**Applied Linear Algebra: MATH 2002 - 64042**

# 1    Contact Information

**Professor:** Dr. Blake Farman
**Phone Number:** (318) 342 - 1851
**Email Address:** farman@ulm.edu
**Website:** https://ulm.edu/~farman
**Office:** Walker 3-34
**Office Hours:** Monday - Thursday, 2:00 pm - 4:30 pm

## 1.1    Preferred Method of Communication

The best way to communicate with me during the semester is through email. I monitor my email Monday - Friday from 9:00 am until 5:00 pm. I normally try to respond within one business day.

### 1.1.1    Official University Email Addresses

The University provides each student with an email address, username@warhawks.ulm.edu, and all official course correspondence will **only** be conducted using official university email addresses.

### 1.1.2    Email Etiquette

When you send an email, your message should contain the following information

| | |
|---|---|
| **Subject:** | A few words that describe the content of your email along with the course identifier (MATH 2002-64042). |
| **Salutation:** | A professional greeting such as "Dear" or "Hello" followed by the appropriate honorific and the recipient's last name. |
| **Body:** | A concise message that clearly expresses the purpose of your email. |
| **Signature:** | A simple closing (e.g. "Sincerely," "Thank you," "Best regards," etc.) followed by your first and last name. |

For your convenience, included below is an example email.

> Subject: Homework Questions - Math 2002- 64042
>
> Dear Professor Farman
>
> I am having trouble with this week's homework. I have tried working through the examples in the text, but I am struggling to understand the concepts involved. Could we schedule a time to meet before the next class to discuss some of the concepts in more detail?
>
> Thank you,
>
> Jane Doe

For more details, you can read this Medium post about How to Email Your Professor.

# 2    Course Description

An introduction to the application of matrix algebra. Emphasis on the application of procedures and algorithms.

# 3   Course Prerequisites

You must have one of the following prerequisites to be eligible to be enrolled in Math 1011:

- A grade of C or better in MATH 1031 (or its equivalency), or

- A grade of C or better in MATH 1014 (or its equivalency).

# 4   Instructional Methods

This course is offered as an asynchronous, online-only course. There will be no face-to-face meetings for this course and you are encouraged, but not required, to attend any online meetings.

- Learning will be facilitated through online videos and the online textbook, and review sessions held on Zoom.

- Homework assignments and written assessments are to be submitted as a PDF through Moodle. Please note that if you do not have a tablet or knowledge of a mathematical typesetting system such as LaTeX, then you will need a scanning device such as a scanner or a smartphone equipped with a scanning app such as Adobe Scan.

# 5   Evaluation

This course will use **Mastery Based Grading**. The content is broken into *standards* that you are expected to master by the end of the course.

This grading system is *iterative* in the sense that you will have multiple opportunities to display mastery of each standard, and *forgetful* in the sense that your previous unsuccessful attempts are discarded once you demonstrate mastery of a standard.

Mastering a standard is a two-step process, consisting of mastering a Homework and a written Assessment. Each week we will cover around 1-2 standards and the homework that accompanies that standard. There will be a written Assessment that is due by the end of the following week.

Below, you can see a list of each standard and the homework that accompany them.

## Systems of Equations

| | |
|---|---|
| **SE 1** | I can identify whether or not a matrix is in Reduced Row Echelon Form. I can use Gaussian Elimination to put a matrix into Reduced Row Echelon Form. (§1.2) |
| **Homework:** Section 1.2.5, Exercises 1 - 2 | |
| **SE 2** | I can used the Reduced Row Echelon Form of an augmented matrix to describe the solution space to a system of linear equations using appropriate notation. (§1.2) |
| **Homework:** Section 1.2.5, Exercises 3 - 5 | |
| **SE 3** | I can use Pivot Positions to determine whether a linear system is consistent and, if so, whether the solution is unique. (§1.4) |
| **Homework:** Section 1.4.4, Exercises 1 - 4 | |

