Mathematics and Science Education
In the College of Sciences and Education

For further information regarding programs, consult the following:
Ph.D. Program ........................ CRMSE
6475 Alvarado Rd., #236
619-594-4696
e-mail: mathsci@sdsc.edu
M.A. Program ........................ Mathematics and Statistics
619-594-6191
Teacher Education
619-594-6131

Mathematics and Science Education Faculty
Joanne Lobato, Ph.D., Professor of Mathematics, Coordinator for Ph.D. Program
Nadine S. Bezuk, Ph.D., Professor of Teacher Education
Alexander W. Chizhik, Ph.D., Professor of Teacher Education
Fred M. Goldberg, Ph.D., Professor of Physics
Victoria R. Jacobs, Ph.D., Professor of Teacher Education
B. Ricardo Nemirovsky, Ph.D., Professor of Mathematics
Walter C. Oechel, Ph.D., Distinguished Professor of Biology
Randolph A. Philipp, Ph.D., Professor of Teacher Education
(Ph.D. Graduate Adviser)
Chris L. Rasmussen, Ph.D., Professor of Mathematics
Stephen K. Reed, Ph.D., Professor of Psychology
Janet S. Bowers, Ph.D., Associate Professor of Mathematics
(M.A.T.S. Graduate Adviser)
Lisa L. Clement Lamb, Ph.D., Associate Professor of Teacher Education
Susan D. Nickerson, Ph.D., Associate Professor of Mathematics
Donna Ross, Ph.D., Associate Professor of Teacher Education
Rafaela M. Santa Cruz, Ph.D., Associate Professor of Teacher Education
Kathy S. Williams, Ph.D., Associate Professor of Biology and Interim Associate Dean of the Division of Undergraduate Studies
Jessica L. Bishop, Ph.D., Assistant Professor of Teacher Education
Kathy H. Vaughn, Ph.D., Assistant Professor of Teacher Education

Committee for Mathematics Education
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Lisa L. Clement Lamb, Ph.D., Associate Professor of Teacher Education
Susan D. Nickerson, Ph.D., Associate Professor of Mathematics
Rafaela Santa Cruz, Ph.D., Associate Professor of Teacher Education
Jessica L. Bishop, Ph.D., Assistant Professor of Teacher Education

Section I.
Master’s Degree Programs

General Information
The Department of Mathematics and Statistics offers two specializations in its program of graduate study leading to a Master of Arts degree for teaching service. The specialization for community college teaching offers candidates a program designed to provide them with the mathematical breadth necessary to teach a wide variety of lower-division collegiate mathematics courses, while also providing them with a better understanding of the issues involved in teaching and learning mathematics. The specialization for secondary teaching offers coursework designed to strengthen the mathematical background of secondary teachers, to provide teachers with a deeper understanding of learning and teaching mathematics in grades 7-12, and to allow teachers the opportunity to analyze curriculum and evaluation efforts in a manner that can lead them to make reasoned judgments about curricular, testing, and instructional issues in grades 7-12 mathematics.

Courses described in this section may also be of interest to students seeking the Master of Arts degree in education with concentrations in elementary curriculum and instruction or secondary curriculum and instruction, offered by the School of Teacher Education.

Associateships
Graduate teaching associateships in mathematical sciences are available to qualified students. Support for qualified candidates may also be available through the School of Teacher Education, through the Center for Research in Mathematics and Science Education or through employment on faculty research grants. Applications are available from the appropriate campus offices.

All students must satisfy the general requirements for admission to the university with classified graduate standing, as described in Part Two of this bulletin.

Advancement to Candidacy
All students must satisfy the general requirements for advancement to candidacy as described in Part Four of this bulletin. In addition, students seeking the Master of Arts degree for teaching service must have passed a qualifying examination in mathematics education.

Specific Requirements for the Master of Arts Degree for Teaching Service in Mathematics
(Major Code: 17011) (SIMS Code: 776305)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Four of this bulletin, the students must complete a graduate program of at least 30 units, 24 of which must be from the Department of Mathematics and Statistics. At least 15 of the 24 must be 600- and 700-numbered courses. A student's program must be prepared in conference with and approved by the graduate adviser.

