Program Cover Sheet --- MAT 205: Linear Algebra I. Basic Course Information

MAT 205: Linear Algebra is a primarily sophomore level course. It will have two 80-minute meeting periods each week and an addition one-hour third period for a computer lab. The prerequisite for the course is MAT 128 or MAT 200 or CSC 270 or STA 215 or STA 216 or STA 305. In place of one of these prerequisites, a student can get placed in the course with either: ECO 105 and either MAT 125 or MAT127; or, STA145 and MAT 127.

Linear Algebra studies the solution of linear equations in many variables, a subject which naturally arises throughout the science, engineering, and social science disciplines. Due to its widespread uses, Linear Algebra is a fundamental mathematics course. In addition, Linear Algebra is a bridge course that connects the single-variable courses in algebra in the high school curriculum (Algebra I, II) with more advanced applied courses such as Differential Equations and Numerical Methods as well as the Abstract Algebra course that forms the foundation of algebra in modern mathematics.

II. Learning Goals

MAT 205: Linear Algebra has three primary learning goals. The first goal is to give students a solid foundation in linear algebra for future courses. Linear Algebra is a fundamental course in the mathematics curriculum due to its many applications. The course will provide an overview of the topics in the traditional introductory linear algebra course. Students will be exposed to the computational and abstract aspects of the subject and will see numerous applications of it. Material learned in Linear Algebra is critical for students going on to take courses such as MAT 305: Abstract Algebra or MAT 326: Differential Equations.

The second primary learning goal of Linear Algebra is the continuing development of a student's mathematical maturity. Abstract thinking, logical reasoning skills, the ability to read and write mathematics, and the ability to do proofs are all skills that need to be developed in a successful mathematics major. All mathematics courses work on these skills, but the course sequence of MAT 200 and MAT 205 has been devised by the department as a sequential series of courses in which these skills will be emphasized and developed in order to prepare students for the more advanced reasoning and communication skills expected of them in the required major courses of Abstract Algebra, Real Analysis, and Complex Analysis.

Linear Algebra's third main goal is to develop students' skills with working with technological tools. The third weekly meeting period of Linear Algebra is a computer lab and is the first course in the mathematics sequence where students will be required to work with computer software packages. In this lab, students will packages such as MATLAB (a linear algebra software package) as well as locally developed software and computer applets to help visualize the material they have learned and apply the theory to applications. The use of a computer enables students to tackle more difficult, but more realistic, problems than otherwise possible.

III. Student Assessment

Students will receive regular feedback on their work through the assignment of homework, quizzes, student presentations and examinations. Through this feedback, students will be able to see and correct their misunderstandings and improve their performance. Student performance on these assessment instruments and the performance of students in their future courses such as Abstract Algebra and Differential Equations will be used to assess the success of Linear Algebra in achieving its learning goals and its contribution to the fulfillment of the MATA, MATT, and MATC program goals. Peer reviews and student evaluations will also be used to evaluate the course.

IV. Learning Activities

Learning activities will consist of a combination of lectures, group work, student presentations, and computer assignments. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and group homework to achieve the learning goals. These learning activities are typical of the learning activities in the MATA, MATT, MATC programs. By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of the concepts of linear algebra and contribute to the learning goals of the programs.

Updated 2/12/25

Departmental Course Syllabus --- MAT 205: Linear Algebra

Introduction: A typical syllabus for Linear Algebra follows this sheet. Any syllabus for Linear Algebra should include the points listed below (the required course requirement sections).

I. Basic information on course and instructor

A. Purpose statement: The Linear Algebra course provides students with a solid foundation in linear algebra. The subject matter of the course is a cornerstone of many higher level courses in mathematics, the sciences, and engineering. Students will be exposed to both the theory and the concrete applications of linear algebra. Students will be taught to use computer software tools as an aid to solving problems. The course will also further develop a student's abstract reasoning ability, their ability to read and write mathematics, and their ability to do proofs. The course should give appropriate training for students continuing directly on to Abstract Algebra. Finally, through the use of fun, challenging problems, the course should also develop a student's problem solving ability and introduce students to the joys of mathematics.

B. Course description: An introduction to vector spaces and systems of linear equations essential for the understanding of both pure and applied mathematics. Selected topics include: systems of linear equations, matrices, linear transformations, linear independence, determinants, vector spaces, eigenvalues and eigenvectors, and orthogonality.

C. Course prerequisites: MAT 128 or MAT 200 or CSC 270 or STA 215 or STA 216 or STA 305. In place of one of these prerequisites, a student can get placed in the course with either: ECO 105 and either MAT 125 or MAT127; or, STA145 and MAT 127

II. Learning goals

A. Content goals: Students will become proficiency with many basic topics in linear algebra. Topics covered will include solving systems of linear equations, matrix algebra, determinants, Cramer's rule, vector spaces, linear transformations, linear independence, eigenvalues and eigenvectors, and orthogonality. Optional topics at the discretion of the professor include: the method of least-squares, difference equations, LU decomposition, systems of differential equations, and quadratic forms. Students should also be exposed to different methods of proof and the use of technological tools as an aid to linear algebra.

B. Performance goals: At the completion of the course, students should demonstrate competence with linear algebra concepts. A successful linear algebra student should be able to solve a system of linear equations using several methods. They should understand the meaning of eigenvalues and eigenvectors and understand their usefulness for many applications. They should be able to recognize when a real world problem involves linear algebra and be able to translate it into a mathematical form. Students should also possess improved reasoning and proof-writing ability and should exhibit a more mature ability with proofs than would normally be expected of a student at the completion of MAT 200. In particular, they should be comfortable with proofs involving abstract concepts such as linear independence and vector subspaces.

III. Student assessment

A. Assessment plan: Students will receive regular feedback on their work through the assignment of homework, lab homework, quizzes, student presentations and examinations. A syllabus should clearly describe the schedule for these assessment tools and how they will be used to calculate grades.

B. Rationale: Through the use of regular feedback from homework, quizzes, student presentations and examinations, students will be able to see and correct their misunderstandings and improve their performance.

C. Methods and criteria: We will use the assessment of homework, quizzes, student presentations, and examinations to evaluate student accomplishment of the course learning goals. These assessment tools are similar to the manner in which students will need to use their knowledge in the future of and are an appropriate way to assess the accomplishment of course learning goals.

IV. Learning activities

A. Summary of learning activities: Learning activities will consist of a combination of lectures, group work, student presentations, and computer assignments. The specific choice will depend upon the individual instructor. Outside of class, students are expected to do a significant amount of individual and group homework to achieve the learning goals.

B. Calendar or outline: A guide to the organization of the course, a schedule of assessment tools, and a plan for the coverage of topics should be provided to the students. Homework, quizzes, and examinations should be spaced at appropriate intervals throughout the semester. As a general rule, it is expected that each of the major topics of systems of linear equations, matrices, vector spaces, eigenvalues/eigenvectors, and orthogonality will be given equal emphasis during the course of the semester.

C. Rationale By giving students a multitude of ways to learn and do mathematics, the learning activities promote a deeper understanding of linear algebra and contribute to the learning goals of these programs. A regular spacing of assessment tools insures that students continual regular feedback on their work.

Updated 2/12/25

MAT 205 Linear Algebra and Its Applications **Spring 2025**

Instructor: Karen Clark
Email: KCLARK@TCNJ.EDU
Office: SCP 210

The instructor reserves the right to make changes to the syllabus as needed, in keeping with the Learning Goals and Objectives for the course.

OFFICE HOURS: Tuesdays 1:30-2:30, Wednesdays 10:00-11:00, and Fridays 12:45-1:45, in my office (SCP 210).

Students do not need an appointment to attend regular office hours, just show up!

CLASS MEETINGS:
Section 1: Tuesdays and Fridays from 8:00-9:20, and Wednesdays from 8:00-8:50.
Section 2: Tuesdays and Fridays from 9:30-10:50, and Wednesdays from 9:00-9:50.
All class meetings will be held in SCP 229.

COURSE DESCRIPTION:
An introduction to vector spaces and systems of linear equations essential for the understanding of both pure and applied mathematics. Selected topics include: systems of linear equations, matrices, linear transformations, linear independence, determinants, vector spaces, eigenvalues and eigenvectors, and orthogonality. This course includes a lab component using MATLAB.
The prerequisite is MAT 200 or MAT 128 or CSC 270 or STA 215 or STA 216 or STA 305. In place of one of these prerequisites, a student can get placed in the course with either: ECO 105 and either MAT 125 or MAT127; or, STA145 and MAT 127.

One course unit. The course will include a fourth hour which will be used to work on labs related to the course content, using MATLAB.

COURSE MATERIALS: For this course we will be using MyLab through Pearson for the text "*Linear Algebra and its Applications*", 6th Edition, by David Lay. The access code includes the ebook for the course.