## Vectors and Matrices

| | |
|---|---|
| **VM 1** | I can add vectors together and scale vectors by a real number. I can determine whether a vector can be expressed as a linear combination of a set of given vectors. (§2.1) |
| **Homework:** Section 2.1.4, Exercises 1 - 6. | |

| **VM 2** | I can add matrices together and scale matrices by a real number. I can perform matrix-vector multiplication. I can perform matrix-matrix multiplication. I can translate a system of equations into a matrix equation of the form $A\mathbf{x} = \mathbf{b}$. (2.2) |
|---|---|
| **Homework:** | Section 2.2.6, Exercises 1 - 6. |
| **VM 3** | I can determine whether a vector is in the span of a given set of vectors. I can describe the span of a set of vectors as a set. I can use this information to determine whether a linear system is consistent. (§2.3) |
| **Homework:** | Section 2.3.4, Exercises 1 - 5, 10. |
| **VM 4** | I can determine whether a given set of vectors is linearly independent. (§2.4) |
| **Homework:** | Section 2.4.5, Exercises 1 - 5, 9 - 10. |
| **VM 5** | I can define a matrix transformation, find its domain and range, and I can compose matrix transformations. I can also determine whether a given function is a matrix transformation. (§2.5) |
| **Homework:** | Section 2.5.4, Exercises 1 - 7 |

## Invertibility and Bases

| **IB 1** | I can use Gaussian Elimination to determine whether a matrix is invertible and, if so, find its inverse. (§3.1) |
|---|---|
| **Homework:** | Section 3.1.5, Exercises 1, 4 - 7. |
| **IB 2** | I can find a basis for a space and translate between the associated coordinate systems. (§3.2) |
| **Homework:** | Section 3.2.5, Exercises 1 - 4, 6 - 7. |
| **IB 3** | I can compute the determinant of a given matrix and I can use this invariant to determine whether the matrix is invertible. (§3.4) |
| **Homework:** | Section 3.4.5, Exercises 1, 3 - 9. |
| **IB 4** | I can determine the null and column spaces for a given matrix and compute a basis for each. I can determine whether a given set satisfies the definition of a vector space. (§3.5) |
| **Homework:** | Section 3.5.5, Exercises 1 - 5. |

## Eigentheory

| **ET 1** | I can determine whether a vector is an eigenvector of a given matrix and, if so, find the associated eigenvalue. (§4.1) |
|---|---|
| **Homework:** | Section 4.1.4, Exercises 1,3,6. |
| **ET 2** | I can use the characteristic polynomial to find the eigenvalues of a given matrix and their multiplicities. I can find a basis for the eigenspace associated to an eigenvalue. (§4.2) |
| **Homework** | Section 4.2.6, Exercises 1,2,5. |
| **ET 3** | I can determine whether a given matrix is diagonalizable and, if so, compute the diagonal matrix to which it is similar. (§4.3) |
| **Homework:** | Section 4.3.5, Exercises 1, 3, 4, 6, 7. |

## Orthogonality

| **OR 1** | I can compute the dot product of two vectors and use this to compute the angle between two vectors. In particular, I can determine whether two vectors are orthogonal. (§6.1) |
|---|---|

| | |
|---|---|
| **Homework** | Section 6.1.4, Exercises 1 - 4. |
| **OR 2** | I can compute the transpose of a matrix and use the transpose to describe the orthogonal complement of a given vector space, including its dimension and a basis. (§6.2) |
| **Homework:** | Section 6.2.4, Exercises 1 - 5. |
| **OR 3** | I can perform Orthogonal Decomposition. (§6.3) |
| **Homework:** | Section 6.3.4, Exercises 1 - 6. |
| **OR 4** | I can use Gram-Schmidt Orthogonalization to find an orthogonal and orthonormal basis for a given vector space. (§6.4) |
| **Homework** | Section 6.4.4, Exercises 1 - 5. |

## 5.1 Grading Scale

Letter grades will be assigned based on the number of standards mastered in the course, as specified in the table below

| Grade | Number of Standards Mastered |
|:---:|:---:|
| A | 18 - 19 |
| B | 16 - 17 |
| C | 14 - 15 |
| D | 12 - 13 |
| F | 0 - 11 |

## 5.2 Assessments

The weekly Assessments contain problems corresponding to the standards covered that week. The standards are graded *independently* and, unlike quizzes or tests that you may have had in the past, there is no partial credit. You must master *each* of the problems that go with the standard.

### 5.2.1 Problem Scoring

Written assessments in this course will be scored on the following scale.

| | |
|---|---|
| **M**astery: | The given solution is correct with no content related errors. Appropriate justification is provided in a clear, easy to follow manner. |
| **P**rogressing: | The given solution demonstrates an understanding of the material, but contains content related errors or lacks justification. |
| **N**eeds Improvement: | The given solution was blank, illegible, or used inappropriate techniques. |

## 5.3 Reassessment

**Homework**

You may resubmit one homework set that you have not mastered each week. When reassessing, you only need to correct and resubmit the exercises with mistakes.

**Standards**

There are 5 scheduled Reassessments days for this course where you have the opportunity to reassess all of the standards that you have not yet mastered. You will be given a large assessment that contains problems for *every* standard that we have covered, and you may attempt as many of the standards that you have not yet mastered as time allows.

# 6   Class Policies and Procedures

At a minimum, all policies stated in the current ULM student policy manual & organizational handbook should be followed (see http://www.ulm.edu/studentpolicy/). Additional class policies include:

## 6.1   Textbook

The required text for this course is *Understanding Linear Algebra* by David Austin, which is freely available:

http://merganser.math.gvsu.edu/david/linear.algebra/ula/ula/frontmatter.html.

## 6.2   Attendance Policy

Students are expected to adhere to the Class Online Attendance Policy outlined in the ULM Student Policy Manual.

Beyond the baseline attendance policy, note that each week there are 10 Office Hours for which you have access to an interactive learning resource (i.e. me). This is arguably the most valuable aspect of this course. For most students, the lecture videos alone will **not** be enough to learn the material, so you are encouraged to actively engage with the material by utilizing this time to ask questions, clarify concepts, etc.

## 6.3   Make-up Policy

In the event of a missed assessment due to absence, the student will be provided an opportunity to reassess on the next Reassessment day.

## 6.4   Academic Integrity

Faculty and students must observe the ULM published policy on Academic Dishonesty (see the ULM Student Policy Manual – http://www.ulm.edu/studentpolicy/).
Any student caught turning in work that is not their own will receive an F in the course and will be reported to the Dean of Students, which could result in removal from the University.

## 6.5   Course Evaluation Policy

At a minimum, students are expected to complete the online course evaluation.

## 6.6   Location

Federal Regulations require determination and verification of every students' physical location while enrolled in classes (where they are physically located while taking classes), regardless of the delivery method (on campus, online). At the beginning of every semester and whenever physical location changes, students must update or verify their current location through banner https://ssb-prod.ec.ulm.edu/PROD/bwgkogad.P_SelectAtypUpdate. Students should do this by the end of the first week of classes.

# 7   Academic Services

# 8   Student Services

You can find information about the following available ULM student services at the websites listed below.

- Student Success Center (http://www.ulm.edu/cass/).

- Counseling Center (http://www.ulm.edu/counselingcenter/).

- Special Needs (http://www.ulm.edu/counselingcenter/special.htm).

- Library (http://www.ulm.edu/library/referencedesk.html)

- Computing Center Help Desk (http://www.ulm.edu/computingcenter/helpdesk)

Additional information can be found on The Student Services web site (http://www.ulm.edu/studentaffairs/).

