



# Theory into Practice

## The Addition of Theoretical Math Courses to an Applied Curriculum

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# Overview

- Who are we?
- What did we do?
- What do we still need to do?

# Colorado School of Mines

- Located in Golden, Colorado
- A public research university devoted to engineering and applied science
- Student body of approximately 4400
- Highest admissions standards of any public university in Colorado

# Department of Mathematical & Computer Sciences (MCS)

- 22 Academic Faculty Members
- 226 Undergraduates, 60 Graduates
- Areas of Concentration
  - Applied Statistics
  - Computational Mathematics
  - Computer Science
- Offering B.S., M.S. and Ph.D in Mathematical Sciences with options of Computational Mathematics, Applied Statistics or Computer Science

# MCS Department

- Supports instruction of the core curriculum
  - 12 Semester hours of Calculus
  - 3 Semester hours of Differential Equations
- Supports instruction for requirements of majors in Engineering, Geophysics and Physics
  - 3 Semester hours of Linear Algebra

# Curriculum Objectives

- The calculus sequence emphasizes mathematics applied to problems students are likely to see in other areas
- Priorities include:
  - Applied problems in the math courses; and
  - Ready utilization of math in the science and engineering courses

# Course Reqs. For Math Major, 2005-06

Year	Courses	
Freshman	Calculus I	Calculus II
Sophomore	Calculus III Programming Concepts	Data Structures Differential Equations Linear Algebra
Junior	Intro. to Probability <b>Algebraic Structures</b> <b>1 Computing Elective</b>	Intro. to Math Modeling 1 Math Elective
Senior	Real Analysis <b>Senior Seminar I</b> 2 Math Electives	Intro. to Scientific Computing <b>Senior Seminar II</b> 1 Math Elective

Field Course

# Course Specifics

- Algebraic Structures
  - Required of all MCS majors
  - Topics include:
    - Logic, Proofs
    - Set Theory
    - Combinatorics
    - Graph Theory

# Course Specifics

- Field Session
  - Required of all MCS majors
  - Students work in groups of 3-4 on a “real world” problem in mathematics or computer science
  - Deliverables include a finished project with supporting documentation

# Course Reqs. For Math Major, 2007-08

Year	Courses	
Freshman	Calculus I	Calculus II
Sophomore	Calculus III Programming Concepts	Data Structures Differential Equations Honors Linear Algebra
	Foundations of Mathematics	
Junior	Intro. to Probability Real Analysis Intro. To Scientific Comp.	Complex Analysis Abstract Algebra 1 Math Elective
Senior	Math Biology Computer Graphics PDEs	Parallel Scientific Computing Capstone Course 2 Math Elective

# Course Specifics

- Foundations of Mathematics
  - Required of MCS math majors
  - Writing intensive
  - Topics include:
    - Logic, proof techniques
    - Reading & writing proofs

# Areas of Concern

- Transition from Core Curriculum to Degree Requirements
  - Linear Algebra gives the first detailed or prolonged discussion on theorems and proofs
  - Linear Algebra also marks the transition of working among fellow engineers to working among fellow math majors
  - To ensure minimal impact to degree requirements, students are expected to declare during their sophomore year

# Areas of Concern

- Department must attract and support math students interested in both applied and theoretic course work
- Foundations course should provide introduction to theoretical techniques and provide examples of use of mathematics in other degree fields

# Future Directions

- Enhance the Foundations course
  - Introduce Mathematical software
  - Relate the theory of mathematics to applications in other degree fields
- Additional theoretical and applied math classes



Questions?