The two specializations leading to the Master of Arts for teaching service require completion of a specific pattern of graduate units described below.

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Specialization in Mathematics for Community College Teaching (SIMS Code: 776320). This specialization is designed to satisfy the requirements for teaching service at the community college level. Students must have completed a bachelor's degree in mathematics (or equivalent) before entering the program and must have completed six units from Mathematics 521A, 524, and 534A. The third course can be taken prior to entrance to the program or as part of the 30-unit degree requirements.

Plan A requires Mathematics 600, 601, 602, and Mathematics Education 603; six units from Mathematics 509, 720, Mathematics Education 604, 605, 606; nine units of electives selected with the approval of the adviser; and Mathematics 799A, Thesis.

Plan B requires Mathematics 600, 601, 602, and Mathematics Education 603; nine units from Mathematics 509, 720, Mathematics Education 604, 605, 606; and nine units of electives selected with the approval of the adviser. In addition, students must pass a comprehensive examination in mathematics education.

Specialization in Mathematics for Secondary Teaching (SIMS Code: 776351). This specialization is designed to strengthen the mathematical background of secondary teachers, while preparing coursework to better understand the learning and teaching of mathematics in grades 7-12. Students should have the equivalent of a bachelor's degree in mathematics before entering the program.

Plan A requires Mathematics 524; Mathematics Education 603; three units from Mathematics 510, 511, 600; three units from Mathematics 521A or 601; three units from Mathematics 534A or 602; six units from Mathematics 509, 720, Mathematics Education 604, 605, 606; six units of electives selected with the approval of the adviser; and Mathematics 799A, Thesis.

Plan B requires Mathematics 524; Mathematics Education 603; three units from Mathematics 510, 511, 600; three units from Mathematics 521A or 601; three units from Mathematics 534A or 602; nine units from Mathematics 509, 720, Mathematics Education 604, 605, 606; and six units of electives selected with the approval of the adviser. In addition, students must pass a comprehensive examination in mathematics education.

Master of Arts Degree in Education

Concentration in Mathematics Education (K-8) (Major Code: 17012)

The Master of Arts degree in education with a concentration in K-8 mathematics education is designed to provide teachers a deeper understanding of issues in learning and teaching mathematics in grades K-8, and increased knowledge of current trends, research, and assessment in mathematics education. Students can expect to acquire new perspectives and skills about mathematics teaching, specialized knowledge of children's mathematical understanding, and preparation for leadership among teachers in mathematics teaching.

1. Prerequisites: Applicant must have at least one year of teaching experience or consent of program coordinator, and must file an application for admission to both the university and the K-8 mathematics education program. Successful applicants must demonstrate personal, professional, and academic potential for success in this program. For specific admission criteria see the K-8 Mathematics Education Master of Arts program Web site at http://coe.sdsu.edu/departments/MathEd/master.htm.

2. Core Program (12 units): MTHED 600 Teaching and Learning Mathematics in Early Grades (Pre-K to 4) (3) MTHED 601 Teaching and Learning Mathematics in the Middle Grades (3) MTHED 603 Seminar on Teaching Issues in Mathematics Education (3) TE 511 Assessment in Mathematics Education (3) PLC 553 Language Assessment and Evaluation in Multicultural Settings (3) PLC 601 Language Policies and Practices (3)

3. Electives (9 units): With the approval of the adviser, select three courses from the following: PLC 553 Language Assessment and Evaluation in Multicultural Settings (3) PLC 601 Language Policies and Practices (3)

Doctoral Program Members: Bezuk, Bishop, Bowers, Chizhik, Goldberg, Jacobs, Lamb, Lobato, Nemirovsky, Nickerson, Oechel, Philipp, Rasmussen, Reed, Ross, Unsworth, Vaughn, Santa Cruz, Williams