## 8.1   Disability Accommodations

The University of Louisiana at Monroe strives to serve students with special needs through compliance with Sections 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act. These laws mandate that postsecondary institutions provide equal access to programs and services for students with disabilities without creating changes to the essential elements of the curriculum. While students with special needs are expected to meet our institution's academic standards, they are given the opportunity to fulfill learner outcomes in alternative ways. Examples of accommodations may include, but are not limited to, testing accommodations (oral testing, extended time for exams), interpreters, relocation of inaccessible classrooms, permission to audiotape lectures, note-taking assistance, and course substitutions.

Current policies on serving students with disabilities can be obtained from the ULM website: http://ulm.edu/counselingcenter/. If you need accommodation because of a known or suspected disability, you should contact the director for disabled student services at:

- Voice phone: (318) 342 - 5220

- Fax: (318) 342 - 5228

- Walk In: ULM Counseling Center, 1140 University Avenue (this building and room are handicapped accessible).

If you have special needs of which I need to be made aware, you should contact me within the first two days of class.

## 8.2   Mental Wellness

If you are having any emotional, behavioral, or social problems, and would like to talk with a caring, concerned professional please call one of the following numbers:

- The ULM Counseling Center (318) 342 - 5220

- The Marriage and Family Therapy Clinic (318) 342 - 9797

- The Community Counseling Center (318) 342 - 1263.

## 8.3   Title IX

*Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including federal loans and grants. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct, sexual violence, sexual harassment and retaliation. If you encounter unlawful sexual harassment or gender-based discrimination, please contact Student Services at (318) 342 - 5230 or to file a complaint, visit www.ulm.edu/titleix.*

Remember that all services are offered free to students, and all are strictly confidential.

## 8.4   Emergency Procedures

The emergency number for the ULM Police Department is (318) 342 - 5350 and should be used for emergency calls. If the campus police are contacted about an emergency for a student, they will go to the student's class to inform the student.

## 8.5    Discipline / Course Specific Policies

**Any policies given here may be altered by the professor if deemed necessary. If this occurs, ample notice will be given.**

## 8.6    FERPA

Do not email or call your professor regarding your course grades. The Family Education Rights and Privacy Act (FERPA) prohibits your professor from discussing your grade in any manner except in person. Please do not have family members, friends, or anyone else contact your professor about your grade as FERPA prohibits your professor from sharing that information with them.

# 9    Tentative Course Schedule

## 9.1    Contact Information

**Professor:** Dr. Blake Farman
**Phone Number:** (318) 342 - 1851
**Email Address:** farman@ulm.edu
**Website:** https://ulm.edu/~farman
**Office:** Walker 3-34
**Office Hours:** Monday - Thursday, 2:00 pm - 4:30 pm

### Week 1

| Day | Date | Homework Due | Assessment |
|-----|------|:---:|:---:|
| Mon | 1/11 | | |
| Tue | 1/12 | | |
| Wed | 1/13 | | |
| Thu | 1/14 | **SE** 1 | |
| Fri | 1/15 | | |

### Week 2

| Day | Date | Homework Due | Assessment |
|-----|------|:---:|:---:|
| Mon | 1/18 | *Martin Luther King Day* | |
| Tue | 1/19 | **SE** 2 | |
| Wed | 1/20 | | |
| Thu | 1/21 | **SE** 3 | |
| Fri | 1/22 | | **SE** 1 |

### Week 3

| Day | Date | Homework Due | Assessment |
|-----|------|:---:|:---:|
| Mon | 1/25 | | |
| Tue | 1/26 | **VM** 1 | |
| Wed | 1/27 | | |
| Thu | 1/28 | **VM** 2 | |
| Fri | 1/29 | | **SE** 2-3 |

## Week 4

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 2/1 | | |
| Tue | 2/2 | *Warhawk Day Off - No Classes* | |
| Wed | 2/3 | | |
| Thu | 2/4 | **VM** 3 | |
| Fri | 2/5 | Reassessment 1 | **SE** 1-3 **VM** 1-2 |

