MATH 240-SECTION 001 – MATRICES AND APPLICATIONS – SPRING 2023

INSTRUCTOR: Dr. Ahmed Kaffel	**OFFICE**: EMS 434 **PHONE**: 414-229-9891
CLASS TIMES & LOCATIONS: MATH240, section 001, TR-1:00-2:15pm, PHY bdg 147	**EMAIL**: kaffel@uwm.edu **OFFICE HOURS**: Tuesday & Thurs 2:30-4pm, and by appointment.

Disclaimer: All items on this syllabus are subject to change, in the event of a natural disaster, pandemic, or other emergency. Any addendum to this syllabus will be posted on Canvas and announced in class.

Prerequisites: A grade at least C in a MATH or MTHSTAT course numbered 200 or higher; or grade at least C in MATH 115(P); or both Proficiency in Trigonometry (a grade of C or better in MATH 117(P), or Level 26 or 36 on Math Placement Test) and Proficiency in Algebra (a grade of C or better in MATH 116(P) or MATH 211(P), or Level 35 on Math Placement Test); or Math Placement Level 40.

Catalog Description: Introduces vector spaces, systems of linear equations, matrices, determinants, linear transformations, eigenvalues, eigenvectors; selected topics in applications. Emphasizes basic concepts, concrete examples and development of computational skills.

Textbook: MyLab Math with Pearson Etext for "Linear algebra and its applications" by Lay, Lay, and McDonald, 6th edition, ISBN: 9780135851159"

Course materials: Instructor notes and practice problems with solutions will be shared with the students to prepare for all quizzes, homework assignments and exams. These notes should only be used as a supplement and not as an alternative to your personal notes. The instructor will help you to understand the material taught in the lectures and will also help you by doing some review problems before the exams. It is very important that you practice these examples.

Course Learning Objectives: Upon successful completion of the course, students will be able to: Find solutions of systems of linear equations by using Gauss-Jordan elimination method.

- Identify and compute algebraic properties of matrices and determinants.
- Demonstrate a thorough knowledge of vector spaces and subspaces.
- Find basis and rank for column, row and null spaces of a given matrix.
- Find eigenvalues, eigenvectors and eigenspace of a square matrix and use them for matrix diagonalization.
- Define linear transformations and examine their properties.

- Identify inner product spaces and orthogonal vectors.
- Understand and demonstrate the applications to linear ordinary differential equations and geometry
- Incorporate software packages tools like MATLAB or Mathematica to help understand linear algebra and to evaluate problems that would otherwise be too large to do by hand.
- Determine if a linear system has a unique solution, infinitely many solutions, or no solution. Perform fundamental matrix operations.
- Determine if a set forms a subspace, a vector space, a spanning set.
- Determine the linear independence/dependence of a variety of sets.
- Find bases for different spaces; determine the dimension and rank of the space.
- Find the inverse of a matrix, compute the determinant of a matrix and determine when a matrix A is diagonalizable.

Canvas: Canvas is UWM's campus-supported digital learning environment. Your instructors will use Canvas to have you access notes, readings, watch videos, take quizzes, submit assignments, and participate in online discussions. You can access Canvas on your computer using a browser and on your mobile device by downloading the Canvas Student app. There will be a Canvas site for announcements, grade documentation and learning resources. If you're not familiar with these technologies, we recommend you also visit the website: https://uwm.edu/canvas/students/ for information on the technology you will need to be successful. For more general questions about technology, contact the ITS Help Desk at helpdesk@uwm.edu or 414-229-4040.

Calculators: are optional for homework and on Exams. No phones, no graphing calculators, no smart watches, no Fitbit, no headphones and no additional electronics are allowed on Exams, Homework, and Quizzes.

TESTS/QUIZZES/HOMEWORK

- **Online Homework:** Online homework worth **20%** of your grade and consist of online assignments through Pearson's MyLab Math (MLM), a ***required online homework system with eBook, MyLab Math (MLM):*** *Linear Algebra and its Applications Sixth Edition*, by Lay and McDonald, published by Pearson. See MLM letter on Canvas for more details. You may always get help and work together on homework. MLM homework is due Monday nights. Due dates are posted on MLM. Homework due dates will be strictly enforced and will not be extended on an individual basis. Late submissions will not be accepted.