University of California, San Diego:

Coordinators: Jeff Rabin and Gabriele Wienhausen

Doctoral Program Members: Alac, Banner, Brydges, Cole, Czworkowski, Datnow, Eggers, Halter, Heyman, Levin, Magde, Núñez, Rabin, Remmel, Sawrey, Simon, Weizman, Wienhausen
Admission to Doctoral Study

Applicants for admission to the doctoral program in mathematics and science education must meet the general requirements for admission to both universities with classified graduate standing as outlined in the respective current catalogs. Applicants must also meet the special requirements of this program. These include: (a) an acceptable baccalaureate degree in mathematics or science (or a related discipline); (b) a master’s degree, or its equivalent, in biology, chemistry, physics, or mathematics; (c) a GPA of at least 3.25 in the last 30 semester (or 45 quarter) units of upper division work and at least a 3.5 in the graduate work attempted; (d) good standing in the last institution attended; (e) suitable scores in quantitative, verbal, and analytic sections of the Graduate Record Examinations.

Students with a master’s degree in mathematics education can also be considered for admission if they meet the following requirements: (a) a bachelor’s degree in mathematics; (b) a master’s degree in mathematics education that includes graduate level mathematics courses in analysis and algebra; and (c) coursework in geometry at the advanced undergraduate or graduate level. The GPA, GRE, and graduate standing requirements specified in the previous paragraph must also be met. Students entering the program with a master’s degree in mathematics education are required to take additional mathematics courses as specified in “Specific Requirements for the Doctor of Philosophy Degree.” Students with a master’s degree in physics education, chemistry education, or biology education should contact the MSED program coordinators.

Students applying for admission to the doctoral program should electronically submit the university application available at http://www.csumentor.edu along with the $55 application fee.

All applicants must submit admissions materials separately to SDSU Graduate Admissions and to the Mathematics and Science Education Ph.D. Program.

Graduate Admissions

The following materials should be submitted as a complete package directly to:

Graduate Admissions
Enrollment Services
San Diego State University
San Diego, CA 92182-7416

(1) Official transcripts (in sealed envelopes) from all postsecondary institutions attended;
Note:
• Students who attended SDSU need only submit transcripts for work completed since last attendance.
• Students with international coursework must submit both the official transcript and proof of degree. If documents are in a language other than English, they must be accompanied by a certified English translation.
(2) GRE scores (http://www.ets.org; SDSU institution code 4682);
(3) English language score, if medium of instruction was in a language other than English (http://www.ets.org; SDSU institution code 4682).

Mathematics and Science Education

The following materials should be delivered or mailed to:
Mathematics and Science Education Ph.D. Program
CRMSE, San Diego State University
6475 Alvarado Road, Suite 206
San Diego, CA 92120-5013

(1) Application for doctoral program in mathematics and science education
(http://www.sci.sdsu.edu/CRMSE/msed/crmse_app02.doc);
(2) Mathematics and Science Education recommendation form as cover sheet
(http://www.sci.sdsu.edu/CRMSE/msed/Recommend Form-CoS.doc);
(3) At least three letters of recommendation.

Specific Requirements for the Doctor of Philosophy Degree

(Major Code: 08997) (SIMS Code: 993501)

Residency Requirements. After formal admission to the doctoral program, the student must complete a 36-unit residency at the University of California, San Diego, of which a maximum of 12 units can be upper division undergraduate courses (100 level). Lower division undergraduate courses do not count toward residency. Students must also complete an 18-unit residency at San Diego State University. The residency requirements cannot be replaced by coursework taken elsewhere.

Language Requirement. There is no formal language requirement for the program.

Course Requirements. All students admitted into the doctoral program will fulfill the following requirements. Any alternative method of fulfilling these requirements must be approved by the graduate advisers.

A. Three research apprenticeship experiences:
SDSU: MSE 801, 802 and
SDSU: MSE 820 or UCSD: MSED 298.

B. Core courses in Mathematics or Science Education.
UCSD: MSED 296A, 296B, 296C and
SDSU: MTHED 603.

Science Education students must also take SDSU: NSCI 600. Mathematics Education students must select two of the following additional courses: SDSU: MTHED 604, 605, 606.

