page, without knowledge of student identity when possible, with scores based on the completeness and correctness of each solution. A complete solution consists of all the logical steps required to go from the statement of a problem to the final answer. A correct solution consists of a correct final answer AND correct logical steps. This approach allows the professor to measure each student’s progress in reaching both the communication and critical thinking outcomes of this course: I’m trying to grade objectively.

Homework problems can be done in groups. It is a great way to get to know your classmates. You should have a good sense of (that is, you should know) how you did on each assignment in this course before you turn it in.

**Required Texts and Resource Materials:**

*Linear Algebra with applications, 9th or 10th edition, Leon. ISBN 9780321962218*

**Expectations:**

*Credit Hour Definition [HEA-NPRM July 1, 2011]*

*• For a semester hour, must approximate not less than one hour of classroom and two hours out of class student work each week in approximately a 15-week semester or trimester*

*• Equivalent work for other academic activities as established by the institution, e.g., lab work, internships, practica, studio work, and other academic work*

To summarize: a credit hour is defined as not less than 45 hours of time spent. So for a 4 credit course, one should expect to spend 180 hours on it: 60 hours or 4 per week in class, 120 hours or 8 per week out of class. Your academic endeavors in college will likely add up to more than a full time job, and anything done in addition to that (work, work study, or athletics) are done in addition to, NOT IN PLACE OF, your academic endeavors. One possible breakdown of the 120 out of class hours for this course:

HW/Reading/Review: 8hr/hw\*13hw = 104 hours

Chapter Exam studying: 2.5hr/ex\*4ex = 10 hours

Final Exam studying: 6hr/fin\*1fin = 6 hours

**Attendance Policy:**

Students are expected to attend all class periods and arrive on time. If you miss class, you are responsible for getting the notes from a classmate. Excessive unexcused absences (10+, or missing consecutive class periods in the first 10 days) are grounds for dismissal (the general excessive absence policy is on my.umary.edu). Any homework or exam missed due to an unexcused absence cannot be made up.

If you are absent, I expect to be notified (email is best) in advance whenever planned and as soon as possible for the unexpected. To be an ``excused absence,'' the absence must be due to an official University of Mary sponsored/sanctioned activity or event, or to extraordinary personal circumstances (such as acute illness or a death in your immediate family). I reserve the right to ask for a doctor's note or other official documentation.

For excused absences, the University has a policy on excused absences related to sponsored/sanctioned activities and events. That policy is available for review online: <http://bit.ly/2thGRjo>. Students participating in such activities and events are expected to review this policy and comply with it. For my side, exams missed for excused absences exams can generally made up within a few days of the absence. Please discuss all excused absences with me, preferably in person, so we can determine appropriate action and address further questions.

**Channel for Communication Relating to this Course:**

*Dr. Bob Willenbring, Instructor > Dr. James Peliska, Administrative Chair, School of Arts and Sciences >*

*Dr. David Tamisiea, Interim Dean, School of Arts and Sciences*

**Statement on Academic Honesty**:

Students are expected to read the University of Mary’s Academic Honor Code and Honor System and abide by all the standards of conduct and requirements contained therein.  When a student is in doubt about whether or not an action might constitute an Academic Honor Code violation, s/he should request clarification from the instructor **before** the action in question is undertaken.  The Academic Honor Code is available for review on my.umary.edu using the following link: <http://bit.ly/2t3ORSu>

**Additional Statement on Academic Honesty and Group Work**:

Cheating is easy to recognize in math. I consult the honor code for further action when I can’t get an admission of guilt. I will often walk through my classroom during exams, to prevent cheating and to answer questions.

Exams are obviously an individual endeavor, but Group work on homework is encouraged. If you are trying to help a friend, and they aren’t getting it, don’t give up and let them copy – you are not helping them, but setting them up for disaster later on. Instead, please offer to accompany them on a visit to my office for help – this is doing both them and me a favor, and you might learn something too. So work WITH your fellow students when you study together: do the same assignment, discuss problems you are struggling to complete, work together to resolve a discrepancy between your solutions, etc.

A good rule: if after an hour of effort, you can’t make any progress towards a solution, *or* after completing many problems, you can’t determine whether your solutions are correct, it’s either time for a break or time for a visit.

**Technology:**

Outside of class, to access the LMS [canvas.umary.edu](https://canvas.umary.edu), one needs a device with internet capabilities. Grades and assignments will be posted on the LMS. A graphing calculator is suggested. I suggest any TI 83/84 edition.

With the exceptions above, *electronic communication and storage devices are not allowed during class, unless they are being used* ***only*** *for note taking and/or keeping time.* If you observe a fellow student using an electronic device for a non-mathematical purpose, kindly ask them to shut it off.

**Statement Regarding Reasonable Accommodations**:

The University of Mary, in compliance with the Americans with Disabilities Act and in the spirit of our mission, offers support for students who provide required documentation. Students with disabilities who need accommodations should apply to the Office of Student Accessibility Services. For further information, contact the Director of Student Accessibility Services (Lynn Dodge), in the Student Success Center, located in the lower level of Welder Library, or at (701) 355-8264, or via email at [ljdodge@umary.edu](mailto:ljdodge@umary.edu).

**Tentative Content Outline (Dates subject to change, check Canvas as semester progresses):**

Chapter 1: Systems of Linear equations, Matrix algebra, elementary matrices (weeks 1-3)

Chapter 2: Determinants and Applications (Weeks 3-4)

Chapter 3: Vector Spaces, Linear Independence, change of base, etc. (weeks 4-7)

Chapter 4: Linear Transformations, and Matrix representations (weeks 7-9)

Chapter 5: Orthgonality, Least squares, Inner products, Gram Schmidt process (weeks 10-13)

Chapter 6: Eigenvalues, Diagonalization, Singular Value Decomposition (time allowing) (weeks 12-15)

Chapter 7: Numerical Linear Algebra as time allows (Matrix norms, Gaussian elimination & pivoting, etc.)

\*Use of Matlab language (in the program Octave) throughout the semester

Highly Tentative exam Dates:  
Exam 1/2: October 3

Exam 3/4: November 7

Exam 5/6: December 5

Comprehensive Final: December 13, 1pm