NEW RIVER COMMUNITY COLLEGE
DUBLIN, VIRGINIA

COURSE PLAN

Course Number and Title: MTH 285 – Linear Algebra

Prepared by: Math Department   Spring, 2015
                                                                      (Date)

Approved by: Spring, 2015
                         (Dean)   (Date)

I.   **Course Description**

This course covers matrices, vector spaces, determinants, solutions of linear equations, basis and dimension, eigenvalues and eigenvectors. Designed for mathematical, computer, physical and engineering science programs. Lecture 3 hours per week. 3 credits.

Prerequisite: Successful completion of MTH 174 or equivalent.

II.   **Introduction**

The course satisfies a mathematics requirement for mathematical, computer, physical, and engineering science programs. The course is designed to develop skills and understanding of the basic operations and concepts of linear algebra.

III.   **Student Learning Outcomes**

Upon successful completion of this course, the student will be able to:
1.   Find the length of a vector.
2.   Perform operations on vectors.
3.   Find a unit vector in the same direction (or opposite direction) as a given vector.
4.   Find the distance between two vectors.
5.   Find a vector equivalent to the directed line segment from one given point to another.
6.   Determine whether two vectors are parallel, orthogonal, or neither.
7.   Convert a matrix to reduced row echelon form.
8.   Solve a system of linear equations using Gauss-Jordan elimination.
9.   Reduce a matrix to row-reduced echelon form.
10.   Determine conditions such that a given system of equations will have no solution, exactly one solution, or infinitely many solutions.
11.   Perform operations on matrices including addition, subtraction, multiplication and scalar multiplication.
12.   Find the transpose of a matrix.
13.   Find the inverse of a square matrix or determine that the matrix has no inverse.
14.   Use the method of inverses to solve a linear system of equations.
15.   Find the rank of a matrix.
16.   Determine the number of solutions of a matrix using the rank.

17. Compute the determinant of a square matrix using cofactor expansion.
18. Find the determinant of a product, inverse, transpose, and diagonal matrix.
19. Use the determinant to determine whether a matrix is singular or nonsingular.
20. Use the determinant of a coefficient matrix to determine whether a system of equations has a unique solution.
21. Determine whether a set of vectors is linearly dependent or independent.
22. Express a vector as a linear combination of other given vectors.
23. Prove or disprove that a given subset is a subspace of $\mathbf{R^m}$.
24. Determine whether a given set of vectors is a basis for a given subspace.
25. Reduce a spanning set of vectors to a subspace.
26. Extend a linearly independent set of vectors to a subspace.
27. Find the dimension of a subspace.
28. Find a basis for the solution space of a homogeneous system.
29. Find a basis for and the rank of the column space or row space of a matrix.
30. Determine whether a given set with defined operations is a vector space.
31. Make determinations concerning independence, spanning, basis, dimension, orthogonality and orthonormality with regards to vector spaces.
32. Deduce whether a given function is an inner product for a vector space.
33. Use the Gram-Schmidt Process to construct an orthogonal basis.
34. Identify whether a given function is a linear transformation.
35. Perform operations on linear transformations including sum, difference and composition.
36. Compute the kernel and image of a given linear transformation.
37. Identify whether a linear transformation is one-to-one and/or whether it has an inverse.
38. Construct a matrix that represents a linear transformation.
39. Compute the change of basis matrix needed to express a given vector as the coordinate vector with respect to a given basis.
40. Calculate the eigenvalues of a square matrix, including complex eigenvalues.
41. Calculate the eigenvectors that correspond to a given eigenvalue, including complex eigenvalues and eigenvectors.
42. Use Markov chains to find short term and long term states.
43. Determine if a matrix, including symmetric matrices, is diagonalizable.

IV. **Instructional Methods**

The instructional methods may include lectures, homework, quizzes, reviews and in class tests. Further information is available in the individual Syllabus or Course Plan Addendum.

V. **Instructional Materials**

Textbook: Linear Algebra and its applications, 4th edition,
David C. Lay, Addison Wesley 2012
ISBN-10: 0321385179   ISBN-13: 978-0321385178

Homework: MyMathLab online homework delivery system
bundled with the textbook if purchased through the NRCC Bookstore
to be purchased separately if a used book is purchased.

Calculator: See instructor for specific requirements.
Cell phones may not be used as calculators.

