MATH 265 LINEAR ALGEBRA
FALL 2021 (Sep 22 – Dec 3)

Instructor: Sahadeb Upretee, PhD   Office Hours: MT 10-11:00 am,WR 12 – 1:00 pm or appointment
E-mail: upretees@cwu.edu   Office: Samuelson 218J
Class Time: MTWR 9:00 - 9:50 AM   Classroom: Samuelson 245

TEXTBOOK: **zyBook: Math 265: Linear Algebra (zyBook code: CWUMath265UpreteeFALL2021)**

Note: You need to subscribe the textbook. A subscription is $58 for Fall 2021. To access this book please
follow the following steps:
  1. Sign in or create an account at *learn.zybooks.com*
  2. Enter zyBook code: CWUMath265UpreteeFall2021
  3. SubscribezyBook

PREREQUISITES: Math 173 with a grade of C or higher

COURSE CONTENT: This course will cover solving of system of linear equations, matrix operations,
properties of determinants, vector space, linear transformations, eigenvalue and eigen vectors.

COURSE OUTCOMES: At the end of the Math 265 course students will be able to:
  ▪ Solve systems of linear equations.
  ▪ Perform basic matrix operations.
  ▪ Determine and use vector space properties.
  ▪ Translate information between the context of systems of equations, coefficient matrices,
    and the domain and range of a linear transformation.
  ▪ Solve problems requiring the use of eigenvalues and eigenvectors.

Chapter 1: System of linear equations
System of linear equations, matrices and linear systems. elementary row operations, eachelon form of matrix,
solution set of a system of linear equations, Gauss-Jourdan elimination.

Learning Outcomes
The students will be able to:
  ▪ Identify a linear equation.
  ▪ Determine whether an n-tuple is a solution to a system of linear equations.
  ▪ Identify the size & types of a matrices.
  ▪ Find the transpose & trace of a matrix.
  ▪ Perform elementary row operations on a matrix and the corresponding system of equations.
  ▪ Identify the pivot positions and pivot columns in a matrix in echelon or reduced echelon form.
  ▪ Perform Gaussian elimination to convert a matrix into echelon form.
  ▪ Use Gauss-Jordan elimination to solve a system of equations.

Chapter 2: Matrix and Determinants

Matrix addition and scalar multiplication, matrix multiplication, matrix equations and linear systems, inverse of a matrix, solving a system using an inverse matrix, elementary matrices. Introduction to determinants, cofactor expansions, application: area and volume, properties of determinants, invertibility and determinants, Cramer's rule.

Learning Outcomes

The students will be able to:
- Perform scalar multiplication, matrix addition & subtraction.
- Identify and use properties of matrices and scalar multiplication.
- Identify properties of matrix multiplication.
- Represent a system of linear equations using a matrix equation.
- Identify whether two given matrices are inverses
- Use an inverse matrix to solve a system of linear equations.
- Use elementary matrices to perform Gaussian elimination.
- Find the determinant of a 3 by 3 matrix.
- Identify minors and cofactors of matrix entries.
- Use determinants to find the area and volume.
- Use Cramer's rule to solve systems of equations.

Chapter 3: Vector Space

Introduction to vectors, vector operations, dot product, cross product, vector spaces and subspaces, inear independence and dependence, basis and dimension.

Learning Outcomes

The students will be able to:
- Find a position vector given an initial and terminal points.
- Find the magnitude of a vector.
- Interpret addition and subtraction of vectors geometrically using the parallelogram rule.
- Find a unit vector.
- Find the vector & scalar projection of a vector onto another vector.
- Use triple scalar product to calculate the volume of a parallelepiped and determine whether vectors are coplanar.
- Identify whether a set of vectors is independent or dependent.
- Find a minimal spanning set for a subspace spanned by a set.
- Find a basis for a subspace defined by the span of a set.
- Identify whether a given set is a subspace.

Chapter 4: Transformations, Eigenvalues and Eigenvectors

Linear transformations between Euclidean spaces, rank and nullity of a linear transformation, composition of linear transformations, general linear transformations, eigenvalues and eigenvectors.

Learning Outcomes

The students will be able to:
- Use matrices to express linear transformations.
- Use properties of matrix transformations.
- Determine the null space and range of a linear transformation.

