88-89/10A

INDIANA UNIVERSITY OF PENNSYLVANIA
SENATE CURRICULUM COMMITTEE B-2

NEW COURSE PROPOSAL

Department: Mathematics

Person to Contact for Further Information: Dr. Joseph Angelo

Course Affected: MA 425 Applied Mathematical Analysis (New Course)

Desired Effective Semester for Change: Spring '88

Approvals: Department Committee Chairperson ____________

Department Chairperson ____________

College Committee Chairperson ____________

College Dean ____________

A. DESCRIPTION AND ACADEMIC NEED

A1. Catalog description attached.

A2. Course syllabus and bibliography attached.

A3. This course will serve as an elective course for students with an [illegible]

analysis theory which lies under the procedures and algorithms for operations research and statistics. It would also be suitable for

A7. This is to be a dual level course. It will be required in the M.S. [redacted]
undergraduate. The proposal is currently proceeding through the approval process. It has been approved by the Mathematics Department Faculty, and is ready for submission to the College Dean and the Graduate Committee of th Senate.

A8. Catalogs for several universities in a comparison group for IUP were examined. Included were catalogs for Clarion, Indiana State University, Marshall, Millersville, University of Pittsburgh, Penn State, Sam Houston, Shippensburg, West Chester University, Western Illinois, and West Virginia. Of those examined, only the following catalogs revealed similar courses:

Penn State University - MATH 405, Advanced Calculus for Engineers [redacted]

University of Pittsburgh - Math 157, Transformational Methods in Applied Mathematics (dual level); MA 220A, Real Analysis (graduate level).

Western Illinois - Course number 531, Real Variables; course number 581, Approximation Theory (both graduate level).

West Virginia University - Math 255, Advanced Real Calculus (dual level).

No single course listed above contains all of the topics of the proposed course

A9. Proposed course is not specifically recommended by a professional [redacted]

C. EVALUATION

C1. Examinations will be used to evaluate student progress [illegible]

C2. The course may not be taken for variable credit.

D. IMPLEMENTATION

D1. a. Faculty currently available.

b. There is sufficient space and equipment.

c. No laboratory supplies are required.

d. Library resources are adequate.

e. No travel funds required.

D2. This course will be offered once each year during the second semester or summer term.

D3. There will probably be just one section each time the course is offered.

D4. Class size should not exceed 20 so that each student can receive appropriate attention from the instructor.

Catalog Description

MA 425 APPLIED MATHEMATICAL ANALYSIS I 3 s.h.

This course provides the necessary background for an

MA 425 APPLIED MATHEMATICAL ANALYSIS I

DESCRIPTION

This course provides the underlying theoretical background necessary for an understanding of mathematical programming, convergence of algorithms, and applications of convexity and factorable functions. It includes concepts in matrix theory and vector analysis which are required to understand the development of efficient algorithms to solve linear and non-linear programming models.

OUTLINE

	Number of Periods
A. INTRODUCTION TO NECESSARY TERMINOLOGY, NOTION, SETS, FUNCTIONS, REAL OR COMPLEX NUMBERS	3

1. Sets and Functions
2. Groups and Fields
3. Fundamental Theorem of Algebra
4. Mean Value Theorem
5. Taylor's Theorem

B. BRIEF REVIEW OF LINEAR ALGEBRA	3

1. Vector Spaces
2. Partitioned Matrices
3. Linear Transformations

C. [illegible]

1. Standard Form
2. Gauss-Jordan Pivoting
3. Gauss-Jordan Reduction Procedure
4. Elementary operations on the scalar form
5. Standard Procedures

   a. Finding Standard Matrices
   b. Resolving LI
   c. Finding the Standard Representation of a Subspace
   d. Finding a Basis for Null A
   e. Resolving Consistency of Ax = b
   f. Finding [illegible]

Number of Periods

D. [illegible]

[illegible]

1. Geometric Interpretations
2. Three Fundamental Forms of k-Planes
3. Elementary Theorem of the Separating Hyperplane
4. Nonegative Solutions

    a. Theorem of the Alternative
    [illegible]

    c. Farkas' Theorem
    d. Gordan's Theorem
    e. Stiemke's Theorem
    f. Gale's Theorem for Inequalities
    g. Von Neumann's Theorem for Semipositive Solutions
    h. Tucker's Theorem for Positive Solutions

5. Basic Solutions
6. Linear Inequalities

    a. Minkowski's Theorem
    b. Modularity Theorem
    c. Weyl's Theorem

E. SQUARE MATRICES IN UNITARY SPACE 6

1. Square Matrices
2. Cayley-Hamilton Theorem

[illegible]

3. Schur's Theorem
4. Unique Solutions

Number of Periods

G. OPTIMIZATION THEORY ON R — 8

1. General Considerations
2. Equality Constraints
3. Lagrance Multiplier Theorem

[illegible]

   a. Kuhn-Tucker Conditions for Inequality Constraints

5. Mixed Constraints

[illegible]

6. Convex Programming

   a. Kuhn-Tucker Theorem for Convex Programming

7. Separation and Representation
8. Minkowski's Separation Theorem

Total: 42

The student will be asked to (i) complete a project related to one of the topics in applied analysis;
(ii) read and write reports on two articles found in the current [illegible]
(iii) complete a take-home final

Gross, D., and C.M. Harris, Fundamentals of Queueing Theory, Wiley-Interscience, 1974.

Hillier, F.S., and G.J. Lieberman, Operations Research, Holden-Day, 1974.

Hillier, F.S., and G.J. Lieberman, [illegible]

[illegible]

McCormick, G.P., Numerical Methods for Non-linear Optimization, Academic, 1972.

Mangasarian, O.L., Nonlinear Programming, McGraw-Hill, 1969.

Phillips, D.T., A. Ravindran, and J.J. Solberg, Operations Research: Principles and Practice, Wiley, 1976.