## Week 5

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 2/8 | | |
| Tue | 2/9 | | |
| Wed | 2/10 | | |
| Thu | 2/11 | **VM** 4 | |
| Fri | 2/12 | | **VM** 3 |

## Week 6

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 2/15 | | |
| Tue | 2/16 | | |
| Wed | 2/17 | *Warhawk Day Off - No Classes* | |
| Thu | 2/18 | **VM** 5 | |
| Fri | 2/19 | | **VM** 4 |

## Week 7

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 2/22 | | |
| Tue | 2/23 | | |
| Wed | 2/24 | | |
| Thu | 2/25 | **IB** 1 | |
| Fri | 2/26 | Reassessment 2 | **SE** 1-3, **VM** 1-5 |

## Week 8

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 3/1 | | |
| Tue | 3/2 | | |
| Wed | 3/3 | | |
| Thu | 3/4 | **IB** 2 | |
| Fri | 3/5 | | **IB** 1 |

## Week 9

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 3/8 | | |
| Tue | 3/9 | | |
| Wed | 3/10 | **IB** 3 | |
| Thu | 3/11 | *Warhawk Day Off - No Classes* | |
| Fri | 3/12 | | **IB** 2 |

## Week 10

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 3/15 | | |
| Tue | 3/16 | | |
| Wed | 3/17 | | |
| Thu | 3/18 | **IB** 4 | |
| Fri | 3/19 | | **IB** 3 |

## Week 11

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 3/22 | | |
| Tue | 3/23 | | |
| Wed | 3/24 | | |
| Thu | 3/25 | **ET** 1 | |
| Fri | 3/26 | Reassessment 3 | **SE** 1-3, **VM** 1-5, **IB** 1-4 |

## Week 12

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 3/29 | | |
| Tue | 3/30 | | |
| Wed | 3/31 | | |
| Thu | 4/1 | **ET** 2 | **ET** 1 |
| Fri | 4/2 | *Spring Break* | |

## Week 13

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 4/5 | *Spring Break* | |
| Tue | 4/6 | *Spring Break* | |
| Wed | 4/7 | | |
| Thu | 4/8 | **ET** 3 | |
| Fri | 4/9 | | **ET** 2 |

## Week 14

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 4/12 | | |
| Tue | 4/13 | | |
| Wed | 4/14 | | |
| Thu | 4/15 | **OR** 1 | |
| Fri | 4/16 | | **ET** 3 |

## Week 15

| Day | Date | Homework Due | Assessment |
|-----|------|--------------|------------|
| Mon | 4/19 | | |
| Tue | 4/20 | | |
| Wed | 4/21 | | |
| Thu | 4/22 | **OR** 2 | |
| Fri | 4/23 | | **OR** 1 |

## Week 16

| Day | Date | Homework Due | Assessment |
|-----|------|:---:|:---|
| Mon | 4/26 | | |
| Tue | 4/27 | | |
| Wed | 4/28 | | |
| Thu | 4/29 | **OR** 3 | |
| Fri | 4/30 | Reassessment 4 | **SE** 1-3, **VM** 1-5, **ET** 1-3, **OR** 1-2 |

## Week 17

| Day | Date | Homework Due | Assessment |
|-----|------|:---:|:---:|
| Mon | 5/3 | | |
| Tue | 5/4 | **OR** 4 | **OR** 3 |
| Wed | 5/5 | *Warhawk Day Off - No Classes* | |
| Thu | 5/6 | *Warhawk Day Off - No Classes* | |
| Fri | 5/7 | *Warhawk Day Off - No Classes* | |

## Finals Week

| Dates | Assessment | Standards Covered |
|:---:|:---:|:---:|
| Mon 5/10 - Fri 5/14 | Final Reassessment | Cumulative |