VI. **Course Content**

- Matrices: including operations, Gauss-Jordan elimination, reduced row-echelon form, inverses, solutions to linear systems and determinants
- Vectors and Vector Spaces
- Basis and dimension
- Eigenvalues and Eigenvectors, including complex
- Linear Transformations

VII. **Evaluation**

The grade for the course will be calculated from Homework, Quizzes and Tests and other work as deemed appropriate by the instructor. See individual Syllabus or Course Plan Addendum for details

VIII. **Attendance**

Regular attendance at classes is required. When absence from a class becomes necessary, it is the responsibility of the student to inform the instructor prior to the absence whenever possible. The student is responsible for the subsequent completion of all study missed during an absence. Any instruction missed and not subsequently completed will necessarily affect the grade of the student regardless of the reason for the absence.

IX. **Cheating Policy**

The giving or receiving of any help from another student or unauthorized individual on any graded portion of the course is considered cheating and will not be tolerated. The use of books, notes, electronic devices or any other unauthorized material during tests is considered cheating, and will not be tolerated. Any student found cheating will receive a grade of "0" on that assignment and may receive an "F" for the course. This "0" cannot be replaced by any other score.

X. **Withdrawal Policy**

Student Initiated Withdrawal Policy

A student may drop or withdraw from a class without academic penalty during the first 60 percent of a session. For purposes of enrollment reporting, the following procedures apply:

a. If a student withdraws from a class prior to the termination of the add/drop period for the session, the student will be removed from the class roll and no grade will be awarded.
b. After the add/drop period, but prior to completion of 60 percent of a session, a student who withdraws from a class will be assigned a grade of "W." A grade of "W" implies that the student was making satisfactory progress in the class at the time of withdrawal, that the withdrawal was officially made before the deadline published in the college calendar, or that the student was administratively transferred to a different program.

c.   After that time, if a student withdraws from a class, a grade of "F" or "U" will be assigned. Exceptions to this policy may be made under documented mitigating circumstances if the student was passing the course at the last date of attendance.

A retroactive grade of "W" may be awarded only if the student would have been eligible under the previously stated policy to receive a "W" on the last date of class attendance. The last date of attendance for a distance education course will be the last date that work was submitted.

Late withdrawal appeals will be reviewed and a decision made by the Director of Student Services.

No-Show Policy

A student must either attend face-to-face courses or demonstrate participation in distance learning courses by the last date to drop for a refund. A student who does not meet this deadline will be reported to the Admissions and Records Office and will be withdrawn as a no-show student. No refund will be applicable, and the student will not be allowed to attend/participate in the class or submit assignments. Failure to attend or participate in a course will adversely impact a student's financial aid award.

Instructor Initiated Withdrawal

A student who adds a class or registers after the first day of class is counted absent from all class meetings missed. Each instructor is responsible for keeping a record of student attendance (face-to-face classes) or performance/participation (DE classes) in each class throughout the semester.

When a student's absences equal twice the number of weekly meetings of a class (equivalent amount of time for summer session), the student may be dropped for unsatisfactory attendance in the class by the instructor.

Since attendance is not a valid measurement for Distance Education (DE) courses, a student may be withdrawn due to non-performance. A student should refer to his/her DE course plan for the instructor's policy.

In accordance with the No-Show Policy, a student who has not attended class or requested/accessed distance learning materials by the last day to drop the class and receive a refund must be withdrawn by the instructor during the following week. No refund will be applicable.

When an instructor withdraws a student for unsatisfactory attendance (face-to-face class) or non-performance (DE class), the last date of attendance/participation will be documented. Withdrawal must be completed within five days of a student's meeting the withdrawal criteria. A grade of "W" will be recorded during the first sixty percent (60%) period of a course. A student withdrawn after the sixty percent (60%) period will receive a grade of "F" or "U" except under documented mitigating circumstances when a letter of appeal has been submitted by the student. A copy of this documentation must be placed in the student's academic file.

The student will be notified of the withdrawal by the Admissions and Records Office. An appeal of reinstatement into the class may be approved only by the instructor.

XI.   Disability and Diversity Statements

If you are a student with a documented disability who will require accommodation in this course, please register with the Disability Services Office located in the Counseling Center for assistance in developing a plan to address your academic needs.

The NRCC community values the pluralistic nature of our society. We recognize diversity including, but not limited to, race ethnicity, religion, culture, social class, age, gender, sexual orientation and physical or mental capability. We respect the variety of ideas, experiences and practices that such diversity entails. It is our commitment to ensure equal opportunity and to sustain a climate of civility for all who work or study at NRCC or who otherwise participate in the life of the college.

XII.   Evacuation Procedure

Evacuation Procedure: Please note the evacuation route posted at the classroom doorway. Two routes are marked in case one route might be blocked.