C. Three courses on quantitative and qualitative research methods.
Select SDSU: MSE 810 and one of the following sequences:
UCSD: PSYC 201A, 201B or
UCSD: MA 282A, 282B or
SDSU: PSY 670A, 670B.

D. Two courses in cognitive science at UCSD selected from:
COGS 102A or 234; COGS 102B, 200, 260; or one of COGS 101A, 101B, 101C.

E. One teaching practicum.
SDSU: MSE 805, 806, or 807 or
UCSD: EDSD 129A/139, or Discipline 500.

F. Two courses from different categories are selected with advisors according to the advisor’s needs and background.

(3) Mathematics and Science: Graduate level courses in biology, chemistry, mathematics, or physics.

(4) Teaching Experience: An option for students who have not yet had teaching experiences at both the K-12 and collegiate levels is to take a second teaching practicum.

(5) Other. Other types of courses (at the graduate or upper division undergraduate level) can be approved by the advisers if they contribute to a coherent program.

G. Two doctoral research courses:
SDSU: MSE 830 and
SDSU: MSE 899 or UCSD: MSED 299.

Beyond these requirements, no specified number of courses is required for the doctoral degree. It is expected, however, that all the doctoral students will supplement the requirements with electives that contribute to individual career objectives.

Additional Requirements for Students Entering with a Master’s Degree in Mathematics Education. Students who are admitted into the doctoral program with a master’s degree in mathematics education will increase the breadth and depth of their mathematical knowledge by fulfilling the requirements specified for Option A or Option B:

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Option A.  
UCSD: MATH 240A, 240B, 240C and  
Pass the UCSD comprehensive examination on analysis at the  
master’s level and  
One graduate algebra course: UCSD: MATH 200A or SDSU:  
MATH 627A or 623. MATH 623 can only be selected if the  
student has already taken a graduate level abstract algebra  
course.

Option B.  
Select two of SDSU: MATH 627A, 627B, 623, and  
Pass the SDSU comprehensive examination on algebra at the  
master’s level and  
UCSD: MATH 240A.

Whether the student selects Option A or Option B, the year-long  
sequence in algebra or analysis must be taken in Year 1 of the doctoral  
program. All of the requirements for Option A or Option B must be  
completed prior to the second year examination; however, students  
are strongly encouraged to fulfill all of the requirements in Year 1. A  
grade of B or better must be earned in each course.

Examinations. Students in the doctoral program will be evaluated  
at the following levels:

(1) First Year Evaluation. The student’s ability to master graduate  
level course material may be assessed after completion of no  
more than 24 semester units of coursework. This examination  
may take place not later than the third semester of the student’s  
enrollment in the program. The evaluation will be based on the  
student’s performance in coursework and on indicated  
research competence, and it will be undertaken by the  
student’s advisory committee together with instructors from the  
student’s first year courses.

(2) Comprehensive Examinations. At the end of the second year,  
the student will take a written comprehensive examination in  
general cognition and an oral examination on issues of learning  
pertinent to the student’s area of specialization.

(3) Oral Examination. During the third year in the program, the  
student will make an oral presentation to the dissertation  
committee to accompany a written proposal for the doctoral  
thesis. The student will be questioned on both the topic of the  
investigation and on the proposed research methodology. Upon  
successful completion of this presentation, the student will  
be recommended for advancement to candidacy for the doctoral  
degree.

(4) Dissertation Defense. After completion of the dissertation, the  
candidate will present a public defense of the doctoral  
dissertation. A copy of the dissertation must be made available  
to the doctoral faculty at both institutions four weeks prior to the  
defense. Copies of the abstract of the dissertation, along with the  
announcement of the defense, must be publicly available  
four weeks before the defense. The student’s dissertation  
committee will make a recommendation to the graduate deans  
to pass or fail the student.

