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LIBERAL STUDIES

UWUCC USE Only
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Action-Date: UWUCC App 4/16/02
Senate App 5/7/02

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Gerald Buriok Phone 7 2608

Department Mathematics

II. PROPOSAL TYPE (Check All Appropriate Lines)

X COURSE MATH 423-424 Complex Variables I and II
Suggested 20 character title

____ New Course* _____
Course Number and Full Title

X Course Revision MATH423-424 Complex Variables I and II
Course Number and Full Title

____ Liberal Studies Approval+ for new or existing course _____
Course Number and Full Title

____ Course Deletion _____
Course Number and Full Title

____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

X Course or Catalog Description Change MATH 423-424 Complex Variables I and II
Course Number and Full Title

_____ PROGRAM: _____ Major _____ Minor _____ Track

____ New Program* _____
Program Name

____ Program Revision* _____
Program Name

____ Program Deletion* _____
Program Name

____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

George E. Mitchell 10/1/01
Department Curriculum Committee

Gerald Buriok 10/1/01
Department Chair

for 2/20/02
College Curriculum Committee

John D. Ed 2/27/02
College Dean

_____
+Director of Liberal Studies (where applicable)

_____
*Provost (where applicable)

Part II. Description of Curriculum Change

1. New Syllabus of record. (Attached.)

2. Summary of proposed revisions.

A proposed change is in the prerequisite, replacing "MATH 124 or 227" with "MATH 124."
MATH 424 Complex Variables II will be deleted from the description and will no longer be offered.

a. Proposed new catalog description:

MATH 423 Complex Variables **3c-0l-3sh**

Prerequisite: MATH 124

An introduction to the theory of functions of a complex variable; topics included are elementary functions, analytic functions, conformal mapping, integration, series and applications.

b. Old catalog description

MATH 423-424 Complex Variables I and II **each 3c-0l-3sh**

Prerequisite: MATH 124 or 227.

An introduction to the theory of functions of a complex variable; topics included are elementary functions, analytic functions, conformal mapping, integration, series and applications.

3. Justification/rationale for change.

Several years ago there was a three-semester calculus sequence MA127 Calculus I, MA 128 Calculus II, and MA 227 Calculus III. This sequence was deactivated in 1998 and we wish to remove all reference to these courses from the catalog. Due to low enrollments in mathematics programs, MATH 424 has been offered only once in the past decade. The faculty has approved a course rotation plan that excludes MATH 424 in future semesters. With the exception of conformal mapping and applications, all of the topics listed in the catalog description have been, and will continue to be, covered in MATH 423. Conformal mapping and applications have been touched on lightly in MATH 423 and have been the heart of the MATH 424 course. We will continue to introduce them in MATH 423. MATH 424 should be considered inactive and be deleted from the catalog.

4. Old syllabus of record. (Attached.)

5. Liberal Studies course approval form and checklist. (Not applicable.)

Part III. Letters of Support.

I. Catalog Description

MATH 423 Complex Variables

3 credits
3 lecture hours
0 lab hours
(3c-01-3sh)

Prerequisite: MATH 124

An introduction to the theory of functions of a complex variables: topics included are elementary functions, analytic functions, conformal mapping, integration, series, and applications.

II. Course Objectives

1. Students will make a careful study of the complex numbers.
2. Students will learn the properties of the elementary functions in a complex variable setting.
3. Students will study and learn the theory of analytic functions.
4. Students will learn how to differentiate functions of complex variables.
5. Students will study conformal mapping.
6. Students will study and learn the theory of integrating complex functions.
7. Students will learn the theory of series in a complex variable setting.
8. Students will learn how to use the theory of complex variables to solve applied problems.

