MAT 512 ALGEBRA FOR TEACHERS SYLLABUS

The goal of the course is to provide the basic algebraic concepts and tools widely used throughout all mathematics courses, both in high school and university curricula, with attention to the Common Core State Standards.

INSTRUCTOR: Professor C. Denson Hill, Office 2-113 Math Tower.
OFFICE HOURS: Monday & Wednesday 2:00 – 3:30 pm.

TEXTBOOKS: (required)
1. Ronald S. Irving, Integers, Polynomials, and Rings, Springer 2004.
paperback ISBN 0-387-20172-6.
2. I.M. Gelfand & A. Shen, Algebra, Birkhauser 1993.
paperback ISBN 0-8176-3677-3.

GRADING POLICY: Homework 40 %; Exam I 30 %; Exam II 30 %.

Homework will be assigned each week, to be handed in and graded. Reading assignments from the textbooks will also be assigned each week, which will be coordinated with the lectures. Exam I will cover the first half of the material, and Exam II will cover the second half, of the material presented in the course.

Students should be able to

- describe the classical number systems used in high school (natural numbers, integers, rational, real and complex numbers) and relations between them;
- use various presentation systems for numbers (e.g., positional systems, aliquot fractions, etc.);
- convert the presentations to each other and perform the arithmetic operations in the systems;
- convert an infinite periodic decimal fraction into an ordinary fraction and back;
- formulate and use the basic properties of algebraic operations (associativity, commutativity, distributivity);
- give definitions of the basic algebraic structures such as monoids, groups, rings, fields, and recognize them in specific situations;
- give definitions of homomorphisms and isomorphisms of groups or rings and recognize whether a specific map matches these definitions;
- give definitions of and fluently operate with the fundamental notions about divisibility of integers (divisor, common divisor, greatest common divisor, prime number, etc.);
- formulate and prove Unique Prime Factorization Theorem, Theorem about division with remainder, Euclidean algorithm;
- find a linear presentation of the greatest common divisor by the Euclidean algorithm, by using continued fractions, by matrix method;
- solve linear Diophantine equations;
- perform basic operations with congruence classes and identify the congruence classes as elements of the residue ring;
- apply modular arithmetics (including the canonical ring homomorphisms) to a wide variety of problems such as divisibility criteria, control of calculations and Diophantine equations;

- identify invertible elements in a residue ring;
- define the Euler function, formulate and prove its properties;
- formulate and prove the Euler theorem and its corollaries (in particular, Fermat's little theorem), as well as apply it to solve congruence problems with large exponents;
- define zero divisor in a ring, define integral domain;
- solve linear equations in the residue rings;
- formulate and prove the theorem about the field of quotients for an integral domain, apply it to the ring of integers;
- prove that polynomials with coefficients in a ring form a ring;
- give definitions of ideal, kernel of a ring homomorphism, quotient ring by an ideal;
- interpret the simplest algebraic extension of fields as quotient rings of the polynomial ring over the field (in particular, represent in this way the field of complex numbers);
- express a symmetric polynomial as a polynomial of elementary symmetric polynomials, use this in problem solving;
- formulate and prove the Vieta theorem.

DISABILITY SUPPORT SERVICES (DSS) STATEMENT:

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, room128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/disabilities]

ACADEMIC INTEGRITY STATEMENT:

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures.