MATH 435 Discrete Mathematics with Applications I

1. <u>Catalog Description</u>

    MATH 435. Discrete Mathematics with Applications I   **4 units**

    Prerequisite: <u>MATH 248</u> with a grade of C- or better and <u>MATH 336</u>, or consent of instructor.

    Methods of discrete mathematics with applications. Generating functions and Lagrange inversion, partition theory, permutation statistics and q-analogues, posets and Moebius inversion. Additional topics including lattice paths and basic hypergeometric series. 4 lectures. Not open to students with credit in <u>MATH 530</u>.

2. <u>Required Background or Experience</u>

    Prerequisite: MATH 248 with a grade of C- or better and MATH 336, or consent of instructor.

3. <u>Learning Objectives</u>

    Upon completion of MATH 435, a student should be able to:

    a. Use generating functions to investigate the properties of integer sequences and to solve counting problems.
    b. Understand integer partitions and become familiar with classical results in the area
    c. Learn how to examine permutations by rises, descents, inversions, and the major index.
    d. Extend their basic knowledge of inclusion/exclusion gained in MATH 336 by examining partially ordered sets and Möbius inversion.
    e. Understand and apply the standard techniques of discrete mathematics to solve problems from probability theory, combinatorics, and number theory.

4. <u>Text and References</u>

    Text to be specified by instructor. Suggested references include:

    - Graham, Ronald, <u>Concrete Mathematics</u>
    - Hardy, G. H. and E. M. Wright, <u>An Introduction to the Theory of Numbers</u>
    - J.H. Van Lint and R.M. Wilson, <u>A course in Combinatorics</u>
    - R. Stanley, <u>Enumerative Combinatorics Vol. I and II</u>
    - P. Goulden and D.M. Jackson, <u>Combinatorial Enumeration</u>
    - G. E. Andrews. <u>The Theory of Partitions</u>

5. <u>Minimum Student Materials</u>

    Paper, pencils and notebook.

6. Minimum University Facilities

    Classroom with ample chalkboard space for class use.

7. Content   Lectures

		Lectures
a.	Generating functions, Lagrange inversion, the exponential formula.	5
b.	Partition theory, Euler's pentagonal number theorem, the Jacobi triple product, Rogers-Ramanujan type identities	10
c.	Permutation statistics, Gaussian numbers, and q-analogues	5
d.	Posets and Möbius inversion, generalized inclusion/exclusion	10
e.	Lattice paths and /or hypergeometric series and/or other advanced topics as selected by instructor (time Permitting)	6
	Total	36

    Note:

    The topics covered in MATH 435 are identical to those covered in MATH 530.
    MATH 530 is the graduate level version of MATH 435, and requires additional
    work for the graduate students enrolled in the course. Students in MATH 530 will
    be responsible for supplementary exercises and additional readings, and a presentation
    or project on the additional readings. Students will be prohibited from taking both
    MATH 435 and MATH 530.

8. Methods of Assessment

    Comprehensive final exam, mid-term exams or quizzes, homework.