UAB Department of Mathematics

SYLLABUS

MA 411/511-2C: Integrating Mathematical Ideas

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Course Description.

This course serves as the capstone course for the Mathematical Reasoning track. It will help students achieve an integrated working grasp of mathematical ideas, engage students in inquiry and reflection in the learning and practice of mathematics, help students develop a productive disposition in tackling mathematical problems, and develop the ability to communicate mathematics and mathematical ideas at all levels, both verbally and in writing.

The course will continue the inquiry-based learning environment of other courses in the Mathematical Reasoning track. The course will integrate ideas from number, algebra, geometry, probability, and statistics. In doing this the student will gain understanding and ability in plausible reasoning, conjecture, and justification in the study of patterns and models, functions, and use of technology. The course will emphasize the use of functions as mathematical models, the various ways of representing functions, and the power and uses of these representations in different contexts. Inquiry-based learning will pervade the course. Students will be expected to communicate mathematics verbally and in writing through small group, whole group, and individual interactions.

Topics.

The course will include the following topics, divided among five fundamental categories. It is important to realize that these topics cannot be treated each in isolation, but only in relation to each other. Therefore, this should not be read as a timeline of the course.

(I.) Reasoning

- Deductive reason and its prime importance for mathematics
- Mathematically convincing arguments (leading to mathematical proofs)
- Inductive reasoning
- Reasoning by analogy
- Plausible reasoning
- Developing ability to make educated guesses
- Developing critical ability

(II.) Patterns and Models

- Seeking and finding patterns in data, geometry, pictures, algebra, probability, and numbers
- Conjecture and plausible reason in finding significant patterns
- Functional relations based on patterns
- Building algebraic models from geometric and numerical patterns
- Exact and approximate representations

(III.) Relations and Functions

- The function concept and the notions of dependence; dependent and independent variables, domain and range.
- Multiple ways to represent a function, the questions they help us answer, advantages and disadvantages of each, and transforming one type of representation into another. Among the representations examined are:

- Verbal descriptions of functions
- Graphical representations
- Numerical/tabular data
- Algebraic representations (mathematical formulas)
    - Functional notation and its uses
    - Discrete and continuous variables
    - Continuous and discontinuous functions
    - Piecewise defined functions
    - Comparison of functions
    - Slope and rate of change
    - Transformations and combinations of functions
    - Special types of functions, with practical, everyday examples of each:
- Linear functions, slope and intercept (extensive and varied approaches to these, with many examples of sources)
- Piecewise linear functions
- Quadratic functions
- Higher order polynomial functions
- Rational functions
- Exponential and logarithmic functions
- Trigonometric functions and periodic or repetitive phenomena or behavior
- Functions not fitting into any standard mathematical category, and how to deal with them

(IV.) Communication: Writing and Speaking

- Communication of mathematics verbally and in writing
- Mathematics is not just a collection of techniques, but is a structured body of knowledge essential to the modern community and to science
- Writing is essential to mathematics, in proofs, explanations, descriptions, and in communication to others (e.g., teaching) and to ourselves
- "If you can't explain it, you don't fully understand it"

Prerequisites. You are expected to have taken MA 125, MA 313, and at least one of MA 314, 315, 316, or 317. If you do not meet these prerequisites, please see the instructor before continuing.

Course Structure. This is not a lecture course, but a hands-on course. Evaluation of student performance will be consistent with this approach.

Portfolio. Students will maintain a portfolio of all work done in the course. At the end of the semester, selections will be made from this portfolio and evaluated.

Course Grades: Students earn their grade in the course through evaluation of their work and class participation. Course grade is determined by overall average of grades earned weighted as follows, on scale: 90-100=A, 80-89=B, 65-79=C, 50-64=D, and below 50 is F.

Grade Element	Percent of Grade
Menu Work	25
Participation/Reflections	10
Mid-term exam	25
Final Portfolio	10
Final Exam	30
Total	100

Major Assignment Dates: The following important assignments should be noted:

Menu 1: due Feb 6
Midterm: Feb 27
Menu 2: due Mar 24
Portfolio: due Apr 21
Final Exam: Apr 28 – 4:15-6:45pm

Cell Phones. Full participation during class is an essential part of success in this course. As such, cell phones must be TURNED OFF and PUT AWAY during **ALL** class meetings**.**

Disability Support Services (DSS). DSS offers tutoring and special accommodations to students who qualify. The UAB DSS office is located on the fourth floor of the Hill University Center, telephone: 934-4205, e-mail: dss@uab.edu. Students who have a DSS-approved accommodation for extended test times will take quizzes and tests that have a longer time duration. See your instructor for further information.

Withdrawal: The last day for withdrawing from this course without the payment of full tuition and fees is January 14, 2019. The last day to withdraw from this course with a grade of ***W*** is March 1, 2019. Students withdraw from a course by completing the appropriate paperwork in the UAB Registrar's Office in the Hill University Center. The signature of the instructor is not required.