Faculty Advisers. Upon admission to the doctoral program, the  
program directors will assign each student a faculty adviser at both  
universities. The faculty advisers will serve as advisers until the  
student’s dissertation committee is appointed.

Dissertation Committee. The dissertation committee will be  
composed of five members with at least two faculty members from  
each campus. The student will select members of the dissertation  
committee in consultation with program faculty and the graduate  
advisers.

Dissertation. Following the successful completion of all  
prescribed coursework and qualifying examinations, the major  
remaining requirement for the Ph.D. degree will be the satisfactory  
completion of a dissertation consisting of original research carried out  
under the guidance of the major professor. Approval of the completed  
dissertation attests that an organized investigation that expands the  
frontiers of knowledge and understanding in mathematics and  
science education has been carried out.

Award of the Degree. The Doctor of Philosophy degree in  
Mathematics and Science Education will be awarded jointly by the  
Regents of the University of California and the Trustees of The  
California State University in the names of both cooperating  
institutions.

Financial Support  
San Diego State University and the University of California, San  
Diego have a number of research and teaching associateships  
available to support students admitted to the Joint Doctoral Program.  
All students applying to the program will be considered for financial  
support.

Section III.  
Certificate Programs

Mathematics Specialist Certificate  
(Offered through the College of Extended Studies)

The mathematics specialist certificate program, prepares creden- 
tialed teachers to become mathematics specialists in the elementary  
grades. Two different certificates are offered, one focusing on the  
primary grades and the other on the upper elementary grades. Persons  
earning the certificates will develop special expertise in the teaching of  
mathematics in elementary schools. For application or further informa- 
tion, contact Dr. Nadine S. Bezuk (nbezuk@mail.sdsu.edu).

Prerequisites for admission include the following:
1. Teaching credential.
2. Two years of classroom teaching experience.
3. Two letters of recommendation.

Requirements for the primary mathematics specialist certificate  
(12 units):
1. Six units to include Mathematics 501A, 501B, 502A, 502B,  
503A, 503B.
2. Six units to include Mathematics Education 571 and 572.

Requirements for the upper elementary mathematics specialist  
certificate (12 units):
1. Six units to include Mathematics 501A, 501B, 502A, 502B,  
504A, 504B.
2. Six units to include Mathematics Education 573 and 574.

Students must pass all courses with Cr/NC grading or receive at  
least a C (2.0) in all courses taken for a letter grade. With consent of  
the adviser, six units of education coursework may be applied toward  
a master’s degree in education.
Algebra Specialist Certificate  
(Offered through the College of Extended Studies)

The algebra specialist certificate program enhances the ability of credentialed middle school teachers to prepare students to succeed in algebra I and improve student achievement in algebra I. Persons earning the certificate will develop special expertise in the teaching of mathematics in middle schools. For application or further information, contact the program advisers.

Prerequisites for admission include the following:
1. Teaching credential.
2. Two years of classroom teaching experience.
3. Two letters of recommendation.

Required courses (16 units):
- MATH 506A  Algebra in the Middle Grades I (3)
- MATH 506B  Algebra in the Middle Grades II (3)
- MATH 507A  Functions and Study of Change I (2)
- MATH 507B  Functions and Study of Change II (3)
- MTHED 575  Developing Algebraic Understanding in Middle Grades (Part I) (2)
- MTHED 576  Developing Algebraic Understanding in Middle Grades (Part II) (3)

Students must receive a C (2.0) in all certificate courses taken for a letter grade. With consent of the adviser, six units of mathematics education coursework with a grade of B (3.0) or better may be applied toward a master’s degree in education.

Courses Acceptable on Master’s and Doctoral Degree Programs in Mathematics and Science Education (MTHED) (MSE)

Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

UPPER DIVISION COURSES

MTHED 574. Children's Mathematics Understanding in Upper Elementary Grades (Part I) (1-3)  
Prerequisite: Admission to mathematics specialist certificate program.
Ongoing assessment and instructional decision-making for increasing children’s achievement and understanding of rational numbers, geometry and measurement in the upper elementary grades. Maximum credit three units.