- Identify the rank and nullity of a linear transformation.
- Identify and use properties of the rank and nullity of a transformation.
- Calculate composition on linear transformations.
- Determine whether a linear transformation has an inverse.
- Find the inverse of a linear transformation, if the inverse exists.
- Derived the standard matrix for a given transformation.
- Use the characteristic equation to find the set of all eigenvalues (or spectrum) of a square matrix.
- Find the eigenvalues and eigenvectors for a given linear transformation.

REQUIRED CALCULATOR: A scientific calculator is required.

IMPORTANT DATES:
First Class: Sep 22.
Class End: Dec 3
Veteran Day: Nov 11 -No Class
Thanksgiving Break: Nov 24-26 No Class
Study Day: Dec 6
Midterm Exam One: Nov -1
Midterm Exam Two: Nov- 29
Comprehensive Final Exam: Update later

EVALUATIONS:
Class Participation:	5%
Weekly Assignments:	30%
Midterm Exam One:	20%
Midterm Exam Two	20%
Comprehensive Final Exam:	25%

Note: In the Class Participation, I expect your active involvement while discussing in the classroom.

GRADING SCALE (MINIMUM CUTOFFS):

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

HOW TO SUBMIT WORK: You'll scan the document and resubmit online. ***The submission must be legible and oriented correctly for me to read it on the computer***. To accomplish this you can:
- You can edit the PDF and resubmit that - rather than printing to begin with, https://type-on-pdf.com/
- You can scan the document to a PDF document using a cell phone camera. Some apps that do this (you can do a Google search to find more apps if you don't like these!) Android: Adobe (free), CamScanner (free version) iPhone: use the built-in Notes App, CamScanner (free version).
- You can take a well-lit, easy to read photograph, insert it into a *Microsoft Word* or *OpenOffice Writer* document so that you make sure the photo is oriented correctly and easy to read, then save the document as a PDF file for upload to Canvas.

DAILY ACTIVITIES

Class (Date)-Day	Content	Assignment Due
1 (9/22/2021)-W	Systems of linear equations	
2(9/23/2021)-R	Matrices and linear systems	
3(9/27/2021)-M	Elementary row operations	HW 1 Due
4(9/28/2021)-T	Echelon forms of a matrix	
5(9/29/2021)-W	Solution set of a system of linear equations	
6(9/30/2021)-R	Gaussian elimination	HW2 Due
7(10/04/2021)-M	Gauss-Jordan elimination	HW 3 Due
8(10/05/2021)-T	Matrix addition and scalar multiplication	
9(10/06/2021)-W	Matrix multiplication	
10(10/07/2021)-R	Matrix equations and linear systems	HW4 Due
11(10/11/2021)-M	Inverse of a matrix	HW 5 Due
12(10/12/2021)-T	Solving a system using an inverse matrix	
13(10/13/2021)-W	Elementary matrices	
14(10/14/2021)-R	LU decomposition	HW 6 Due
15(10/18/2021)-M	Introduction to determinants	HW 7 Due
16(10/19/2021)-T	Cofactor expansions	
17(10/20/2021)-W	Application: Area and volume	
18(10/21/2021)-R	Invertibility and determinants	HW 8 Due
19(10/25/2021)-M	Cramer's rule	HW 9 Due
20(10/26/2021)-T	Review Day/Self Review	
21(10/27/2021)-W	Introduction to vectors	
22(10/28/2021)-R	Exam 1 Review	HW 10 Due
23(11/01/2021)-M	Exam 1	
24(11/02/2021)-T	Vector operations	
25(11/03/2021)-W	Dot product	
26(11/04/2021)-R	Cross product	HW 11 Due
27(11/08/2021)-M	Vector spaces and subspaces	HW 12 Due
28(11/09/2021)-T	Linear independence and dependence	
29(11/10/2021)-W	Basis and dimension	
30(11/15/2021)-M	Linear transformations between Euclidean spaces	HW 13 Due
31(11/16/2021)-T	Rank and nullity of a linear transformation	
32(11/17/2021)-W	Exam 2 Review	
33(11/18/2021)-R	Composition of linear transformations	HW 14 Due
34(11/22/2021)-M	General linear transformations	HW 15 Due
35(11/23/2021)-T	Eigenvalues and eigenvectors	
36(11/29/2021)-M	Exam 2	
37(11/30/2021)-T	Problem Solving: Eigenvalues and eigenvectors	
38(12/01/2021)-W	Final Exam Review	HW 16 Due

EMAIL CORRESPONDENCE: I will respond to student communications during business hours (M-F, 8 am-5 pm). You can typically expect a reply within approximately 24 hours, not including weekends. If you email me with questions about specific problems, I can be more helpful if you send pictures of what you've tried so far.