- **Quizzes:** Weekly quizzes worth **15%** of your grade and will be given either in class or remotely in Pearson for the weeks when there is no exam. Students must be in attendance to receive credit for the quizzes. No make-ups will be allowed but the lowest quiz score will be dropped. Unless explicitly stated, calculators and notes will not be allowed on quizzes.

- **Midterm Tests:**
  Midterm exam# 1: 02/23/2023, 1:00-2:15pm, PHYS bdg 147.
  Midterm exam# 2: 04/13/2023, 1:00-2:15pm, PHYS bdg 147.

Each midterm test is counted **20%** toward the final grade. There will be no makeups for the Midterm Tests unless for sudden medical emergencies.

- **Final Exam:** There will be a comprehensive final exam, worth **25%** of your grade. The final exam will be scheduled later.
  - ✓ Non-CAS graphing calculators are allowed on the exams, but graphing calculators that do symbolic algebra are not allowed on the exams. Your calculator may be viewed during exams, and it will be taken away if it is a CAS calculator or have its memory cleared if anything suspicious is written therein. The instructor has the right to regard any suspicious material in your calculator memory as cheating.
  - ✓ Any student who accesses a phone or any internet-capable camera device during an exam for any reason automatically receives a score of zero on the exam. All such devices must be turned off and put away and made inaccessible during the exam.

MAKE UP POLICIES: All exams will be taken on the dates indicated in the syllabus.

Note: Students experiencing personal emergencies (or observing religious holidays) may request accommodations (e.g., extensions) for attendance, homework, exams, or other assignments. Requests should be submitted to the instructor, in writing. Documentation may be requested.

Make-up exams will NOT be given for reasons of a non-refundable airline tickets, vacation plans, work schedules, weddings, family reunions, and other such activities. Students should consult the final exam schedule before making end-of-semester travel plans. The Dean of the college must approve any exceptions to these rules.
The final exam schedule listed in the Schedule of Classes will be strictly followed. Except to resolve those situations described below, no changes may be made in this schedule without prior approval of the Dean of the college in which the course is offered. Under this schedule, if a conflict occurs, or a student has more than three exams on one day, the instructors may be consulted about an individual schedule adjustment. If necessary, the matter may be pursed further with the appropriate dean(s).
Students should consult the final exam schedule before making end-of-semester travel plans. Exceptions to the schedule and requests for make-up examinations can be granted only by the Dean and the Department Chair, and for one of the following reasons:

- There is a time conflict between the math final and another final exam.
- The student has more than three exams scheduled on the same day as the math final.
- Religious conflict.

If the make up request for the final exam is approved, it will be scheduled.

GRADING POLICY: Grades will be based on your overall weighted percentage. . The final grade will be calculated using the following weights:

- Quizzes: 15 %
- Online Homework: 20%
- Two Midterm Tests: 40 %
- Final Exam: 25%.

$$\boldsymbol{Total\ Score = 0.15 * Quizzes\ score + 0.2 * homework\ score + 0.2 * Midterm\ Test1\ score + 0.2 * Midterm\ Test2\ score + 0.25 * Final\ Exam\ score}$$

Grading Scale: Plus/Minus grading will apply

A	A-	B+	B	B-	C+	C	C-	D+	D	D-
93	90	87	83	80	77	73	70	67	63	60

Grades for assignments and exams will be posted on Canvas. Please check your recorded grades regularly to monitor your progress in the course and to ensure accuracy of the recorded grades.

INCOMPLETES: If there is a last-minute personal or medical emergency, the student may receive a grade of Incomplete and make up the final exam within one calendar year. In order to be given an incomplete, all the following conditions should be met:
a) You are already passing the course with the work that has been completed
b) You have only a "little" work to be finished; and,
c) You can give substantiation of illness or other unusual non-academic circumstances
The student must provide written documentation and be passing the class at the time to receive an Incomplete.