MTHED 575. Developing Algebraic Understanding in Middle Grades (Part I) (1-3)  
Prerequisite: Admission to algebra specialist certificate program.
Ongoing assessment and instructional decision-making to increase children’s achievement and understanding of rational number concepts in middle grades, laying foundation for understanding algebra. Maximum credit three units.

MTHED 576. Developing Algebraic Understanding in Middle Grades (Part II) (1-3)  
Prerequisite: Admission to algebra specialist certificate program.
Ongoing assessment and instructional decision-making to increase children’s achievement and understanding of proportional reasoning, patterns, and functions in middle grades, laying foundation for understanding algebra. Maximum credit three units.

DOCTORAL COURSES

MSE 801. Faculty Research (1) Cr/NC  
Prerequisite: Admission to doctoral program in Mathematics and Science Education.  
Issues of learning with reference to how they are addressed by doctoral faculty. Students will interview and write a one-page statement of research interests for each of eight doctoral faculty members.

MSE 802. Orientation Practicum (1-3) Cr/NC  
Prerequisite: Admission to doctoral program in Mathematics and Science Education.  
Experience with research programs will introduce students to a variety of research questions and approaches. One research program per unit; minimum three units required in program. May be repeated with new content. See Class Schedule for specific content. Maximum credit four units applicable to an advanced degree.
MSE 805. Supervised Teaching of Teacher Preparation
Courses (3) Cr/NC/RP
Prerequisite: Admission to doctoral program in Mathematics and
Science Education.
Students will plan and teach, under supervision, a course that
prepares prospective teachers to teach mathematics or science at
either the elementary or secondary level.

MSE 806. Supervised School Practicum (3) Cr/NC/RP
Prerequisite: Admission to doctoral program in Mathematics and
Science Education.
School-based project focusing on inservice of teachers or on
curriculum development, or work with a school district administrator
or mathematics or science.

MSE 807. Specially Designed Practicum (3) Cr/NC/RP
Prerequisite: Admission to doctoral program in Mathematics and
Science Education.
Practical experience to assist students in gaining experience in
career they have selected.

MSE 810. Seminar in Research Design (3)
Prerequisites: Admission to doctoral program in Mathematics and
Science Education; Psychology 670A, and consent of instructor.

MSE 820. Research Project (3-6) Cr/NC/RP
Prerequisite: Admission to doctoral program in Mathematics and
Science Education.
Participation in an ongoing research project and development of a
related study.

MSE 830. Research Seminar (3)
Prerequisite: Successful completion of qualifying examination.
Students and faculty present ongoing research for discussion and
critique.

MSE 897. Doctoral Research (1-15) Cr/NC/RP
Prerequisite: Mathematics and Science Education 820.
Independent investigation in general field of the dissertation.

MSE 898. Doctoral Special Study (1-8) Cr/NC/RP
Prerequisites: An officially constituted doctoral committee and
advancement to candidacy.
Individual study in the field of specialization.

MSE 899. Doctoral Dissertation (1-15) Cr/NC/RP
Prerequisites: An officially constituted dissertation committee and
advancement to candidacy.
Preparation of the dissertation for the doctoral degree. Enrollment
is required during the term in which the dissertation is approved.

For additional courses applicable to the Master of Arts
degree for Teaching Service see:
Mathematics 600. Geometrical Systems
Mathematics 601. Topics in Algebra
Mathematics 602. Topics in Analysis

For additional courses related to mathematics educa-
tion see:
Teacher Education 511. Assessment in Mathematics
Teacher Education 610A. Seminar in Mathematics Edu-
cation–Elementary School

Courses for Mathematics and Algebra
Specialist Certificate Programs and
Mathematics Education (MATH)
Refer to Courses and Curricula and Regulations of the Division of Gradu-
ate Affairs sections of this bulletin for explanation of the course numbering
system, unit or credit hour, prerequisites, and related information.