III. Course Outline

A. Complex Numbers (4 hours)
   1. The Algebra of Complex Numbers
   2. The Geometry of Complex Numbers
   3. The Topology of Complex Numbers

B. Complex Functions (6 hours)
   1. Functions of a Complex Variable
   2. Transformations and Linear Mappings
   3. Limits and Continuity
   4. Branches of Functions
   5. The Reciprocal Transformation

C. Analytic and Harmonic Functions (4 hours)
   1. Differentiable Functions
   2. The Cauchy-Riemann Equations
   3. Analytic Functions and Harmonic Functions

D. Sequences and Series (3 hours)
   1. Definitions and Basic theorems for Sequences and Series
   2. Power Series Functions

E. Elementary Functions (5 hours)
   1. The Complex Exponential Function
   2. Branches of the Complex Logarithm Functions
   3. Complex exponents
   4. Trigonometric and Hyperbolic Functions
   5. Inverse Trigonometric and Hyperbolic Functions

F. Complex Integration (7 hours)
   1. Complex integrals
   2. Contours and Contour Integrals
   3. The Cauchy-Goursat Theorem
   4. The Fundamentsl Theorems of Integration
   5. Integral Representations for Analytic Functions
   6. The Theorems of Morera and Liouville and Some Applications

G. Taylor and Laurent Series (5 hours)
   1. Uniform Convergence
   2. Taylor Series Representations
   3. Laurent Series Representations
   4. Singularities, Zeroes and Poles
   5. Applications of Taylor and Laurent Series

H. Conformal Mapping (4 hours)
   1. Basic Properties of Conformal Mappings
   2. Bilinear Transformations
   3. Mappings Involving Elementary Functions
   4. Mapping of Trigonometric Functions

I. Applications (4 hours)
   1. Two-Dimensional Mathematical Models
   2. Steady State Temperatures
   3. Two-Dimensional Electrostatics
   4. Two-Dimensional Fluid Flow
   5. The Joukowski Airfoil

IV. Evaluations Methods

The final grade for the course will be determined as follows:

40% Tests. Tests will be based on the lecture material.
20% Final Examination. The final examination will be comprehensive.
40% Homework, Quizzes, and Projects. These will cover both lecture and textbook assignments. The projects will be designed to extend the lecture material or to develop an application not discussed in class.

Grades will be assigned as follows:
A: 90%-100%
B: 80%-89%
C: 70%-79%
D: 60%-69%
F: 0%-59%

V. Required Textbook

John H. Mathews and Russell W. Howell. Complex Analysis For Mathematic and Engineering, Third Edition. Boston, Mass: Jones and Bartlett Publishers, 1997

VI. Special Resource Requirements

Some instructors my require students to purchase special calculators.

VII. Bibliography

1. Churchill, R.V., Brown, J.W. and Verhey, R.F., Complex Variables and Applications, New York: McGraw-Hill, 1974.

2. Rubenfeld, Lester A., A First Course in Applied Complex Variables, New York: John Wiley & Sons, 1985.

Mathematics Department
Indiana University of Pennsylvania
Indiana, PA 15705

Course Number: MA 423/523

Course Title: Complex Variable I

Credits: 3 semester hours

Prerequisites: MA 124 or MA 227

Textbook: Fundamentals of Complex Analysis for Mathematics, Science, & Engineering
Saff & Snider
Prentice-Hall

Revised: 9/95

Catalog Description:

Introduction to the theory of functions of a complex variable: topics included are elementary functions, analytic functions, conformal mapping, integration, series, and applications.

Course Outline/Time Schedule:

I. Complex Numbers and Their Geometric Representatives
   - A. Definitions
   - B. Algebraic Properties
   - C. Polar Form
   - D. Exponential Form
   - E. Powers and Roots

II. Functions of a Complex Variable
   - A. Limits
   - B. Continuity
   - C. Derivatives
   - D. Cauchy-Riemann Equations
   - E. Analytic Functions
   - F. Elementary Functions

III. Integration
   - A. Contours and Line Theorem, Independence of Path
   - B. Cauchy-Gorsat Theorem
   - C. Maximum Modulus
   - D. Fundamental Theorem of Algebra

E. Applications

IV. Series
- A. Representation by Power Series
- B. Laurent and Taylor Series
- C. Uniform Convergence
- D. Integration and Differentiation of Power Series
- E. Uniqueness of Series Representation

V. Residues and Poles
- A. Residue Theorem
- B. Zeros and Poles
- C. Evaluation of Improper Real Integrals
- D. Improper Integrals Involving Sines and Cosines

VI. Conformal Mapping
- A. Linear Fractional Transformations
- B. Conformal Mapping
- C. Transformation of Harmonic Functions
- D. Applications of Conformal Mapping