Grade Corrections: If you believe that a test, a quiz, an exam or a homework was graded or tallied incorrectly you may submit the request for a regrade along with explaining why you believe you deserve more points. Regrades will be accepted up to two class periods after the exam, quiz or the homework grade is posted. You must let the instructor know (in writing asap via email) within one week of receiving the grade; otherwise, he can't promise that he will consider the issue.

IMPORTANT DATES:

- First day of classes: **01/23/2023**
- Last day to add a class, change sections or change grading basis for classes: **3-Feb-2023**
- Last day to drop or withdraw without transcript notation: **17-Feb-2023**
- Last day to drop or withdraw ("W" will be on transcript): **9-Apr-2023**
- Midterm exam# 1**:** ***02/23/2023,*** 1:00-2:15pm, PHYS bdg 147.
- Midterm exam# 2**:** ***04/13/2023,*** 1:00-2:15pm, PHYS bdg 147.
- Spring Break: **March 19-26 No Classes**
- Last Day of Classes: **11-May-2023**
- Study Day – No classes: **12-May-2023**
- Final exams are during **the period May 13, 15-20. No final exams on May 14.**
- Final exam: date and time will be posted later.
- Graduation ceremony: **21-May-2023**

Withdrawal from Course: If you intend to withdraw, it is your responsibility to withdraw yourself from the course before the due date. Do not assume that just because you have stopped attending class you will be automatically withdraw from the course. If you quit attending and not officially withdraw, you could receive a grade of F.

Attendance: This class will be meeting face to face on Tuesday and Thursday. Attendance is essential to succeed in this course and it will be recorded. Missing class almost always results in poorer performance on quizzes, homework and exams. Absences prevent you from getting the full benefit of the course, generally resulting in lower scores. If you miss a class, it is your responsibility to obtain and learn the material you missed.
You are expected to attend with the appropriate lecture notes for the class, having completed all the assigned problems for the previous lecture. You are expected to come to the class on time, stay through the entire lecture, be prepared to participate, ask questions, and be willing to learn Mathematics.

Participation: Class participation and active learning are important aspects of this class, so your engagement is critical to your success regardless of modality/delivery. All students who participate in class will receive extra credit points (which can be added to the quiz grades) for (*correctly*) *answering* specific *extra credit questions. Do not miss this opportunity to improve your quiz grades.*

Ethics and Behavior: High standards of personal conduct and consideration of others are required in order to create a classroom climate conductive to learning. Disruptive behavior will not be tolerated. Norms for classroom conduct are based on respect for the instructor and the fellow students. Classroom disturbances such as talking loudly or showing disrespect to students/faculty will not be tolerated. Electronic media devices such as cell phones, tablets, laptops, music players, etc. are strictly prohibited in class and must be turned off and put away during the duration of class. Behavior such as texting, updating social media, playing games, or otherwise distracting fellow students is inappropriate.

Academic Support: It is your responsibility to keep abreast of the course, to master the material covered, and to take the initiative for getting the help you need. You are encouraged to obtain help from the course instructor. However, if you miss a class, you are responsible for the missed materials. Students are encouraged to email me, to make appointments and schedule meeting during or beyond my office hours.
The *minimum time* an average student should *expect* to spend on this class is as follows:
Time for lectures = 32.5 hours, Time completing assignments = 52 hours, Time learning/reading/reviewing course material = 30 hours, Time for preparation and study for exams = 25 hours, Time taking exams = 4.5 hours, Total time spent on this class = 144 hours

Academic misconduct: Cheating on exams or plagiarism are violations of the academic honor code and carry severe sanctions, including failing a course or even suspension or dismissal from the University. The University has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonestly. Students are

responsible for the honest completion and representation of their work. Further information can be found at: https://uwm.edu/deanofstudents/academic-misconduct/
-Sharing your log in information with someone else or using someone else's login is considered academic dishonesty and will be prosecuted to the full extent of UWM policy.
Academic dishonesty will not be tolerated. Acts of academic dishonesty include, but are not limited to:

- The illegitimate use of materials (electronic devices, crib sheets, or phones, etc.) in any from during a quiz or examination.
- Asking someone to provide you with the answers, or the step-by-step instructions for completing exams or quizzes. Copying answers from the examination paper of another student.
- Obtaining, through theft, bribery, or collision, or otherwise improperly securing an examination paper prior to the time and date for the administration of the examination. Also, use of an examination paper previously administrated (e.g., during an earlier term) without the consent of the instructor who authored the examination is considered an act of academic dishonesty.
- Communicating examination answers with other students during an examination.
- Tempering with an examination after it has been corrected and then returning it for more credit. Aiding or abetting any such offenses.
- Copying material from a Web page and submitting it as one's own work.
- Copying answers from the quiz or examination paper of another student.
- Plagiarizing or falsifying materials or information used in the completion of any assignment, which is graded or evaluated as the student's individual effort.

In order to help preserve the academic integrity of the class, students should be expected to show photo ID's before each exam. Students who fail to show all work or wrong work/right answer on an exam question or for any other reason are suspected of academic misconduct will be required to have a private video conference session with the instructor in which they explain their answers and their actions.

TENTATIVE DATES FOR LECTURES AND EXAMS (Subject to change)

Week	Textbook sections and topics
Jan 24, 26	6.1 Inner Product, Length, and Orthogonality 1.1 Systems of Linear Equations 1.2 Row Reduction and Echelon Forms
Jan31, Feb 2	1.3 Vector Equations 1.4 The Matrix equation 1.5 Solution Sets of Linear Systems
Feb 7,9	1.6 Applications of Linear Systems 1.7 Linear Independence 1.8 Introduction to Linear Transformations
Feb 14,16	1.9 The Matrix of a Linear Transformation 2.1 Matrix operations 2.2 The inverse of a Matrix
Feb 21	2.3 Characterizations of Invertible Matrices Review Midterm Test 1

Feb 23	**Midterm Test 1, *02/23/2023 ,*** 1:00-2:15pm, PHYS bdg 147
Feb 28, Mar 2	2.6 The Leontief Input–Output Model 2.7 Applications to Computer Graphics
Mar 7,9	3.1 Introduction to Determinants 3.2 Properties of Determinants
Mar 14, 16	3.3 Cramer's Rule, Volume, and Linear Transformations
Mar 28,30	4.1 Vector Spaces and Subspaces 4.2 Null Spaces, Column Spaces, Row Spaces, and Linear Transformations
April 4, 6	4.3 Linearly Independent Sets; Base 4.5 The Dimension of a Vector Space
April 11 April 13	Review Midterm Test 2 **Midterm Test 2, *04/13/2023,*** 1:00-2:15pm, PHYS bdg 147
April 18, 20	5.1 Eigenvectors and Eigenvalues
April 25,27	5.2 The Characteristic Equation 5.3 Diagonalization
May 2,4 May 9	5.5 Complex Eigenvalues Review for the Final exam **Final Exam,** will be posted later.

Additional University Policies:

- Room changes, course cancellations, etc., will be emailed to the students, and posted outside of the classroom door.
- An announcement will be posted via Canvas if a class must be cancelled.
- Students with disabilities or who have an Eligibility Letter/Student Accommodation Plan should contact me early in the semester to discuss the assistance they may need.
- Sexual harassment is reprehensible and will not be tolerated by the University. Further information can be found at: https://uwm.edu/sexual-assault/
- Information on other UWM policies can be found at http://uwm.edu/secu/wp-content/uploads/sites/122/2016/12/Syllabus-Links.pdf
- Students will be allowed to complete examinations or other requirements that are missed because of a religious observance.
- If you will need special accommodations in order to meet any of the requirements of the course, please contact the instructor as soon as possible.
- For all the face-to-face meetings, all campus members are responsible for following the Panther Community Health and Safety Standards. If you are sick, or have symptoms, please do NOT come to class.

DISCLAIMER: This syllabus is tentative and should not be considered definitive. The instructor reserves the right to modify it (including the dates of the tests) instructor to accommodate instructional and/or student needs. Such change will be announced to the class at the appropriate time. It is the student responsibility to attend class regularly and to make note of any change.