UPPER DIVISION COURSES

MATH 501A. Reasoning: Place Value and Arithmetic
Operations (1)
Prerequisites: Teaching credential and consent of instructor.
Place value and its role in development and understanding of arith-
metic operations, to include numeration systems, student methods,
standard algorithms, and mental computation.

MATH 501B. Reasoning: Rational Numbers and Real Number
Systems (1)
Prerequisites: Teaching credential and consent of instructor.
Rational numbers and structure of real number system, to include
meanings and models for fractions with attention to operations on
rational numbers.

MATH 502A. Reasoning: Geometric Shapes (1)
Prerequisites: Teaching credential and consent of instructor.
Geometry to include classification and representation of polyhe-
dra, hierarchical relationships among quadrilaterals, symmetry and
transformations in the plane.

MATH 502B. Reasoning: Measurement (1)
Prerequisites: Teaching credential and consent of instructor.
Key ideas of measurement, development of area formulas for two-
dimensional figures, size changes, and similarity.

MATH 503A. Reasoning: Foundations of Quantitative Thinking (1)
Prerequisites: Teaching credential and consent of instructor.
Reasoning about measurable characteristics in problem context,
and relationships among these measurements. Additive, multiplicatively
relationships, and role of these ideas in development of
quantitative reasoning skills in primary grades.

MATH 504A. Reasoning: Quantities and Mathematical
Relationships (1)
Prerequisites: Teaching credential and consent of instructor.
Reasoning about measurable characteristics in problem context,
and relationships among these measurements. Additive, multiplicatively
reasoning, and proportional reasoning in middle grades.

MATH 504B. Reasoning: Algebra and Nature of Change (1)
Prerequisites: Teaching credential and consent of instructor.
Pattern searching, generalizing, graphing to represent quantitative
relationships, and role of these topics in preparing elementary and mid-
school students for algebra.

MATH 506A. Algebra in the Middle Grades I (3)
Prerequisites: Teaching credential and consent of instructor.
Mathematical foundations that underlie concepts and procedures
emphasized in algebra I and algebra II as taught at middle and high
school level, to include focus on real number system, ratios, propor-
tional reasoning, equality, number theory, and proof.

MATH 506B. Algebra in the Middle Grades II (3)
Prerequisites: Mathematics 506A, practicing teachers with valid
teaching credential, and consent of instructor.
Mathematical foundations that underlie concepts and procedures
emphasized in algebra I and algebra II as taught at middle and high
school level, to include focus on functions in context of relations,
patterns, and graphing.
MATH 507A. Functions and Study of Change I (2)
Prerequisites: Mathematics 506B, practicing teachers with valid teaching credential, and consent of instructor.
Mathematical ideas surrounding linear functions and change to include proportionality, slope, and graphing. Arithmetic and geometric sequences.

MATH 507B. Functions and Study of Change II (3)
Prerequisites: Mathematics 507A, practicing teachers with valid teaching credential, and consent of instructor.
Mathematical ideas surrounding nonlinear functions and variable rates of change to include quadratic and exponential situations.

GRADUATE COURSES

MATH 600. Geometrical Systems (3)
Prerequisites: Mathematics 521A and an upper division course in geometry.
Ordered and affine geometries, decompositions, dilations. Projectivities and projective space. Absolute geometry, isometries, groups generated by inversions.

MATH 601. Topics in Algebra (3)
Prerequisites: Mathematics 521A and 534A.
Unique factorization domains, rings and ideals, groups, algebraic field extensions. A course designed for secondary school teachers.

MATH 602. Topics in Analysis (3)
Prerequisites: Mathematics 521A and 534A.
Topics in analysis, including the real number system, convergence, continuity, differentiation, the Riemann-Stieltjes integral, complex analysis, designed to give the secondary teacher a broad understanding of the fundamental concepts.

Mechanical Engineering: Refer to “Engineering” in this section of the bulletin.
Molecular Biology: Refer to “Biology” in this section of the bulletin.