ESSEX COUNTY COLLEGE

Mathematics and Physics Division

MTH 239 – Introduction to Linear Algebra

Course Outline

Course Number & Name: MTH 239 Introduction to Linear Algebra

Credit Hours: 3.0 **Contact Hours:** 3.0 **Lecture:** 3.0 **Lab:** N/A **Other:** N/A

Prerequisites: Grade of "C" or better in MTH121 or placement

Co-requisites: None

Instructor: Nadia Lvov

Email: TBA

Office Hours: By appointment

Course Description: This course is an introduction to the theory and applications of linear operatorson finite dimensional vector spaces. Topics include linear systems, matrix algebra, Euclidean and general vector spaces, subspaces, change of basis and similarity, the eigenvalue problem, projections, orthogonality and least squares, inner product spaces and quadratic forms.

Textbook: *Elementary Linear Algebra with Applications,* 10th edition – binder-ready version, by Howard Anton & Chris Rorres; published by Wiley, 2010; ISBN #: 978-0-470-55992-5

General Education Goals: Upon successful completion of this course, students should be able to do the following:

1. **Written and Oral Communication**: Students will communicate effectively in both speech and writing.
2. **Quantitative Knowledge and Skills**: Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
3. **Scientific Knowledge and Reasoning**: Students will use the scientific method of inquiry through the acquisition of scientific knowledge.
4. **Technological Competency/Information Literacy**: Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.
5. **Society and Human Behavior**: Students will use social science theories and concepts to analyze human behavior and social and political institutions and to act as responsible citizens.
6. **Humanistic Perspective**: Students will analyze works in the field of art, music, or theater; literature; and philosophy and/or religious studies; and will gain competence in the use of a foreign language.
7. **Historical Perspective**: Students will understand historical events and movements in World, Western, non---Western, or American societies and assess their subsequent significance.
8. **Global and Cultural Awareness of Diversity**: Students will understand the importance of global perspective and culturally diverse peoples.
9. **Ethics**: Students will understand ethical issues and situations.

Course Goals: Upon successful completion of this course, students should be able to do the following:

1. Demonstrate knowledge of the fundamental concepts and theories from linear algebra; (GEG 2)
2. Utilize various problem---solving and critical---thinking techniques to set up and solve applied problems in engineering, sciences, business and technology fields; (GEG 2)
3. Communicate accurate mathematical terminology and notation in written and/or oral form in order to explain strategies to solve problems as well as to interpret found solutions; (GEG 1, GEG 2)
4. Use appropriate technology, such as graphing calculators and computer software, effectively as a tool to solve such problems as those described above. (GEG 2)

Methods of Instruction: Instruction will consist of a combination of lectures, presentation of sample problems, clarification of homework exercises/textbook material, and general class discussion.

Attendance Policy: Regular and prompt attendance is essential for academic success. Faculty members take attendance at each scheduled class session. Students are expected to attend and be on time for

all classes. Individual faculty members may establish specific attendance policies. Attendance records will be turned in to the appropriate Division/Department Chair and/or Program Director at the end of the term and in the interim upon request. Any students with more than three unexcused absences will automatically fail the course.

Methods of Evaluation: Final course grades will be computed as follows:

Grading Components	% of final course grade
• **2 Tests** (dates specified by the instructor) Tests will show evidence of the extent to which students meet course objectives, including, but not limited to, identifying and applying concepts, analyzing and solving problems, estimating and interpreting results, and stating appropriate conclusions using correct terminology.	**40%**
• **Midterm Exam** The same objectives apply as with tests, but it is anticipated that students will provide evidence of synthesizing a combination of concepts.	**30%**
• **Final Exam** The **comprehensive** final exam will examine the extent to which students have understood and synthesized all course content and achieved all course objectives.	**30%**

Grading System:

A	**90% - 100%**	**Superior**
B+	**87% - 89%**	**Very Good**
B	**80% - 86%**	**Good**
C+	**77% - 79%**	**Above Average**
C	**70% - 76%**	**Satisfactory**
D	**60% - 69%**	**Passing**
F	**59% - 0**	**Failing**

Academic Integrity: Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

- plagiarism – the failure to acknowledge another writer's words or ideas or to give proper credit to sources of information;
- cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
- interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
- fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

Student Code of Conduct: All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College's Code of Conduct.

Course Content Outline: This is a tentative course schedule, the instructor reserve the right to make changes on it to make it better for the student`s development. Notice will be given should any changes take place.

Class Meeting

(90 minutes)	**Chapter/Section**	
	CHAPTER 1 SYSTEMS OF LINEAR EQUATIONS AND MATRICES	
1	1.1	Introduction to Systems of Linear Equations
	1.2	Gaussian Elimination
2	1.3	Matrices and Matrix Operations
	1.4	Inverse Algebraic Properties of Matrices
3	1.5	Elementary Matrices and a Method for Finding A^{-1}
	1.6	More on Linear Systems and Invertible Matrices
4	1.7	Diagonal, Triangular, and Symmetric Matrices

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Class Meeting (90 minutes)	Chapter/Section	
	CHAPTER 2 DETERMINANTS	
5	2.1	Determinants by Cofactor Expansion
	2.2	Evaluating Determinants by Row Reduction
6	2.3	Properties of Determinants, Adjoint Cramer's Rule
7	**Test #1** on Chapters 1 & 2	
	CHAPTER 3 EUCLIDEAN VECTOR SPACES	
8	3.1	Vectors in 2-space, 3-space, and *n*-space
	3.2	Norm, Dot Product, and Distance in R^n
9	3.3	Orthogonality
	3.4	The Geometry of Linear Systems
	CHAPTER 4 GENERAL VECTOR SPACES	
10	4.1	Real Vector Spaces
11	4.2	Subspaces
	4.3	Linear Independence
12	**Midterm Exam**	
13	4.4	Coordinates and Basis
	4.5	Dimension
14	4.6	Change of Basis
15	4.7	Row Space, Column Space, and Null Space
16	4.8	Rank, Nullity, and the Fundamental Matrix Spaces
17	4.9	Linear Transformations from R^n to R^m
	4.10	Properties of Matrix Transformations
	CHAPTER 5 EIGENVALUES AND EIGENVECTORS	
18	5.1	Eigenvectors and Eigenvalues
19	5.2	Diagonalization
20	5.3	Complex Eigenvalues
21	**Test #2** on Sections 4.4 – 5.3	
	CHAPTER 6 INNER PRODUCT SPACES	
22	6.1	Inner Products
	6.2	Angle and Orthogonality in Inner Product Spaces
23	6.3	Orthogonal Bases, Gram-Schmidt Process
24	6.4	Least-Squares
25	Comprehensive **Final Exam** on all course material covere	