To enhance your learning experience and provide discounted access to the text, this course is part of an inclusive access model called First Day®. You will be able to easily access the etextbook and online homework for this course from Canvas. TCNJ will bill you at the discounted price ($89.99) as a course charge for this course - the charge should appear on your tuition bill.

You have the option to opt-out of the First Day® program in Canvas. The deadline for opting out is February 6.

For more information and FAQs click here: https://customercare.bncollege.com

You will need to use MATLAB for assignments. To download MATLAB onto your personal computer you need to go to https://software.tcnj.edu/ , log in and follow the instructions. **The download is free for TCNJ students.** You may also use Matlab online (for free) by setting up an account at https://matlab.mathworks.com/ using your TCNJ email. If you have any difficulty accessing Matlab please let me know as early in the semester as possible.

I will be using Canvas to send weekly course announcements, post links to MyLab online homework, resources for exams, and course assignment deadlines. Students should be checking Canvas for updates frequently.

COURSE REQUIREMENTS: Students are expected to read the appropriate section in the textbook after each lecture.

Homework using MyLab:

- There will be online homework assignments, using MyLab, which you will generally have one week to complete.
- The numbers and functions in each assignment will be randomized for different students.
- Please read the instructions for each assignment carefully as the number of attempts allowed for each problem will depend on the type of question – for multiple choice type problems students will be limited to one attempt. For other types of questions students will typically have 10 attempts.
- I've set up MyLab so that students may request and will be automatically granted an extension for a maximum of three days after the homework due date. There will be a 10% penalty per day on those questions that are answered after the original homework due date.
- Unless I have indicated otherwise **you may not use any outside sources, including those available on the internet, or tutors, in solving homework problems. All work submitted must be your own.**

Written homework:

- I will be assigning some problems each week that you are to write up solutions to and submit on Canvas.
- You must show all work for full credit, and as indicated above, **you may not use any outside sources in solving these homework problems.**
- Students are responsible for making sure that any work submitted electronically is in a form that is easy for me to process (for example, each assignment should be consolidated into one file, pdf is preferred).

- Students may submit written homework up to three days late, with a 10% per day penalty.

Suggested problems: There is a set of practice problems in MyLab for each section we will cover in the course. Completing these assignments is entirely optional, but doing these problems is a great way to solidify your understanding of course material, and to study for exams.

Labs:

- You will be expected to complete about half of each week's lab assignment during the lab period each week. You will generally have one week to finish the lab assignment.
- Prior to each lab period you may be asked to read some background information/instructions and complete a short pre-class Canvas quiz as part of the lab assignment.
- Lab attendance is required.

Students are responsible for being familiar with the college integrity policy. Students may work on homework assignments in groups of two or three people if they wish, however it is expected that students complete their own MyLab and written homework problems independently. **Students may not discuss homework problems with a tutor before the assignment is due.**

Exams: There will be three in-class exams. The tentative dates for these exams are:

- Tuesday February 25,
- Tuesday April 1,
- Friday May 2.

If you are ill and unable to attend the exam you must contact me before the start of the exam. Makeup exams may be more difficult than the original. Old exams with solutions will be posted on Canvas for practice, but you should not expect your exam to look identical to what is posted there.

Final: There will be a cumulative final exam at the end of the semester. Final exams are scheduled for May 13-20.

COURSE PURPOSE & LEARNING GOALS: MAT 205: Linear Algebra has three primary learning goals. The first goal is to give students a solid foundation in linear algebra for future courses. Linear Algebra is a fundamental course in the mathematics curriculum due to its many applications. The course will provide an overview of the topics in the traditional introductory linear algebra course. Students will be exposed to the computational and abstract aspects of the subject and will see numerous applications of it. Material learned in Linear Algebra is critical for students going on to take courses such as MAT 305: Abstract Algebra or MAT 326: Differential Equations.

The second primary learning goal of Linear Algebra is the continuing development of a student's mathematical maturity. Abstract thinking, logical reasoning skills, the ability to read and write mathematics, and the ability to do proofs are all skills that need to be developed in a successful mathematics major. All mathematics courses work on these skills, but the course sequence of MAT 200 and MAT 205 has been devised by the department as a sequential series of courses in which these skills will be emphasized and developed in order to prepare students for the more advanced reasoning and communication skills expected of them in the upper level courses Abstract Algebra, Real Analysis, and Complex Analysis.

Linear Algebra's third main goal is to develop students' skills with working with technological tools. The third weekly meeting period of Linear Algebra is a computer lab and is the first course in the mathematics sequence where students will be required to work with computer software packages. In this lab, students will use packages such as MATLAB (a linear algebra software package) as well as locally developed software and computer applets to help visualize the material they have learned and apply the theory to applications. The use of a computer enables students to tackle more difficult, but more realistic, problems than otherwise possible.

Students are expected to keep current with the homework assignments, and to review material in groups as much as possible. The homework assignments are meant to provide a means to solve problems based on the material discussed in lecture. I encourage regular feedback from students if you are struggling with a particular topic.

COURSE SCHEDULE:

Midsemester progress reports are due on Monday March 24 and the last day to withdraw from a class is Monday March 31.

Spring break will be March 17-21.

There will be no classes on Tuesday April 29 due to the Celebration of Student Achievement.

We will cover the following sections in the text (not necessarily in this order):

1.1-1.5,1.7-1.9 Linear Equations
2.1-2.3 Matrix Algebra
3.1-3.3 Determinants
4.1-4.3,4.5-4.6 Vector Spaces
5.1-5.3 Eigenvalues and Eigenvectors
6.1-6.3 Orthogonality

GRADING:

MyLab Homework, Written Homework and Lab Assignments = 20%
Exams = 50% (highest two exams = 20% each, lowest exam = 10%)
Final = 30%

Grades will be calculated as below: round as usual

Letter gr	A	A-	B+	B	B-	C+	C	C-	D+	D	F

ade											
Percentage	93-100%	90-92%	87-89%	83-86%	80-82%	77-79%	73-76%	70-72%	67-69%	63-66%	<63%

Class Participation: I will consider class participation in computing your final grade if your grade is borderline. I encourage students to participate in class by asking and answering questions but I ask that you please raise your hand so that I can call on you.

COMMITMENT TO DIVERSITY, EQUITY, INCLUSION, ACCESS AND BELONGING:

The TCNJ community is composed of people with diverse backgrounds, perspectives, and experiences, and the college is committed to diversity, equity, inclusion, access and belonging. The college's Campus Diversity Statement can be viewed here: https://diversity.tcnj.edu/campus-diversity-statement/

CLASSROOM ENVIRONMENT AND COMMITMENT TO STUDENT SUCCESS, SAFETY AND WELL-BEING:

The TCNJ community is dedicated to the success, safety and well-being of each student. TCNJ strictly follows key policies that govern all TCNJ community members rights and responsibilities in and out of the classroom. In addition, TCNJ has established several student support offices that can provide the support and resources to help students achieve their personal and professional goals and to promote health and well-being. You can find more information about these policies and resources at the "TCNJ Student Support Resources and Classroom Policies" webpage here: https://academicaffairs.tcnj.edu/tcnj-syllabus-resources/

Students who anticipate and/or experience barriers in this course are encouraged to contact the instructor as early in the semester as possible. The Accessibility Resource Center (ARC) is available to facilitate the removal of barriers and to ensure reasonable accommodations. For more information about ARC, please visit: https://arc.tcnj.edu/

ADDITIONAL INFORMATION:

If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. Email is a good way to reach me, and students are always able to make an appointment to speak to me.

Extra Credit: I do not give extra credit assignments, so you need to make sure that you are keeping up with the classwork as it is assigned.

Email: I might periodically send messages to the class so you should get in the habit of checking your email at least daily. I will respond to email sent to me within 24 hours, and within 48 hours on weekends.

Canvas: I will post information using Canvas announcements frequently. Please make sure you have changed your Canvas settings if necessary to make sure you receive announcements I post.

Weather: If there is any kind of weather event, make sure to check the college webpage and your email before heading to class. At times the college may be open but I may not be able to get to campus. In this event I will send an email to the class. I encourage students to make sure they are signed up for TCNJ Emergency Alerts: Instructions for doing so are located at https://emergency.tcnj.edu/tcnj-alerts/

Tutoring: There is a Math/Science Tutoring Center which provides free tutoring for this course. You may arrange for a regular tutor, or go to drop-in tutoring. I will post the drop-in tutoring schedule on Canvas when it becomes available. The Department of Mathematics and Statistics also provides tutoring, and I will share that information when the schedule becomes available. **Students may not discuss MyLab problems, homework problems that are to be graded, or lab assignments with the tutors. This is a violation of the academic integrity policy.**

Cell phones: Please make sure they are turned off during class. Texting is absolutely forbidden during class. If I observe students texting in class it will affect the final course grade.

Attending the other section: If for some reason on a specific day you need to attend the other section of the class you should request permission from me at least one day ahead of time.