BROWARD COMMUNITY COLLEGE
COURSE OUTLINE

LAST REVIEW: 2008-09 *(i.e. 2003-2004)* **NEXT REVIEW:** 2013-14 *(i.e. 2008-2009)* **STATUS:** A *(A, I, D)*

COURSE TITLE: Linear Algebra

COMMON COURSE NUMBER: MAS 2103

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN *(per 16 week term)*

CLOCK HOURS: *(Voc. Course ONLY)*

Lecture: **48** Lab: **0**

Clinic: **0** Other: **0**

PREREQUISITE(S): MAC 1114 and MAC 1140

COREQUISITE(S): None

PRE/COREQUISITE(S):

COURSE DESCRIPTION *(750 characters, maximum)*:

A first course in linear algebra, emphasizing the algebra of matrices and vector spaces. Recommended for students majoring in mathematics or related areas. This course may be taken for honors credit with instructor's approval. Recommendation of the Mathematics Department or at least a grade of "C" in each of the prerequisite courses is required. This course may be taken for honors credit with the permission of the instructor.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): 5A
General Education Requirements – Associate in Science Degree (AS), meets Area(s): 4 or 5
General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s):

UNIT TITLES

1. **Matrices and Systems of Equations**
2. **Vector Spaces**
3. **Transformations and Matrices**
4. **The Inverse of a Linear Transformation**
5. **Representations of Linear Transformations**

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be evaluated on the course outcomes.

Written Tests/Quizzes/Homework Assignments/Projects

****** Complete the following only if course is seeking general education status ******

GENERAL EDUCATION Competencies and Skills *:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

1.	**Read with critical comprehension**	
2.	**Speak and listen effectively**	
3.	**Write clearly and coherently**	1.1-1.5, 2.1-2.11, 3.1-3.7, 4.1-4.12, 5.1-5.8
4.	**Think creatively, logically, critically, and reflectively (analyze, synthesize, apply, and evaluate)**	1.1-1.5, 2.1-2.11, 3.1-3.7, 4.1-4.12, 5.1-5.8
5.	**Demonstrate and apply literacy in its various forms:** *(highlight in green ALL that apply)* (1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental)	1.1-1.5, 2.1-2.11, 3.1-3.7, 4.1-4.12, 5.1-5.8
6.	**Apply problem solving techniques to real-world experiences**	2.11, 4.9
7.	**Apply methods of scientific inquiry**	
8.	**Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings**	
9.	**Demonstrate an understanding of and appreciation for human diversities and commonalities**	
10.	**Collaborate with others to achieve common goals.**	
11.	**Research, synthesize and produce original work**	
12.	**Practice ethical behavior**	
13.	**Demonstrate self-direction and self motivation**	1.1-1.5, 2.1-2.11, 3.1-3.7, 4.1-4.12, 5.1-5.8
14.	**Assume responsibility for and understand the impact of personal behaviors on self and society**	
15.	**Contribute to the welfare of the community**	

* *General Education Competencies and Skills endorsed by '05-'06 General Education Task Force*

Common Course Number: MAS 2103

UNITS

Unit 1 Matrices and Systems of Equations

General Outcome:

1.0 The students should be able to use matrix operations and other procedures in finding the solutions of homogeneous and nonhomogeneous systems of linear equations and apply these procedures to the study of vector spaces.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

1.1 Solve systems of homogeneous and nonhomogeneous linear equations by the elimination method and by the reduction of the augmented matrix of the system.

1.2 Determine criteria for the existence and uniqueness of solutions.

1.3 Perform vector operations and apply vector methods to the solution of problems.

1.4 Evaluate the determinant of a matrix.

1.5 Perform matrix operations, find the inverse of a square matrix when the inverse exists, and solve matrix equations.

Common Course Number: MAS 2103

Unit 2

General Outcome:

2.0 The students should be able to develop an understanding of the concept of a vector space, prove that a mathematical system is a vector space, and determine its dimension.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

2.1 Define a vector space.

2.2 Determine whether a particular set is linearly independent.

2.3 Determine whether a subset of a vector space spans the vector space.

2.4 Determine whether a subset of a vector space is a basis for the vector space.

2.5 Determine the coordinates of a vector with respect to a basis.

2.6 Identify subspaces of a vector space.

2.7 Determine the dimension of a vector space and of its subspaces.

2.8 Find the rank and nullity of a matrix.

2.9 Find the dot product of two vectors.

2.10 Define orthogonal and orthonormal sets and find orthogonal bases for vector spaces.

2.11 Apply these concepts in the solution of problems.

Common Course Number: MAS 2103

Unit 3

General Outcome:

3.0 The students should be able to demonstrate an understanding of the definition of linear transformation, identify linear transformations, and apply matrix methods to linear transformations.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

3.1 Define a linear transformation.

3.2 Identify projections, rotations, and reflections.

3.3 Find the matrix of a linear transformation.

3.4 Find product transformations.

3.5 Apply the rules of transformation multiplication.

3.6 Make use of the relationship between matrix and transformation.

3.7 Apply these concepts to geometric situations.

Common Course Number: MAS 2103

Unit 4

General Outcome:

4.0 The students should be able to determine when a linear transformation is invertible, how to find the inverse, and how to relate the theory of invertibility to coordinate changes.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

4.1 Determine if the inverse of a matrix exists.

4.2 Find the inverse of a matrix using row reduction.

4.3 Find the inverse of a product of matrices.

4.4 Find the transpose of a matrix.

4.5 Determine if a matrix is orthogonal.

4.6 Find the inverse of a linear transformation.

4.7 Describe transformations of rotations, reflections, and projections.

4.8 Use the inverse of a matrix of a transformation to change from one coordinate system to another.

4.9 State and use the properties of determinants to evaluate large (m x m) determinants.

4.10 State the relationships between the inverse of a matrix and its determinant.

4.11 Find the adjoint of a matrix.

4.12 Find the inverse of a matrix using the determinant and the adjoint.

Common Course Number: MAS 2103

Unit 5

General Outcome:

5.0 The students should be able to find the matrix for a linear transformation relative to any arbitrary basis, and find a basis and a diagonal matrix such that the diagonal matrix is the matrix for a given linear transformation relative to the basis when such a diagonal matrix exists.

Specific Measurable Learning Outcomes:
Upon successful completion of this unit, the student shall be able to:

5.1 Find the matrix of a linear transformation by investigating its effects on the standard basis vectors.

5.2 Find the matrix for a linear transformation relative to any arbitrary basis.

5.3 Explain how changing the basis will affect the matrix of a linear transformation.

5.4 Find the eigenvalues and corresponding eigenvectors for a given matrix.

5.5 Find a basis consisting of eigenvectors of a linear transformation when such a basis exists.

5.6 Find a basis and a diagonal matrix such that the diagonal matrix is the matrix for a given linear transformation relative to the basis when such a diagonal matrix exists.

5.7 Determine when a matrix is similar to a diagonal matrix.

5.8 Find a diagonal matrix similar to a symmetric matrix.