HOMEWORK: Each week two homework will be assigned, and due dates will be announced in the Canvas. I will select homework problems from the textbook. Students are encouraged to discuss among the friends but do not copy other's work directly. If I find identical solutions, then both parties will get zero points. Your work should be clear, in a logical order, and provide sufficient explanation. You must upload a single pdf file of the homework into Canvas.

EXAM POLICY: There will be two midterm exams and one comprehensive final exam. All exams are cumulative. They will be taken in class, you will be allowed to use your book and notes.

TIME INVESTMENT REQUIREMENT:
The information listed below illustrates the total investment of time by an average student to achieve the learning goals of the course. (30 hours/credit x 5 = 150 hours)
The amount of time that an average student should expect to spend on this class is as follows:
- 50 hours - Time spent in the classroom, online instruction, taking exams and doing worksheets, etc.
- 100 hours - Time for preparation and study for in-class worksheets, homework, monthly and final exams, discussion during office hours.

COURSE POLICIES

COVID-19 STATEMENT 2021:

In accordance with *Proclamation 21.14.1*, CWU has chosen to make vaccinations a priority this fall. We believe a fully vaccinated community is the best way to protect our individual and collective health and safety. **Proof of full vaccination against COVID-19 will be required by October 18, 2021,** for all employees and students. Medical and /or religious accommodation requests will be considered. All employees and students are required to wear masks while indoors.

FACE COVERING POLICY 2021

Cloth face coverings must be worn indoors by all CWU students, employees, and visitors. The mask must cover mouth and nose, fitting as snugly as possible against the sides of the face. Student not wearing a mask will be asked to put one on, if they refuse, students will be asked to leave the classroom and building.

MENTAL HEALTH STATEMENT:
"*Stress and other life circumstances that may be out of your control can make learning and focusing difficult. If you find stress or other mental health concerns make academics difficult, Central has resources to support you. I encourage you to reach out as soon as you notice you're struggling.*"

RESOURCES FOR STUDENTS:

CWU Counseling Center: https://www.cwu.edu/medical-counseling/counseling-clinic

Mental Health Crisis Support outside normal business hours: 1-800 – 273 - 8255, Text HOME to 741741 or call 911.

Wellness Center: https://www.cwu.edu/wellness/   509-963 -3213

Student Rights and Responsibilities: https://www.cwu.edu/student-rights/office-student-rights-responsibilities

CENTRAL WASHINGTON UNIVERSITY COVID-19 REPORTING FORM: available on
http://cwu.edu/student-success/covid-form

POLICY ON ACADEMIC DISHONESTY:
Students are on their honor to follow the student conduct code as outlined in the Washington Administrative Code. Violations of this section will result in a failing grade in the course in addition to further possible university sanctions. (See http://apps.leg.wa.gov/WAC/default.aspx?cite=106-125)

POLICY ON DIVERSITY:
University-level education is about broadening horizons and looking at academic issues from a variety of perspectives. With this in mind, the participants in this class are encouraged to bring their own life experiences and viewpoints to bear on classroom discussions and assignments. Along with the freedom to express one's views comes the responsibility to respect the views of others. No student will be discriminated against based on race, ethnicity, age, creed, religion, gender, sexual orientation, marital status, or political ideology.

DISABILITY SERVICES:
Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any obstacles to learning, contact Disability Services to discuss a range of available options. Student Disability Services is located in Hogue 126. Call (509) 963-2214 or email ds@cwu.edu for more information. (see https://www.cwu.edu/disability-services/)

SUBMITTING ELECTRONIC FILES:
All electronic files must be submitted in .doc, .docx or .pdf format. If you don't have Microsoft Office, you can download it for free, using your CWU email and password from the MS Office website. Here is the guide on (https://cwu.teamdynamix.com/TDClient/2015/Portal/KB/ArticleDet?ID=9080), how to download MS Office. Mac users make sure to save documents with visible extension (.docx or .rtf).

RELIGIOUS HOLIDAY ABSENCES: In compliance with RCW 28B.137.010, CWU makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Students must present written notice to their instructor within the first two weeks of the class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.