MISSOURI WESTERN STATE COLLEGE

DIVISION OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 206

COURSE NAME: Mathematical Transitions

COURSE DESCRIPTION:

This course is designed to prepare students thoroughly for the transition into university level mathematics. It main content is the development of formal proof and concise logical reasoning. Also we introduce matrices and

PREREQUISITE:

Credit or concurrent enrollment in MAT 177

TEXT:

This course does not require any textbooks.

COURSE OBJECTIVES:

The major goal of this course is to develop competence to use mathematics as to communicate, to reason, and to solve problems.

It is assumed that this major goal will have been reached, at least partially, if the following objectives are accomplished. Successful students will be able to:

1. Utilize different logical proof techniques.
2. Utilize the axiomatic approach in developing mathematical proofs.
3. Communicate using mathematical language and symbolism.
4. Discuss the different number systems and their relative densities
5. Explain function continuity and test functions for being continuous
6. Utilize infinite Sequences and Series
7. Transfer problems between axiomatic and analytical geometry systems.
8. Utilize matrix theory to find solutions of linear equations.

STUDENT COMPETENCIES:

In order to meet the above objectives, successful students will:

1. Construct truth tables of propositions.
2. Use proof by contradiction and contrapositive arguments
3. Use induction and strong induction arguments.
4. Prove theorems about sets using the algebraic properties of sets.
5. Construct functions on sets that have the different cardinalities
6. Test if functions are injective, surjective or bijective
7. Define the different number systems
8. Prove the density arguments of the real and rational numbers
9. Use the completeness axiom in a proof
10. Define complex numbers, find different roots of unity
11. Define series and sequences, prove convergence using ε-δ
12. Prove Boltzano-Weirstrass theorem and show Cauchy convergence
13. Define continuity using ε-δ methods
14. Represent problem situations using sequences and/or series.
15. Define matrices and basic matrix operations
16. Find the determinant of a matrix
17. Find the inverse of a square matrix

COURSE OUTLINE:

I. Proof Techniques
   A. truth tables
   B. logical equivalences

C. quantifiers, negation, implications
D. compound statements,
E. contrapositive/converse/contradiction arguments

II. Induction
A. Finite sums
B. Towers of Hanoy
C. Strong induction
D. Geometrical induction

III. Functions and Sets
A. Sets, subsets
B. Cartesian product
C. Function representation
D. surjective, injective and bijective
E. pre-image and compostion

IV. Number systems
A. Definitions of {N,Z,Q,R}
B. Completeness Axiom
C. Cardinality of {N,Z,Q,R}
D. Archimedean property
E. Density theorems
F. incompleteness of Q

V. Complex numbers
A. Argand diagrams
B. De Moivre's theorem
C. Roots of unity
D. Rotations in the complex plane

VI. Series and sequences
A. Limits ε-n definitions
B. Monotone convergence theorem
C. Boltzano-Weirstrass theorem
D. Cauchy convergence criterion
E. Comparison test, ratio test, root test

VII. Continuity
A. Limit of a function
B. sequential limit
C. uniform continuous

VIII. Geometry
A. Axiomatic Geometry
B. Analytical Geometry

IX. Matrices
- A. Matrix operations
- B. Solving linear systems
- C. Matrix inverse
- D. Matrix determinants